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INTEC High-Level Waste Studies
Universal Solvent Extraction Feasibility Study

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DISCLAIMER

ABSTRACT

This report summarizes a feasibility study that has been conducted on the Universal Solvent Extraction (UNEX) Process for treatment and disposal of 4.3 million liters of INEEL sodium-bearing waste located at the Idaho Nuclear Technology and Engineering Center. This feasibility study covers two scenarios of treatment. The first, the UNEX process, partitions the actinides and Cs/Sr from the SBW and forms remote-handled TRU and contact-handled LLW forms. The second process, known as the Modified UNEX Process, partitions the Cs/Sr from the SBW and creates remote-handled LLW and contact-handled TRU waste forms. Phase one of this study, covered in the 30% review document, dealt with defining the processes and defining the major unit operations. The second phase of the project, contained in the 60% review, expanded on the application of the UNEX processes and included facility requirements and definitions. Two facility options were investigated for the UNEX process, resulting in a 2 x 2 matrix of process/facility scenarios as follows: Option A, UNEX at Greenfield Facility, Option B, Modified UNEX at Greenfield Facility, Option C, UNEX at NWCF, and Option D, Modified UNEX at NWCF. Phase three of this study, included in this document, covers life-cycle costs for all options presented along with results and conclusions determined from the study.

SUMMARY

A feasibility study for the processing of 4.3 million liters of sodium-bearing waste (SBW) through the Universal Solvent Extraction (UNEX) process has been completed. Four different processing options pertaining to the UNEX process were addressed. These options include Option A, UNEX process in a Greenfield Facility, Option B, Modified UNEX in a new (Greenfield) Facility, Option C, UNEX in NWCF, and Option D, Modified UNEX in NWCF.

This study covers the Design Basis and Assumptions for the project, Process Descriptions, Facility Descriptions, Cost Estimates, Project Schedule, Requirements and Assessments, and is concluded with Uncertainties and Recommended Resolutions.

Two options for processing the SBW have been evaluated. The first was the UNEX process, which separates the actinides, Cesium (Cs) and Strontium (Sr), from the SBW and creates a remote-handled TRU along with a contact handled LLW. The second separation option evaluated was the Modified UNEX process which separates the Cs/Sr from the SBW and results in a remote-handled LLW and a contact-handled TRU waste. Results from this study show that a total of 44,700 drums of waste will be generated from the UNEX process, while 29,200 drums will be created using the Modified UNEX process.

Cost estimates for the processes and facilities have also been determined. Option A, the UNEX process in a Greenfield Facility, has an estimated life-cycle cost of \$744 million of which roughly \$514 million is allocated for capital costs. Option B, the Modified UNEX process, is estimated to cost \$890 million with \$514 million dollars associated with Capital Costs. Option C, the UNEX Process in the NWCF, has a Life Cycle Cost of roughly \$848 million dollars with \$604 million allocated for Capital Costs. Lastly, Option D, Modified UNEX in the NWCF, is estimated to cost roughly \$995 million of which \$609 million is allocated for capital costs. All cost estimates associated with this study include costs for storage of the final waste forms.

From an economics perspective, all four options are very capital intensive relative to the discounted LCC. This is largely the result of the SBW treatment facility size, its throughput requirements, and the duration of the treatment campaign. However, options that employ Greenfield construction have a lower discounted LCC. Additionally, the two options that employ the Modified UNEX Process is more resource intensive since a majority of the treated SBW is disposed at WIPP. As a result, the lowest cost alternative (Option A) employs both the advantages of a Greenfield site construction and minimizes the volume of waste disposed at WIPP by employing the UNEX Process. The next-lowest cost alternative (Option C) continues to employ the UNEX process. This suggests that the marginal cost differences in the treatment process is more of a cost driver than the marginal cost differences in facility location.

A preliminary schedule for the project was also estimated in this study. Assuming a start date of January 2001, the UNEX separations project would be completed in January 2013. This timeline includes conceptual design, project support, design, construction, facility acceptance, project management, and interim storage of waste.

ACKNOWLEDGMENTS

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ACRONYMS

AEA	Atomic Energy Act
AHU	Air Handling Units
ANLW	Argonne National Laboratory – West
ANN	Aluminum Nitrate Nonahydrate
ASME	American Society of Mechanical Engineers
CAA	Clean Air Act
cfm	Cubic Feet per Minute
CFP	Cross Flow Process
CFR	Code of Federal Regulations
ChCoDiC	Chlorinated Cobalt Dicarbollide
CH-LLW	Contact-Handled Low Level Waste
CHT	Contact-Handled Transuranic Wasteform
CMF	Centrifugal Membrane Filtration
CMPO	Diphenyl-N,N-dibutylcarbamoyl-methyl phosphine oxide
CPP	Chemical Processing Plant
CsIX/TRU	Cesium Ion Exchange/Transuranic
DBA	Design Basis Accidents
D&D	Decontamination and Decommissioning
DET	Determination of Equivalent Treatment
DF	decontamination factor
DOE	U.S. Department of Energy
DOT	Department of Transportation
DTPA	Diethylenetriamine Pentaacetic Acid
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Act

FS-13	Phenyltrifluoromethyl Sulfone
GC	Guanidine Carbonate
GFF	Greenfield Facility
GTCC	Greater Than Class C
HEPA	High-Efficiency Particulate Air (filter)
HLLWE	High Level Liquid Waste Evaporator
HLW	high-level waste
HRA	Hot Repair Area
HVAC	heating, ventilation, and air conditioning
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LAW	Low Activity Waste
LDR	Land Disposal Restrictions
LDUA	Light Duty Utility Arm
LET&D	Liquid Effluent Treatment and Disposal
LLW	Low Level Waste
MACT	Maximum Achievable Control Technology
nCi	nanoCurie
NGLW	Newly Generated Liquid Waste
NRC	Nuclear Regulatory Commission
NWCF	New Waste Calcining Facility
PaR	PaR Systems Corporation (remote equipment)
PEG 400	Polyethylene Glycol 400
PEWE	Process Equipment Waste Evaporator
PFD	Process Flow Diagram
PLC	Program Logic Control

RCRA	Resource Conservation and Recovery Act
RH-LLW	remote-handled low-level waste
RHTC	remote-handled TRU crystallite
RHTS	remote-handled TRU solids
SBW	sodium-bearing waste
SREX	Strontium Extraction Process
TCLP	Toxicity Characteristic Leaching Procedure
TD	technology development
TF	Tank Farm
TFD	Thin Film Dryer
TOC	Total Organic Carbons
TRU	Transuranic
TRUEX	Transuranic Extraction Process
TSS	Total Suspended Solids
UDS	Undissolved Solids
UHCs	Underlying Hazardous Constituents
UNEX	Universal Solvent Extraction Process
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WM	Waste Management
XFR	Transfer

Universal Solvent Extraction Feasibility Study

1. INTRODUCTION

Treatment of radioactive waste at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Engineering and Environmental Laboratory (INEEL) is mandated under a Settlement Agreement signed October 16, 1995, between the U.S. Department of Energy (DOE), the U.S. Department of Navy, and the State of Idaho. A portion of the Agreement requires that liquid sodium-bearing waste (SBW) in the INTEC Tank Farm tanks be calcined (i.e., treated) by the end of 2012. Initially, the SBW was to be treated in the New Waste Calcining Facility (NWCF) at INTEC. Due to permitting considerations associated with the NWCF, development of alternative treatment options are being considered.

An April 3, 1992, Consent Order of the Notice of Noncompliance between the U.S. Environmental Protection Agency (EPA) and the State of Idaho requires that the DOE "cease use" of five of eleven tanks, which are contained in pillar and panel vaults, by March 31, 2003. As a result of the early closure of these tanks, there is a concerted effort to treat all liquid waste in preparation for tank closures.

1.1 Background

This study investigates treatment of the current INTEC tank farm liquid waste inventory, plus any newly generated liquid waste (NGLW) produced before January 2013 and stored in the INTEC tank farm. It assumes that the NWCF calciner will not be operational, and further assumes that the NWCF building can be used for Universal Solvent Extraction (UNEX) or Modified UNEX processes.

Four approaches to the UNEX and Modified UNEX treatment options are considered:

1. UNEX treatment process in a new (Greenfield) Facility

2. UNEX treatment process with a portion of the processing equipment located in the NWCF building and the remainder of the processing equipment in a new Greenfield Facility

3. Modified UNEX treatment process in a new Greenfield Facility

4. Modified UNEX treatment process with a portion of the processing equipment located in the NWCF building and the remainder of the processing equipment in a new Greenfield Facility.

1.2 Objective and Scope of Work

The primary objectives of this study are to determine the feasibility and costs of the UNEX and Modified UNEX processes for treating SBW and NGLW at INTEC. The following activities are being performed in this study to meet these objectives:

- Conducting literature and theoretical research of known technological issues dealing with processability and waste form properties

- Development of a design basis to include anticipated composition of waste requiring processing and the processing schedule

- Development of an integrated process strategy that includes interface with existing INTEC facilities, unit operations-treatment trains, startup and shutdown operational issues, process control strategies, radiological dose and contamination control strategies, and disposition of primary and secondary waste streams

- Selection, definition, and sizing of major processing equipment and materials handling systems

- Generate facility and site layouts that support and contain process equipment and site interfaces

- Generate estimates of operational labor, materials, and utilities required during process operations

- Perform regulatory compliance and permitting analysis to include facility operation and wasteform disposal

- Develop capital cost and life-cycle cost estimates supporting construction, operation, and decommissioning of the defined facility.

- Performing analysis of the overall feasibility of the process for SBW and examining the potential for applicability to processing other wasteforms.

- Develop a project schedule for each of the UNEX options.

1.3 Concept Overview

The basic UNEX and Modified UNEX processes are illustrated in the process flow diagrams included in Appendix B. Both of the processes consist of the following major steps:

1. Rough filtration of undissolved solids (UDS) from the liquid waste feed stream

2. Radionuclide extraction by liquid/liquid solvent centrifugal contactors

3. Processing of the high-activity fraction by evaporative drying

4. Processing of the low-activity fraction by neutralization and grouting

5. Packaging and temporarily storing the high-activity and low-activity waste products.

The UNEX and Modified UNEX processes differ by the extraction of radionuclides. In the UNEX process, over 99% of the cesium, strontium, and the actinides are extracted into a remote-handled TRU crystallite (RHTC) form. The Modified UNEX process likewise extracts over 99% of the cesium and strontium, but allows the actinides to remain with the low-activity fraction.

2. DESIGN BASIS AND ASSUMPTIONS

2.1 Site description

The design basis for this study assumes that the UNEX or Modified UNEX facility will be located within the existing boundaries of INTEC. Conceptual site layouts are included in Appendix D. The site identified in this study lies north of Cyprus Avenue and west of Lodge Pole Street. Access portals for personnel, materials delivery, and waste transport will be through existing INTEC portals.

2.2 Mass and Energy Balance

The UNEX and Modified UNEX material balances were prepared using an Excel Visual Basic model. The basis for the input parameters to the model and the calculation methods used in the model are briefly discussed below. Most of the input parameters were taken from (1) J. D. Law, "Update of Flowsheet Assumptions for Treatment of SBW with the UNEX and Modified UNEX Processes," March 14, 2000, (2) J. D. Law, "Flowsheet Assumptions for Treatment of SBW with the UNEX Process," JLAW-04-99, October 25, 1999, and (3) J. D. Law, "Flowsheet Assumptions for Treatment of SBW with a Modified UNEX Process (Cs and Sr Removal Only), JLAW-05-99, November 15, 1999.

The material balances for the UNEX and Modified UNEX processes are included in Appendix C of this study. Process equipment energy balances were performed for major process equipment, based on the flow rates defined in the material balance, and are also included in Appendix C.

2.2.1 Feed Composition

The feed volume and composition of liquid waste to be treated in the UNEX or Modified UNEX process was calculated by

1. Obtaining existing Tank Farm inventory volumes and compositions
2. Calculating volumes and compositions of tank farm wastes after concentration in the High-Level Liquid Waste Evaporator (HLLWE) for tanks that are presently dilute
3. Obtaining the most recent estimates of NGLW volumes for the period 2000-2012
4. Obtaining NGLW stream compositions
5. Calculating the composition of all combined NGLW streams after concentration in the PEWE and HLLWE
6. Calculating the total liquid waste volume and average composition of all waste, including waste presently in the tank farm that will not be further concentrated, waste presently in the tank farm after concentration in the HLLWE, and concentrated NGLW
7. Adjusting radionuclide concentrations to account for decay to January 1, 2008
8. Calculating UDS chemical and radionuclide concentrations.

2.2.1.1 SBW Waste Volume and Chemical Species Concentrations. Present Tank Farm volumes were taken from the INEEL HLW Systems Engineering web page "Tank Farm Volumes," http://challenger.inel.gov/nichtt/jm/tankdata/Tankmap.htm, and are current to January 31, 2000. Each tank volume, except for WM-188, was increased by 5%, an assumed dilution due to steam jet transfer. The steam jet dilution factor is needed both to obtain the accurate waste volume that will be received in the treatment process feed tank and for consistency with composition analyses that were obtained from steam jetted samples.

The primary source for chemical specie concentration of Tank Farm waste is the worksheet "TF Inven" in the Excel spreadsheet prepared by D. Staiger, "Clark Residual Estimate 2016 for No Action Alternative 24 Jan 2000" dated March 1, 2000. Although this spreadsheet has not been published, the data is consistent with that on the Tank Farm web pages (accessible from http://challenger.inel.gov/nichtt/jm/tankdata/Tankmap.htm, updated January 7, 2000) and is also consistent, with a few exceptions, with R. E. Schindler, "Composition of Wastes in Tank Farm," Schindler-04-99, February 11, 1999.

For a few tanks and a few species, primarily As, Cd, Ni, and Zr, concentrations were either not shown in Staiger's tables or were shown as detection limit values, so data from Schindler-04-99 were used. The concentration of mercury in WM-189 in Staiger's tables and Schindler-04-99 is not correct based on an e-mail note from R. E. Schindler I received June 8, 1999. The corrected value is documented in Table 1 of R. A. Wood, "Updated Aluminum Nitrate/WM-189 Blend Calculations for 500°C and 600°C Operation During NWCF Run H4," RAW-01-00, February 14, 2000.

Chemical species compositional data for WM-188 were taken from Patterson (1999). Because the WM-188 samples were taken directly from the tank, steam jet dilution was not included in the volume of WM-188.

Concentrations of As, F, PO_4, Se, and TOC for WM-182 were taken from unpublished data from Light Duty Utility Arm samples taken in FY-2000. For a number of trace species such as Ag, Mn, and Mo, data was available for some but not all of the tanks, and so missing concentrations were assumed to be equal to the weighted average of the tanks for which data were available.

Nonradioactive cesium concentrations were obtained by using the ratio of nonradioactive cesium to ^{137}Cs calculated from data in D. R. Wenzel, "Calculation of 1999 Radionuclide Inventory for Sodium Bearing Waste," Wen-20-99, May 18, 1999. Wenzel's data provides total cesium, ^{134}Cs, ^{135}Cs, and ^{137}Cs concentrations; from these, the concentration of nonradioactive cesium can be obtained by difference. The ratio was corrected to a decay date of January 2000 and then multiplied by ^{137}Cs concentrations for each tank, also decayed to January 2000.

Nitrate concentrations were calculated by charge balance, and deviated from measured values by an average 0.3 moles/liter.

UDS concentrations for WM-180, WM-181, WM-185, and WM-189 were taken from R. E. Schindler, "Composition of Wastes in Tank Farm," Schindler-04-99, February 11, 1999. UDS concentrations for the other tanks were taken from K. J. Rebish/J. A. Nenni, "Tank Farm Inventory," KJR-02-94/JAN-03-94, June 23, 1994. The UDS concentration in the "average" SBW feed, used in the mass balance for this study, was derived from the above-referenced UDS values for tanks in the Tank Farm. These values ranged from a low of 0.17 g/liter for WM-181 to 5.05 g/liter for WM-186. Liquid in some of the existing tanks will be concentrated in the HLLWE, and it was assumed that the UDS concentrated by the same factor as nonvolatile species.

2.2.1.2 SBW Radionuclide Concentrations. Radionuclide concentrations were taken from three sources. Values in Dan Staiger's spreadsheet "Clark Residual Estimate 2016 for No Action Alternative 24 Jan 2000" dated March 1, 2000; worksheet "TF Inven" were decayed from July 1999 to

January, 2000. Concentrations of a few species, primarily uranium isotopes and ^{129}I, were not available on this spreadsheet for some of the tanks, but were shown on the Tank Farm web pages, accessible from the summary page http://challenger.inel.gov/nichtt/jm/tankdata/Tankmap.htm. Concentrations not available from either of these sources were calculated from data in D. R. Wenzel, "Calculation of July, 1999 Radionuclide Inventory for INTEC Wastes," Wen-27-99, November 7, 1999. Radionuclides concentrations were calculated by using ratios derived from Wenzel. For example, the concentration of ^{243}Am was obtained by multiplying the concentration of ^{241}Am by the ratio of $^{243}Am/^{241}Am$ shown in Wenzel, corrected to a decay date of January 2000.

2.2.1.3 NGLW Volume and Composition. Projected volumes of NGLW are given in Clark Millet's Excel spreadsheet "Baseline Option C-600-REV 4," received March 7, 2000. The following adjustments were made to the projections shown by Millet:

1. Tank farm flushes were deleted from the NGLW, based on the assumption that any non-water components of the tank farm flushes would be accounted for in the SBW inventory.

2. Waste from NWCF operations in the years 2010–2012 were deleted based on assuming no restart of the calciner in 2010.

3. Calciner closure flushes were moved up from 2015 to before 2012.

The composition of the NGLW was calculated from individual stream compositions shown in Appendix B of Tripp (1998) and from volume fractions of individual waste streams as determined from Clark Millet's spreadsheet. Compositions are not available for every NGLW waste stream, hence the streams were grouped into similar types. The total NGLW was calculated as the weighted average of seven waste streams as shown in Table 1.

Table 1. Waste streams used for weighted average.

Fraction	Stream
0.009	CPP-603 Deactivation
0.02	CPP-601/627/640 Deactivation
0.144	NWCF Decon Facility
0.123	CPP-601 Lab Drains
0.23	PEW De-scale
0.202	NWCF Flushes
0.48	Type 0 (NWCF-derived)

The chemical composition of the Type 0 waste was assumed equal to the average Tank Farm waste composition; compositions of the other wastes, in dilute form, were taken from Tripp (1998). Radionuclide concentrations of concentrated Type 0 waste were assumed to be equal to 20% of concentrated Tank Farm waste, except for ^{3}H and ^{129}I. Because this waste is derived from processing Tank Farm waste, theoretically it would add no radioactivity to the SBW. However, to account for radionuclides in other NGLW streams for which no or incomplete radiochemical analyses are available and to allow for small amounts of radioactivity that may be present in lines and other tanks in the NWCF, a value of 20% was assumed. However because of the volatility of ^{3}H and ^{129}I in calcination, the Type 0 NGLW was assumed to have no ^{3}H and ^{129}I.

The NGLW waste streams were concentrated according to the PEW and HLLW evaporator concentration ratios in Clark Millet's spreadsheet, with one exception. The CPP-601 Lab Drains waste was only concentrated by a factor of 20 to avoid excessively high nitrate concentrations in the concentrate. When the NGLW is evaporated, a portion of the nitric acid present in these evaporator feeds will be volatilized and then be recovered in the Liquid Effluent Treatment and Disposal (LET&D) Facility bottoms, which will become a separate NGLW stream. To account for this acid return in the total NGLW, no acid was removed in the concentration calculations.

Radionuclide concentrations in NGLW were decayed from the data of analysis to January 1, 2008.

2.2.1.4 SBW Concentration in the HLLWE. Liquid presently in Tanks WM-181, WM-184, WM-186, and WM-187 was assumed concentrated by evaporation in the HLLWE. Approximately 50% of the waste in WM-181 was combined with the waste in WM-184 and concentrated by a factor of 1.73. The remaining WM-181 liquid was combined with the waste in WM-186 and concentrated by a factor of 2.39. The basis for these concentration factors as well as fractions of nitric acid, HCl, HF, and Hg removed from the waste are included in data provided by R. E. Schindler, "HLLWE Feed Blends for Wastes From WM-186, WM-184 and WM-181," Schi-17-98, July 28, 1998. WM-187 liquid, which is even less concentrated than the other tanks, was concentrated by a factor of 2.6. The evaporator condensate composition, and hence the amount of HNO_3, HCl, HF, and Hg removed, was based on interpolated data in Schi-17-98 based on evaporator feed composition.

2.2.1.5 Trace Species Concentrations. Molar concentrations of fission products and other trace species in SBW were taken from D. R. Wenzel, "Calculation of 1999 Radionuclide Inventory for Sodium Bearing Waste," Wen-20-99, May 18, 1999 and D. R. Wenzel, "Calculation of the Mass of Individual Elements in ICPP Wastes From Fission," Wen-05-98, March 2, 1998. These species include Ce, Nb, Nd, Pd, Pr, Ru, Sn, Sr, Ac, At, Be, Br, Cf, Cm, Dy, Er, Eu, Fr, Ga, Gd, Ge, Ho, In, La, Li, Pa, Pm, Po, Ra, Rb, Rh, Sb, Sm, Tb, Te, Th, Tl, Tm, Y, and Yb.

2.2.1.6 SBW Radionuclide Decay. Radionuclide concentrations of SBW were decayed from January 2000 to January 2008 based on half-life data. Generation rates of ^{241}Am, ^{242}Cm, ^{231}Th, ^{233}U, ^{234}U, ^{137m}Ba, and ^{90}Y were included in these calculations.

2.2.1.7 UDS Composition. The chemical composition of UDS is based on unpublished calculations of Arlin Olson shown in Table 2.

Table 2. UDS composition.

Component	wt%	Compounds
Al	1.80%	$AlPO_4$
B	2.99%	B_2O_3
Ca	0.91%	CaF_2
Cd	0.16%	$CdCrO_4$
Cr	0.23%	Cr_2O_3
Cu	0.16%	$CuMoO_4$
Fe	2.49%	$FePO_4$-$2H_2O$
Hg	0.59%	$HgCl_2$
K	1.60%	KCl
Li	0.16%	$KNbO_3$
Mg	1.62%	Li_3PO_4
Mn	0.39%	$MgSiO_3$
Mo	1.62%	MnO_2
Na	4.35%	MoO_3
Nb	0.15%	Na_3PO_4
Ni	1.46%	NaCl
Pb	0.16%	NaF
Pd	0.10%	NiO
Rh	0.16%	$PbSO_4$
Ru	1.62%	PdO
Si	4.09%	RhO_2
Sn	0.81%	RuO_2
Ti	0.16%	SiO_2
Zn	0.16%	SnO_2
Zr	13.95%	TiO_2
Cl	2.72%	$Zn_3(PO_4)_2$
F	2.66%	$Zr(SO_4)_2$-$4H_2O$
PO_4	13.45%	ZrO_2
SO_4	14.76%	
H_2O	7.12%	
O	17.41%	
	100.00%	

Data from three sources were used to calculate radionuclide concentrations in UDS:

1. M. C. Swenson, "Historical Tank Farm Sample Results," MCS-27-92, December 17, 1992

2. M. Patterson, *Light Duty Utility Arm Deployment in Tank WM-188*, INEEL/EXT-99-01302, December, 1999

3. Unpublished data from Light Duty Utility Arm samples of WM-182 taken in FY-2000.

Activities for solids in each tank were decayed from their date of analysis to January 1, 2008 and combined into an average based on the relative proportion of UDS in each tank. Concentrations of ^{241}Am, ^{137m}Ba, and ^{90}Y include generation rates from ^{241}Pu, ^{137}Cs, and ^{90}Sr.

2.2.2 SBW Filtration

The material balance assumes 90% removal of UDS. The basis for the UDS removal efficiency is the activity of TRU and other radionuclides in the LAW grout product. At 90% removal efficiency, the TRU activity in the LAW grout is 2.6 nCi/g, and the "sum of the fractions" is 92% of the NRC limit for Class A waste.

The UDS return composition assumes a solids concentration of 20% (in SBW liquid) in the UDS concentrate diluted to 10% by water jet transfer. The UDS return rate is 50 gpm for a period of about 16 minutes every month.

2.2.3 UNEX Feed Adjustment

3.3-molar HF is added to the filtered SBW in a volume ratio of 0.1 HF solution to 1.0 SBW feed to complex zirconium in the SBW.[1] This feed adjustment is not needed if actinides are not removed (Modified UNEX). The density of 5.2- molar HF is 1.04 g/cm^3, as per Table 2-58 of Perry et al (1997).

The 3.3- molar HF solution is made up from a 50% HF solution, equivalent to 30- molar HF, and having a density of 1.198 g/cm^3.

2.2.4 UNEX Separations

The basis for material balance calculations for the UNEX process, including number of extraction, scrub, and strip stages, organic to aqueous ratios, distribution coefficients, and solvent, scrub and strip compositions, is given in J. D. Law, "Update of Flowsheet Assumptions for Treatment of SBW with the UNEX and Modified UNEX Process," March 14, 2000; J. D. Law, "Flowsheet Assumptions for Treatment of SBW with the UNEX Process," JLAW-04-99, October 25, 1999; and J. D. Law, "Flowsheet Assumptions for Treatment of SBW with a Modified UNEX Process (Cs and Sr Removal Only)," JLAW-05-99, November 15, 1999.

The material balance model uses the above input parameters to iteratively calculate stage-by-stage compositions through the UNEX extraction, scrub, and strip sections until a convergence tolerance is satisfied. The convergence tolerance, equal to the maximum fractional change of a composition or rate from one iteration to the next, was set at 10^{-12}.

[1] The UNEX feed fluoride adjustment is specified in J. D. Law, "Update of Flowsheet Assumptions for Treatment of SBW with the UNEX and Modified UNEX Process," March 14, 2000.

The composition of the UNEX solvent and of scrub and strip feed solutions are given in the above letters of Jack Law. The material balance model includes make-up modules for these feed streams. Chemicals to make up the UNEX solvent and strip solutions, including Phenyltrifluoromethyl Sulfone (FS-13), Diphenyl-N,N-dibutylcarbamoyl-methyl phosphine oxide (CMPO), Polyethylene Glycol 400 (PEG-400), chlorinated cobalt dicarbolide (ChCoDiC), guanidine carbonate (GC), and Diethylenetriamine Pentaacetic Acid (DTPA) are assumed available in pure form. Aluminum nitrate for scrub feed was assumed to be procured as a 50 wt% solution of $Al(NO_3)_3$, equivalent to a 59.5% solution of aluminum nitrate nonahydrate (ANN). Make up water and nitric acid for these feeds are supplied by the acid fractionator condensate and bottoms.

The material balance shows a single concentration of UNEX solvent in raffinate and strip effluents, based on a total entrainment and solubility of 1g/liter. Jack Law provides a breakdown of solvent carry-over by component and effluent in "Update of Flowsheet Assumptions for Treatment of SBW with the UNEX and Modified UNEX Process," March 14, 2000, as shown in Table 3 below. The value used in the material balance was approximated from this data.

Table 3. Breakdown of solvent carry-over by component and effluent.

	Raffinate	Strip
PEG-400 solubility, mg/liter	50	250
FS-13 solubility, mg/liter	200	120
ChCoDiC solubility, mg/liter	5	5
CMPO solubility, mg/liter	5	5
Solvent entrainment, mg/liter	700	233
Total, mg/liter	960	613

The solubility of water in the UNEX solvent was assumed in the material balance to be 1 g/liter, based on data provided by Jack Law.

2.2.5 UNEX Strip Processing

The strip effluent from UNEX is concentrated and crystallized in a thin-film dryer or alternative crystallizer. The thin-film dryer would concentrate the strip solutions to a powder with a moisture content of 10 wt %. The RHTC solids were assumed to have a density of 0.58 g/cm^3, based on the loose-fill density of guanadine carbonate.

2.2.6 LAW Evaporation and Acid Recovery

Material balance calculations for the LAW evaporation are based on results from ASPEN PLUS vapor-liquid equilibrium calculations. The equations used in the model are:

$F_{HNO3} = 0.025 *(VRF) - 0.045$	for UNEX with actinide removal
$F_{HNO3} = 0.03765 *(VRF) - 0.052$	for UNEX without actinide removal
$F_{HCl} = (0.072 * (VRF) - 0.148)$	for actinide removal
$F_{HCl} = (0.1094 * (VRF) - 0.1695)$	for no actinide removal
$F_{Hg} = 8.35x\ 10^{-8} * (VRF) - 1.48 \times 10^{-7}$	for both cases

For HF, ASPEN PLUS results show only ~0.005 % of the fluoride in the feed carrying into the overhead. Based on data for the PEWE, the HF carryover was set to 0.5%.

The LAW evaporator concentrates the feed to a total solids content of 600 g/liter. The density of the bottoms is assumed to be 1.35 and of the overhead 1.002.

The INTEC LET&D facility will be used recover nitric acid from the LAW overhead. For the Modified UNEX process, the LET&D facility will recover about 65% of the acid needed (as 100% HNO_3) in the process. 15.9-molar HNO_3 acid, along with recycle water is used to make-up the total process nitric acid requirement for the Modified UNEX process. A small amount of make-up acid will be required in the UNEX process for start-up and initial chemical inventories.

2.2.7 LAW Neutralization and Grouting

Two different grout formulations were used for the two material balance cases based on the anticipated disposal sites for the waste products. For grouts such as would be required for the UNEX actinide removal case, development at the INEEL has shown that SBW can be grouted directly with proper pH adjustment (Herbst et al. 1998). The concentrated LAW from the UNEX process will be very similar in composition to SBW, hence the direct grouting development results (42.5 % waste loading) were used as the basis for grouting parameters. The following grout formulation was used (from Table 12 of Herbst et al. 1998):

For "performance grouts" such as would be required for the UNEX actinide removal case, development at the INEEL has shown that SBW can be grouted directly either with an acidic or a basic formulation (Herbst et al. 1998). However, the basic formulation allows for a higher waste loading (42.5%) than the acidic formulation (30%). The concentrated LAW from the UNEX process will be very similar in composition to SBW, hence the direct grouting development results were used as the basis for grouting parameters. To minimize the grout volume, the following basic grout formulation was used (from Table 12 of Herbst et al. 1998):

- Neutralization with 50% NaOH: to a pH of 12 (0.1457 kg 50% NaOH per kg grout)
- Solid grout additives: 14.0% Ca(OH)2
  8.6% Portland cement
  77.4% Blast furnace slag
- Waste loading 0.425 kg of neutralized liquid per kg of grout

The waste loading equates to a "dry" loading of about 22.4%. The grout density was assumed to be 1.63 kg/liter, as per test results for direct grouting of SBW with the basic formulation (Table 12, Herbst et al. 1998).

For the case of disposal at WIPP, the grout formulation used is based on high-waste grouts developed for the CsIX/TRU Grout process for disposal at WIPP. The formulation used for the Modified UNEX process with no actinide removal is (from Table 6 of Herbst et al. 1999)[2]:

[2] The grout formulation used for the modified UNEX is closest to samples H-32 and H-8, but with slight modifications based on discussions with John McCray. See also J. A. McCray, "Status Report for CsIX and NGLW Demonstration Grout Testing," JAM-03-99, September 30, 1999.

- Weight Fraction Waste 0.70
- CaO 0.16
- Blast Furnace Slag 0.10
- Portland Cement 0.04.

In this case, CaO is added to the waste before the other additives to neutralize it and prevent hydrogen sulfide formation and degradation of the cement clinker. The water content of the resulting grout amounts to 38.5%, and the waste loading of 0.70 kg liquid per kg grouted waste corresponds to a "dry" waste loading of 41.4 wt %.

Test data for grouts developed for the CsIX/TRU Grout process with an 80% loading remain soft after curing, but generally meet the WIPP criteria for no free liquids. CaO needs to be mixed with the waste before addition of the other additives to ensure no free liquid formation.[3] Results from formulations using 70% waste loading were "somewhat hard" and met LDR TCLP limits for Hg, Cr, Cd and Pb.[3]

For both cases, solid grout additives are assumed fed to the grout mix tank by gravity rather than pneumatically, thus the exhaust from the grout mix tank and the entrained solids in this exhaust will be low. The average exhaust flowrate was based on a 2.4 times the grout flowrate, and the solids entrainment fraction was assumed to be 0.001%. The exhaust is filtered by a prefilter and two stages of HEPA filters, with assumed efficiencies of 95%, 99.5%, and 99.5% respectively.

2.3 Equipment Sizing and Selection

2.3.1 SBW Feed Filtration Equipment

Separation of the suspended solids (concentration 3 g/L) in the SBW (stream 115) is necessary for the processing of the waste stream. This separation process is performed by two centrifugal membrane filtration (CMF) systems, which use a high-shear rotary cross-flow process (CFP) to achieve a 95% filtration efficiency of the SBW feed. Each of the two CMF systems will employ two parallel mounted filtration housings, each containing ten 11-in.-diameter disks with each disk having a total permeable surface area of approximately 1 ft^2. Each of the centrifugal housings has the capability of processing 2,500 gal/day of waste during continuous operation. A single centrifugal pump with a variable capacity of up to 10 gpm is used to supply the inlet feed to the CMF housings. The rotation of the CMF filtration discs, located inside the housings, is accomplished by a single 15-hp motor. All the components associated with a single CMF are mounted on a base plate, which is approximately 3-ft wide by 5-ft long, has an overall height of 5 ft, and weights approximately 1,600 lb.

All wetted parts of the CMF are fabricated from stainless steel, with seals commensurate with proven performance for the expected activity levels associated with the inlet stream. Inspection and maintenance of the filter membrane and internal components is accomplished by vertical extraction of the rotor and filtration disks after removal of j-clamp retention bolts holding the rotating assembly to the CMF housing.

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[3] J. A. McCray, "Status Report for CsIX and NGLW Demonstration Grout Testing," JAM-03-99, September 30, 1999

2.3.2 Separation Equipment

Performance of the extraction, scrub, and strip portions of the UNEX process is accomplished through the use of centrifugal contractors. Due to the arrangement of the individual inlet and discharge ports on the separate contactor stages, individual pumps between each stage are not required. Consequently, the entire driving head for fluid transport through the contactor stages may be provided by a single pump on both the inlet and discharge main supply lines.

For the 24 stages (2 scrub, 8 strip, and 14 extraction) required by the UNEX process, centrifugal contactors with an 11-cm diameter rotor are required. The combined assembly, consisting of 24 stages, will require approximately 65 ft^2 of floor space and when mounted on 9-in. centers an overall footprint for the contactor assembly of 3-ft wide and 22-ft long may be achieved. The cost estimate for the complete 24-stage assembly is $900K with any additional stages costing $25K each.

2.3.3 RHTC Processing Equipment

Generation of the remote-handled low-level waste (RH-LLW) or TRU (RHTC) crystallite will be accomplished by a vertically mounted Thin-Film Dryer (TFD). To handle the expected 335-lb/hour feed rate (consisting of 97% water), the TFD will have 22 ft^2 of internal heat transfer area. The TFD operates with 150 psig steam to effect the drying and with cooling water to condense and recover vapor. The heated section of the dryer and the drive mechanism alone have a combination height of 11 ft. An additional 13.2 ft of overhead clearance is required for rotor removal. The TFD would be skid mounted with an accompanying condenser, condensate tank, and condensate transfer pump. Additional information for the TFD is provided in Appendix F.

2.3.4 LLW/CHT Processing Equipment

The LAW Evaporator is a skid mounted, latent heat, steam-heated evaporator capable of evaporating approximately 130 gal/hour on a continuous basis. The skid mount supports the 537 gal evaporation tank, feed and recirculation pumps, off-gas condenser, steam heat condensate collection tank, and all necessary piping and instrumentation and control devices. All PLC controllers and other control instrumentation are remote-mounted for access by operations personnel. The skid which supports the evaporator equipment is 58-in. wide x 127-in. long x 99-in. high with an estimated dry weight of 3,200 lb.

2.3.5 LLW Grouting Equipment

The Modified UNEX grout consistency is closely approximated in both content and viscosity by the grout mixture used in the CsIX/TRU Grout design study. This study will use the equipment configuration and grouting facility layout presented in the CsIX/TRU Grout study. The equipment consists of dry grout ingredient feed systems and a vertical mixer drive system compatible with in-drum lost-paddle mixing of grout in 55-gal drums.

2.3.5.1 Modified UNEX Grouting Facility. Clean 55-gal drums are remotely transported to one of three grout mixing stations, where grout formation is accomplished in the 55-gal drum located inside a containment cell. The lidless drum and grout mixture, which contains the discarded mixing blade, is then remotely transported to a curing room where up to 30% by wt. of the drum contents is lost to the atmosphere. After the grout has cured, the drum and contents are transferred back to the containment box, where the drum lid is installed and the drum external surfaces decontaminated. Upon decontamination, the drum is remotely transferred to the drum storage area attached directly to the grouting facility building. The estimated number of 55-gal drums produced from the entire Modified UNEX run is 29,200 drums based upon an 80% fill of each 55-gal drum. It is expected that since the mixing operation is conducted in-drum and in-cell, only three mixing stations will be required to meet the roughly 49 drums/day of grout output required for the Modified UNEX process.

2.3.5.2 UNEX Grouting Facility. The UNEX grouting facility is essentially the same as the facility proposed for the Modified UNEX process with the exception that open lid curing of the grout mixture is not required. Consequently, the formation of the grout in the 55-gal drums can be performed in-drum, out-of-cell. This requires the individual drums to be mated and decoupled from a grout mixing glovebox. However, it eliminates the required decontamination of the drum externals following the mixing process. Since the mating process of the drum to the grout mixing glovebox is a time consuming process, it is anticipated that at least six individual mixing stations will be necessary to produce the 72 drums/day of grout required by the UNEX process flow rates. It is estimated that the drum storage facility for the entire production of UNEX drums must be capable of handling 44,700 drums based upon an 80% fill of each drum. A typical UNEX grouting glovebox design is presented in Figure 1 below.

Bulk dry material is delivered to the process facility by truck, where a semi-dense phase conveyor system powered by a pneumatic air source is employed to transfer the material to the appropriate bulk storage tank located outside of and next to the grouting facility (drawing P-6). As the grouting process consumes material from the day tanks (T-205-6a, 6b, 6c) which are located near to the grout mixing stations, a separate semi-dense phase conveyor is used to fill them from the bulk storage tanks (T-206-1,2,3).

A gravity feed system is employed to move material from the day storage tanks to the vertical drive auger for injection into the grout mixing drums. The material may be either volume-metered in a batch method, or a load scale, mounted under the vertical auger, may be employed to provide a direct material weight before use in the grouting procedure. The feed rate of material to the auger is controlled by a rotary valve located on the bottom discharge of the dry storage tanks and may be set to achieve the desired feed rate by the operator.

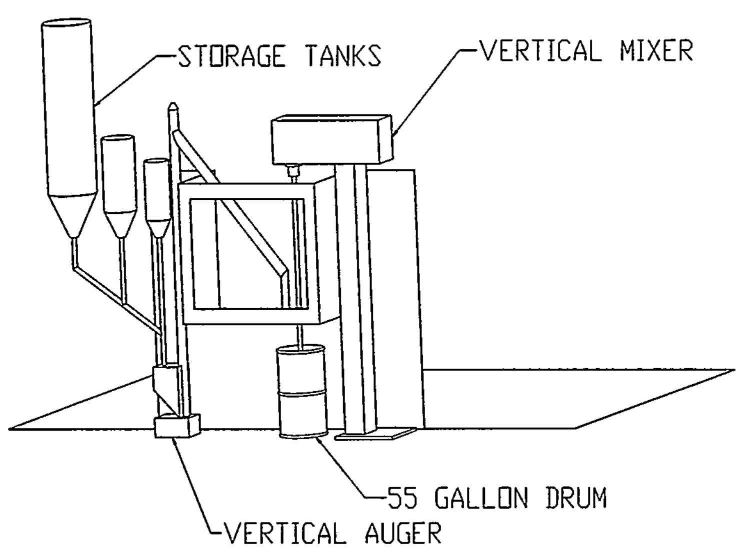


Figure 1. Typical UNEX grouting glovebox design.

2.4 Interim Storage Requirements

Interim storage capacity will be provided for the total life-cycle quantity of waste generated from the UNEX process or the Modified UNEX process. In the case of the UNEX process, storage capacity will be provided for 45,000 55-gal drums of contact-handled low-level waste (CH-LLW) and 360 2 x 10-ft cylinders of remote-handled TRU (RH-TRU). In the case of the Modified UNEX process, storage capacity will be provided for 30,000 55-gal drums of CH-LLW and 250 2 x10-ft cylinders of RH-TRU.

2.5 Surge Capacity Requirements

Surge capacity requirements serve to provide a buffer in decoupling unit operations for the UNEX processes due to normal evolutions that are intermittent in nature or due to system upset conditions. A nominal surge capacity requirement of 24-hours is used to drive the number and sizing of tanks between unit operations. The primary operations, which serve as the basis for identifying surge capacities, are the transfer of SBW from and return of UDS to the tank farms, the shut down and start up of the UNEX contactors, the TFD operations, and the LAW treatment train. The following discusses each of these operations.

The transfer of SBW from the tank farms and the subsequent return of the UDS are intermittent operations and assumed to be performed on a daily basis. To support this operation, one SBW feed tank and two SBW day tanks are provided. The SBW feed tank is sized for 24-hours of operation at the mid-level, which provides flexibility in the steam-jet transfer of SBW from the tank farms to the UNEX process. The SBW feed tank feeds the cross-flow filter stations at a rate of 298 liter/hour. Since the SBW filtration operates with two stations in parallel, each respective SBW day tank is sized for 12-hours of operation. Only one station will be on-line at a time to feed the UNEX process with filtered SBW at 298 liters/hour, while accumulating solids in the on-line tank. Once the on-line tank is depleted, it is taken off-line and the other filter station is placed on-line. The accumulated RHTS in the off-line SBW day tank are pumped back to the tank farm and, subsequently, the day tank is refilled with SBW from the SBW feed tank.

A 24-hour surge capacitance is provided between the cross-flow filtration and the UNEX contactors by three extraction feed tanks. One of the three tanks is always on-line to fill from the SBW filters at a rate of 298 liters/hour, a second is on-line to feed the UNEX contactors at the same flow rate, and a third is off-line for holding and sampling. Each tank is sized for a 25% additional capacitance beyond the 24-hour fill at 298 liters/hour to provide some operating margin and some low-level of fill when placing and taking each of the tanks on and off-line.

A 24-hour surge capacitance is provided between the UNEX strip contactors and the TFD at a rate of 148 liters/hour. Since both the UNEX contactors and the TFD can be shut down relatively quickly (i.e. within an hour) in the case of an upset condition, the UNEX strip effluent tank could be operated at near capacity to allow for a full 24-hour operating buffer. This capacitance is consistent with TFD operations, which could require a relatively rigorous start-up scheme to establish conditions for thin-film drying. Once steady-state conditions are established, perturbations should be minimized.

Surge capacitance is provided between the UNEX contactors and the LAW evaporator by two UNEX raffinate tanks and one LAW evaporator feed tank. Each of the two UNEX raffinate tanks is sized for 12-hours of fill at a rate of 445 liters/hour. One of the two tanks is always on-line to receive raffinate from the UNEX extraction contactors. The other is off-line for holding and sampling. Once sampling is complete and the LAW is accepted, the off-line tank is drained to the LAW evaporator feed tank. Once the on-line UNEX raffinate tank is filled, the other is placed on-line while the former is held for sampling.

The LAW evaporator feed tank is sized for 48 hours of fill at a rate of 593 liters/hour which, when operated at the mid-level, provides a 24 hour capacitance for filling or draining.

Surge capacitance is provided between the LAW evaporator and the grouting stations by three neutralization tanks. Each of these tanks is sized for 12 hours of fill at a rate of 297 liters/hour. These tank sizes take exception to the 24-hour nominal surge capacitance in an effort to keep the tank size down and the solid phase of the neutralized solution in suspension. Also, the smaller tank sizes aid in heat removal for these jacketed tanks. With three neutralization tanks, one is on-line for filling and neutralizing, a second is on-line for filling drums intermittently at the grouting stations, and a third is off-line for holding and sampling.

2.6 Sampling Requirements

The purpose of in-process sampling is to monitor the UNEX process performance and verify that waste form requirements are met. The scope of this discussion is qualitative and limited to the primary sample locations in the UNEX processes, as well as make-up feed streams. The in-process streams include the UNEX feed and raffinate streams, the remote-handled waste forms, the neutralization tanks, and the contact-handled waste forms. The make-up feed streams include the UNEX solvent and the UNEX scrub and strip solutions. The following discusses sampling locations, frequency, and duration for each of these streams.

2.6.1 Sampling Locations, Frequency, and Duration

In both the UNEX and Modified UNEX processes, the SBW is filtered to remove UDS before solvent extraction. Additionally, in the UNEX process the SBW is conditioned with hydrofluoric acid (HF) before introduction to the contactors. Consequently, three extraction feed tanks are provided to accommodate sampling requirements at this point in the process. Two of the three tanks are on-line for filling and draining, and one of the three tanks is off-line for sampling. The tanks are sized for 24-hour capacitance, within which time the sampling of the extraction feed to verify UDS and HF conditioning must be completed. Each of the three tanks is configured with an air sparge for mixing. If UDS concentrations are too high, the extraction feed shall be returned to the SBW feed tank. If the HF concentration in the extraction feed is too low, than additional HF may be added. If it is too high, then each of the tanks is configured for aluminum nitrate addition to bind the excess free fluoride, after which the solution may be fed to the extraction contactors.

Since the principal function of the UNEX process is cesium, strontium, and actinide extraction, the key sampling location is the UNEX raffinate stream. For the UNEX process, the cesium, strontium, and actinide concentrations in the raffinate require monitoring to ensure that the contact-handled waste form will meet LLW criteria. The cesium concentration may be monitored on-line and nonobtrusively; however, a sample is required regardless to analyze for strontium and actinides. To accommodate these needs, two UNEX raffinate tanks are incorporated into the flow diagrams, each with a 12-hour storage capacitance, which is the estimated time necessary to obtain sample results. Thus, one tank will accumulate raffinate from the contactors and the other will be held for storage awaiting sample analysis results. After the waste stream is qualified, the contents of the off-line raffinate storage tank are discharged to the LAW evaporator feed tank. The same sampling approach applies for the Modified UNEX process, with the exception that analysis of actinides will not be required. If sampling and analysis showed that a raffinate stream were off-spec, then the off-spec material would be returned to one of the extraction feed tanks for reprocessing.

The remote-handled waste forms will be sampled on a per-canister or per-lot of canisters basis. The form of the sample would be a grab sample of the crystallite. The purpose of the sample would be to characterize the waste form and verify that waste acceptance criteria (WAC) are met. Of particular concern would be the RH-LLW from the Modified UNEX process, which would additionally need to be characterized for RCRA metal immobilization. The duration to provide sample results could be several days.

In the neutralization tank, the pH of the concentrated UNEX raffinate is adjusted before grouting. This adjustment could possibly be accommodated in a continuous mode of operation by an on-line monitor for pH. However, to provide more operational flexibility and surge capacitance, three neutralization tanks have been incorporated into the flow diagrams. Each tank is configured to maintain the precipitated solids in suspension and to sample before drum filling. Each of the three neutralization tanks is sized with a 12-hour storage capacitance, which is the estimated time necessary to obtain sample results. Two of the three tanks are on-line for receiving/neutralizing concentrated raffinate from the LAW evaporator and filling drums at the grouting stations, while the third tank is held off-line for sampling. After satisfactory sample results are obtained, the off-line tank may supply the grouting stations.

The contact-handled waste forms will be sampled on a per-lot of drums basis. The form of the sample would likely be a core sample of the cured grout. The purpose of the sample would be to characterize the waste form and verify that WAC are met. The duration of the sampling and analysis could be a couple of weeks, which includes a nominal 7-day cure period for grout in addition to waste characterization analyses.

Due to uneven losses of UNEX solvent constituents, (i.e., ChCoDiC, PEG-400, CMPO, and FS-13), the solvent will be sampled periodically to characterize the necessary make-up stream. The make-up will be provided intermittently, as opposed to continuous injection of make-up constituents, based on the solvent sample results. This approach necessitates the ability of the UNEX process to function within a range of specific extractant concentrations. Specific losses of UNEX solvent constituents are described in Section 2.7.1 of this report. Operating ranges for the UNEX solvent constituent concentrations remain to be defined. Once defined and solvent analytical techniques are developed, the necessary sampling periodicity may be identified.

The UNEX scrub and strip make-up streams are prepared daily. The UNEX scrub and strip make-up tanks are sized for a 24-hour delivery at 117 and 148 liters/hour, respectively. The solutions are prepared in these tanks from raw materials and sampled before delivery to the respective feed tanks. The feed tanks are sized at 110% of the make-up tank volume to provide some operating margin in the daily make-up of these streams.

2.7 Make-up Feeds

2.7.1 UNEX Solvent

During the extraction process, losses of UNEX solvent will be incurred. As is shown in the process flow diagrams, UNEX solvent is fed in a countercurrent manner through a series of staged contacts (centrifugal contactors) with the SBW waste feed solution, a wash solution, and a guanadine carbonate strip solution. After contact with the various aqueous solutions, the solvent is recirculated to a surge tank for continuous reuse. During extraction/contact within the centrifugal contactors, some of the solvent itself is transferred into the various aqueous phases. The mechanism for the transfer of solvent is through solubility of the solvent constituents into the various aqueous phases and through entrainment as emulisified entities. The V. G. Khlopin Radium Institute issued a report (Khlopin 1999) describing various aspects of the UNEX solvent system. One task of that report was to quantify the solubility of the solvent constituents with respect to the various process solutions. Values were determined for solvent losses from a solvent consisting of 0.08-molar ChCoDiC, 0.02-molar CMPO, and 0.6 vol% PEG-400.

These components were in a UNEX process diluent consisting of FS-13. The solubility of ChCoDiC and CMPO in the aqueous solutions is negligible. Values for entrainment were determined by assuming a 0.05 vol% based on the use of centrifugal contactors in optimum operating regimes. When considering the mass balance of the process (Barnes 1999), the rate of solvent losses can be determined. Using the solubility values in conjunction with the specified flow rates from the proposed PFDs/mass balance for the UNEX system, solvent losses can be estimated. The solvent losses for the various contactors are presented in Table 4.

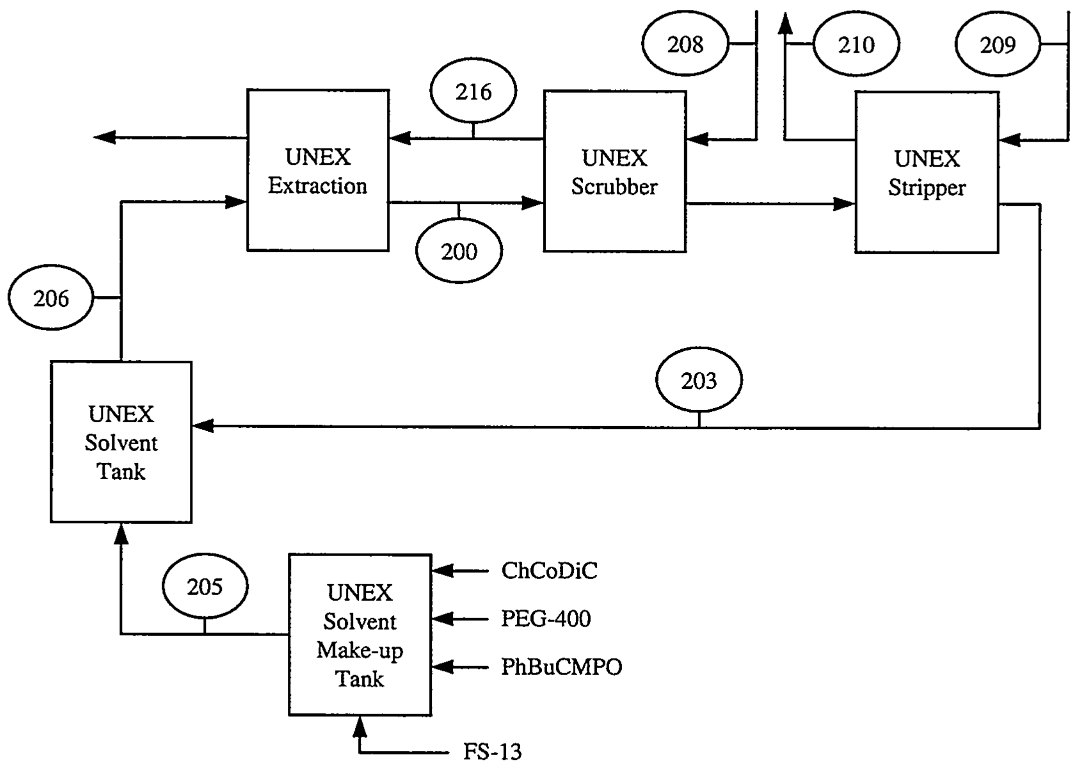
(Note that although the actual treatment of SBW will be performed in a series of tank batches, the mass balance from the PFD, as well as this analysis, is treated as a continuous steady-state process to allow for numerical estimates.)

To correct for these losses to the UNEX solvent, the solvent make-up tank must contain preset constituent concentrations that properly account for these losses. The make-up solution is set at 0.071-molar ChCoDiC, 0.030-molar CMPO, and 10.7 vol% PEG-400. The total inventory of make-up solvent required for 200 days (24 hour/day) of processing is 735 gal. The minimum inventory for the individual constituents of the make-up is 3,163 kg for FS-13, 294 kg for PEG-400, 94 kg for ChCoDiC, and 28 kg for CMPO. This amount of solvent is in addition to the amount that is kept in the surge tank and the amount that is inconstant circulation during processing. Figure 2 provides a block flow diagram that features solvent recirculation and presents the solvent composition by weight percents.

Table 4. Losses of UNEX solvent components with process streams due to entrainment and solubility.

Stream	Entrainment		Solubility		Total	
	Raffinate	Strip prod	Raffinate	Strip prod	Raffinate	Strip prod
FS-13	276 g/hr	276 g/hr	89 g/hr	18 g/hr	365 g/hr	294 g/hr
ChCoDiC	8.3 g/hr	8.3 g/hr	2.2 g/hr	0.74 g/hr	10.5 g/hr	9.0 g/hr
PEG-400	1.1 g/hr	1.1 g/hr	22 g/hr	37 g/hr	23.1 g/hr	38.1 g/hr
CMPO	1.5 g/hr	1.5 g/hr	2.2 g/hr	0.74 g/hr	3.7 g/hr	2.2 g/hr
Total	287 g/hr	287 g/hr	115.4 g/hr	56.5 g/hr	402 g/hr	343 g/hr
Total UNEX solvent loss = 745 g/hr/1290 g/L = 0.58 L/hr						

The mode in which solvent additions are made to the system needs to be determined. Process control aspects, as related to sampling and solvent composition, are briefly addressed in Section 2.6. The individual components will need to be metered to the make-up tank as solutions of FS-13 (diluent) in amounts dictated by on-going solvent analysis. The make-up tank concentrations determined in this section will serve as a starting point. It should be noted that make-up of UNEX solvent losses could also be accomplished by introducing the prescribed quantities of FS-13 and PEG into the aqueous strip feed solution. Such an approach is presently being explored in UNEX process development testing.



Percent Weight Compositions			
	Stream Numbers		
Constituent	203	205	206
FS-13	96	88.4	96
PEG-400	0.492	8.2	0.5
ChCoDiC	3.0	2.63	3.0
Ph2Bu2CMPO	0.5	0.78	0.5

Figure 2. Block flow diagram featuring the UNEX solvent and the make-up feed.

2.8 Secondary Waste Streams

The significant secondary waste streams from the UNEX processes include HEPA filters, Personal Protective Equipment (PPE), and the end-of-life UNEX solvent. The following describes each of these streams, including estimated volumes and disposition options.

2.8.1 HEPA Filters

Ventilation of facilities to support the UNEX process requires HEPA filtration for contamination control. Emission sources to the filtered exhaust include UNEX process tank venting, HAW and LAW evaporator off-gassing, and grouting station operations in addition to general area facility suspect exhaust. Operating experience at the NWCF has identified the required change-out rate of a nominal two HEPA filters per month of operation. A similar usage of HEPA filters for treatment of the SBW in the NWCF or in a Greenfield Facility over a three-year period would result in approximately 10 m^3 of HEPA filter waste. The spent filters would be treated in a HEPA filter leaching process at INTEC, before disposal at WIPP as a TRU waste or Hanford as a LLW.

2.8.2 Personal Protective Equipment

Maintenance of the UNEX process will produce some quantity of PPE. Again, operating experience at the NWCF has shown that approximately 10 m^3 per year of PPE waste is produced. By extension to a 3-year operating lifetime for treatment of the SBW with the UNEX process, an estimated 30 m^3 of waste would be produced. The PPE would be packaged for disposal at WIPP as a CH-TRU waste or Hanford as LLW.

2.8.3 Spent UNEX Solvent

Approximately 400 gal of UNEX solvent will remain at the end of the SBW treatment campaign. The spent solvent will be sufficiently stripped of actinide and radioactive constituents to be classified as CH-LLW. The solvent constituents alone are not hazardous or listed per RCRA. However, since the SBW contains listed materials the spent UNEX solvent will be a listed waste. Treatment of the waste solvent for disposal, at a minimum, would require solidification. This could be accomplished in a UNEX grouting station after treatment of LAW is complete. Specifically, spent solvent could be loaded into drums and mixed with an organo-philic solidifying agent. Such an approach is estimated to produce 100 55-gal drums of solidified solvent waste. The waste would be disposed as a contact-handled listed hazardous waste at Hanford.

3. REGULATORY, PROCESS, AND EQUIPMENT ASSUMPTIONS

This study assumes an immediate decision to proceed with this technology.

3.1 Regulatory Assumptions

The following major regulatory assumptions are used in this feasibility study:

- The wastes resulting from the UNEX or Modified UNEX option will be delisted before final interim storage for shipment to the disposal sites.

- A waste incidental to reprocessing (WIR) ruling will be established and the SBW will not be considered HLW. Consequently, the waste products to be derived from the SBW processing will be considered LLW and TRU waste.

- A determination of equivalent treatment (DET) petition will be approved by EPA for using grouting instead of the LDR specified treatment (i.e., retorting) to stabilize the high mercury waste ($\geq$ 260 mg/kg total mercury) for disposal.

3.2 Process and Equipment Assumptions

For a feasibility study, a number of assumptions are necessary to provide some preliminary definition for an integrated UNEX process. The liquid-liquid extraction portion of the integrated UNEX process is characterized by empirical data from Russian and INTEC operating experience. However, the pre- and post-extraction unit operations lack such process development. Thus, the majority of the process assumptions center around these unproven operations. Many assumptions regarding the UNEX and Modified UNEX processes and equipment have been made throughout this document, particularly in Section 2.2, Mass and Energy Balance. The following is a summary list of the key assumptions in assessing the feasibility of these processes and their respective equipment.

- The projected total volume of SBW to be treated is 4.3 million liters. This total volume is based on existing SBW and estimated NGLW volumes, some of which is expected to be concentrated by the HLLWE. An average waste composition is assumed for this total waste volume, which is based on existing waste characterization data and projected compositions for NGLW. The process flows for the UNEX processes are based on treating the total SBW volume in 3 years at an operating capacity of 200, 24-hour days per year.

- An UDS concentration of 3.1 g/liter is assumed to be present in the SBW as a result of transferring the liquid waste from the tank farms to the UNEX processes. The cross-flow filters are assumed to remove 90% of these solids. In the filtration process, the removed UDS are assumed to concentrate up to 40 wt% in the SBW solution. It is additionally assumed that the accumulated UDS will be able to be pumped back into the tank farm. It is also assumed that the 90% filtration efficiency is sufficient to preclude adverse effects on the liquid-liquid contactor operations from UDS carryover.

- It is assumed that a TFD will be capable of continuously producing an appropriate remote-handled waste form. For either the UNEX or Modified UNEX process, a waste form with no free liquid is required. For mass balance purposes, this is assumed to be $\leq$10 wt% moisture. TFD vendors have identified the need to perform bench-scale drying tests and pilot-scale TFD operations with surrogate GC/DTPA solutions to determine whether application of a TFD is feasible and scalable.

- The current revision of the WIPP WAC (rev. 7, November 1999) does not include WAC for RH-TRU. Therefore, the most recently drafted WAC for RH-TRU (rev. 6, April 1999) is used in this study for comparison to the RHTC waste form from the UNEX process.

- It is assumed that the RHTC waste form will meet gas generation requirements per the WIPP WAC. However, further evaluation and gas generation testing of the RHTC waste form will likely be required to verify compliance with this requirement.

- Although WIPP WAC identify RH-TRU dose rate limits on contact with a canister of up to 1,000 rem/h with pre-approval, the position of this feasibility study has been to limit the RHTC dose rates to <100 rem/h. To this end, it is assumed that a RH-TRU canister specific to the UNEX process may be developed, which provides the appropriate shielding, i.e. approximately 2 cm of steel.

- Since the Modified UNEX process LAW form is comparable to that of the CsIX/TRU Grout process, the respective grouting equipment and drum-handling scheme are referenced for use within this study.

- It is assumed that the RH-LLW and CH-LLW forms would meet Universal Treatment Standard (UTS) for the characteristic and underlying hazardous constituent (UHC) metals, i.e. As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag. However, further testing of these waste forms will be required to verify compliance with these standards.

- The design basis for surge capacitance between unit operations within the UNEX process is nominally 24-hours. Given this basis, it is assumed that all equipment can be shut down or started up within a 24-hour period. In addition, it is assumed that in-process sampling and analyses can be performed within one 12-hour work shift to support continuous operations.

- It is assumed that fissile material contained in the SBW will not precipitate and/or concentrate in any fashion requiring special geometry equipment and/or monitoring systems to prevent a criticality.

- The UNEX and Modified UNEX processes assume that the LET&D facility will be available to process LAW evaporator overheads.

4. PROCESS DESCRIPTION

4.1 SBW Transfer to Facility

The SBW tanks are equipped with transfer lines that were used to transfer the SBW to the calciner. These lines will be used to access the SBW during UNEX processing. For the purpose of this feasibility study, it is assumed that transfer of the SBW from the tank farm will be performed using the steam jet transfer equipment already present at the SBW tank farm.

4.1.1 NWCF Transfers

The SBW will be transferred from the tank farm to the NWCF in the same way it is currently handled.

4.1.2 GFF Transfers

This system will be used to drive the SBW through new, belowgrade lines to the GFF and directly into the SBW feed tank (T-201-1). Any residual SBW in the transfer lines following transfer operations may either be gravity drained back to the tank farm valve box for disposition or flushed through the system to the SBW feed tank using the tank farm steam supply.

4.1.3 Retrieval

The SBW tanks are equipped with steam jets and valve boxes. This equipment will be used in the retrieval of SBW from the tanks.

4.1.4 Transport

Liquid transfers at INTEC are accomplished almost exclusively using steam jet pumps. These pumps operate by injecting plant steam from a nozzle through a venturi creating a pressure gradient that draws liquid into the stream and propels it down the line. Steam jet pumps are desirable for remote operations because they have no moving parts. Also, unlike air jet pumps that require a downstream separator that creates a secondary waste stream, the steam simply condenses in the liquid stream. Steam condensation generally results in about a 3 – 5% dilution of the liquid stream, as well as some heating of the liquid. For the liquids involved in this process, slight dilution and some heating are generally not a concern.

4.2 SBW Feed Filtration

4.2.1 SBW Primary Filter

The SBW stream is delivered to the SBW feed tank located next to the CMF support stand. The SBW is then transferred to one of two frame-mounted SBW feed tanks. The frame-mounted CMF feed pump draws suction from its dedicated SBW feed tank and delivers the SBW to the two CMF housings, at a flow rate of 10 gpm. Inside the housings the SBW comes in contact with the rotating variable speed disks, which have a permeable membrane filter located on their outer surface. As the SBW flows across the discs the solids are collected on the membrane surface where through the combined action of the SBW flow and centrifugal action generated by the rotating discs, a shearing action is imparted to the collected solids. This action minimizes the formation of a secondary boundary layer on the membrane thereby resulting in permeation of material at and below the membrane cutoff size. Once the concentrated solids have been removed from the rotating discs they are swept into the SBW flow stream and carried out of the CMF housing back to the SBW feed tank. The filtered stream, or permeate, is routed through the spinning shaft which supports the filter discs and is transferred to the extraction feed tank (stream 120). The CMF may be adjusted to provide a concentrated stream outlet to the SBW feed tank that has a concentration of up to 40% solids. After the desired solids concentration is reached in the SBW feed tank, the slurry is transferred back to the tank farm through the use of a progressive cavity pump located next to the CMF frame.

4.3 UNEX Feed Adjustment

4.3.1 HF Make-Up

HF make-up to the process will be accomplished through the HF make-up feed tank. HF acts as a zirconium complexing agent in the SBW feed and UNEX scrub. HF is needed in the process to keep Zr from being extracted in the process. The extraction of Zr inhibits the extraction of TRU elements, so it is beneficial to minimize the amount of Zr extracted.

The HF feed system must be constructed with materials compatible with HF due to the corrosive nature of HF. One material to be considered is Hasteloy.

4.4 Separation Process

Liquid-liquid contactors operate upon similar principals regardless of the manufacturer of the device. The proposed contactors for the UNEX process are electric-motor-driven centrifugal, single-stage devices that function as both contactor and separator (Figure 3). The proposed contactors have an upright design with their electrical drive motor mounted on top. The contactors' vertically mounted rotor imparts a pumping action to the fluids being processed thereby enabling the contactor to have a limited self feed capability. This means that utilization of a high-pressure feed pump or individual pumps located between each stage is unnecessary.

The method of operation of the contactors is very basic. Two immiscible fluids of different densities are fed to the contactor inlets and are rapidly mixed in the annular space between the spinning rotor and stationary housing. The mixed phases are directed toward the center of the rotor bottom by radial vanes (or other means) at the base of the housing. As the liquids enter the central opening of the rotor they are accelerated toward the rotor wall. Once there, the mixed phases are rapidly accelerated to rotor speed and separation begins as the liquids are displaced upward by continued pumping. At this point, the centrifugal separation efficiency may be affected by varying the centrifugal velocity of the contactor rotor or by adjusting the residence time of the liquids in the contactor by changing the volumetric flow rate of the inlet liquid streams. Separation of the higher-density liquid from the lower-density liquid is accomplished by selecting the proper sized weir, which directs the layered fluids to the individual outlet collection rings and ports. It is important to maintain equilibration of pressure between the centrifugal housing, discharge pipes, and receiver tanks (if used) to insure proper separation efficiency of the individual stages of the liquid-liquid contactors.

Operating ANL Centrifugal Contactor

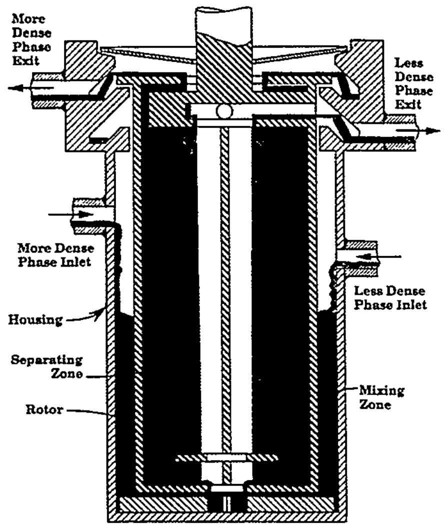


Figure 3. ANL Centrifugal Contactor.

4.4.1 UNEX Process

In the UNEX process, both Cs/Sr and actinide elements are extracted by the process solvent. The universal solvent used in the UNEX process consists of FS-13 diluent with ChCoDiC (Cs extraction), PEG-400 (Sr extraction), and CMPO (actinide extraction).

Initially, the SBW comes in contact with the universal solvent and the Cs/Sr and actinides are extracted in the first 14 contactors. Once the Cs/Sr and actinides are removed, the raffinate is directed to the LAW evaporator for further processing.

The solvent, rich in actinides and Cs/Sr, is then directed into the scrub contactors where Zr and Fe are scrubbed from the solvent by a solution of 0.3-molar HF, 0.05-molar $Al(NO_3)_3$, and 0.1-molar HNO_3. After passing through the scrub contactors, the solvent is passed through the strip contactors where the Cs/Sr and actinides are stripped from the solvent using a GC/DTPA solution. Once the solvent has been stripped of Cs/Sr and actinides, the solvent is fed back to the UNEX Solvent Feed Tank where it is recycled back into the process. The strip solution, rich in Cs/Sr and actinides, is then directed to the HAW evaporator for further treatment.

4.4.2 Modified UNEX Process

The Modified UNEX process is virtually the same except that the actinides are not extracted from the SBW. All other portions of the process are the same as presented in Section 4.4.1 above. Actinides are left with the raffinate by leaving out the CMPO in the extraction solvent.

4.5 RHTC Processing

4.5.1 RHTC Evaporation and Crystallization

The objective in processing the UNEX strip is twofold – to consolidate the waste volume and to provide a waste form that contains no free liquid. An additional objective for the final remote-handled waste form from the Modified UNEX strip is immobilization of RCRA metals. These objectives can be accomplished for either the UNEX or Modified UNEX process by a Thin-Film Dryer (TFD), a schematic of which is shown in the Figure 4. The feed inlet stream is presented near the top of the heated section of the TFD through a standard piping connection. The feed is composed of roughly 97 wt% water and 3 wt% solids, the majority of which is GC. As the feed inlet stream flows down through the TFD, rotating blades spread, agitate, and move the feed down and off the heated shell allowing a very short residence time of feed on the heated shell. The resulting vapor driven off during the heating process flows countercurrent to the feed and condenses in a condenser external to the TFD. Any droplets which are entrained with the vapors are thrown back to the heated shell by the centrifugal force imparted by the rotating action of the TFD. After the vapors condense, the resulting distillate is directed to the LAW stream. Noncondensable gases are discharged to a filtered exhaust system. The remaining bottoms flow out of the TFD by gravity and mechanical force and are collected for disposal. Condensate resulting from the steam heating process of the TFD is directed back to the condensate collection system through a float or thermally actuated condensate flow-control valve utilizing the driving head provided by the incoming heating steam. The TFD concentrates the solids to a 10 wt% residual moisture content.

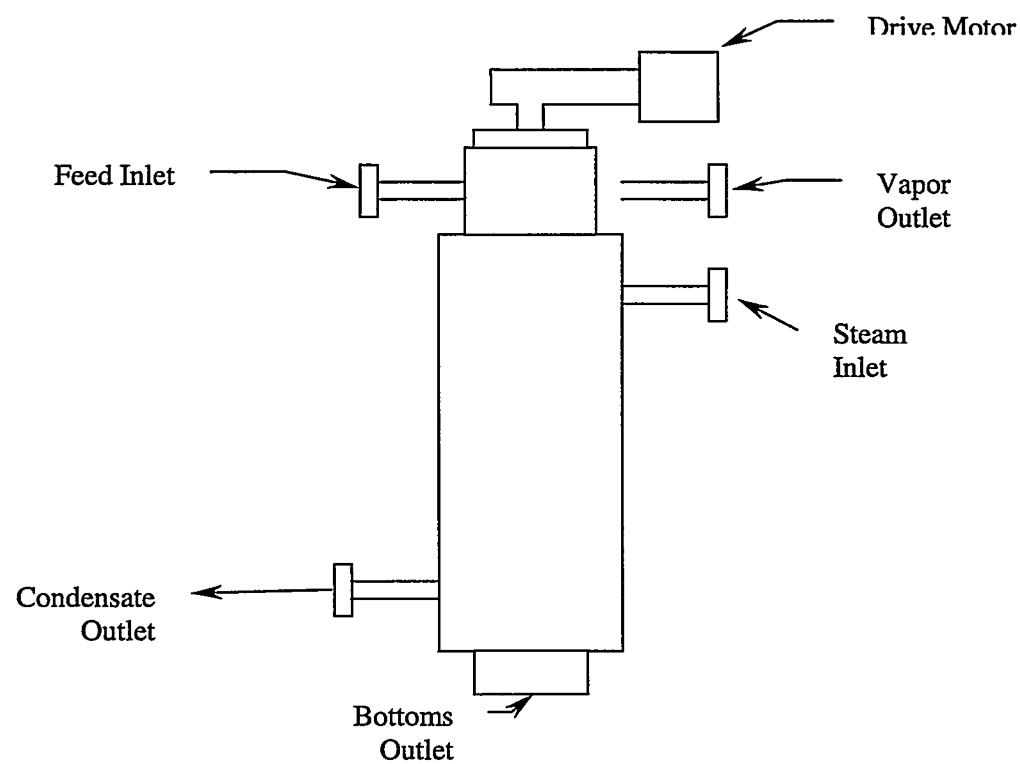


Figure 4. Schematic of Thin-Film Dryer.

4.5.2 RHTC Stream Characteristics

4.5.2.1 Physical. For the UNEX and Modified UNEX processes, the physical forms of the remote-handled crystallite waste streams are essentially identical. In each case, a guanidine carbonate solution, containing the respective extracted constituents, is evaporated to dryness in a TFD. The end form is a loose-fill crystallite, which can be loaded directly into an appropriate waste container. For a common planning basis between the UNEX and Modified UNEX processes, the crystallite waste form is assumed to be loaded into a 2-ft diameter x 10-ft RH-TRU canister. The estimated loose-fill density of the crystallite is 0.58 g/cc. "Dryness" of the waste form refers to no free liquid. It is estimated that the RHTC waste form will contain up to 10% residual moisture, which would be in a hydrated crystalline form or as surface wetting, but not as a free-standing liquid.

4.5.2.2 Chemical. For the UNEX and Modified UNEX processes, the remote-handled crystallite waste streams are chemically similar, although minor constituent concentrations differ, i.e., The UNEX process strip solution contains DTPA in addition to the guanidine carbonate. By taking a 0.25-molar solution of guanidine carbonate to dryness, the remote-handled crystallite waste form is roughly 90 wt% solids and 10 wt% moisture. Minor constituents include calcium, sodium, and potassium, each of which is <3 wt%. In the UNEX process, nearly half of the zirconium is extracted and deposited in the RHTC waste form. The extraction of RCRA metal constituents relative to the filtered SBW is listed in Table 5 below.

Table 5. Distribution of RCRA metals in remote-handled waste forms.

Constituent	Filtered SBW	RHTC		RHLLW		RCRA	
(RCRA waste code)	mg/l	% Extracted	mg/kg	% Extracted	mg/kg	TC (mg/l)	UTS (mg/l)
As	4.27	<0.1	4.59E-4	<0.1	7.85E-4	5.0	5.0
Ba	8.98	73.3	50.5	75.0	50.6	100.0	21
Cd (D006)	591	<0.1	0.0636	<0.1	0.109	1.0	0.11
Cr (D007)	276	<0.1	0.0296	<0.1	0.0507	5.0	0.60
Pb (D008)	224	76.0	1300	77.7	1300	5.0	0.75
Hg (D009)	578	0.3	12.0	0.3	12.1	0.2	0.025
Ni	153	<0.1	0.0165	<0.1	0.0282	NA	11.0
Se (D010)	1.20	<0.1	1.29E-4	<0.1	2.21E-4	1.0	5.7
Ag	3.45	<0.1	3.71E-4	<0.1	6.35E-4	5.0	0.14

The UNEX and Modified UNEX processes extract barium and lead into the remote-handled waste forms. A minor portion of mercury also carries over into the remote-handled wastes in sufficient concentrations to be of possible concern for RCRA treatment. The RCRA metals are acceptable in the RHTC waste form, in accordance with the WIPP WAC. However, the levels of lead and mercury concentrations in the RHLLW are sufficient to warrant TCLP testing to verify metal immobilization for Subtitle C land disposal.

4.5.2.3 Radiological. The UNEX and Modified UNEX processes differ by the extraction of radionuclides. In the UNEX process, over 99% of the cesium, strontium, and the actinides are extracted into a RHTC form. The Modified UNEX process likewise extracts over 99% of the cesium and strontium, but allows the actinides to remain with the raffinate. Thus, the Modified UNEX process produces an RH-LLW. Given a slight potential for disposal of the RH-LLW at a commercial, non-DOE facility, the radiological classifications of the remote-handled waste forms per NRC guidelines (10 CFR 61.65) are identified in Table 6. The SBW (as is) and the RHTC waste classifications are presented alongside the RH-LLW in Table 6 for comparison purposes only.

By extracting the cesium, strontium, and actinides and subsequently consolidating the waste stream, the UNEX process yields an RH-TRU waste with actinide concentrations increased more than an order of magnitude over the original SBW. The RH-LLW form from the Modified UNEX process would be Class C due to the concentration of Cs-137 and Sr-90 specific activities.

Applicable radiological properties of the RHTC waste in the form of a loose-filled 2 x 10-ft column are shown in Table 7 along with anticipated WIPP WAC. The current revision of the WIPP WAC (rev. 7, November 1999) does not include those for RH-TRU. Those shown in the subject table are taken from the most recent draft revision (rev. 6, April 1999).

Table 6. Radiological classification of remote-handled waste forms.

NRC Waste Classification (10 CFR 61.65)					SBW (as is)	UNEX	Mod. UNEX
		Concentrations			SBW	RHTC	RH-LLW
Constituents of Concern		Class A	Class B	Class C	(filtered)		
		Long-Lived Radionuclides					
C-14	Ci/m^3	0.8	N/A	8	NL	NL	NL
Tc-99	Ci/m^3	0.3	N/A	3	0.0176	0.00238	0.00342
I-129	Ci/m^3	0.008	N/A	0.08	4.36E-04	9.22E-8	2.26E-07
Alpha emitting,>5-yr half-life							
Am-241					65	2,230	0.0765
Am-243					0.0268	0.922	3.16E-05
Cm-244					1.73	59.6	0.00204
Np-237					2.89	90.3	0.00309
Pu-238					458	15,600	0.535
Pu-239					57.7	1,960	0.0672
Pu-240					13.3	451	0.0155
Pu-242					0.0159	0.543	1.86E-05
Total alpha	nCi/g	10	N/A	100	599	20,400	0.699
Pu-241	nCi/g	350	N/A	3,500	277	9,400	0.322
Cm-242	nCi/g	2,000	N/A	20,000	0.0238	0.818	2.80E-05
Sum of Class A fractions					61	2,070	0.0823
Sum of Class C fractions					6.1	207	0.00823
		Short-Lived Radionuclides					
<5-yr half-life:							
Cm-242					3.14E-05	4.74E-4	1.62E-08
Ce-144					1.23E-05	1.86E-4	6.38E-09
Cs-134					0.0164	0.248	0.354
Eu-155					0.0714	1.08	3.69E-05
Pm-147					0.0746	1.58E-5	3.86E-05
Pr-144					NL	NL	NL
Ru-106					4.92E-05	1.04E-8	2.55E-08
Sb-125					0.00603	1.27E-6	3.07E-06
total <5-yr	Ci/m^3	700	N/A	N/A	0.169	1.33	0.354
H-3	Ci/m^3	40	N/A	N/A	0.0356	7.54E-6	1.84E-05
Co-60	Ci/m^3	700	N/A	N/A	0.0237	5.03E-6	1.23E-05
Ni-63	Ci/m^3	3.5	70	700	0.0479	1.02E-5	2.48E-05
Sr-90	Ci/m^3	0.04	150	7,000	38.3	579	829
Cs-137	Ci/m^3	1	44	4,600	41.7	632	899
Sum of Class A fractions					999	15,107	21,600
Sum of Class B fractions					1.20	18.2	26.0
Sum of Class C fractions					0.0146	0.220	0.314
Waste Form Classification					N/A	N/A	C

Table 7. Comparison of RHTC waste form with WIPP WAC.

Criteria	WIPP WAC	RHTC Estimations
Pu-239 Fissile Gram Equivalent	<325 g/canister	178 g/canister
Pu-239 Equivalent Activity	≤1,000 PE-Ci/canister	9.8 PE-Ci/canister
Contact Dose Rate	≤1,000 rem/h per canister (pre-approval required if >100 rem/h per canister)	343 rem/h (unshielded); 100 rem/h (2 cm of steel shielding)
	≤270 mrem/h neutron dose rate per canister	Requires Further Analysis
Thermal Power	≤300 W per canister	5.1 W
TRU alpha activity	>100 nCi/g of water matrix	20,400 nCi/g
	≤23 Ci/L of waste matrix	<0.1 Ci/L

Radiological estimations for the RHTC waste form comply with the most recently drafted WIPP WAC for RH-TRU. One criterion, which does not presently apply to RH-TRU but could require further investigation, is gas generation. The RHTC is largely composed of guanidine carbonate, which is a hydrogenous material, i.e., $C_3H_{12}N_6O_3$, and 10 wt% moisture. Whether such a waste matrix in combination with the specific alpha activity poses a gas generation concern needs to be determined to qualify this matrix as a viable waste form that is transportable to WIPP. A brief evaluation performed by IT Corporation concludes that gas generation may be an issue. The IT Corporation evaluation is included in Appendix J.

4.5.3 RHTC Form

For planning purposes, the remote-handled waste from both the UNEX and Modified UNEX processes is loaded into a RH-TRU canister in the form of a 2 ft. diameter by 10 ft. long column of loose-fill crystallite. At an estimated density of 0.58 g/cc, the fill weight of a waste canister is 464 kg or 1,020 lb.

4.5.4 RHTC Quantity

Both the UNEX and Modified UNEX processes are estimated to produce 166,000 kg and 115,000 kg of RHTC waste, respectively. By assuming a nominal usable volume of 800 liters per canister, a total of 250–360 RH-TRU canisters is estimated to be produced from these processes.

4.6 LLW/CH-TRU Waste Form (CHT)Processing

4.6.1 LLW/CHT Evaporation

The LAW Evaporator is a steam-heated, latent heat evaporator capable of meeting the evaporation requirements associated with inlet feed stream number 401. The evaporator is mounted on a skid which supports all the components, control devices, and piping necessary for both continuous and batch style evaporating operations. The evaporator feed pump (P-204-1) takes suction from the evaporator feed tank (T-204-1) and supplies sufficient volume flow to the 537 gal evaporator storage tank to make up for tank volume reduction due to the evaporative process or due to bleed off of concentrate to the UNEX neutralization tank. Steam, supplied at 30 psig, provides the energy necessary for the evaporation process to occur. As the latent heat of vaporization is remove the resulting condensate is collected in a skid-mounted condensate collection tank where it is ultimately forced back to the condensate collection system through a level control valve in the collection tank. A pump takes suction on the evaporation tank and provides agitation of the tank by continuous recirculation, thereby helping to keep accumulated solids in suspension. The evaporator can be operated in two different modes: (1) The batch mode, where the evaporative process continues until the desired concentration level is reached in the evaporation tank, at which time the entire tank volume is sent to the neutralization tank; or (2) in the continuous mode, where a continuous bleed from the discharge of the recirculation pump is directed to the neutralization tank while holding a constant concentrate level in the evaporation tank. Both modes of operation require a continuous feed to the evaporation tank to make up for decreasing tank volume. Condensable gases released during the evaporative process are condensed and collected in the LET&D feed tank (T-204-3) while noncondensables are scavenged off of the tank through the building HVAC system. Any condensate in the LET&D feed tank is directed to the LET&D system for processing.

Since the radiological exposure levels associated with the evaporator and its associated support tanks and equipment do not warrant installation in a shielded cell, it has been decided to locate these components in the grouting building in a separate radiologically controlled access room. This allows the evaporator to be near to the grouting process, eases maintenance accessibility, and minimizes main hot cell square footage.

4.6.2 LLW/CHT Acid Fractionation

Existing facilities for liquid process waste treatment/recycle at the INTEC consist of two systems: the Process Equipment Waste Evaporator (PEWE) system, and the LET&D system. The PEW system consists essentially of an evaporator (actually a pair of evaporators) that concentrates liquid process waste. Overheads from the PEWE are sent to LET&D, which is essentially an acid fractionator. The LET&D system concentrates the PEWE overheads by fractional distillation, up to an acid concentration of 10 to 15 molar. There is a partial condenser at the top of the distillation column that provides reflux for the system, but otherwise LET&D overheads are sent to the main stack for discharge. LET&D bottoms are recycled back to the UNEX process.

At this point in the design process for UNEX, it is not clear whether or not the PEWE system will be available to process liquid effluent from the separations process. The scope of the current design study does not include resolution of this question. Therefore, for the current design study it is assumed that the UNEX plant will include its own evaporator to perform the function of the PEW evaporator(s). Overheads from the UNEX evaporator would then tie into LET&D system. Since UNEX requires make-up acid at 5 molar concentration, it is also assumed that LET&D would not be operated to fully concentrate the acid to 10 to 15-molar, but that bottoms would be recycled back to UNEX at the desired 5M concentration. Otherwise, LET&D would be operated as it is now.

4.7 LLW/CHT Neutralization and Grouting

4.7.1 Feed Stream and Neutralization Process

The objective in processing the UNEX and Modified UNEX raffinate streams after volume consolidation (through evaporation) is to solidify the aqueous stream such that no free liquid remains. An additional objective for the UNEX process is to immobilize RCRA metals. These objectives are accomplished by adjusting the pH of the raffinate streams and subsequently solidifying the waste with a grout mixture. In the UNEX process, sodium hydroxide is mixed with the LAW concentrate and LET&D bottoms in a jacketed neutralization tank to nominally adjust the pH to 12. This puts the waste material into a form, which can be grouted into a hard setting matrix. The combination of a strong base with an acidic solution in the neutralization tank will generate heat and precipitate solids. The energy liberated from the neutralization process will be removed by the cooling jacket, which directs cooling water around the tank. The neutralization tank will employ a continuous, pump driven, recirculation system to maintain tank homogeneity and once sampled and accepted will discharge to the mixing station for incorporation into the grouting mixture.

The grouting process is slightly different for the Modified UNEX process, which produces a CH-TRU waste form destined for WIPP. WIPP WAC allow for RCRA metals and do not require a hard-setting grout. Consequently, a higher waste loading can be achieved by changing the pH adjustment and grouting mixture requirements. For the Modified UNEX process, the raffinate waste stream pH is nominally adjusted to 2-3 with calcium oxide. Also, the grouting mixture is changed to incorporate calcium oxide in place of calcium hydroxide. Since the Modified UNEX grout is similar to that of the CsIX/TRU Grout process, The CsIX/TRU Grout grouting process and equipment are referenced for application to the Modified UNEX process.

4.7.2 Grout Characteristics

4.7.2.1 Physical. The difference in treatment requirements between the UNEX and Modified UNEX processes and consequent changes in pH adjustment and the grouting mixture result in different waste loadings and physical forms. The UNEX process produces a hard-setting grout with a waste loading of 49 wt% and an estimated density of 1.63 g/cc. The structural strength requirement for this CH-LLW form is driven by anticipated WAC to be set for Subtitle C waste disposal at Hanford. The CH-TRU waste from the Modified UNEX process is more of a stiff putty consistency than a hard-setting concrete. The waste loading, however, is higher at 70 wt% with an estimated density of 1.40 g/cc.

4.7.2.2 Chemical. For the UNEX process, the hard-setting grout is largely composed of blast furnace slag (40 wt%), water (26 wt%), calcium hydroxide (7 wt%), Portland Cement (4 wt%), and nitrate compounds – predominantly sodium nitrate. For the Modified UNEX process, the grout is largely composed of water (39 wt%), calcium oxide (16 wt%), blast furnace slag (10 wt%), Portland Cement (4 wt%), and nitrate compounds – predominantly sodium nitrate. The concentrations of RCRA metals relative to the filtered SBW are listed in Table 8.

Table 8. Distribution of RCRA metals in contact-handled waste forms.

Constituent (RCRA waste code)	Filtered SBW mg/l	CH-LLW % Retained	CH-LLW mg/kg	CH-TRU % Retained	CH-TRU mg/kg	RCRA TC (mg/l)	RCRA UTS (mg/l)
As	4.27	>99.9	1.51	>99.9	2.70	5.0	5.0
Ba	8.98	26.7	0.85	26.6	1.51	100.0	21
Cd (D006)	591	>99.9	210	>99.9	375	1.0	0.11
Cr (D007)	276	>99.9	98	>99.9	175	5.0	0.60
Pb (D008)	224	24.0	19.2	23.9	34.1	5.0	0.75
Hg (D009)	578	99.7	205	99.7	366	0.2	0.025
Ni	153	>99.9	56	>99.9	100	NA	11.0
Se (D010)	1.20	>99.9	0.425	>99.9	0.76	1.0	5.7
Ag	3.45	>99.9	1.22	>99.9	2.19	5.0	0.14

The UNEX and Modified UNEX processes extract barium and lead into the remote-handled waste forms. A minor portion of mercury is also estimated to carry over into the remote-handled wastes. Thus, the remaining RCRA metals accumulate in the contact-handled waste forms. The RCRA metals are acceptable in the CH-TRU waste form, in accordance with the WIPP WAC. Significant leaching of RCRA metals is not expected from the performance grout, however, the levels of total cadmium, chromium, lead, and mercury concentrations in the CH-LLW are sufficient to warrant TCLP testing to verify metal immobilization for Subtitle C land disposal.

4.7.2.3 Radiological. The UNEX and Modified UNEX processes differ by the extraction of radionuclides. In the UNEX process, over 99% of the cesium, strontium, and the actinides are extracted into a RHTC form. The Modified UNEX process likewise extracts over 99% of the cesium and strontium, but allows the actinides to remain with the raffinate. Thus, the UNEX process produces a CH-LLW and the Modified UNEX a CH-TRU waste. Given a slight potential for disposal of the CH-LLW at a commercial, non-DOE facility, the radiological classifications of the contact-handled waste forms per NRC guidelines (10 CFR 61.65) are identified in Table 9. The SBW (as is) and the CH-TRU waste classifications are presented alongside the CH-LLW in Table 9 for comparison purposes only.

Table 9. Radiological classification of contact-handled waste forms.

NRC Waste Classification (10 CFR 61.65)					SBW (as is)	UNEX	Mod. UNEX
		Concentrations			SBW		
Constituents of Concern		Class A	Class B	Class C	(filtered)	CH-LLW	CH-TRU
			Long-Lived Radionuclides				
C-14	Ci/m3	0.8	N/A	8	NL	NL	NL
Tc-99	Ci/m3	0.3	N/A	3	0.0176	0.0101	0.0154
I-129	Ci/m3	0.008	N/A	0.08	4.36E-04	4.24E-04	6.47E-04
Alpha emitting, >5-yr half-life:							
Am-241					65	1.24E-05	54.1
Am-243					0.0268	2.78E-09	0.0223
Cm-244					1.73	2.45E-12	1.44
Np-237					2.89	0.126	2.41
Pu-238					458	2.15	382
Pu-239					57.7	0.248	48
Pu-240					13.3	0.0795	11.1
Pu-242					0.0159	6.30E-05	0.0132
Total alpha	nCi/g	10	N/A	100	599	2.60	499
Pu-241	nCi/g	350	N/A	3,500	277	1.62	230
Cm-242	nCi/g	2,000	N/A	20,000	0.0238	3.36E-14	0.0198
Sum of Class A fractions					61	0.3470	51
Sum of Class C fractions					6.1	0.0347	5.1
			Short-Lived Radionuclides				
<5-year half-life:							
Cm-242					3.14E-05	5.48E-17	2.77E-05
Ce-144					1.23E-05	2.14E-12	1.09E-05
Cs-134					0.0164	5.17E-06	2.41E-05
Eu-155					0.0714	3.63E-05	0.0630
Pm-147					0.0746	0.0430	0.0658
Pr-144					NL	NL	NL
Ru-106					4.92E-05	2.84E-05	4.34E-05
Sb-125					0.00603	0.00349	0.00532
total <5-yr	Ci/m3	700	N/A	N/A	0.169	0.047	0.134
H-3	Ci/m3	40	N/A	N/A	0.0356	0.0205	0.0314
Co-60	Ci/m3	700	N/A	N/A	0.0237	0.0137	0.0210
Ni-63	Ci/m3	3.5	70	700	0.0479	0.0277	0.0423
Sr-90	Ci/m3	0.04	150	7,000	38.3	0.0215	0.0326
Cs-137	Ci/m3	1	44	4,600	41.7	0.0302	0.0871
Sum of Class A fractions					999	0.576	0.915
Sum of Class B fractions					1.20	0.00123	0.00280
Sum of Class C fractions					0.0146	4.92E-05	8.40E-05
NRC Classification					N/A	A	N/A

By extracting the cesium, strontium and actinides into the RHTC waste form the UNEX process produces a CH-LLW form that would be Class A. In the absence of actinide extraction, the Modified UNEX process produces a CH-TRU waste form with a similar concentration of long-lived radionuclides as the original SBW.

Applicable radiological properties of the CH-TRU waste in the form of a grout-filled 55-gal drum are shown in Table 10 along with WIPP WAC (rev. 7, November 1999).

Table 10. Comparison of CH-TRUcWaste Form with WIPP WAC.

Criteria	WIPP WAC	CH-TRU Estimations
Pu-239 Fissile Gram Equivalent	≤200 g/55-gal drum	2.7 g/55-gal drum
Pu-239 Equivalent Activity	≤80 PE-Ci/55-gal drum	0.152 PE-Ci/Drum
Contact Dose Rate	≤200 mrem/h on contact; ≤10 mrem/hr at 2 m	144 mrem/hr
Thermal Power	≤40 W per TRUPACT-II (14 Drum Capacity)	5.7 E-3 W/Drum
TRU alpha activity	>100 nCi/g of waste matrix	499 nCi/g

Radiological estimations for the Modified UNEX process contact-handled waste form comply with the current revision of the WIPP WAC for CH-TRU. One criterion, which applies to CH-TRU and would require further investigation, is gas generation. The CH-TRU waste form is composed of roughly 39 wt% water. Whether such a waste matrix in combination with the specific alpha activity poses a gas generation concern needs to be determined to qualify this matrix as a viable waste form.

4.7.3 LLW/CH-TRU Form

For planning purposes, the remote-handled waste for both the UNEX and Modified UNEX processes is loaded into 55-gal drums. 55-gal drums are one of relatively few accepted waste containers at WIPP. A larger waste container could be considered for the CH-LLW, if such were acceptable in a Subtitle C landfill at Hanford. A larger waste container could reduce the number of grouting stations necessary to process an equivalent of three 55-gal drums per hour. Based on a 44-gal loading within a 55-gal drum and an estimated density of 1.63 g/cc, the fill weight of a UNEX process CH-LLW waste container is 271 kg or 598 lb. Likewise for the Modified UNEX process with an estimated density of 1.40 g/cc, the fill weight of a CH-TRU waste container is 233 kg or 514 lb.

4.7.4 LLW/CH-TRU Quantity

The UNEX process is estimated to produce 12,100 metric tons of CH LLW, which translates into approximately 7440 m^3 or 44,700 55-gal drums. The Modified UNEX process is estimated to produce 6,810 metric tons of CH-TRU, which translates into approximately 4870 m^3 or 29,200 55-gal drums.

5. FACILITY DESCRIPTION

Four different facility layout scenarios were examined for the two UNEX processes. Two of the scenarios, Greenfield Facility (GFF) for UNEX and Modified UNEX, require the construction of a new building to house both processes. The other two scenarios, New Waste Calcining Facility (NWCF) for UNEX and Modified UNEX, requires the construction of two new buildings, one for the grouting process associated with the Low Activity Waste portion of both processes and one for High Activity Waste processing. Both NWCF scenarios place the bulk of the remaining radiological processes in the NWCF. Since the process variations between the UNEX and Modified UNEX scenarios are slight in regards to the facility layout requirements, differences which arose during the evaluation of the GFF and NWCF scenarios are detailed only where they are pertinent. See Appendix D for facility layout drawings.

Major assumptions made during the generation of the GFF and NWCF scenarios are as follows:

- Main containment cell height is based upon the ability to lift and move the major process components over the tallest piece of equipment.
- Maintenance which cannot be performed in the Main Cell will be performed in a "Hot Repair Area" (HRA).
- All maintenance including D&D associated with the Thin Film Dryer (TFD) will be performed in the Main Cell.
- Removal of the TFD from the Main Cell will only be performed upon D & D of the facility.
- The radiological concerns associated with the Low Activity Evaporator do not warrant its installation in the Main Cell.
- The Interim Storage Facility detailed in Rawlins (1997) is used as a baseline design for this study.
- All support utilities required for the operation of the UNEX process, with the exception of process steam, will be supplied by existing utility systems at INTEC.

5.1 Greenfield Facility (GFF)

Based upon the process detailed in this study's 30% review, the GFF has been designed around seven different systems; cross flow filtration, liquid/liquid contacting, HAW evaporation, low activity waste (LAW) evaporation, LAW grouting, LAW storage and handling, and HAW storage and handling.

The building design is sited to vacant property inside INTEC on the intersection of Hemlock Street and Cypress Avenue. This location allows adequate ground for a separate Interim Storage Building to the east side the building and for ease of truck access to and around the UNEX facility.

To site the building in this location, the abandoned slabs and foundations from two removed buildings must be demolished, as well as street sections on Cypress Avenue and Palm Avenue.

The design focuses on the relationship and proximity between the frequent truck access for loading and unloading supplies and the drum storage and UNEX separation processes. The design allows semitractor trailers to approach from either street with sufficient turning space to backup to loading and unloading stations.

The UNEX process hot cell forms the structural core of the building, surrounded by structural steel framed secondary and tertiary zones with composite steel/ concrete floors and roofs and enclosed by precast concrete curtainwall panel exterior walls. The Hot Cell itself assumes mass concrete walls, floors, and roof for radiation shielding and structural sheer strength.

Interior partitions in the separations and drum process areas are assumed to be one-hour fire-rated and either grouted form block or concrete masonry finished with skim-coated veneer plaster or furred gypsum wallboard. Interior partitions in administration areas are assumed to be light-gage steel stud frames and painted gypsum wallboard.

The design also uses the layout and flow process presented in the CsIX/TRU Grout Feasibility Study for the SBW for filling, lidding, decontaminating, and handling LAW drums before conveying them to storage (Losinski et al. 1998). For the Modified UNEX Separation process design, the only difference in the design is that LAW drums do not need hot cells, inspection stations, or curing time. As result, the drum may be contact-handled, filled, lidded, and decontaminated in gloveboxes rather remotely in hot cells.

5.1.1 GFF Processing Facility

The GFF is designed as separate but adjoining buildings. The buildings required for the greenfield design include the following:

1. UNEX Separation Process Building

2. Drum Process Building

3. Administrative Building

The UNEX Separation Process building has a central, two-story process main cell for remote handling and process of equipment and incoming SBW waste streams.

The Drum Process building has three separate areas for filling, decontaminating, storage, inspection, and loading before being shipped to permanent repository or disposal.

The Administrative building supports the operation and administration of the personnel stationed at these facilities. The size and complexity of spaces necessary for this support are based on assumptions and layout presented in Losinski et al. (1998). See Appendix D.

The main cell, located in the UNEX Separation Process building, is the heart of the GFF processing facility. It houses the major processing components associated with cross flow filtration, liquid/liquid contacting, and HAW evaporation. The main cell has both an upper and lower level with the upper level floor being comprised of removable metal grating which can be removed to allow access to the component located on the lower floor level. Table 11 below identifies the equipment located on the upper and lower levels of the main cell.

Table 11. Main cell equipment.

Equipment Number	Description	Location
T-201-1	SBW FEED TANK	Lower
T-201-2a & b	SBW DAY TANK	Lower
T-201-5a, b, & c	Extraction Feed Tank	Lower
T-202-5	UNEX Solvent Tank	Lower
T-202-6a & b	UNEX Raffinate Tank	Lower
T-202-14	UNEX Strip Effluent Tank	Lower
P-201-1	SBW XFR Pump	Lower
P-201-2a & b	Filter Feed Pump	Lower
P-201-5	Extraction Feed Pump	Lower
P-201-6a & b	SBW Slurry XFR Pump	Lower
P-202-5	Solvent Feed Pump	Lower
P-202-6a & b	Raffinate XFR Pump	Lower
P-202-6b	Raffinate Off Spec XFR	Lower
P-202-14	Strip Effluent XFR Pump	Lower
P-203-1	Strip TFD XFR Pump	Lower
VP-203	TFD Vacuum Pump	Lower
CON-202-1-14	Extraction Contactor	Upper
SB-202-1-2	Scrub Contactor	Upper
SP-202-1-8	Strip Contactor	Upper
CF-201-1 & 2	Cross Flow Filters	Upper
TFD-203-1	Thin Film Dryer	Lower

Generally, the pumps have been located on the main-cell lower floor level near to the tanks from which they take their suction. The major processing components, with the exception of the TFD, have been located on the upper floor level to maximize their accessibility during operation and maintenance evolutions. The overall height of the TFD as presented at the 30% review was 25 ft. This restricted the maintenance activities on the TFD because of available main cell crane clearance. It is anticipated that the overall height of the TFD will be significantly less than previously presented. This will enable TFD maintenance to be readily accomplished in the main cell while also allowing a decrease in overall facility height.

The UNEX Process Hot Cell includes a 20-ton bridge crane and is sized in area to accommodate all SBW waste-handling equipment, including tanks, pumps, and thin-film drier, with sufficient clearances from obstructions, pipe runs, and construction installation. The Hot Cell is also sized in height to allow adequate clearance over all equipment on the mezzanine level and for crane clearance.

Slave manipulators will be located with windows in the Hot Cell walls at regular intervals to allow complete reach coverage near walls on all sides. Once operations in the Hot Cell have begun, no human occupancy inside the Cell will occur. All handling and operations inside the Hot Cell will be. accomplished by remote equipment, including slave and PaR manipulators. The PaR manipulator will be mounted to the bridge crane to save head clearance height. Objects inside the Hot Cell requiring manipulation, disconnect, or removal will be within reach of slave manipulators that in turn place them where a PaR manipulator or bridge crane can reach.

5.1.2 HAW Evaporation

Evaporation of the HAW in the TFD will produce a dry powder that will be directed down from the bottom of the TFD into a 2 x 10-ft storage can that has been mated to the bottom of the main cell. Access to the mating annulus located below the TFD is provided by a cask transfer corridor which extends from the GFF to the Interim Storage Facility detailed in Rawlins (1997). To maintain continuous uninterrupted operation of the TFD, two storage cans must be able to mate to the main cell floor and accomplish their loading through a diverting valve connected to the TFD outlet. The diverter valve will allow the filling of one can to proceed while the other full can is remotely capped and replaced. Upon completion of the filling and lid welding procedure, the can is transferred through the belowgrade cask transfer tunnel to the Interim Storage Facility.

Areas surrounding the Process Hot Cell act as secondary radiation buffer zones and are accessed through airlocks and similar transition zones. These secondary zones are used for grout mixing, interior make-up tanks, and process air filtration and ventilation.

Aligned over the Hot Cell on the next story, the Hot Repair Shop resides. The Repair Shop includes a 20-Ton bridge crane and has the same area and same floor-to-ceiling height as the Hot Cell for the same reasons. The Hot Repair Shop has an equipment access floor hatch to the Hot Cell that is offset in alignment with an access hatch in the floor above. The Repair Shop is designed for limited handling and repair or replacement of equipment in the Hot Cell and will include most machine shop and bench equipment.

5.1.3 Grouting

The Drum Process Building is separated from the UNEX Process Building by fire-rated concrete walls. The building is divided into three functional drum process areas. They are: Filling and Palletizing, Automatic Storage Retrieval, and Drum Packaging and Shipping. This facility design assumed the design introduced by Losinski et al. (1998). See also Appendix D.

As in the CsIX/TRU Grout study, the design incorporates a first-in-first-out, automatic storage retrieval system for drum storage on pallets. The facility may accommodate up to 48,400 drums on pallets, as initially estimated to be needed for this study. As designed, the retrieval system will place four drums per pallet in a stack, 22 rows of 57 pallets long, by 10 pallets high.

Each drum may be individually retrieved, sent to an inspection station, de-palletized, and packaged in HalfPac Tru-Waste containers for eventual delivery to a final repository.

5.1.4 Administrative Building

Because actual personnel analyses are yet forthcoming, the UNEX design assumes approximately the same space as shown the CsIX/TRU Grout study mentioned earlier. As a result, the study provides administration spaces and operations change rooms for a staff of approximately 20–40 people, assuming approximately 40 % operators.

5.2 New Waste Calcining Facility

Part of this feasibility study includes the evaluation of placing process equipment associated with both the UNEX processes in the NWCF. The installation of this equipment will take advantage of the existing NWCF infrastructure, which includes building utilities, HVAC, and off-gas systems. This study assumes these systems are adequate to handle the demands generated by the UNEX processes and that no changes or upgrades are needed to accommodate the UNEX equipment.

It is further assumed that the calcining process will no longer be needed and that Calciner operability can be degraded or totally incapacitated as a result of new equipment installation. The following systems are needed and their operational status cannot be impugned.

- Decontamination Facility

- Building HVAC
- Vessel Off-gas
- Waste Water Collection
- Pneumatic Transfer System

Sufficient hot cell and floor space capable of meeting the assumed conditions has been identified in the Calciner Cell, Off Gas Cell, Blend and Hold Cell, and Valve Cubicle.

5.2.1 NWCF Cell Descriptions

5.2.1.1 Calciner Cell. The Calciner cell has approximately 650 ft^2 of floor space and is about 34 feet high. The Calciner vessel occupies the west half of the cell with the east half remaining relatively free of equipment. The calciner must be removed to allow the installation of the equipment in Table 12.

Table 12. Calciner cell equipment.

Equipment Number	Description
T-201-2a	SBW Day Tank
T-201-2b	SBW Day Tank
P-201-6a	SBW Slurry XFR Pump
P-201-6b	SBW Slurry XFR Pump
CF-201-1	Cross Flow Filter
CF-201-2	Cross Flow Filter

The slurry transfer pumps and cross flow filter will be positioned along the south wall of the Calciner cell to take advantage of the viewing window and manipulator coverage provided. An additional window with manipulator support must be provided to allow maintenance and operational activities to occur. It is anticipated that the shielding provided by the existing cell wall (57 in. of concrete) will be sufficient to allow unrestricted personnel access to the operating corridors next to the cell.

Remote maintenance will be performed on the UNEX equipment using the overhead PaR and crane in conjunction with the manipulator slaves. The PaR and crane gain access to the cell through the cell hatches.

5.2.1.2 Off Gas Cell. The Off Gas Cell has approximately 528 ft^2 of floor space and is 39 feet high. It currently contains three tanks that must be removed to allow the installation of off-gas cell equipment (Table 13).

Table 13. Off-gas cell equipment.

Equipment Number	Description
CON-202-1-14	Extraction Contactors
SB-202-1-2	Scrubbing Contactors
SP-202-1-8	Stripping Contactors
T-202-5	UNEX Solvent Tank
P-201-5	Extraction Feed Pump
P-202-5	Solvent Feed Pump

The extraction, scrubbing, and stripping contactors will be mounted along the south wall of the cell with the pumps and tanks located in the mid part of the cell thereby allowing full or partial access of all in cell components by the manipulator slaves which must be installed in the south cell wall.

Remote maintenance for in-cell components will be performed using the overhead PaR and crane in conjunction with the manipulator slaves. The PaR and crane gain access to the cell through the cell hatches.

5.2.1.3 Blend and Hold Cell. The blend and hold cell has approximately 770 ft^2 of floor space and is 39 ft high with the removable hatches pulled. The cell currently contains one 4000 gal and two 3,000 gal tanks which must be removed to allow the installation of the following UNEX equipment:

Table 14. Blend and hold cell equipment.

Equipment Number	Description
T-201-5A	Extraction Feed Tank
T-201-5B	Extraction Feed Tank
T-201-5C	Extraction Feed Tank
T-201-1	SBW Feed Tank
T-202-6A	UNEX Raffinate Tank
T-202-6B	UNEX Raffinate Tank
T-202-14	UNEX Strip Effluent Tank

The extraction feed tanks are located along the south wall of the cell to allow shorter suction piping runs to the extraction feed pump located in the adjacent Off Gas Cell just as the remaining tanks are located along the north wall to minimize their piping runs to the pumps located in the valve cubicle. Since the only components located in the Blend and Hold Cell are tanks it is unlikely that any form of regular maintenance activity would occur in the cell. However, any placement or relocation of the tanks in the cell is supported by the overhead crane and PaR manipulator located in the maintenance area.

5.2.1.4 Valve Cubicle. The valve cubicle is about 60 feet long, 11.5-ft wide, and 34-ft high. Four pumps associated with the UNEX process are located in this area mainly to minimize suction line runs from the tanks located in the Blend and Hold cell while still allowing maintenance access through the use of the valve cubicle PaR. The following pumps (Table 15) will be located in the valve cubicle.

Table 15. Valve cubicle equipment.

Equipment Number	Description
P-201-1	SBW XFR Pump
P-202-6a	Raffinate XFR Pump
P-202-6b	Raffinate Off Spec. XFR Pump
P-202-14	Strip Effluent XFR. Pump

5.2.2 NWCF Storage Area

Several of the pumps and tanks associated with the UNEX process require no special radiological controls or shielding. These components have been located on the 3rd level storage area of the NWCF. Maintenance and operational evolutions involving these tanks is by direct personnel access. Transfer of replacement components or tanks is accomplished through the elevator located in the southeast corner of the NWCF. The components located in the maintenance area, which support the UNEX process, are as follows (Table 16).

Table 16. Storage Area equipment.

Equipment Number	Description	Equipment Number	Description
T-201-3	HF Storage Tank	P-201-3	HF XFR Pump
T-201-4	HF Make-up Tank	P-201-4	HF Pump
T-202-1	Dicarbolide Tank	P-202-1	Dicarbolide Feed Pump
T-202-2	PEG Feed Tank	P-202-2	PEG Feed Pump
T-202-3	CMPO Tank	P-202-3	CMPO Feed Pump
T-202-4	FS-13 Tank	P-202-4	FS-13 Feed Pump
T-202-7	Recycled Acid Storage Tank	P-202-7	Acid Feed Pump
T-202-8	Alum. Nitrate Storage Tank	P-202-8	Alum. Nitrate Feed Pump
T-202-9	Scrub Make up Tank	P-202-9	Scrub Make up XFR Pump
T-202-10	Scrub Solution Feed Tank	P-202-11	Scrub Solution Feed Pump
T-202-11	DTPA Storage Tank	P-202-12	Strip Make up Xfr Pump
T-202-12	Strip Make up Tank	P-202-13	Strip Solution Feed Pump
T-202-13	Strip Solution Feed Tank		

5.3 Thin Film Dryer Facility (TFD)

The dry powder high activity waste stream produced by the UNEX processes is generated by the Thin Film Dryer (TFD). The dryer is a vertically mounted unit with the liquid inlet stream presented at the top and the dry powder discharge being ejected from the bottom. The dry powder is slated for collection in a 2 x 10-ft can, which will subsequently be stored in the interim storage facility. Since the NWCF layout does not support an access path to the under side of the TFD, should it be located in one of the existing NWCF cells, a separate facility used to house the TFD and enable the transfer of the 2 x 10-ft cans from the TFD to the Interim Storage Facility must be provided.

The TFD facility contains a single main cell with 484 ft^2 of floor area (22-ft square) which is approximately 26 ft high. The following equipment is located in the TFD facility main cell (Table 17).

Table 17. TFD equipment.

Equipment Number	Description
TFD-203-1	Thin Film Dryer (TFD)
VP-203-1	TFD Vacuum Pump
P-203-1	TFD Condensate Pump
T-203-1	TFD Condensate Tank
T-203-2	Strip Feed Tank
P-203-2	TFD Feed Pump

Maintenance and handling of the in-cell equipment is performed through the use of the manipulator slaves located on the east and west walls of the cell and by using the in-cell 20 ton bridge crane. Maintenance, which cannot be performed in the main cell, can be conducted by moving the affected components into the HRA located directly over the main cell by using the HRA crane. Transport of materials into or out of the HRA is accomplished using the high bay bridge crane and the truck lock access hatch located on the east side of the facility. The truck lock also has a floor access hatch, which allows for the transport of equipment into the cask access tunnel, which extends below the main cell floor. This tunnel provides the access of the 2' x 10' cans to the underside of the TFD where mating of the can to the TFD discharge connection is accomplished. It is proposed that two cans be mated to the discharge connection of the TFD at one time through the use of a diverter valve connection. This will enable one full can to be transported through the access tunnel to the Interim Storage Facility following lid installation while the second can is filled from the TFD, thereby avoiding unnecessary interruption of TFD operations.

5.4 GFF Grouting Facility

The grouting facility, which in the case of the GFF, is attached directly to the UNEX processing facility, is based upon the design generated in Losinski et al. (1998).

It is anticipated that the grout consistency for the Modified UNEX process will closely approximate the grout consistency used during the CsIX/TRU grouting facility design effort. Since the drum production for both the CsIX/TRU Grout and Modified UNEX processes are roughly equivalent, the design and configuration of the CsIX/TRU grouting facility should adequately meet the requirements associated with the Modified UNEX process. Consequently, no changes to the CsIX/TRU Grout design for presentation as the Modified UNEX grouting method have been performed.

5.4.1 Modified UNEX Grouting Facility

Clean, empty 55-gal barrels are moved along an automated track system to one of three grout mixing cells, where the waste form and grouting constituents are placed into the drum and mixing occurs. The drums are then moved to a curing cell to allow the grout to harden and any release of moisture during the curing process to occur. Testing on grout, which is expected to closely approximate the grout consistence of the Modified UNEX "nonperformance" grout, has indicated a loss of up to 30 wt% due to water evaporation during the curing process. Because of this, it is recommended that the curing process occur with the lids removed from the drums. This will enhance the formation of the grout matrix given the high degree of moisture loss due to evaporation. The drums are then moved back to the mixing cell, where the lids are installed on the drums and the outside of the drum is decontaminated before relocation of the drums to the automated drum storage facility. The storage facility for the Modified UNEX process must be capable of handling the entire 3-year combined production run of 29,160 drums (based upon an 80% fill capability).

5.4.2 UNEX Grouting Facility

The UNEX process will produce a "performance" type grout which has a significantly lower moisture concentration than the Modified UNEX grout. This removes the necessity for an "open-lid" curing process and consequently allows the grout formation process to be an in-barrel, out-of-cell, mixing process which precludes the external contamination of the 55-gal grout drums that is inherent to the Modified UNEX grouting process. Consequently, the CsIX/TRU Grout design has been modified to reflect the handling of noncontaminated drums during the UNEX grouting process. To maintain the required drum production rate of 72 drums of grout per day, it was necessary to add an additional three grouting stations to the CsIX/TRU Grout design. Since the grouting process will not be an in-cell process, the grouting stations, rather than consisting of a shielded thick wall cell as presented in the CsIX/TRU Grout process, will be of a standard thin-wall glovebox design with a mating port on the bottom of the glovebox. Clean drums will be transported to the gloveboxes using an automated transport system. They are then mated to the grouting glovebox where the constituents are added and mixing occurs. The drums are then de-coupled from the glovebox and transported in a clean condition to the drum storage area. Due to the radiation field associated with the grout mixture produced by the UNEX process (about 100 mrem/hour) a shield ring must be used to limit exposure to personnel during the grout mixing process. The shield ring will be located around the outside of the 55-gal drum when it is coupled to the bottom of the glovebox and must remain in place until the drum is transported to the curing/storage location. The storage facility of the UNEX process must be capable of handling the entire three-year combined production run of 44,606 drums (based upon an 80% fill capability)

Both grouting facility layouts will provide an operating area for the LAW evaporator and associated support equipment. It is anticipated that standard, 10 inch thick, cinder block walls will provide sufficient shielding for personnel near to the evaporator enclosure area. Operation of the evaporator and its support equipment will be accomplished remotely while maintenance will be performed "hands on" after component draining has been performed.

5.5 NWCF Grouting Facility

The NWCF layout will send the raffinate and strip evaporator condensate liquid streams to the grouting facility, which was designed in support of the GFF portion of this study, for evaporation and solidification. The handling process will be exactly the same as earlier described for the GFF process.

5.5.1 GFF &TFD HVAC

This feasibility study will address two facilities and a third facility housing the thin film dryer (TFD). The first two facilities are nearly identical with the exception of a process and the drum storage capacity. The two facilities are designated as UNEX and Modified UNEX. The UNEX facility will have additional primary containment zones for the grout/drum processing and an approximate drum storage capacity of 44,000. The Modified UNEX facility will have drum storage capacity of about 23,000 and the grout/drum process will have less space dedicated to primary confinement.

Each facility will be required to have two ventilation confinement zones. This section addresses the confinement zones and the nonconfinement areas. A ventilation confinement system in conjunction with physical barriers, maintain a continuous airflow pattern from areas of low potential contamination to areas of high potential contamination. The objectives of the confinement systems are to prevent the spread of radioactive and other hazardous materials to occupied areas; and to minimize the release of radioactive and other hazardous materials in facility effluents. The primary confinement area consists of process hot cells and hot maintenance areas, which will be exhausted through two stages of HEPA filters. The primary confinement boundary will be comprised of hot cell walls, welded stainless steel ductwork and HVAC equipment designed to maintain its structural integrity during and after operational and natural-phenomena design basis accidents (DBAs). The secondary confinement boundary consists of the operating corridors and other building structures that surround the primary confinement. The secondary confinement boundary contains all ventilation system equipment such as HEPA filter units and exhaust fans. The nonconfinement boundary consists of offices, control rooms, clean loading bays, storage and support areas outside the secondary confinement boundary. The nonconfinement zones do not require once-through ventilation systems and will be maintained at a slight positive pressure with respect to ambient. Drum storage will be maintained at a slightly negative pressure and also have HEPA filters, but will not require once-through air. HEPA filters will remove contaminated particulates, but no carbon absorber beds will be provided in the primary filter trains.

Drawings HV-1, HV-2 and HV-3 depict the air flow diagram of the HVAC system for the three facilities. Several air handling units (AHU) will supply conditioned air to the secondary confinement zones. Air from the secondary confinement zones will be forced into the primary confinement zones by supply blowers through a single stage testable HEPA filter.

The facilities will be provided with an independent chiller system consisting of central chillers and pumps, delivering to various cooling coils. The facilities will use steam or electricity for heating the once-through air and for the office and other occupied areas. Electrical power and steam requirements for heating will be provided. The HVAC system will be controlled by a central electronic system located within each facility.

Redundancy will ensure proper ventilation confinement during HEPA filter replacement or fan maintenance. Redundancy is provided through an additional fan and HEPA filter bank for each zone. Exhaust ductwork from containment zones will be located in areas that will not be normally occupied and designated secondary containment. HEPA filter housings will have the capability to be leak tested and tested for filter efficiency in place. Single stage HEPA filtration will be provided at the hot cell intakes to prevent possible contamination from momentary back flow to the occupied areas. HEPA filters units will be designed per the American Society of Mechanical Engineers (ASME), N509, Nuclear Power Plant Air-Cleaning Units and Components, and tested per ASME N510, Testing of Nuclear Air Treatment Systems. Confinement boundaries will be sealed to maintain isolation when pressure differentials fall below normal conditions. Exhaust systems for the primary and secondary confinements will be round stainless steel welded joint ductwork designed and installed in accordance with applicable Sheet Metal and Air

Conditioning Contractors National Association, Uniform Mechanical Code, and American Conference of Governmental Industrial Hygienists standards.

Confinement zones will be supplied by once-through ventilation. Airflow from the secondary confinement zones will be HEPA filtered to before the primary confinement zones. The once-through ventilation will be HEPA filtered and discharged with no air recirculation. Each HEPA filter unit includes a stainless steel plenum housing, a deluge system, demister, prefilter, two stages of side-bagout HEPA filters for the primary zone exhaust, single stage side-bagout HEPA filters for secondary zone exhaust and primary supply, DOP test sections and ports, and an exhaust fan. The exhaust fans have integral adjustable flow control. It is assumed that the supply and exhaust fans for the hot cells can be powered from the standby power source. This allows the ventilation confinement to be maintained in the hot cells during a loss of off-Site power condition.

Automatic local stand-alone controllers will be provided with the HVAC equipment. Graphic displays mimicking the HVAC system will be available in the control room for monitoring and for remote manual override control. The HVAC system will have local operator stations. However, the control room operator will have supervisory control capability to start and stop the HVAC system and to change setpoints. Alarms and out-of-tolerance conditions will be displayed in the control room.

Each facility will be designed with the following ventilation parameters:

- Eight air changes per hour for primary confinement
- Four air changes per hour for secondary confinement
- 0.75 cfm per square foot for administrative areas
- 1.5 cfm per square for the mechanical rooms.
- 1.5 cfm per square foot for the drum storage facility.
- One stage of testable HEPA filters for secondary confinement exhaust
- Two stages of testable HEPA filters for hot cell exhaust
- One stage of testable HEPA filters for hot cell inlet
- Once-through ventilation for primary and secondary confinement zones
- Room pressures maintained in accordance with Tables 18 – 20.

Each UNEX and Modified UNEX facility is divided into four independent HVAC systems. This is due to two factors. The primary factor is due to the differing operational life of the processes, as specific processes end they undergo D & D, but the remaining facilities will remain operational. The second factor is due to the different process that require isolation from the occupied areas. The four areas are listed in Tables 18 and 19. The TFD facility has a single HVAC system.

Special HVAC requirements are necessary for the process facilities. The administration area and mechanical rooms have no special requirements. The UNEX, Modified UNEX and TFD process requires a secondary confinement zone around the primary confinement zone hot cells. These confinement zones require HEPA filtration and the HVAC room is designated as secondary confinement. The drum process facility also has secondary and primary confinement zones require HEPA filtration and similar HVAC designations as the UNEX process. The drum storage is considered a noncontaminated area but HEPA filtration is provided as a containment safeguard.

Table 18. UNEX Area requirements.

Room	Area	Room Requirements	Static Pressure iwg	Room cfm	Total cfm/Area
Administration	one	.75 cfm/ft^2	0.1	5,877	
Admin Mechanical		1.5 cfm/ft^2	0.1	3,750	total 9,627
Half Pac Loading	two	1 cfm/ft^2	-0.25	4,000	
De-Palletizer/Palletizer		1 cfm/ft^2	-0.25	2,250	
Drum Storage		1 cfm/ft^2	-0.25	56,488	
Truck Bay Clean Drum Stor		1 cfm/ft^2	0.1	2,400	
Drum Storage HVAC		1.5/hr	-0.25	2,475	total 67,613
Drum Process Primary	three	8/hr	-0.75	11,607	
Drum Process Secondary		4/hr	-0.25	8,707	
Drum Process Loading		4/hr	-0.25	4,000	
Truck Lock Drum Process		4/hr	0.1	3,333	
Drum Process HVAC		4/hr	-0.25	10,417	
Drum Process Mech		2/hr	0.1	1,667	total 39,730
UNEX Primary	four	8/hr	-0.75	41,344	
Transfer Tunnel		8/hr	-0.75	3,360	
UNEX Secondary		4/hr	-0.25	74,816	
UNEX Secondary		4/hr	-0.25	8,512	
Truck Lock UNEX		4/hr	0.1	4,000	
UNEX HVAC		4/hr	-0.25	20,000	
UNEX Mechanical		1.5/hr	0.1	2,500	
Freight Elevator		1/hr	0.1	680	
Stair Air Lock South		2/hr	0.1	1,813	
Stair Air Lock North		2/hr	0.1	1,813	total 158,839

Table 19. Modified UNEX Area requirements.

Room	Area	Room Requirements	Static Pressure iwg	Room cfm	Total cfm/Area
Administration	one	.75 cfm/ft^2	0.1	5,877	
Admin Mechanical		1.5 cfm/ft^2	0.1	3,750	total 9,627
Half Pac Loading	two	1 cfm/ft^2	-0.25	4,000	
De-Palletizer/Palletizer		1 cfm/ft^2	-0.25	2,250	
Drum Storage		1 cfm/ft^2	-0.25	29,507	
Truck Bay Clean Drum Stor		1 cfm/ft^2	0.1	2,400	
Drum Storage HVAC		1.5/hr	-0.25	2,475	total 40,632
Drum Process Primary	three	8/hr	-0.75	8,707	
Drum Process Secondary		4/hr	-0.25	10,157	
Drum Process Loading		4/hr	-0.25	4,000	
Truck Lock Drum Process		4/hr	0.1	3,333	
Drum Process HVAC		4/hr	-0.25	10,417	
Drum Process Mechanical		2/hr	0.1	1,667	total 38,280
UNEX Primary	four	8/hr	-0.75	41,344	
Transfer Tunnel		8/hr	-0.75	3,360	
UNEX Secondary		4/hr	-0.25	74,816	
UNEX Secondary		4/hr	-0.25	8,512	
Truck Lock UNEX		4/hr	0.1	4,000	
UNEX HVAC		4/hr	-0.25	20,000	
UNEX Mechanical		1.5/hr	0.1	2,500	
Freight Elevator		1/hr	0.1	680	
Stair Air Lock South		2/hr	0.1	1,813	
Stair Air Lock North		2/hr	0.1	1,813	total 158,839

Table 20. Thin Film Dryer Area requirements.

Room	Area	Room Requirements	Static Pressure iwg	Room cfm	Total cfm/Area
Truck Lock	one	1 cfm/ft^2	-0.25	1,260	
Office/Stair well		.75 cfm/ft^2	0.1	1,055	total 2,315
Primary Hot Repair	two	8/hr	-0.75	4,013	
Primary Main Cell		8/hr	-0.75	3,306	
Transfer Tunnel Primary		8/hr	-0.75	4,680	
Secondary		4/hr	-0.25	23,493	
HVAC		4/hr	-0.25	892	total 36,384

The secondary confinement areas require the largest volume of once-through air. The air exhausted from the secondary confinement zones is supplied to the primary confinement areas. As shown in the HVAC Flow Diagram the cfm required to meet the capacity of the secondary zones exceeds the cfm for the primary zone. The cost to heat, cool, filter and force the once-through air through each facility is mainly attributed to the volume of secondary confinement zones. The secondary confinement zones are the principal factor affecting HVAC system capital and operational costs.

Tables 21 through 23 show the preliminary equipment list for the three separate facilities in this study. This is not an all-inclusive list of instruments, components and equipment.

Table 21. UNEX Equipment.

Quantity	Equipment Description	Size/Power/Capacity	Comments
none	Ventilation Centrifugal Fans	5 hp	Includes standby fans
none	Ventilation Centrifugal Fans	15 hp	Includes standby fans
5	Ventilation Centrifugal Fans	20 hp	Includes standby fans
7	Ventilation Centrifugal Fans	25 hp	Includes standby fans
5	Ventilation Centrifugal Fans	30 hp	Includes standby fans
5	Ventilation Centrifugal Fans	40 hp	Includes standby fans
14	Ventilation Centrifugal Fans	50 hp	Includes standby fans
3	Ventilation Centrifugal Fans	60 hp	Includes standby fans
2	HEPA 4x4 Banks Single Stage	12 filters per bank	one filter is 24 by 24-in.
23	HEPA 4x4 Banks Single Stage	16 filters per bank	one filter is 24 by 24-in.
2	HEPA 4x4 Banks Dual Stage	12 filters per bank	one filter is 24 by 24-in.
4	HEPA 4x4 Banks Dual Stage	16 filters per bank	one filter is 24 by 24-in.
	Chiller: Compressors and Fans	530 hp combined	
	Chiller: Compressors and Fans	375 hp combined	
	Actuated Air Dampers	0.5 hp each	flow control to rooms
	Pre filters	208,000 cfm.	outside air filters
	Heating coils	208,000 cfm	steam or electric heat
	Cooling coils	208,000 cfm	
	Heat Recovery coils		for exhaust air
	Heat Recovery coils		for intake heat/cool coils

Table 22. .Modified UNEX Equipment.

Quantity	Equipment Description	Size/Power/Capacity	Comments
none	Ventilation Centrifugal Fans	5 hp	
2	Ventilation Centrifugal Fans	15 hp	Includes standby fans
5	Ventilation Centrifugal Fans	20 hp	Includes standby fans
11	Ventilation Centrifugal Fans	25 hp	Includes standby fans
3	Ventilation Centrifugal Fans	30 hp	Includes standby fans
3	Ventilation Centrifugal Fans	40 hp	Includes standby fans
14	Ventilation Centrifugal Fans	50 hp	Includes standby fans
none	Ventilation Centrifugal Fans	60 hp	Includes standby fans
2	HEPA 4x4 Banks Single Stage	12 filters per bank	one filter is 24 by 24-in.
19	HEPA 4x4 Banks Single Stage	16 filters per bank	one filter is 24 by 24-in.
2	HEPA 4x4 Banks Dual Stage	12 filters per bank	one filter is 24 by 24-in.
4	HEPA 4x4 Banks Dual Stage	16 filters per bank	one filter is 24 by 24-in.
	Chiller: Compressors and Fans	530 hp combined	
	Chiller: Compressors and Fans	380 hp combined	
	Actuated Air Dampers	0.5 hp each	flow control to rooms
	Pre filters	183,000 cfm.	outside air filters
	Heating coils	183,000 cfm	steam or electric heat
	Cooling coils	183,000 cfm	
	Heat Recovery coils		for exhaust air
	Heat Recovery coils		for intake heat/cool coils

Table 23. Thin Film Dryer Equipment.

Quantity	Equipment Description	Size/Power/Capacity	Comments
1	Ventilation Centrifugal Fans	5 hp	
2	Ventilation Centrifugal Fans	15 hp	Includes standby fans
2	Ventilation Centrifugal Fans	20 hp	Includes standby fans
none	Ventilation Centrifugal Fans	25 hp	Includes standby fans
4	Ventilation Centrifugal Fans	30 hp	Includes standby fans
2	Ventilation Centrifugal Fans	40 hp	Includes standby fans
5	HEPA 4x4 Banks Single Stage	12 filters per bank	one filter is 24 by 24-in.
2	HEPA 4x4 Banks Dual Stage	12 filters per bank	one filter is 24 by 24-in.
	Chiller: Compressors and Fans	114 hp combined	
	Actuated Air Dampers	0.5 hp each	flow control to rooms
	Pre filters	27,000 cfm.	outside air filters
	Heating coils	27,000 cfm	steam or electric heat
	Cooling coils	27,000 cfm	
	Heat Recovery coils		for exhaust air
	Heat Recovery coils		for intake heat/cool coils

5.5.2 Heat Recovery Systems

It is assumed that later stages of design will provide greater detail and a more specific system description. The inclusion of a heat recovery system may have the potential to reduce operational costs. Here are two types of heat recovery systems applicable to these facilities that completely separates air streams and eliminating cross-contamination. The face velocity is a primary factor in effectiveness and capital costs.

Coil energy recovery loops have an effectiveness range of 45% to 65%. The effectiveness is directly correlated to the delta T and the minimum low temperature to prevent freezing. Relative to other system parameters, the three facilities have a low delta T and a freezing limitation. Expected effectiveness is in the low end of the range, approximately 45%. Coil energy recovery loops require a liquid loop, typically a refrigerant and compressors. This system has more moving parts than other heat recovery systems and thus requires more maintenance.

Heat pipe heat exchangers have a higher effectiveness than coil energy recovery loops but also have freeze protection problems. The performance of heat pipes is correlated directly to face velocities and the number of rows or heat pipes. Doubling the number of rows of heat pipes in a 60% effective heat exchanger increases the effectiveness to 75%. Effectiveness is also based upon the proper selection of fluid for the operating temperature range. According to Heat Pipe Technology Inc. typical costs range from $0.50 to $1.00 per cfm for a heat pipe recovery system.

Fixed plate exchangers have potential for cross contamination and are not considered here.

A coil energy recover loop is recommended primarily due to the flexibility of locating the heat exchangers in both exhaust and intake air streams. This will not require special routing of ducts to get close proximity that is required in a heat pipe exchanger system. Special duct routing would require additional floor space and added cost to the building structure. The heat recovery system exchangers can be located in line with the intake steam and cooling coils and just behind the HEPA filter banks before going to the exhaust stack. The cost would be similar to a heat pipe system $0.50 to $1.00 per cfm.

5.5.3 Heating Loads With Steam or Electric Requirements

150 psi of saturated steam converts to 860 Btu/lb of steam.

1 Btu/hour = 0.293 Watts

According to the ASHRAE Fundamentals Handbook:

$Q = 0.93\ (\text{cfm})\ (T_2 - T_1)$ in units of Btu/hour

5.5.3.1 UNEX Facility. Based upon the cfm requirements for the cumulative supply to occupied areas and secondary confinement zones:

cfm = 211,372

$T_2 = 80°F$

Typically, air is heated to 95°F, but due to the high rate of volume changeout, 80°F is used for more realistic results that are still conservative.

$T_1 = -19°F$

$Q = 0.93\ (211{,}372)\ (80-(-19))$ = 19.46 million Btu/hour

= 5,700 kW

= 22,600 lb/hour Steam.

5.5.3.2 Modified UNEX Facility. Based upon the cfm requirements for the cumulative supply to occupied areas and secondary confinement zones:

cfm = 182,841

$T_2 = 80°F$

Typically, air is heated to 95°F, but due to the high rate of volume changeout, 80°F is used for more realistic results that are still conservative.

$T_1 = -19°F$

$Q = 1.1\ (182{,}841)\ (80- (-19)) \quad = 16.83$ million Btu/hour

= 4,900 kW

= 19,600 lb/hour Steam.

5.5.3.3 Thin Film Dryer Facility.

cfm = 26,700

$T_2 = 80°F$

Typically air is heated to 95°F, but due to the high rate of volume changeout, 80°F is used for more realistic results that are still conservative.

$T_1 = -19°F$

$Q = 1.1\ (26{,}700)\ (80- (-19)) \quad = 2.46$ million Btu/hour

= 700 kW

= 2,850 lb/hour Steam.

5.5.4 Ventilation Fans, HP

The ventilation fan sizing was based upon software and vendor data to ensure common fan motor sizes. The static pressures for each zone were conservatively approximated and all filters were assigned worst-case pressure losses. Table 24 details the assigned pressure drops, final static pressures were based upon additional pressure drops through each zone.

Table 24. Zone pressure drops.

Equipment	Static pressure loss
Pre-filter for intake from atmosphere	1 in. w.g
Heating and cooling coils	1 in. w.g
Single HEPA filter bank	3 in. w.g
Dual HEPA filter bank	6 in. w.g
Each zone total	4 in. w.g
Duct to stack	1 in. w.g

According to the flow diagrams shown on drawings HV-1, HV-2 and HV-3, the fan hp totals are shown in Table 25. Each confinement zone is given a standby fan for immediate backup.

Table 25. Fan horsepower.

Facility	Number of fans	Cumulative hp
UNEX	39	1,510
Modified UNEX	38	1,315
Thin Film Dryer	11	275

The lists of fans are detailed in the equipment tables 4 through 6 for each facility. Hp requirements are based upon centrifugal fans from GreenHeck, based upon cfm and static pressure loads.

5.5.5 Cooling, Compressor and Fan HP

Converting the Btu/hour to tons the conversion is 12,000 Btu/hour = 1 ton. According to the ASHRAE Fundamentals Handbook:

$Q = 0.93\ (\text{cfm})\ (T_2 - T_1)$ in units of Btu/hour

5.5.5.1 UNEX Facility. Based upon the cfm requirements for the cumulative supply to occupied areas and secondary confinement zones.

cfm = 211,372

$T_2 = 95°F$

$T_1 = 60°F$

Typically air is cooled to 55°F, but due to the high rate of volume changeout, 65°F is used for more realistic results that are still conservative.

$Q = 0.93\ (211{,}372)\ (95 - 60) = 6.88$ million Btu/hour

5.5.6 Modified UNEX Facility

Based upon the cfm requirements for the cumulative supply to occupied areas and secondary confinement zones:

cfm = 182,841

$T_2 = 95°F$

$T_1 = 60°F$

Typically air is cooled to 55°F, but due to the high rate of volume changeout, 65°F is used for more realistic results that are still conservative.

$Q = 0.93\ (182{,}841)\ (95 - 60) = 5.95$ million Btu/hour

5.5.7 Thin Film Dryer Facility

cfm = 26,700

$T_2 = 95°F$

The assumed exit temperature from the secondary confinement zones:

$T_1 = 60°F$

Typically air is cooled to 55°F, but due to the high rate of volume changeout, 65°F is used for more realistic results that are still conservative.

Q = 0.93 (143,500) (95- 60) = 0.87 million Btu/hour

Based upon Product Data from Carrier, the 30GU series Flotronic™ Air-Cooled Reciprocating Liquid Chillers 60 Hz require the following combined horsepower from fans and compressors for the tonnage calculated. The Thin Film Dryer Facility will require reduced capacity chillers.

6.88 million Btu/hour = 573 tons requiring a combined 905 hp

5.95 million Btu/hour = 496 tons requiring a combined 784 hp

0.87 million Btu/hour = 72 tons requiring a combined 114 hp

Total = 1,803 hp.

5.6 Remote Maintenance Philosophy

Operating and maintenance access to the components located in the main cell is accomplish remotely through the use of manipulator slaves, PaR manipulator, or 20-ton overhead bridge crane. All components, accept for the storage tanks, are located within the viewing area of a shielded window and area of accessibility of the manipulator slaves. Any maintenance procedures which can not be accomplished in the main cell through the use of the remote handling devices will be accomplished by repositioning the failed component below the overhead access hatch with the in-cell crane and raising the component into the Hot Repair Area, which is located above the main cell, using the HRA crane. Once the component is positioned in the HRA it may be contact-handled or disposed of depending upon a case evaluation. An equipment lay down area has been designated in the main cell for those components which can not be immediately transferred out for dispensation.

The major maintenance process associated with the TFD would require the removal of its internal blades for repair. To accommodate this procedure, the TFD has been located on the lower level of the main cell. Disassembly of the TFD would be performed using a coordinated effort from the manipulators and overhead handling system. Due to the high radiation and contamination levels associated with the TFD, it is not proposed that any maintenance be performed in the HRA unless exposure levels are first evaluated. Should the TFD become totally disabled, sufficient space has been allocated in the main cell to allow it to be repositioned and abandoned with continued process operations being supported by a new TFD. The replacement TFD may be installed though access hatches provided in the HRA and main cell. Overhead access to the HRA is provided by the High Bay crane, which also provides crane support for loading and unloading operations in the truck loading bay.

Tanks located in the main cell are not considered to be high maintenance items and hence are not afforded manipulator coverage for repair. Initial placement and replacement access to the tanks is provided by the overhead handling systems with access being accomplished after removal of the grated floor covering the tanks.

The following are features which will provide remote handling capabilities in the facilities:

- Hot Repair Area (HRA) - A shielded area located directly above the main cell which has direct access to the main cell through a sliding floor hatch and remote operated crane. Any equipment located in the main cell which requires repair which cannot be handled remotely shall be transferred to the HRA for hands on repair.

- Master Slave Manipulators - Remote arms which extend through a shield wall in the vicinity of a viewing window which are operated directly by personnel performing remote manipulations.

- Viewing Windows - Shielded viewing windows which allow direct visually observation of limited areas of a shielded cell.

- Overhead Crane - A remotely controlled crane which allows movement and positioning of components inside a shielded cell. Certain components on the crane can be remove for repair or maintenance to the HRA otherwise the crane must be maintainable in the main cell by remote means.

- Equipment Lay down Area/Decontamination Cell - An area in the main cell which is used for the temporary storage of new or replace components. It should enable components to be accessed by the overhead handling systems for repair or preliminary decontamination before relocating the component to the HRA. This area may include a spray wash down system and should be separated from the main cell environment by a walled enclosure.

- Breathing Air Stations - A breathing air station used to supply personnel entering the HRA in forced air hoods.

- Equipment Transfer Buffer Room - A room adjacent and attached to the HRA which will allow personnel to transfer clean equipment into the HRA.

- Transfer Hatch - A floor or ceiling mounted hatch which can be remotely operated to allow access from the HRA to the main cell or from the HRA to the High Bay area.

- Personnel Buffer Zone - A buffer zone which allows the transfer of personnel into or out of the HRA.

- Glove Wall - A vertical wall section which supports glove access into the HRA for components that require contact handling for maintenance or repair.

- Repair Pit - A vertical below grade pit which will allow the TFD to be lowered to a level of the viewing windows and manipulators for remote repair activities.

5.7 Hot Cell Design Requirements

The following will also be provided to permit in-cell remote handling operations and to reduce operator exposure:

- Permanently located lifting devices to aid in remote maintenance operations.
- Tool ports, in-cell tool racks, and tables.
- Decontamination system for external and internal equipment surfaces as well as cell surfaces.
- Quick-disconnect piping connections on all in-cell components
- Stainless steel lining for the inside of high contamination areas as appropriate to facilitate decontamination.
- Remote maintenance service stations with remote connectors for utilities needed inside the shielded areas, including air, fluids (water, decontamination solutions) electric and video.
- Equipment which will be placed in the main cell must be designed for remote maintenance capability.

The following remote capabilities should also be included in the cell design:

- The capability for viewing and remotely transferring radioactive items and materials as required to maintain personnel radiation exposures to as-low-as-reasonably achievable levels.
- Remote process equipment will be accessible for ease of operation and maintenance.
- In-cell lights for remote cells will be designed for remote replacement.
- Provision will be made for tool storage and worktables as required.
- Clearances for standard operation and removal of master-slave manipulators will be provided.
- Remote connectors, bolts, flanges, wrenches, sockets, extensions, and other tooling should be standardized to the extend possible to reduce the need for wrench changes and varied operating envelopes during equipment replacement.
- Equipment will be movable, maintainable and replaceable without disturbing adjacent equipment whenever possible.
- Design of in-cell equipment supports and concrete embedments will consider possible retrofit of alternate process equipment.
- Equipment components and subsystems will be of modular design, if feasible, to facilitate removal and replacement.

- All remotely serviced equipment will be checked for dimensional fit and proper operation before installation.

5.8 Decontamination and Decommissioning

Upon completion of the processing schedule, all components which may be directly removed from the main cell to the HRA will be decontaminated in the HRA and transferred out of the facility using standard waste boxes. Any components that are too large to be removed to the HRA or have a radiological impact incompatible with contact handling will be dismantled in the main cell. The resulting individual component pieces will be transferred to the HRA by cage lift and transferred to a standard waste box for disposal.

5.9 Interim Storage

The TFD for both the UNEX and Modified UNEX processes will produce a HLW stream which must be transferred away from the TFD operations area to a temporary storage facility capable of handling and storing the receptacle which will contain the HLW product. It is anticipated that the storage facility to be used for this purpose will be the Interim Storage Facility detailed in a previous feasibility study (Rawlins 1997)).

The following assumptions have been made for using the ISF in conjunction with the UNEX process:

1. The storage capability of the ISF will be sufficient to handle the approximately 500 2 x 10-ft cans produced during the entire UNEX run.

2. The waste will be stored in 2 x 10-ft cans.

3. The maximum weight of the 2 x 10-ft cans is 5,300 lb.

4. The ISF will be a new facility physically located next to either the GFF or TFD facility.

A tunnel will have to be provided between either the GFF or TFD facility to allow the transfer of the cans, belowgrade, to the receiving room of the ISF. The ISF storage capabilities ranging from 170 to 18,000 cans with storage areas laid out in a modular configuration. Each module is capable of handling 1,890 cans, stacked three cans high. Since the total number of cans produced during the UNEX run is about one quarter of the maximum storage capability of a single ISF module, it is evident that the ISF storage capability depicted in the design study can be greatly reduced and still meet the UNEX storage requirements.

5.10 Process Energy

Energy balances were performed on all major pieces of equipment requiring significant amounts of energy. The major processes that were evaluated include crystallization, evaporation, and neutralization. The energy requirements were determined for these processes in both the UNEX and Modified UNEX cases. Energy balance calculations and additional detail on assumptions used in the analysis can be found in Appendix C.

Table 26 provides the heating and cooling process requirements for operation of the TFD (TFD-203-1). (Values for power are given on a yearly basis.)

Table 26. Crystallization process requirements.

Process	Heating		Cooling	
	Power (kW)	Steam (lb/hr)	Power (kW)	Cooling Water (lb/hr)
UNEX	105.0	300.0	-1.93	73.3
Modified UNEX	89.2	254.9	-1.64	62.3

Table 27 provides the heating and cooling process requirements for operation of the LAW evaporator (EV-204-1). (Values for power are given on a yearly basis.)

Table 27. LAW evaporation (EV-204-1) process requirements.

Process	Heating		Cooling	
	Power (kW)	Steam (lb/hr)	Power (kW)	Cooling Water (lb/hr)
UNEX	266.7	832.6	-4.62	175.2
Modified UNEX	200.4	594.2	-3.40	129.0

Table 28 provides the cooling requirements for neutralization. (Values for power are given on a yearly basis.)

Table 28. Neutralization process requirements.

Process	Cooling	
	Power (kW)	Cooling Water (lb/hr)
UNEX	-15.48	587.0
Modified UNEX	-14.22	539.3

5.11 Steam Facility

The UNEX facility requires an estimated maximum steam supply of 25,450 lb/hour. Modified UNEX requires a similar amount 22,350 lb/hour; both of these facilities includes the TFD. The existing steam supply is from CPP-606. Currently the boilers are undergoing replacement and are scheduled for completion by October 2000. The CPP-606 Boiler Replacement project will install four new boilers with an operating capacity of 23,000 lb/hour for each boiler. The total for the four boilers combined is approximately 92,000 lb/hour (Figure 5). According to the INTEC Thermal Energy Study Final Report, the maximum steam supplied does not allow for the additional capacity for the proposed UNEX or Modified UNEX facilities until after fiscal year 2015.

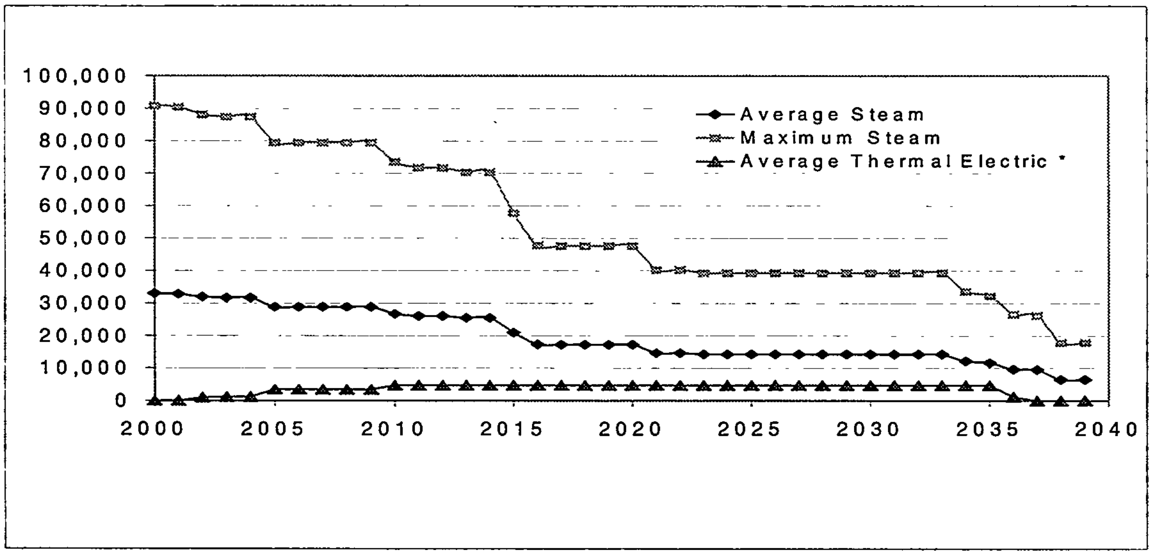


Figure 5. Projected INTEC thermal energy demands, FY-00 through FY-40.

A new steam facility is planned to meet the steam demand for the either facility. A plan view of the building and the layout of two boilers are shown in the accompanying drawing. Two boilers are shown one for operational demands and the second as an immediate standby. At this stage of design a standby is included, later stages may determine whether a standby boiler is justified. The cost estimate and information from the CPP-606 Boiler Replacement project was used for the drawing and the two boiler cost estimate. The boiler building provides adequate room for installation, associated utilities and changeout, of the boilers. The drawing does not detail the multiple utilities and systems required for the boiler but they are incorporated into the cost estimate.

5.12 Utilities

5.12.1 Storm Drain System

The storm drain shall connect to the overall INTEC surface drain system. However, there is an existing open ditch that tracks along the north side of Palm Avenue east towards Lodge Pole Street then turns to the south before Cypress Avenue then turns to the east again, towards the storm water collection pond. This open ditch is carrying mostly surface water from the tank farm area. Since the UNEX Projects proposed building is right on top of Palm Avenue, the open ditch shall be relocated to along south side of Cypress Avenue. See drawing U-7.

5.12.2 Sanitary Sewer System

There are existing 6-in. sewer effluent lines (6-in. WQP-109754) along north side of Palm Avenue and 4-in. sanitary lines (4-in. WQ NY-152739) along the south side of Palm Avenue. Both the lines will be under UNEX building facilities. These effluent lines shall be relocated to the north of the UNEX facilities and the 4-in. sanitary line shall be relocated to north side of Cypress Avenue. See drawing U-4.

5.12.3 Fire Water System

There is an existing fire water system line south of Cypress Avenue. The UNEX facilities fire system can connect to this system if the existing systems can provide enough pressure. See drawing U-6.

5.12.4 High-Pressure Air Line

There is an existing high-pressure airline (AV-UT-500) located along the west side of Beech Street and an outlet valve next to structure 616. This valve can be used as tie-in point of the high-pressure airline for the UNEX facilities. The line layout shall be along Beech Street towards the north, over Cypress Avenue then turn east to the UNEX facilities. See drawing U-5.

5.12.5 Potable Water Line

An existing potable water line (4-in. CW-NR-110865) is located along the north side of Palm Avenue and turns to the south on Cedar Street. This line can be used as a potable water line for the UNEX facilities. A portion of this line will need to be relocated. See drawing U-3.

5.12.6 Cooling Water and Demin Waterlines

An existing demin water line (3-in. DWNW-109601) is located along west the side of Beech Street and turns to Building 616. This bend can be use as tie-in point for demin water. The cooling water will come from Building 606, so both demin water and cooling water lines will be along the west side of Beech Street and north over to Cypress Avenue then will turn to east along Cypress Avenue to the UNEX facilities. See drawing U-2

5.12.7 SBW Feed & UDS Return Lines

The SBW feed line and UDS return lines will connect to the existing B7 valve box. These lines will go from the valve box north to the UNEX facilities. Since the New Generated Liquid Waste Tank Farm (NGLWTF) is likely to be located north of existing tank farm and most process pipe lines are going to connect at the B7 valve box, these two lines shall be combined with NGLWTF project.. See drawing U-8.

5.12.8 Electricity

An existing electrical duct bank is located along the west side of Hemlock Street and goes northward over to Elm Avenue then turns to the west along the north side of Elm Avenue. The duct bank from Cypress Avenue to Elm Avenue will be under the UNEX facility, therefore, it will need to be relocated to the west of the TFD facility. See drawing E-5.

5.12.9 Electrical Requirements

5.12.9.1 Existing And Planned Electrical Utilities At INTEC. The INTEC power system ties into the 138kV INEEL loop at Substation 2, which is located outside the west area fence. Substation 2 transforms the 138kV to 13.8kV and provides power to Substation 10 and Substation 15, which are located within the INTEC complex. Power at 13.8kV is then distributed from Substation 10 and Substation 15 through the complex. The Electrical and Utility System Upgrade (EUSU) project is currently under construction and nearing completion. The EUSU project has installed a new 13.8kV electrical distribution system throughout the complex. This new system will provide greater safety, additional capacity and greater reliability.

Currently, standby power is provided by each facility. Standby generators are located at various facilities and operate as an island of power during a normal power outage. The EUSU project will construct a standby power plant and install new standby. Standby power will than be distributed through the complex by the new 13.8kV distribution system, The Utility Control System (UCS) will control the usage of standby power.

5.12.9.2 Power Requirements.

5.12.9.2.1 Normal Power—The electrical requirements of the UNEX Process and the Modified UNEX Process were analyzed. The results of the analysis are included in Tables 1 and 3 of Appendix C. Normal power is the power that is required during normal operations and includes the standby power loads, which are supplied by the standby generator, when normal power is interrupted.

Normal power will be supplied to the facilities housing the UNEX process by 13.8 kV feeders from Substation 15. A combination of new and existing duct banks will be used to route the feeders.

5.12.9.2.2 Standby Power—The requirements for standby power for the UNEX Process and the Modified UNEX Process were analyzed the results of the analysis are included in Tables 2 and 4 of Appendix C.

The standby loads for the UNEX process consist of the following:

- UPS Normal and Bypass feeds
- Selected lighting and miscellaneous loads
- Selected exhaust fans
- Other loads as determined in later designs.

Standby power to the UNEX process will be provided over the normal power distribution system from Substation 60, the Standby power plant substation, through Substation 15. The standby power system is at or near capacity. Upon completion of the EUSU project, an evaluation of the spare capacity will be performed. If necessary, a 2,000-kVA diesel generator and associated equipment will be installed next to the standby generator plant and connected to the standby power bus. Shedding of the nonessential loads will be performed by the UCS. The UCS will control the operation of circuit breakers and equipment to assure that only those loads requiring standby power remain in operation

5.12.9.3 Distribution System. If the UNEX or Modified UNEX process is housed in the new Greenfield Facility, both normal and standby power will be provided by one set of redundant feeders. The

EUSU project has installed a redundant pair of sectionalizing switches in the north east quadrant of the complex. These switches, PSS-NCE-1507A and PSS-NCE-1557A, are supplied by one set of 500-kcmil cables each. These are switches are fed directly from Substation 15 and are very lightly loaded. New duct banks will be run from these switches to a new load center. The load center will be double-ended and will provide a redundant source of power to the UNEX process.

If the UNEX or Modified UNEX process is housed in the existing Waste Calcine Facility, the electrical distribution system is not adequate and an additional load center would be constructed to supplement the existing power. The power would be taken from switches PSS-NCE-1507A and PSS-NCE-1557A and routed to the new load center through new and existing duct banks.

5.12.9.4 Uninterruptible Power Supply (UPS). A solid-state UPS with a static transfer switch will be provided. The UPS will be provided with a 20-minute battery backup. Both the normal feed and the bypass feed to the UPS will be on standby power. The UPS will feed a 208Y/120 Volt panel. The UPS and the panel will be located in the electrical room. The UPS will support the following loads:

- Voice paging/evacuation systems
- Environmental monitoring system
- Other critical loads as determined during design.

6. COST ESTIMATE

6.1 Life-Cycle Costs

The purpose of a life-cycle cost (LCC) analysis is to determine the least cost alternative, from a resource perspective. For Federal Agencies like the U.S. Department of Energy (DOE), the preferred evaluation methodology is discounted LCA as prescribed by the Office of Management and Budgets (OMB) document A-94. Thus, all costs presented are actually discounted Life-cycle analyses.

In general, the purpose of life-cycle analysis is to determine the current value of the resources required to implement the option, assuming each alternative provides equal product and/or service output. In other words, we are interested only in evaluating the cash flows; we will not evaluate the value of the benefits because we have assumed all alternatives will meet the minimum technical performance standard (technical viability).

6.1.1 Economic Methodology

All costs are estimated in FY-2000 dollars and not inflated (one of two analysis methods accepted by OMB.) For purpose of this feasibility study, all production rates and resulting costs in production were flat-lined (assuming constant production.) As prescribed in OMB Circular A-94, all constant value cash flows are discounted 3.1% (compounded annually) to FY-2000 to calculate the present value (PV) of the projected cash flow. The total of all discounted cash flows over the life of the project is the discounted LCC (dLCC). This methodology, prescribed by OMB in Circular A-94 (discount rate update in January 2000), is used to determine the most cost-effective method in acquiring, operating, and maintaining Government programs and agencies. In general, this test for cost effectiveness mandates that the best alternative is one with lowest PV, assuming each alternative meets minimum performance requirements. Thus, system performance must be ensured in economic analysis. As prescribed by OMB A-94, any previously incurred capital costs for equipment and facilities are considered "sunk" and are not included in cost-effectiveness analysis.

6.1.2 Operations Cost Methodology

The design team generated most of the operation costs. A majority of these costs were either labor or direct materials consumed in the process of operation. Other incidental costs such as training and working capital were estimated using best engineering judgement equally applied to all options.

Costs were organized into a pre-operations, operations, and post-operations periods. These were decomposed into direct and support activities. These were then decomposed into a functional organization according to the design team's input. This included: (1) material receipt and rough filtration, (2) radionuclide extraction, (3) evaporative drying, (4) neutralizing and drying, (5) packaging, (6) interim storage, (7) transportation to disposition site, (8) and support functions of capital maintenance, facility maintenance, administration, QA /safety/Radcon, and process maintenance. Lastly, some economic evaluations include a cost category for intangible costs that are often mitigated through the administration of additional capital and/or operations investment. Such a methodology usually allows for the inclusion of an operations benefit that is not included when a cost/benefit analysis is not performed (i.e., an intangible cost may be the added cost of a system that fails more often because less costly selected over better performing equipment.) However, discussions with the design team suggested that the stand-alone independence of the facility would not impact other INTEC operations. Additionally, the failure rates of any of the options are probably equal, thus, if there are any intangible costs impacts, they impact the options equally.

Labor costs were estimated based on a general classification of the laborer. The design team provided the labor type and estimated number of laborers. The economic evaluation assumed annual burdened costs of $100K for operator/technicians, $125K for scientists/engineers, and $155K for management and supervisors. The design estimated a total of 110 personnel are required to operate the facility for any option; thus, there are no marginal labor cost advantages between a greenfield and existing facility, or the UNEX and Modified UNEX Process.

The design team provided all consumable materials and unit costs. These were calculated according to the volume throughput of SBW (and because the volume was equal over three years, these costs were equal for three years.) Interim storage and transporting/dispositioning costs for treated SBW was included in the evaluation. Including these costs completes the LCC evaluation and the effect the treatment process has on follow handling. For example, the evaluation assumed that UNEX treated waste could be handled a little more cost-effectively since they could be contact-handled ($250 versus $500 per drum; $2500 versus $3500 for canisters). Similarly, the disposal could be performed on-site ($600 per drum) versus WIPP ($8.8K per drum). All contact-handled canisters disposed at Hanford cost $26.4K. Lastly, an operations contingency equal to 35% was included to account for unknown operations/post-operations costs. This cost did not include a contingency on the capital cost estimate which has its own contingency included.

6.1.3 Schedule Methodology

For all options, the analysis assumed a 5-year construction schedule starting in FY-2003. Although meeting the financial obligations may be accelerated, this was the assumed schedule to meet treatment by the start of FY-2008. All options also assumed a three-year operating schedule, after which the facility would be maintained in standby operations until FY-2020. During standby, the analysis assumed the option would be maintained at 50% of direct capital maintenance, 33% of support labor and administration, 25% of process maintenance, 50% of facility maintenance, and incur zero costs for QA, radcon, safety and direct operations.

The analysis assumed that the NWCF and the Hg removal system would be decommissioned, decontaminated, and demolished (DD&D) in FY-2021. For purposes of simplicity, this activity of DD&D would occur over a one-year period, although a realistic time period could require 10 or 15 years. The evaluation estimated a DD&D cost to be 13% of the original capital investment because of the expected low levels of contamination and relative ease in dismantling a facility of these construction techniques.

6.1.4 Life-Cycle Results

From a LCC perspective, all four options are very capital intensive. This result is primarily a factor of the SBW facility size, its throughput requirements, and the duration of the treatment campaign. Option A (Greenfield/UNEX option) has the lowest dLCC because of the less costly capital infrastructure and the disposition path for the treated SBW. The next lowest alternative is Option C which employ the UNEX process. This suggests that the marginal cost differences in the treatment process is more of a cost driver than the marginal cost differences in facility location.

6.1.5 Economic Recommendation

Based on the economic evaluation, it appears that Option A has a significant cost advantage over all other options. This evaluation has estimated that the UNEX Process is at least 20% more cost-effective than the Modified UNEX Process (once the effects of dispositioning are accounted for.) Secondly, Option A includes Greenfield construction which is at least 20% more cost effective than the

NWCF/Greenfield option. In both cases, 20% margins are considered significant enough of a difference to select one alternative over another. However, because a large portion of the overall cost advantages is due to the variable of disposition path, this economic evaluation recommending that additional analysis be provided to validate the volume and the disposition path of treated SBW.

Life-cycle estimates for UNEX and MUNEX have been completed for both the Greenfield Facility and the NWCF and are shown in Table 29. See Appendix E for a complete cost analysis breakdown.

Table 29. Life-cycle cost estimates for UNEX and MUNEX in GFF and NWCF.

Options	Life-cycle Costs
UNEX in GFF (Option A)	744,347,000
MUNEX in GFF (Option B)	890,140,000
UNEX in NWCF (Option C)	848,500,000
MUNEX in NWCF (Option D)	994,568,000

6.2 Capital Costs

Capital cost estimates for UNEX and MUNEX have been completed for both the Greenfield Facility and the NWCF. Costs for each different option are listed below in Table V-II.

Table 30. Capital costs for UNEX and MUNEX in GFF and NWCF.

Option	Total Project Cost
UNEX in GFF (Option A)	514,000,000
MUNEX in GFF (Option B)	514,000,000
UNEX in NWCF (Option C)	604,000,000
MUNEX in NWCF (Option D)	609,000,000

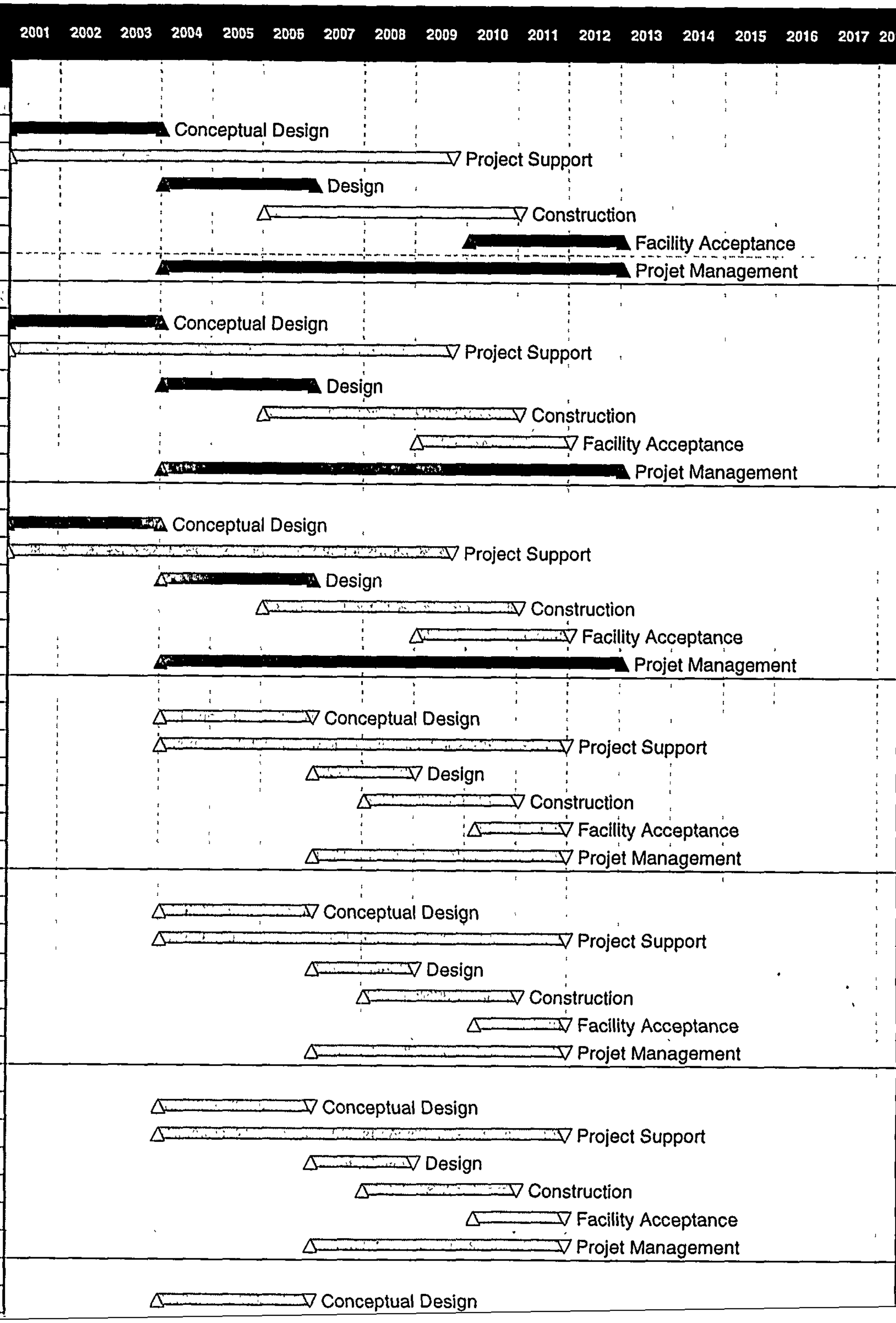
Details for each of the estimates include Other Project Cost (OPC), allowances for Project Development, Technical Development, Project Execution, and Project Acceptance/Closeout. Also included in each estimate are Total Estimated Cost (TEC) allowances for Engineering and Design (Title I and II), Quality Assurance, Project Management, Construction Management, Construction A/E Support, Construction (direct and indirect costs), Procurement, Escalation, G&A allowance, and contingency.

Due to minimal detail and scoping definition, this estimate is considered a planning estimate and is not intended to be used to establish a cost baseline. The complete capital cost estimate is provided in Appendix E.

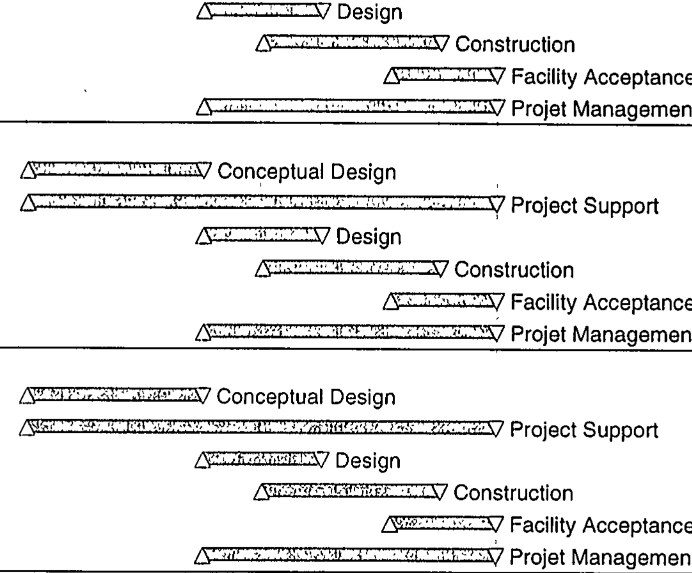
7. PROJECT SCHEDULE

The following schedule is based on an INEEL Decision Analysis Session held to review and evaluate SBW treatment options.

Act ID	Description	Orig Dur	Early Start	Early Finish
UNEX Study Final Schedule				
UNEX for SBW - Unescalated Costs				
1010	Conceptual Design	780	02JAN01	09JAN04
1020	Project Support	2260	02JAN01	25SEP09
1030	Design	780	12JAN04	11JAN07
1040	Construction	1300	10JAN06	18JAN11
1050	Facility Acceptance	780	20JAN10	21JAN13
1060	Projet Management	2340	12JAN04	21JAN13
UNEX for SBW for SBW - Escalated Costs				
2000	Conceptual Design	780	02JAN01	09JAN04
2010	Project Support	2260	02JAN01	25SEP09
2020	Design	780	12JAN04	11JAN07
2030	Construction	1300	10JAN06	18JAN11
2040	Facility Acceptance	780	19JAN09	18JAN12
2050	Projet Management	2340	12JAN04	21JAN13
UNEX for SBW - Discounted Costs				
3000	Conceptual Design	780	02JAN01	09JAN04
3010	Project Support	2260	02JAN01	25SEP09
3020	Design	780	12JAN04	11JAN07
3030	Construction	1300	10JAN06	18JAN11
3040	Facility Acceptance	780	19JAN09	18JAN12
3050	Projet Management	2340	12JAN04	21JAN13
CH Storage for UNEX for SBW- Unescalated Costs				
4000	Conceptual Design	780	12JAN04	11JAN07
4010	Project Support	2065	12JAN04	28DEC11
4020	Design	520	12JAN07	16JAN09
4030	Construction	780	16JAN08	18JAN11
4040	Facility Acceptance	465	17MAR10	28DEC11
4050	Projet Management	1285	12JAN07	28DEC11
CH Storage for UNEX for SBW- Escalated Costs				
5000	Conceptual Design	780	12JAN04	11JAN07
5010	Project Support	2065	12JAN04	28DEC11
5020	Design	520	12JAN07	16JAN09
5030	Construction	780	16JAN08	18JAN11
5040	Facility Acceptance	465	17MAR10	28DEC11
5050	Projet Management	1285	12JAN07	28DEC11
CH Storage for UNEX for SBW-Discounted Costs				
6000	Conceptual Design	780	12JAN04	11JAN07
6010	Project Support	2065	12JAN04	28DEC11
6020	Design	520	12JAN07	16JAN09
6030	Construction	780	16JAN08	18JAN11
6040	Facility Acceptance	465	17MAR10	28DEC11
6050	Projet Management	1285	12JAN07	28DEC11
RH Storage for UNEX for SBW-Unescalated Costs				
7000	Conceptual Design	780	12JAN04	11JAN07



7020	Design	520	12JAN07	16JAN09
7030	Construction	780	16JAN08	18JAN11
7040	Facility Acceptance	465	17MAR10	28DEC11
7050	Projet Management	1285	12JAN07	28DEC11
RH Storage for UNEX for SBW-Escalated Costs				
8000	Conceptual Design	780	12JAN04	11JAN07
8010	Project Support	2065	12JAN04	28DEC11
8020	Design	520	12JAN07	16JAN09
8030	Construction	780	16JAN08	18JAN11
8040	Facility Acceptance	465	17MAR10	28DEC11
8050	Projet Management	1285	12JAN07	28DEC11
RH Storage for UNEX for SBW-Discounted Costs				
9000	Conceptual Design	780	12JAN04	11JAN07
9010	Project Support	2065	12JAN04	28DEC11
9020	Design	520	12JAN07	16JAN09
9030	Construction	780	16JAN08	18JAN11
9040	Facility Acceptance	465	17MAR10	28DEC11
9050	Projet Management	1285	12JAN07	28DEC11



8. REQUIREMENTS AND ASSESSMENTS

8.1 Federal and State Regulations

The SBW and NGLW wastes contain both RCRA hazardous contaminants and radionuclides. Therefore, the management of the wastes must be in compliance with the requirements of EPA RCRA Subtitle C for the hazardous wastes and of the AEA-based requirements for radioactive wastes. The State of Idaho adopted the Federal RCRA regulations pursuant to the Idaho Hazardous Waste Management Act of 1983, and it has the authority to implement them in Idaho. The regulations are incorporated by reference into the Idaho "Rules and Standards for Hazardous Wastes." The AEA requirements are implemented and administered by DOE. The principal DOE requirement is compliance with DOE Order 435.1, "Radioactive Waste Management," and by implication, compliance with DOE Order 460.1A, "Packaging and Transportation Safety," and DOE Order 460.2 on "Departmental Materials Transportation and Packaging Management." These, in turn, imply compliance with applicable U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulations. The wastes are also subject to all other applicable federal, state, and local laws and regulations.

The waste management activities and their schedules must also comply with the terms and conditions of the Idaho Settlement Agreement, the Consent Order and other INEEL specific requirements. Also, the wastes must be managed in a way that meets the enforceable requirements and intent of the INEEL Site Treatment Plan developed in accordance with the Federal Facilities Compliance Act (FFCA).

The treatment options under consideration will result in waste forms that must meet the applicable regulatory requirements and that satisfy the WAC of the repositories identified as most suitable for them. A detailed discussion of the regulatory requirements that apply to this treatment process and facility can be fund in Appendix G of this report.

8.2 Waste Treatment and Acceptance Requirements

The UNEX or the Modified UNEX process would generate several primary and secondary waste products. The primary products are designated as high-activity waste (HAW) and low-activity waste (LAW). The HAW and LAW designation is based on the projected radionuclides and their concentrations in the wastes. The HAW will predominantly contain TRU nuclides that would meet the definition of TRU waste. The LAW will mainly contain cesium and strontium which would be qualified as LLW. The treatment options for the primary waste streams are expected to generate two waste forms. These are grout and crystallite. The primary products of the UNEX process are called CH-LLW grout (Class A) and RH-TRU crystallite. For the Modified UNEX, the primary waste products are designated as RH-LLW crystallite (Class C) and CH-TRU grout.

The secondary wastes include the final process solvents remaining at the end of the treatment campaign, HEPA filters, and PPE. The specific final waste forms for the secondary waste streams would depend on the treatment options selected. The determination of the treatment options relies on the nature and chemical composition of these wastes.

The primary and secondary waste streams must be treated to meet the RCRA land disposal restriction (LDR) standards or alternative methods approved by EPA for land disposal. They must also meet the criteria of the respective repositories they are destined to be sent.

Based on the DOE-HQ and NRC assessments, it appears that the SBW as it sits today in the Tank Farm may be considered HLW. The SBW would need a waste incidental to reprocessing (WIR) determination using the "Evaluation" process established in DOE Manual 435.1 to be managed as non-HLW. For the purpose of this study, it is assumed that the WIR ruling will be established and the SBW will not be considered HLW. The HAW and LAW fractions to be derived from the SBW processing will be considered TRU waste and LLW, respectively.

The SBW feed to the UNEX or the Modified UNEX process carries a number of RCRA characteristic and listed components, as defined in 40 Code of Federal Regulations (CFR) Part 261, Subparts C and D. The characteristic components consist of corrosive chemicals, heavy metals, and others known as the underlying hazardous constituents (UHCs). The hazardous waste numbers (HWNs) currently assigned to the waste are D002, D004-D0011, other D-codes, and listed F001, F002, F005 and U134. The wastes would be subject to the RCRA LDR requirements before any of these residues can be land disposed.

Because the waste is listed, any residues from treatment of the listed wastes would carry the same listed HWNs, as a result of RCRA "derived-from rule" (40 CFR 261.3 (C)(2)(I). Consequently, the resultant waste residues would be considered listed and would carry all the listed HWN. Without delisting, the treated waste products would continue to be regulated under RCRA even after LDR requirements are met, unless excluded from the RCRA Subtitle C regulations. "Delisting" is currently the only EPA approved mechanism for obtaining such an exclusion.

Currently, some of the potential target repositories under consideration in this study are not RCRA Subtitle C facilities. These facilities are not authorized to receive any RCRA listed waste for disposal. Others such as the Waste Isolation Pilot Plant (WIPP) and the Hanford site accept certain LDR treated listed LLW. The Nevada Test Site (NTS) accepts mixed LLW for disposal, however, it does not accept such waste from the off-site generators at the present time. Per DOE's record of decision (ROD) issued in February 2000, the NTS and Hanford site will be used for the disposal of both LLW and mixed LLW from the DOE complex in the future. Nevertheless, in this study, it is assumed that the wastes resulting from the UNEX or Modified UNEX option will be delisted before final interim storage for shipment to the disposal sites.

Before shipment, delisting petitions for the target waste must be granted for both Idaho and the receiving state. If the target waste were transported through other states on its way to the receiving state, it would have to be accompanied by a manifest. Potentially, notification of transitory states may be performed before shipment as a courtesy.

The design and operation of the interim storage facility that would be used for the final waste products would not require compliance with the RCRA requirements. This is based on the assumption that the delisting petitions for the target-waste products would be granted before interim storage. However, since the SBW also contains characteristic constituents, the facilities used for processing the liquid SBW (before interim storage) must be designed, constructed, and operated in accordance with the RCRA requirements. Both the liquid waste processing and the interim storage facilities must comply with all other applicable DOE regulations. These requirements are defined in 40 CFR 264 (IDAPA 16.01.05.008) and in 40 CFR 270 (IDAPA 16.01.05.012).

Some of the tanks with SBW feed to the UNEX process contain a relatively large amount of mercury. Based on the total amount of mercury in the waste in these tanks, the SBW is considered a high mercury subcategory waste (≥ 260 mg/kg total mercury) from RCRA standpoint. For high-mercury subcategory waste, the RCRA LDR treatment standard is RMERC (retorting mercury) followed by stabilization of the retorted residue. A large percentage of mercury in the SBW feed will end up in the final LLW grout if mercury is not removed from the upstream. Grouting is not the LDR specified treatment for high mercury waste. Therefore, a determination of equivalent treatment (DET) petition will need to sought by the INEEL and approved by EPA for using grouting to stabilize the waste for disposal. It is assumed that the DET petition will approved by EPA for using grouting to stabilize the waste for disposal.

Appendix G provides a detailed analysis of the applicable regulatory requirements and a description of the criteria of the potential repositories for waste acceptance and disposal.

9. UNCERTAINTIES AND RECOMMENDED RESOLUTIONS

At this point, there are a few uncertainties to be resolved to be certain this project is feasible. For example, it is not known at this juncture whether the HAW fraction from the process can be evaporated in the TFD to an acceptable solids concentration for grouting. Another unknown at this time is whether a suitable grouting formula can be developed that will meet all repository requirements. Listed below are the uncertainties and recommended resolutions for the UNEX and Modified UNEX project.

9.1 Research

9.1.1 Mercury Study

9.1.1.1 Introduction. The purpose of the UNEX and modified UNEX processes is to remove cesium, strontium, and actinides from the SBW. The extracted radionuclides in the UNEX solvent are stripped into guanidine carbonate/DTPA solution. This allows the UNEX solvent to be reused and minimize final waste quantities. While the main purpose of the UNEX solvent is to extract the targeted radionuclides, there are concerns about the fate of other heavy metals, in particular mercury. The focus of this appendix is to track the movement of the mercury species in the process and to determine how mercury will impact the final waste forms. The main reference that will be used to follow mercury in the process is the UNEX mass balance developed by Barnes (1999). Additionally, EPA/RCRA references appearing in the Code of Federal Regulations and the Federal Register will be used. This section will first discuss the following details:

- Mercury regulatory issues
- Amount of mercury in the tank farm
- Partitioning of mercury in the UNEX process
- Final disposition of mercury
- Technical development needs.

9.1.1.2 Regulatory Issues involved with Mercury. The concern over the presence of mercury in the UNEX process is born from regulatory issues. Mercury is a volatile metal at room temperature and as a result, the regulatory agencies treat mercury contamination in waste differently than other metal contaminants, i.e. cadmium, chromium, lead, etc. The key issue with mercury in waste is to determine if the waste exhibits the characteristic of toxicity for mercury (D009) at the point of generation. If the waste is characteristic for mercury, the subcategory of the waste and the treatment standard relative to total mercury concentration in the waste must be identified for LDR purposes.

Point of generation – The original point of generation of the waste of interest is the sodium bearing waste. The current regulations say that a waste is D009 (characteristic for mercury) at 0.2 mg/L. The molar concentration for this is 9.96E-7-molar Hg. For all the tank farm waste (WM-180 through WM-189), the lowest mercury concentration is in WM-181 which is 4.49E-4-molar Hg. All the tank farm waste exhibits the characteristic of mercury and will carry a D009 code.

Mercury Subcategory – Due to the concentration of mercury, some of the waste in the tank farm is currently considered a nonwastewater[4]. According to 40 CFR 268.40, there are two subcategories for mercury as a nonwastewater – low mercury subcategory and high mercury subcategory. The concentration of mercury that determines the subcategory is a total mercury concentration of 260 mg/kg or, in this case (assuming a density of ~1.0 g/ml), a total concentration of mercury of 260 mg/L. This value can be expressed as a molar concentration of 1.29E-3 M. In Tables 31 and 32, the concentration of mercury in each of the tanks and the subcategories are given. (NOTE: The mercury subcategory assignment is based on the premise that each tank could be treated as individual wastes. For this study, it will be assumed that the entire SBW in the tank farm is ONE waste stream, per the blending strategy.)

Table 31. Mercury inventory in the Tank Farm (before blending scheme).

Tank Number	Mercury Conc (M)	Mercury Subcategory
WM-180	9.72E-4	LOW/Wastewater
WM-181	4.49E-4	LOW/Wastewater
WM-182	9.97E-4	LOW/Wastewater
WM-183	2.89E-3	HIGH/Nonwastewater
WM-184	6.88E-4	LOW/Wastewater
WM-185	3.90E-3	HIGH/Nonwastewater
WM-186	9.02E-4	LOW/Wastewater
WM-187	2.69E-3	HIGH/Nonwastewater
WM-188	7.48E-3	HIGH/Nonwastewater
WM-189	5.10E-3	HIGH/Nonwastewater

Table 32. Mercury inventory in the Tank Farm (after blending scheme).

Tank Number	Mercury Concentration (M)	Mercury Subcategory
WM-180	9.72E-4	LOW/Wastewater
WM-188	1.32E-3	HIGH/Nonwastewater
WM-189	4.03E-3	HIGH/Nonwastewater
New	1.53E-3	HIGH/Nonwastewater

Treatment Standards – The treatment standard for high subcategory mercury waste is given in 40 CFR 268.40 as IMERC and RMERC for the organic subcategory or RMERC for the inorganic subcategory. Although the waste stream has been identified as a nonwastewater per 40 CFR 268.2(f), the actual physical form of the waste, especially after filtration is that of a wastewater. Typically in retorting operations, mercury is more volatile than the majority of the waste matrix from which it is to be removed. The SBW raffinate is not amenable to retorting due to the 97 to 99 wt% water composition. As a result, retorting of process residues is not recommended.

9.1.1.3 Movement of Mercury in the UNEX Process. One of the purposes of this study is to track and analyze the movement of mercury in the process. The starting point for this analysis is the mass balances that exist for the UNEX process (Barnes 1999). These mass balances were developed from process flow diagrams using an EXCEL model and input parameters. Unlike the solvents TRUEX or

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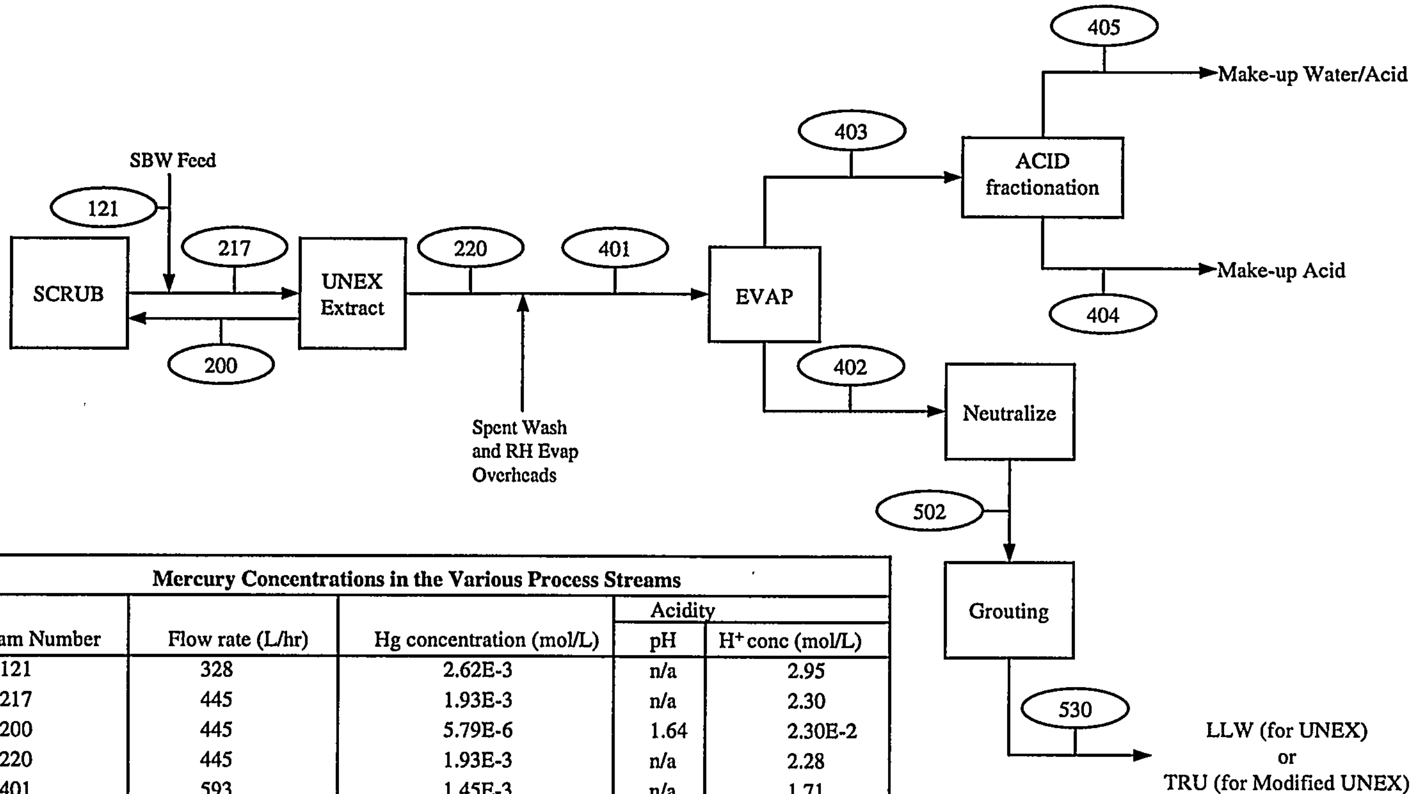
[4] According to 56 FR 3874: "Any wastes that contain greater than 260 mg/kg of total mercury, but that otherwise appear to meet the definition of wastewaters, are, in fact, classified as nonwastewaters that must be recovered."

SREX processes, the UNEX solvents show little affinity to mercury. In the TRUEX process, the carbonate wash step was instrumental in backwashing the mercury out of the extraction solvent.

Figure 6 shows a simplified process flow diagram for the UNEX/modified UNEX processes that illustrate how the mercury is partitioned from process to process. The speciation of the mercury in solution can be inferred by the molar concentration of mercury and the various anions in solution. Due to a chloride to mercury molar ratio of 17 to 1 in most of the streams, it may be concluded that most of the mercury in solution exists as chloride complexes.



Mercury Concentrations in the Various Process Streams				
Stream Number	Flow rate (L/hr)	Hg concentration (mol/L)	Acidity	
			pH	H^+ conc (mol/L)
121	328	2.62E-3	n/a	2.95
217	445	1.93E-3	n/a	2.30
200	445	5.79E-6	1.64	2.30E-2
220	445	1.93E-3	n/a	2.28
401	593	1.45E-3	n/a	1.71
403	352	1.28E-10	1.05	8.85E-2
405	345	0	3.00	1.00E-3
404	7.5	0	n/a	4.14
402	246	3.48E-3	n/a	3.98
502	297	2.89E-3		
530	842	205 ppm	n/a	n/a

Figure 6. UNEX/Modified UNEX process flow diagram.

The feed stream to the UNEX process (**Stream 121/217**) undergoes extraction with the selected solvent system (UNEX or modified UNEX). The raffinate (**Stream 220**) retains nearly all of the mercury (distribution coefficient for mercury of 0.003). The exit solvent stream (**Stream 200**) contains a minimal amount of mercury. The raffinate stream (**Stream 220**) is combined with both the UNEX wash effluent and the remote-handled stream evaporator overheads to form a stream (**Stream 401**). This combined stream is fed to an evaporator and the mercury is partitioned between the evaporator bottoms (**Stream 402**) and overheads (**Stream 403**). At the temperature of the evaporator, it is assumed that 98.6% of the Hg is retained in the bottoms.

The evaporator overhead stream (**Stream 403**) is sent to an acid fractionator that splits the stream into two fractions. The overhead stream from the acid fractionator (**Stream 405**) is used as water for the grout mixing tank, the acid make-up tank, the HF make-up tank (for UNEX), and the strip and carbonate wash tanks. The bottoms stream from the acid fractionator (**Stream 420**) is used as the make-up acid for the SBW filter wash, the UNEX scrub, and the solvent wash feed tanks. The presence of mercury in the evaporator bottoms stream results in relatively small concentrations of mercury becoming recycled throughout the contactors.

The evaporator bottoms stream (**Stream 402**) is sent to a neutralizing tank to be adjusted to a pH of 1.3 by addition of NaOH. The stream exiting the neutralization (**Stream 502**) is sent to the grout tank to be solidified with a combination of Portland cement, blast furnace slag, and calcium hydroxide. The final solidified form (**Stream 530**) will be targeted as a LLW for disposal at a subtitle C disposal facility (UNEX process) or as a TRU for disposal at WIPP (modified UNEX process).

9.1.1.4 Effect of mercury on the final disposition of waste forms. A recommended strategy of treating the SBW waste stream is to apply for a Determination of Equivalent Treatment (DET) exclusion from retorting. Through future TD studies, data can be provided to the governing agencies to demonstrate the effectiveness of alternate methods for mercury treatment. At the time of this feasibility study, the impacts to planned schedules or budgets due to the DET are not known. Since demonstration of the UNEX process is required for RCRA treatment before permitting and needs to be scheduled and budgeted, extra costs for specific DET activities/requirements would be a relatively small adder to these activities.

9.1.1.5 Technology development needs. If it is deemed through evaluation that a mercury removal process is required on the raffinate stream, suitable processes need to be evaluated. One consideration with mercury removal from the raffinate is dealing with the high acidity. There are a few candidate processes that would need refinement from a bench/pilot-scale before inclusion to any PFD plans. These are electrochemical reduction, sorption with a potassium copper hexacyanoferrate resin, and the Sachtleben-Lurgi process. A brief discussion of the process and technology needs will be presented.

One alternative for mercury removal from the raffinate would be electrochemical reduction using a flow through electrochemical cell. Elemental mercury would serve as a cathode pool in an electrochemical cell. Soluble species of mercury in aqueous solution would be reduced to its elemental form at the cathode pool. Along with the mercury, some metals (including a few radionuclides) will also reduce into the mercury cathode pool. Experimental studies conducted by the INEEL Technical Development Group are on-going to analyze the feasibility of treating calcine off-gas scrub solutions. Initial results using a flow through system have indicated that acidic scrub solutions of 0.15-molar Hg can be treated to produce concentrations of 0.015-molar Hg. Assuming that 0.015-molar Hg is the lowest concentration that can be attained, only the most Hg-laden tanks could be effectively treated. The residual from this process is elemental Hg with some amalgamation of metals on the top. This form could then be retorted to recover "pure" mercury for sulfur amalgamation. The residues of retort could be added back to the raffinate for grouting. Further developmental efforts into this process would focus on the following.

- Refinement of the process to treat down to Hg concentrations below 0.015 M.

- Effects of co-reduction of metals on the process and final Hg waste form

Another potential treatment option for mercury in the raffinate stream is to process the stream through a potassium copper hexacyanoferrate ion exchange sorbent (silica dioxide substrate). This resin was investigated at the INEEL (Brewer et al. 1999) for the removal of Cs from Tank Farm Wastes. The study found that the sorbent was not effective for removal of Cs due to chemical interference from mercury. [Note: For the raffinate stream from UNEX, there will be negligible Cs present.] For tests on simulated dissolved calcine, the results of this report indicate that although the resin performed well for removing mercury in the absence of chlorides (a DF between 1.6 to 2.9 for the first 320 bed volumes - breakthrough occurring near 400 bed volumes). With a molar ratio of 3 to 1 (chloride to mercury), poor removal of mercury (DF=1.1) resulted. When tank farm waste was tested (SBW from WM-183 and WM-185), the chloride to mercury molar ratio was between 4 to 6. The results were difficult to interpret due to fluctuating DFs. At the levels of mercury removal required for the raffinate (<260 mg/L), these resins may be adequate. The main waste form resulting from this process would be a mercury-loaded resin, which would require retort per the RCRA requirements. Further developmental efforts into this process would focus on the following.

- Understanding the process better and how it relates to mercury removal. The earlier study was focussed on cesium removal.

- Testing the system for mercury in the absence of cesium, which is the main competitor with mercury for sorption sites.

Another process that may be able to remove mercury from the UNEX raffinate is the Sachtleben-Lurgi process. This process has been used in Duisburg, Germany for precipitation of arsenic and other heavy metals, including mercury, from acidic scrubber waters (SAIC 1998). The wastewaters are off-gas scrub solutions resulting from the smelting operations of metal ores. The process includes the addition of small amounts of a soluble hydrosulfide salt to provide the hydrosulfide ion (HS^-) to the reaction, assuring more complete heavy metal removal. The resulting waste form from this process is a mercuric precipitate that may not require further retort pending TCLP. Further developmental efforts into this process would focus on the following.

- Determine conditions in which this process operates

- Determine collection units for solids

All of these processes could require investigation if it is determined retort of a residue of treatment is required before final treatment. If retort is not required for any of the treatment residues, these mercury removal processes would not be needed.

9.1.2 Solvent Evaluation

To maintain reliable and prolonged operation of any extraction system, it is necessary to ensure the stability of the extractant composition and properties. In the UNEX process, changes in extractant composition arise from radiation and chemical decomposition of its components, as well as a result of the washing by aqueous solutions.

The UNEX-extractant contains four components: phenyltrifluoromethylsulfone (FS-13), as the diluent, and chlorinated cobalt dicarbollide (ChCoDiC), diphenyl-N,N-dibutylcarbamoylmethylene phosphine oxide (CMPO) and polyethyleneglycol (PEG), as the extractants.

9.1.2.1 Characteristics

Some components of the UNEX extractants are well known, due to extensive studies and experience of their use in radiochemical facilities. For example, high chemical and radiation stability of ChCoDiC and PEG have been demonstrated at a HLW partitioning facility (Khlopin 1999). ChCoDiC is also characterized by its very low solubility in acidic media and thus very low losses with aqueous solutions[1]. In existing practices, the constant growth of ChCoDiC concentration is observed in extraction mixture due to diluent washout.

There is rather wide Russian and American experience of using different CMPO for HLW reprocessing, which confirms their high radiation and chemical stability.

The diluent for the UNEX process, FS-13, has not currently been used in radiochemical processes and, therefore, its radiation and chemical stability has been unknown. Studies have recently been performed in St. Petersburg, Russia by V.G. Khlopin Radium Institute to evaluate the radiation and chemical stability of FS-13. The results of these studies can be found in the 1999 final report entitled "Applicability of the Russian Separation Technology to Processing of US Radioactive Wastes."

Radiation and chemical stability of FS-13 studies were conducted in two cases. First, irradiation of FS-13 by itself produced a maximum decomposition of 4.5 molecules/100 eV. Second, irradiating FS-13 in contact with an aqueous solution of nitric acid produced a total decomposition of 4.5 to 5.0 molecules/100 eV.

Table 33 summarizes the characteristics of the extraction solvents. More information on UNEX extraction solvents can be found in the process description of the extraction stage in Section IV.

Table 33. Characteristics of the extraction solvents.

Compound	Composition	Reactivity	Degradation
Phenlytrifluoromethyl sulfone (FS-13)	$C_7H_5F_3O_2S$	The distribution coefficients of Cs, Sr and Eu are unaffected by the irradiation dose (in ranges up to 20 Wh/l), which is indicative of high radiation stability of all components in the extraction mixture.	Radiation losses of FS-13 diluent in 350 extraction cycles at a dose of 20 Wh/l in one- and two-phase systems do not exceed 0.9%; Washed out by highly acidic solutions, but losses with solutions of UNEX process do not exceed 0.3 g/l.
Chlorinated cobalt dicarbollide (ChCoDiC)	$(C_2B_9H_8Cl_3)_2Co^-$	High chemical and radiation stability	Low solubility in acidic media and, thus, very low losses with aqueous solutions
diphenyl-N,N-dibutylcarbamoylmethylene phospine oxide (Ph_2Bu_2CMPO)	$(C_6H_5)_2POCH_2CON(C_4H_9)_2$	High chemical and radiation stability	
Polyethylene glycol 400 (PEG-400)	$HO-(CH_2CH_2O)_n-H$	High chemical and radiation stability	Low solubility in acidic media and, thus, very low losses with aqueous solutions

Adapted from V.G. Khlopin Radium Institute, "Applicability of the Russian Separation Technology to Processing of US Radioactive Wastes", 1999.

9.1.2.2 Safety Issues

This section is written to address possible safety issues with the UNEX solvent during storage and use. Information about the four components is needed to determine safety concerns. A report was written in which some of these safety issues were determined (Khlopin 1999). The discussion that follows is a summary of the testing that is discussed in the report.

Some components of UNEX-extractant are rather well studied, and through experience in practice, it was determined that ChCoDiC, PEG, and CMPO have high chemical and radiation stability. The diluent for the process, FS-13, was previously not used in radiochemical processes, and as such, its radiation and chemical stability is unknown. In addition, by weight, the FS-13 represents 96% of the solvent. Three particular issues that were addressed were:

- Amount of hydrogen formed from radiolysis
- Formation of combustible mixture of diluent (FS-13)
- Thermal stability with nitric acid

They determined the total dose rate released from the aqueous feed solution to be 0.0009 W per liter of solution. Using assumptions which include assigning numerical values to the solvent flow rate, mixing chamber volume, number of contactor stages, and percent of nuclides transferred, a dose per solvent cycle in the UNEX process (0.065 W-hour per l) was obtained. As recirculation passes are accumulated, this number will increase accordingly.

The integral dose rate was determined to be 20 W-hour per 1 liter of FS-13. The main products of radiolysis are hexafluoroethane and benzenesulfonic acid (liquids), and hydrogen gas (95%). When FS-13 was irradiated in the presence of nitric acid, additional products of radiolysis are trifluoronitromethane and nitrobenzene (liquids), sulfide and fluoride ions (in aqueous phase), and hydrogen gas (80%). The rate of radiological gas-evolution is equal 4.5 to 5.1 ml/hour per liter of solution.

The investigators concluded that the values of t_{flash} and t_{low} for the organic products involved with FS-13 diluent are well above the maximum temperatures that would be used in the extraction operations. The researchers concluded that the temperatures at which a fire hazard is possible are much higher than the maximum operational temperatures of the UNEX process. The process should be considered as fire-explosion safe if "normal" conditions are met.

A series of experiments used a 14-molar solution of HNO_3 with the FS-13 diluent (at a ratio of 3:1 by volume). This mixture was placed in a cell that would allow for heating (120 to 150°C). There was no direct mixing of the acid phase with the solvent. Varying densities of acid were used by varying the NO_3^- ion (addition of nitrate salts). The data obtained from these tests indicated that FS-13 is resistant to the action of highly concentrated nitric acid solutions. Recordable gas evolution occurred began at105°C and the rate of evolution was deemed low. In a closed reactor vessel (autoclave), there was no heat release from nitric acid and FS-13 up to 150°C (no mixing in the system). At around 160°C, self-heating begins, but the exotherm was reported to be weak – 15 to 17°C rise in 10 to 15 minutes. After this period, the mixture stabilizes. The researchers concluded that the potentially hazardous processes (gas-evolution, self-heating of mixtures) come about at the temperatures well in excess of the operating conditions, and therefore also conclude that the process operations have a significant margin of safety with respect to thermal stability.

9.1.2.3 Suppliers

Vendors and prices for UNEX and Modified UNEX raw materials were researched and tabulated. In many cases, several vendors were identified, with varying unit prices. Price ranges for raw materials are shown below (Table 34)

Table 34. Cost of raw materials.

Material	Price	Unit
Hydrofluoric acid (HF)	$30.39	16 L
Aluminum nitrate ($Al(NO_3)_3$)	$4.65 - $6.31	1 lb
Phenyltrifluoromethyl sulfone (FS-13)	$30	1 kg
diphenyl-N,N-dibutylcarbamoyl phosphine oxide (CMPO)	$1	1 g
Polyethylene glycol 400 (PEG 400)	$86	0.5 lb
Chlorinated cobalt dicarbollide (ChCoDiC)	$3	1 g
Guanidine carbonate	$118	5 kg
Diethylenetriamine pentaacetic acid (DTPA)	$10.5 - $33	1 kg
Nitric acid (HNO_3)	$219.24 - $284.92	15 L
Sodium hydroxide (NaOH)	$741.6 - $2885	200 L

9.1.2.4 Possibility for glass loading

Vitrification of UNEX HAW Crystalline Waste

The high activity fraction of the waste from the UNEX process is primarily an organic material. Guanidine carbonate ($2[(NH_2)_2C{=}NH]\cdot H_2CO_3$) and other organic compounds constitute more the 80 % of the waste. It is vitally important to understand how these materials will behave in a glass melter. To date, limited development work has been done, including preparation of a borosilicate glass sample at 1,100–1,200°F using guanidine carbonate strip product solution from pilot testing.

The thermal regime in a glass melter is complex. Feed material is exposed to temperatures ranging from a few hundred degrees to over 1,100° C. As the feed heats up and becomes part of the "cold cap" floating on the molten glass, it also passes through a variety of chemical environments. Initially, the material is at 200° C to about 600° C with adequate ambient oxygen to support combustion. As the feed heats up further and begins to decompose, it enters an area with reduced oxygen content between the top of the cap and the molten glass. With the UNEX High Activity Waste (HAW), the decomposition products may include partially oxidized materials such as CO, HCN, and oxides of nitrogen.

In recent pilot-scale melter tests, a small amount of powdered activated carbon was blended with inorganic feed material to control redox conditions in the melt. The carbon was less than 1 % of the feed by weight. While this mixture was being fed to the melter, small flames were observed coming from the cold cap. The effect was similar to several cigarette lighters being turned on and off rapidly. With a much higher percentage of organics in HAW feed, substantial amounts of CO would be generated, resulting in a potential safety hazard.

A glass melter can be used for thermal treatment of organics. However, it is not a substitute for an incinerator, in which combustion conditions can be optimized. It is suggested that a safety assessment be conducted before there is further process development or design work done on this portion of the UNEX flowsheet.

9.1.3 Citrate Study

In the UNEX process, citrate was proposed as an ingredient in the scrub cycle for purposes of removing extracted zirconium. If citrate were used in this manner, it is highly possible that it would end up in the low level waste (LLW) form, which is assumed to be grouted before disposal. Citrate was not proposed as an ingredient in the Modified UNEX process and will not be evaluated for that process.

Citrates are organic compounds that belong to the family of hydroxy carboxylic acids. Hydroxy carboxylic acids, or their salts, are commonly used as retarding agents because of their incompatibility with alkali carbonates, alkali bicarbonates, and metal nitrates. Citrate is also a known metal complexing agent and can complicate stabilizations when it is present in solutions. In the UNEX process, it is assumed that grouting is the selected treatment for the LLW stream. Therefore, it is necessary to determine the effects of citrate on grouting of the LLW and to define permissible citrate loadings for grout, if applicable.

An extensive literature search was performed to collect and document information on citrate in grout. This proved to be difficult, as discussions revealed that testing of citrate in grout is limited. In discussions with B.E. Scheetz of the Pennsylvania State University materials research laboratory and A. K. Herbst and J. A. McCray of the Idaho National Engineering and Environmental Laboratory (INEEL), it was revealed that grout tests with citrates have not been performed at the INEEL. The only known testing of this type has been done in the United Kingdom. These tests have revealed citrate in grout prevents curing and have resulted in the United Kingdom banning any citrates in processes that lead to grouting. Based on these findings, the INEEL has done no testing of citrates in grout, but has relied on past experience.

The issue then was to determine the levels of citrate that prevent curing of grout. R.D. Spence of Oak Ridge National Laboratory has stated that retarder admixtures are usually effective in concrete mixtures as low as a few tenths of a percent. Retardation may either prevent ultimate curing of the final waste form, or extend the time it takes to cure. Because results may vary for each individual waste form and there are no known development tests for grouting sodium-bearing waste containing citrates, it may very well be necessary to perform tests and identify problem areas.

The number of processing steps necessary for the production of an acceptable grout may dramatically increase, because all evidence reveals small quantities of citrate can reduce or eliminate curing reactions. Additional precautions and processing steps may include specific development tests for grouting sodium-bearing waste containing citrate and the steps to convert citrate to a grout former downstream of the centrifugal contactors. Because these steps may be very extensive, it was decided that it is best to eliminate citrate from the UNEX process and replace it with a different compound that will not hinder the grouting process. Other possible compounds may include hydrofluoric acid, sodium fluoride, or aluminum fluoride.

9.1.4 Sodium Fluoride vs HF

The UNEX extraction process uses hydrogen fluoride as a zirconium and iron sequestering agent in both the SBW feed and in the UNEX scrub. Zirconium and Fe compete with the actinides during the extraction process inhibiting the full extraction of actinides. Fluoride ion from the HF complexes the zirconium and Fe thus decreasing the amount of Zr and Fe extracted in the process.

There are inherent problems in dealing with HF though. HF is highly toxic and very corrosive. Special care must be taken when handling HF to prevent it from coming in contact with the skin. Therefore, special training must be conducted for anyone working with HF. Also, special protective wear must be used when handling this chemical. HF is also very corrosive to most materials. Because of this, special alloys must be used for storage tanks, transfer lines, and pumps.

This problem could be alleviated though through the use of sodium fluoride since all that is required out of the complexing compound is the F- ion. Sodium fluoride does not have the toxicity of HF and is not as corrosive.

Another benefit of using NaF is the fact that it could be added to the filtered SBW feed tanks and scrub make up stream as a solid. This would decrease the size of the storage tank needed thus decreasing the footprint of the process.

The only possible problem with NaF has to do with the increase in Na concentration in the SBW. Na competes in the extraction process with Cs and it is not known if increasing the Na concentration from 1.4M to 1.7M, which would happen if NaF is used, would change the extraction efficiency with respect to Cs. Bench-scale tests do need to be conducted to determine this before any decision is made as to use of NaF over HF.

9.2 Applicability to Calcine Treatment

The UNEX or Modified UNEX process could be applied to treat calcined waste. However, the scale of equipment presented in this study is insufficiently sized to appropriately handle the liquid waste volume generated from redissolving the entire inventory of calcined waste at INTEC. The following elaborates on these findings.

Calcined waste exists largely in two forms – alumina and zirconia calcine. Bench-scale experimental studies were performed in FY-00 with UNEX treatment of redissolved zirconia calcine. The preliminary results were favorable, yielding comparable or higher separation factors for cesium, strontium, and actinides then those achieved from UNEX treatment of SBW. The differences in UNEX process performance between SBW and redissolved calcine revolve largely around the concentrations of interfering constituents, which differ between SBW and alumina and zirconia calcine. Based on the experience with UNEX treatment of SBW and redissolved zirconia calcine and on the chemical make-up of alumina calcine, the UNEX process is also expected to perform well with redissolved alumina calcine. Bench-scale experimental studies of UNEX treatment of alumina calcine are planned.

UNEX treatment of calcined waste would require the material's retrieval from the Calcined Solids Storage Facility (bin sets) and subsequent dissolution in nitric acid as a head-end process to feed into the UNEX cross-flow filtration system. A previous study has identified a technique to vacuum out the calcined solids from the storage bins and pneumatically transfer the material to dissolution process equipment (Landman and Barnes 1998). The recent experimental study of UNEX treatment of zirconia calcine used 10 liters of 3M nitric acid for dissolution of every 1 kg of zirconia calcine, resulting in a solution of approximately 1M acid concentration. A similar acid volume to calcine loading ratio is also expected for dissolution of alumina calcine, although the initial concentration of acid would vary in order achieve a 1M acid concentration as a UNEX feed. Filtration of the redissolved calcine is required to remove UDS, which would be returned to the tank farm as presented in this study. The amount of UDS estimated from dissolution of calcined waste is comparable to that of the SBW, i.e. approximately 3g/liter.

The inventory of calcined waste is about 3800 m^3, 1230 of which (or 1400 metric tons) is alumina and the balance (or 4900 metric tons) zirconia. Given the prescribed acid to calcine dissolution ratio, the inventory of calcined waste would result in the generation of some 63 million liters of redissolved calcine liquid waste. At a UNEX processing rate of approximately 300 liters/hour, 24-hours/day, and 200 operating days/yr, as presented in this study, the inventory of calcine waste would require approximately 44 years to process. Such a treatment rate is inconsistent with the Settlement Agreement between the State of Idaho and the DOE, which requires treatment of calcined waste into a form suitable for transport to a permanent repository by a target date of December 31, 2035.

9.3 Research and Development Needs

During the course of this feasibility study, several issues and/or uncertainties were identified where additional research and technology development activities could be conducted that would enhance the feasibility study design. The following major areas were identified:

9.3.1 Sodium Bearing Waste Filtration Characteristics

Filtration characteristics of the tank farm waste must be determined to select and size the appropriate equipment for the remote solids liquid separation (SLS) unit operation. Physical properties such as particle size distribution and solids content are required. Methods must be developed to obtain appropriate samples, determine experimental methodologies, and evaluate filter requirements. All development efforts must be geared toward the use of the concentrated tank farm wastes after evaporation.

9.3.2 Filtered UDS Radiological and Rheological Properties

To ascertain the necessary handling equipment, shielding requirements, and appropriate treatment unit operations, the radiological and rheological properties of the undissolved solids (UDS) filtered from the tank farm waste must be determined. With regard to radiological properties, the total curie content and radionuclide distribution must be evaluated. Determination of the radiological properties will require samples of the UDS from the tank farm for characterization and analysis. Rheological properties include bulk density, moisture content, friability, and transport characteristics – many of which are dependant on the type of filteration equipment used for solids liquid separation. Consequently, samples of actual tank waste must be obtained in sufficient quantities to gather UDS samples amenable to determination of solids characteristics.

9.3.3 Feed Composition Variability

UNEX Development work to date has focused on treatment of the tank waste as it exists in the tanks today, as well as the projected average tank waste composition of the SBW after evaporation in the HLW evaporator. The composition of SBW feed to the UNEX process will vary from tank to tank, as well as vary based upon operation of the high-level waste evaporator. The effect of these feed variations on the extraction of the Cs, Sr, and TRU's should be evaluated and UNEX flowsheets developed which will result in the necessary removal efficiencies of these components. Feed composition variability may also affect the grouting, solvent crystallization, and the extraction solvent loss processes.

9.3.4 Solvent composition Variability

The concentration of the extractants in the UNEX process solvent will vary during operation due to the solubility of PEG and phenyl trifluoromethyl sulfone in the aqueous raffinate and strip product streams. To know when adjustment of the solvent is required, the range of acceptable extractant concentrations (PEG, cobalt dicarbollide and CMPO) must be known. This information is important in that it defines how tightly the solvent composition must be controlled and also affects to some degree how "tight" the quality specification on raw solvent materials must be.

9.3.5 Chemical/Radiological Stability of Solvents

Due to the relatively long periods of time that the waste forms generated from the UNEX processes may need to be stored before shipment to a final waste repository, radiological stability and long term chemical stability of the solvents must be demonstrated.

9.3.6 Hazards Analysis

An analysis of the hazards associated with the operation of the high temperature unit operation in the UNEX process should be performed. This includes analysis of potential hazardous decomposition products associated with the entrained/dissolved solvent components in the aqueous raffinate feed to the evaporator and the RH TRU strip feed to the thin film dryer.

9.3.7 Hydrogen Generation

Operation of the UNEX process concentrates the fission products into the RH TRU crystallite. The generation of hydrogen in the RH TRU canisters should be evaluated to determine the potential level of hydrogen buildup, if any, during storage or shipping of the canisters.

9.3.8 Solvent Purity Specifications

Extraction of the Cs, Sr, and/or TRU elements by the UNEX solvent likely will be effected by the purity of the solvent components. The purity specifications required for each of the extractants and the diluent to obtain efficient extraction of these components needs to be determined.

9.3.9 Solvent Commercialization

The commercial availability of the UNEX solvent components for the volumes required to process the SBW needs to be evaluated. The synthesis of the phenyl trifluoromethyl sulfone diluent is of the most concern as it is the only component currently not commercially available in any quantity.

9.3.10 Solvent Loss Rates/Adjustment

Due to the solubility of some of the UNEX solvent components (PEG and phenyl trifluoromethyl sulfone) in the aqueous raffinate and strip product streams, adjustment of the solvent during operation will be required to maintain the solvent within the desired compositional range. Development of analytical methods for solvent composition analysis should be performed so solvent composition can be monitored during operation. Methods of adjustment of the solvent should be evaluated including the addition of PEG to the strip feed to maintain the PEG concentration.

9.3.11 Alternative Scrub Reagents

The use of partially complexed hydrofluoric acid in the scrub solution introduces potential concerns with regards to personnel handling of the scrub makeup solution and corrosion of the process piping/equipment. Alternative scrub reagents, such as sodium fluoride, likely could be used to suppress the extraction of Zr and Fe. Development work should be performed to determine the viability of using an alternative scrub reagent. It should be noted that this development item does not apply to the Modified UNEX process which does not use a fluoride scrub since CMPO, which extracts Zr and Fe, is not present in the solvent.

9.3.12 Strip Product Chemical Variability

Composition of the strip product solution may vary based upon the composition of the SBW feed solution to the UNEX process. The effect of any variations of the strip product composition on the operation of the thin film dryer should be evaluated.

9.3.13 Spent Solvent Disposition

At the end of treatment of the SBW, the UNEX solvent will require disposal. Potential disposal options should be evaluated including solidification and incineration. Experimental studies to support this evaluation, such as testing of solidification agents, will need to be performed.

9.3.14 Crystallization of HAW Fraction

Development of suitable unit operations associated with crystallization of organic compounds is generally very compound specific and many issues such as foaming, crystal agregation, formation of tars and gums, etc. can only be addressed by unit operation process development. To date, the work in this area has been highly speculative and must be demonstrated with the HAW fraction chemical constituents.

9.3.15 Instrumentation and Control Associated with Remote-level Sensing in HAW 2X10 Canisters

Remote instrumentation capable of accurately performing feed control of evaporator crystallite to the 2X10 canisters and sensing the fill level are recognized as significant engineering challenges. This highly specialized equipment will require significant research and development to ensure process reliability.

9.3.16 Criticality Analysis

Any process in which the uranium in the SBW is concentrated (UNEX only) raises the issue of whether a potential criticality scenario is credible. Criticality safety analysis personnel should perform an evaluation of the UNEX process criticality scenarios.

9.3.17 Mercury Removal from SBW

If it is determined that mercury must be removed from the SBW as part of the UNEX process, development efforts are required for potential mercury removal processes. Specifically, mercury removal from the UNEX raffinate would require development. Potential mercury removal processes include electrochemical reduction and mercury precipitation by the Sachtleben-Lurgi process as described earlier in this report.

9.3.18 Grout Formulation

As can be seen from the mass balance, the grout formulation for the low activity fraction in the UNEX and Modified UNEX process directly influences the volume of grout produced. Grout volume is a major element in either processing scenario in that it directly affects the capacity of the grout line, the size of the interim storage facility, transportation costs to the final disposal facility, and the ultimate disposal cost. The grout formulation must be compatible with the waste acceptance criteria for the final disposal site and for all requirements imposed by interim storage. The best grout formulation would correspond to the highest waste loading which meets the storage and disposal requirements.

Current research work performed by A. Herbst, et. al, suggest that higher waste loadings than those used in this feasibility study can be achieved. Further research work is needed to demonstrate optimal waste loadings and to verify that the grouts are stable over long-term storage intervals.

9.3.19 Grout Neutralization Reaction and Kinetics

Before grouting of the UNEX raffinate, the solution is neutralized using hydroxide solutions. The reaction kinetics of the neutralization should be developed to determine the rates at which the neutralization chemical should be added and the potential for uncontrolled reactions.

9.3.20 Grout Mixing

Grout mixing at the scale (55 gal) proposed in this study has not been demonstrated for our waste specific types. Engineering issues such as paddle design, mixer torque, heat dissipation requirements, mixer cycle time, and other mixer-specific data have not been generated to date. This information is required to refine the grout mixing process line design.

9.3.21 Grout Cure and Physical Properties

Development work on the grouting of SBW has been performed but grout development as applied specifically to the UNEX raffinate has not been performed. Grout waste forms should be made using the UNEX raffinate solutions and the physical properties of the resulting grout waste form evaluated. Additionally, the effect of the trace organics present in the UNEX raffinate on curing of the grout waste form is unknown and should be evaluated.

Due to uneven losses of UNEX solvent constituents, i.e. chlorinated cobalt dicarbollide, PEG-400, CMPO, and FS-13, the solvent will be sampled periodically to characterize the necessary make-up stream. The make-up will be provided intermittently, as opposed to continuous injection of make-up constituents, based on the solvent sample results. This approach necessitates the ability of the UNEX processes to function within a range of specific extractant concentrations. Specific losses of UNEX solvent constituents are described in Section 5 of this report. Operating ranges for the UNEX solvent constituent concentrations remain to be defined. Once defined and solvent analytical techniques are developed, the necessary sampling periodicity may be identified.

The grout curing requirements for production-scale processing also requires significant additional research. For example, the high waste loading grouts are known to evolve approximately 30% moisture during the curing process. It is not known how long a full-sale drum of grout would need to cure for this quantity of moisture to be liberated. This is vital information to adequately engineer the size of grout curing areas and their associated ventilation systems.

9.3.22 Crystallization of HAW Fraction

At this point, it is not known whether the UNEX HAW stream can be evaporated to a solids concentration high enough for use in the grouting process. For this to be determined, bench-scale evaporation studies will have to be conducted.

10. REFERENCES

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Appendix A

Equipment List

UNEX AND MODIFIED UNEX PUMP DATA

PUMP NAME	ID #					PRESSURE			PUMP DATA							GPM		WXHXL	LOCATION	
		S.G	L/HR	LPM	GPM	INLET	OUT	STYLE	MAKE	MODEL	GEAR	RPM	TORQ.	IDEAL H.P	H.P.	MIN	MAX	INCHES	NWCF	
SBW TRANSFER	P-201-1	1.32			20.0	ATM	< 60	PARFLEX						20	30			24 X 24 X 4	VAL. CUB.	MC
FILTER FEED PUMPS (2X)	P-201-2a&b	VENDOR SUPPLIED - SKID MOUNTED																	CAL. CELL	MC
HF XFR PUMP	P-201-3				10.0	ATM	< 100	CAVITY	IDEX	10K	G35	1750	580	1.01	2	10.0	11.0	24 X 24 X 4	OUTSIDE	OUTSIDE
HF PUMP	P-201-4	1.03	30	0.50	0.1	ATM	< 60	CAVITY	IDEX	114	K23	1450	45	0.06	0.125	0.1	1.0	12 X 12 X 3	STR AREA	AER
EXTRACTION FEED	P-201-5	1.29	328	5.47	1.4	ATM	<60	CAVITY	IDEX	114	K23	2850	45	0.13	0.375	1.2	2.2	12 X 12 X 3	OFF GAS	MC
SBW SLURRY XRF (2X)	P-201-6a & b	40%			20.0	ATM	< 60	PARFLEX						20	30			24 X 24 X 4	CAL. CELL	MC
DICARBOLIDE FEED	P-202-1	1.42	0.4	0.01	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
PEG FEED	P-202-2	1.42	0.4	0.01	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
CMPO FEED	P-202-3	1.42	0.4	0.01	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
FS-13 FEED	P-202-4	1.42	0.4	0.01	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
SOLVENT FEED	P-202-5	1.42	445	7.42	2.0	ATM	< 60	CAVITY	IDEX	114	K23	3450	45	0.15	0.25	1.2	2.2	12 X 12 X 3	OFF GAS	MC
RAFFFINATE XFR	P-202-6a	1.21	445	7.42	2.0	ATM	< 60	CAVITY	IDEX	114	K23	3450	45	0.15	0.25	1.2	2.2	12 X 12 X 3	VAL. CUB.	MC
RAFFINATE OFF SMC	P-202-6b	1.21			10.0	ATM	< 100	CAVITY	IDEX	10K	G35	1750	580	1.01	2	10.0	11.0	24 X 24 X 4	VAL. CUB.	MC
ACID FEED	P-202-7	1.13	2.9	0.05	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
ALUM NITRATE FEED	P-202-8	1.54	1.5	0.03	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
SCRUB MAKEUP XFR	P-202-9	1.01	117	1.95	0.5	ATM	< 60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.6	1.7	12 X 12 X 3	STR AREA	AER
SCRUB SOLUTION FEED	P-202-10	101	117	1.95	0.5	ATM	< 60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.6	1.7	12 X 12 X 3	STR AREA	AER
DTPA FEED (M-UNEX ONLY)	P-202-11	1.1	1.3	0.02	0.0	ATM	< 60	METER	DURCO	DIATUBE	-	-	-	0.30	0.75	0.0	0.0	12 X 12 X 1	STR AREA	AER
STRIP MAKEUP XFR	P-202-12	1.01	148	2.47	0.7	ATM	< 60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.7	1.7	12 X 12 X 3	STR AREA	AER
STRIP SOLUTION FEED	P-202-13	1.01	148	2.47	0.7	ATM	< 60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.7	1.7	12 X 12 X 3	STR AREA	AER
STRIP TO TFD FEED	P-202-14	1.02	148	2.47	0.7	ATM	<60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.7	1.7	12 X 12 X 3	VAL. CUB.	MC
STRIP CYSTALLIZER CONDENSATE	P-203-1		VENDOR SUPPLIED - SKID MOUNTED																TFD FAC.	MC
TFD FEED	P-203-2	1.02	148	2.47	0.7	ATM	<60	CAVITY	IDEX	114	K23	2400	45	0.11	0.25	0.7	1.7	12 X 12 X 3	TFD FAC.	MC
LAW EVAPORATOR FEED	P-204-1	1.16	593	9.88	2.6	ATM	<120	CAVITY	IDEX	5500	G23	1450	250	0.36	0.75	2.2	3.8	12 X 12 X 3	GRT. FAC.	GRT. FAC.
LAW EVAPORATOR RECIRC/XFR	P-204-2	VENDOR SUPPLIED - SKID MOUNTED																	GRT. FAC.	GRT. FAC.
LET&D SUPPLY	P-204-3	1	352	5.87	1.5	ATM	<60	CAVITY	IDEX	114	K23	2850	45	0.13	0.25	1.2	2.2	12 X 12 X 3	GRT. FAC.	GRT. FAC.
NAOH FEED	P-205-1	1.53	52	0.87	0.2	ATM	< 60	CAVITY	IDEX	114	K23	1450	45	0.06	0.125	0.1	1.0	12 X 12 X 3	GRT. FAC.	GRT. FAC.
NEUTRALIZATION TANK	P-205-2a,b,c	1.38	297	4.95	1.3	ATM	< 60	CAVITY	IDEX	114	K23	2850	45	0.38	0.75	1.2	2.2	12 X 12 X 3	GRT. FAC.	GRT. FAC.

UNEX & MODIFIED UNEX PROCESS STORAGE TANK DATA

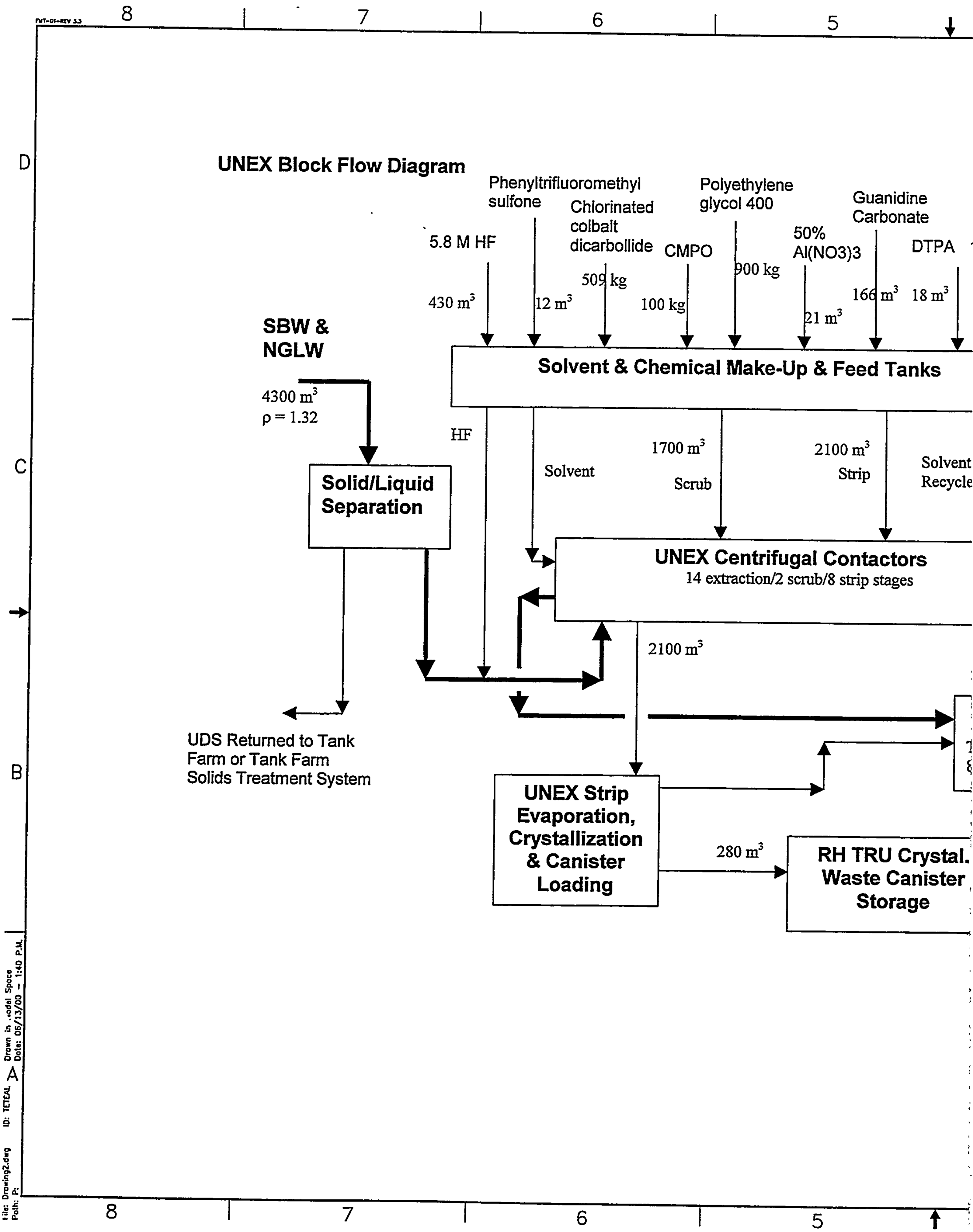
UNEX TANKS	ID#	LPH	STYLE	VOLUME		SIZE		MATERIAL		LOCATION	
		FLOW	BOTTOM	GAL	FT3	DIAMETER	HEIGHT	BASE	LINER	NWCF	GFF
SBW FEED	T-201-1	298	CONICAL	4718	629	96	150	C.S.	S.S.T	B&H CELL	M.C.
SBW DAY	T-201-2a&b	298	CONICAL	1179	157	60	96	C.S.	S.S.T	CAL. CELL	M.C.
HF STORAGE	T-201-3		ROUND	4000	533	96	127	C.S.	C-276	STOR. AREA	A.E.R.
HF MAKEUP	T-201-4	30	ROUND	237	32	36	54	C.S.	C-276	STOR. AREA	A.E.R.
EXTRACTION FEED	T-201-5abc	298	ROUND	2359	315	72	134	C.S.	S.S.T	B&H CELL	M.C.
DICARBOLLIDE FEED	T-202-1		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
PEG 400 FEED	T-202-2		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
PH2BU2CMPO FEED	T-202-3a,b		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
FS-13	T-202-4		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX SOLVENT	T-202-5		ROUND	500	67	48	64	C.S.	S.S.T	OFF GAS CELL	M.C.
UNEX RAFFINATE	T-202-6a,b	445	ROUND	1761	235	72	100	C.S.	S.S.T	B&H CELL	M.C.
RECYCLE ACID	T-202-7		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
ALUMINUM NITRATE	T-202-8		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX SCRUB MAKEUP	T-202-9	102	ROUND	807	108	48	103	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX SCRUB SOLUTION FEED	T-202-10		ROUND	888	118	48	113	C.S.	S.S.T	STOR. AREA	A.E.R.
DTPA STORAGE (UNEX ONLY)	T-202-11		ROUND	55	7	23	31	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX STRIP MAKEUP	T-202-12	143	ROUND	1132	151	60	92	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX STRIP SOLUTION FEED	T-202-13		ROUND	1245	166	60	102	C.S.	S.S.T	STOR. AREA	A.E.R.
UNEX STRIP EFFLUENT	T-202-14	142	ROUND	1124	150	60	92	C.S.	S.S.T	B&H CELL	M.C.
CRYSTALLIZER CONDENSATE	T-203-1		ROUND	10	1	10	29	C.S.	S.S.T	TFD FAC.	M.C.
STRIP TFD FEED (NWCF ONLY)	T-203-2	142	ROUND	1124	150	60	92	C.S.	S.S.T	TFD FAC.	M.C.
LAW EVAPORATOR FEED	T-204-1	593	ROUND	9388	1252	120	191	C.S.	S.S.T	GRT. FAC	GRT. FAC
LET&D FEED	T-204-3	352	ROUND	352	47	36	80	C.S.	S.S.T	GRT. FAC	GRT. FAC
NAOH STORAGE	T-205-1	52	ROUND	400	53	36	91	C.S.	S.S.T	GRT. FAC	GRT. FAC
NEUTRALIZATION	T-205-2a,b,c	302	CONICAL	1200	160	60	98	C.S.	S.S.T	GRT. FAC	GRT. FAC
		LBS									
SLAG STORAGE	T-205-5	40000	CONICAL		875	108	165	C.S.		GRT. FAC	GRT.FAC
Ca(OH)2 STORAGE	T-205-6	40000	CONICAL		1071	120	164	C.S.		GRT. FAC	GRT.FAC
CEMENT STORAGE	T-205-7	40000	CONICAL		641	108	121	C.S.		GRT. FAC	GRT.FAC
		KG/HR									
SLAG DAY STORAGE	T-205-6a	334	CONICAL		257	72	109	C.S.		GRT.FAC	GRT.FAC
Ca(OH)2 DAY STORAGE (UNEX ONLY)	T-205-6b	60	CONICAL		46	36	78	C.S.		GRT.FAC	GRT.FAC
CEMENT DAY STORAGE	T-205-6c	37	CONICAL		28	36	48	C.S.		GRT.FAC	GRT.FAC

UNEX & MODIFIED UNEX PROCESS EQUIPMENT DATA

			LOCATION		POWER	
EQUIPMENT	ID#	(W X L X H)	NWCF	GFF	H.P.	WATTS
EXTRACTION CONTACTOR	CON-202-1-14	3' X13' X 5'	OFF GAS CELL	M.C.	3.5	
SCRUB CONTACTOR	SB-202-1-2	3' X 2' X 5'	OFF GAS CELL	M.C.	0.5	
STRIP CONTACTOR	SP-202-1-8	3' X 7' X 5'	OFF GAS CELL	M.C.	2	
THIN FILM DRYER	TFD-203-1	7' X 7' X 16'	TFD FAC	M.C.	20	
LAW EVAPORATOR	EV-204-1	8' X 10' X 8'	GRT FAC	GRT. FAC		1800
VERTICAL AUGER	VA-205-1-6	20" X 40" X 140"	GRT FAC	GRT. FAC	6	
VERTICAL MIXER	VM-205-1-6	30" X 60" X 140	GRT FAC	GRT. FAC	60	
X-FLOW FILTER	CF-201-1 & 2	36" X 60" X 65"	CAL. CELL	M.C.	30	
				TOTAL	122	1800
				TOTAL K.W.	92.8	

Appendix B

Process Flow Diagrams



8
7
6
5
D
C
B
A
UNEX Block Flow Diagram
Phenyltrifluoromethyl sulfone
Chlorinated colbalt dicarbollide
Polyethylene glycol 400
Guanidine Carbonate
5.8 M HF
CMPO
50% Al(NO3)3
DTPA
430 m³
12 m³
509 kg
100 kg
900 kg
21 m³
166 m³
18 m³
SBW & NGLW
4300 m³
ρ = 1.32
Solvent & Chemical Make-Up & Feed Tanks
HF
Solvent
1700 m³
Scrub
2100 m³
Strip
Solvent Recycle
Solid/Liquid Separation
UNEX Centrifugal Contactors
14 extraction/2 scrub/8 strip stages
2100 m³
UDS Returned to Tank Farm or Tank Farm Solids Treatment System
UNEX Strip Evaporation, Crystallization & Canister Loading
280 m³
RH TRU Crystal. Waste Canister Storage
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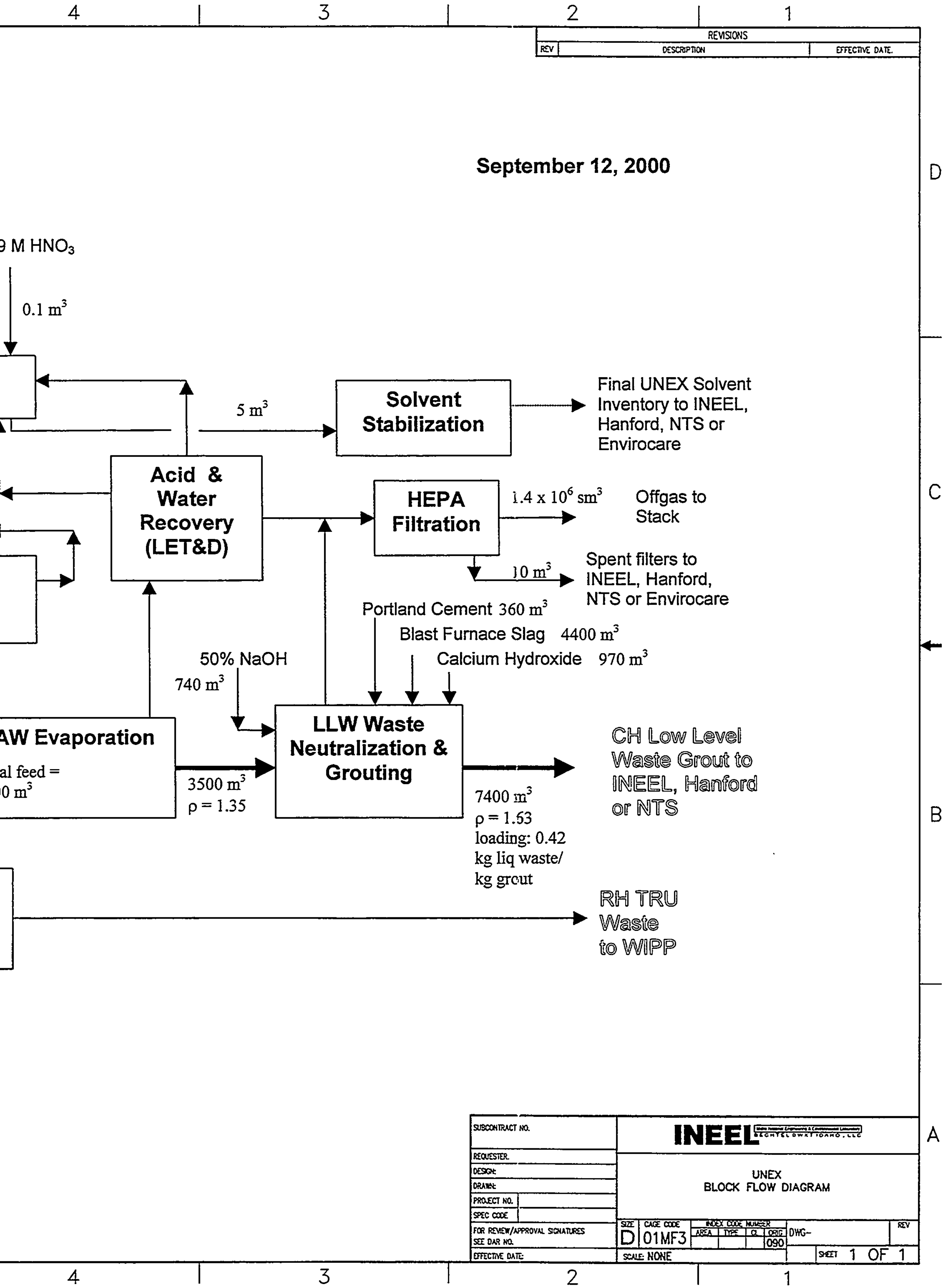
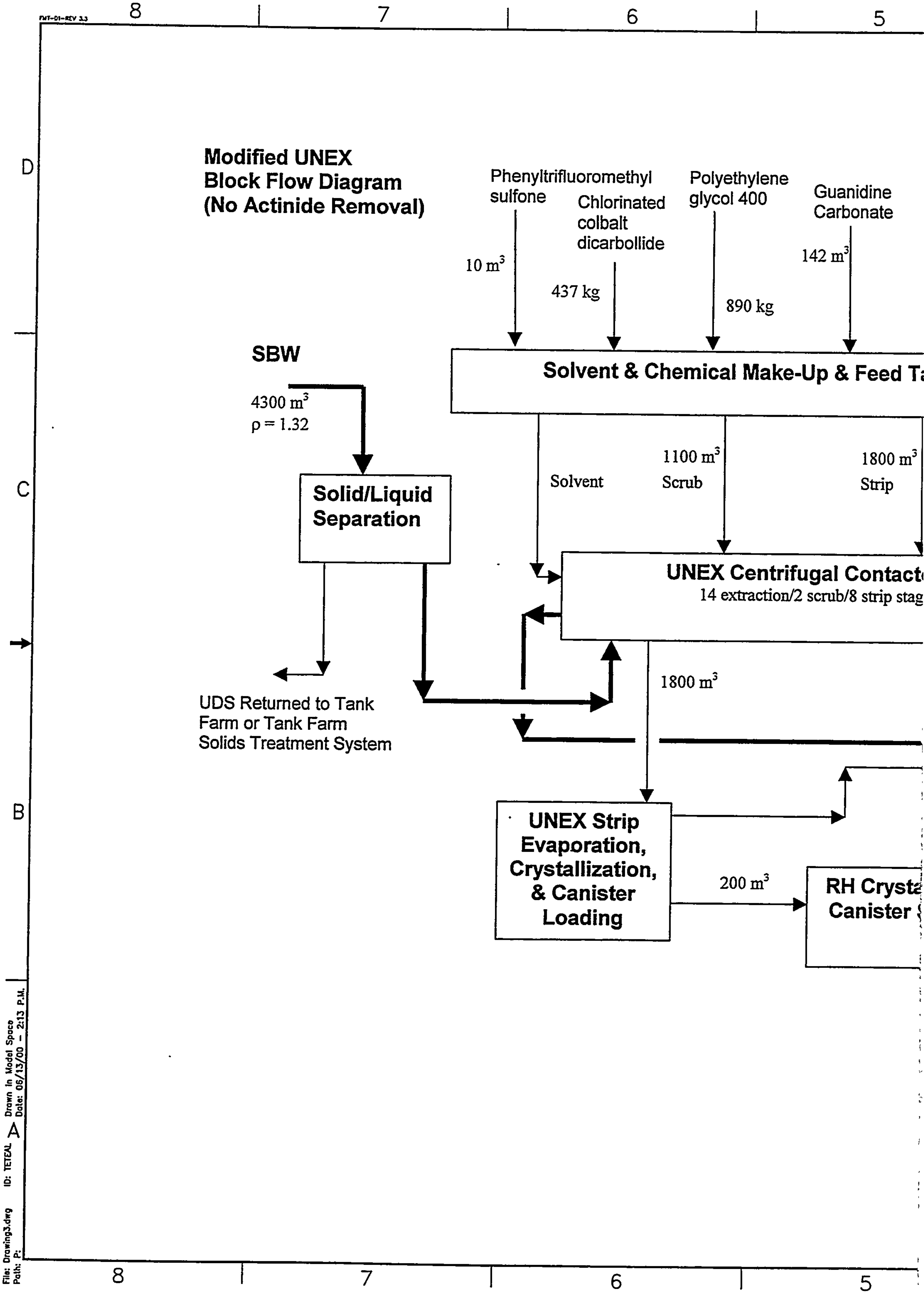
Drawn in Model Space
Date: 06/13/00 - 1:40 P.M.



September 12, 2000
9 M HNO3
0.1 m3
5 m3
Solvent Stabilization
Final UNEX Solvent Inventory to INEEL, Hanford, NTS or Envirocare
Acid & Water Recovery (LET&D)
HEPA Filtration
1.4 x 106 sm3
Offgas to Stack
10 m3
Spent filters to INEEL, Hanford, NTS or Envirocare
Portland Cement 360 m3
Blast Furnace Slag 4400 m3
Calcium Hydroxide 970 m3
50% NaOH
740 m3
AW Evaporation
al feed =
0 m3
3500 m3
ρ = 1.35
LLW Waste Neutralization & Grouting
7400 m3
ρ = 1.53
loading: 0.42
kg liq waste/
kg grout
CH Low Level Waste Grout to INEEL, Hanford or NTS
RH TRU Waste to WIPP
REVISIONS
REV
DESCRIPTION
EFFECTIVE DATE
SUBCONTRACT NO.
REQUESTER
DESIGN
DRAWN
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES
SEE DAR NO.
EFFECTIVE DATE
INEEL
UNEX
BLOCK FLOW DIAGRAM
SIZE
D
CAGE CODE
01MF3
INDEX CODE NUMBER
AREA
TYPE
CL
ORIG
090
DWG-
REV
SCALE NONE
SHEET 1 OF 1



Modified UNEX
Block Flow Diagram
(No Actinide Removal)
Phenyltrifluoromethyl sulfone
10 m3
Chlorinated colbalt dicarbollide
437 kg
Polyethylene glycol 400
890 kg
Guanidine Carbonate
142 m3
SBW
4300 m3
ρ = 1.32
Solvent & Chemical Make-Up & Feed Ta
Solid/Liquid Separation
Solvent
1100 m3
Scrub
1800 m3
Strip
UNEX Centrifugal Contact
14 extraction/2 scrub/8 strip stag
UDS Returned to Tank Farm or Tank Farm Solids Treatment System
1800 m3
UNEX Strip Evaporation, Crystallization, & Canister Loading
200 m3
RH Crysta
Canister
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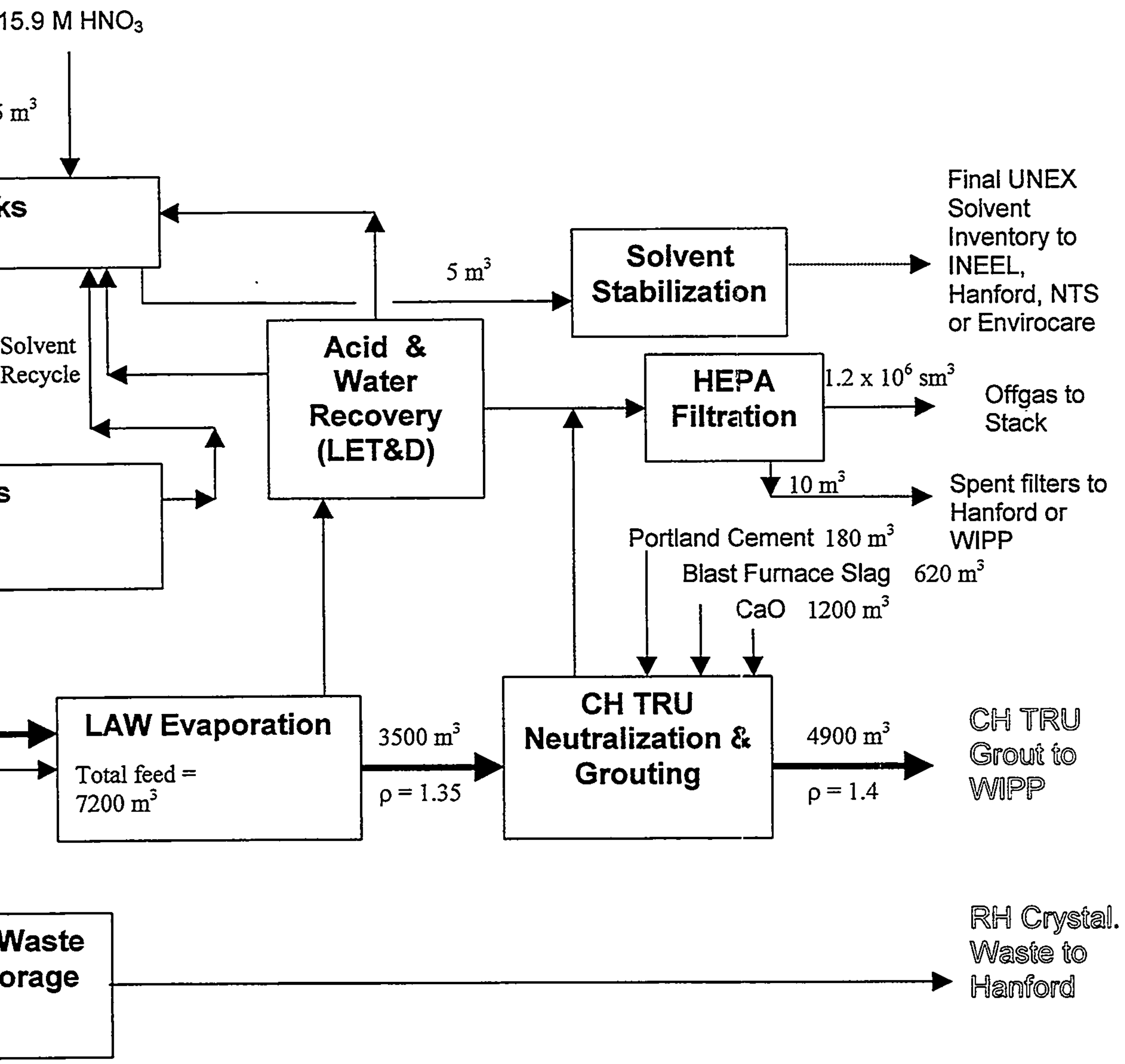
Drawn In Model Space
Date: 06/13/00 – 2:13 P.M.

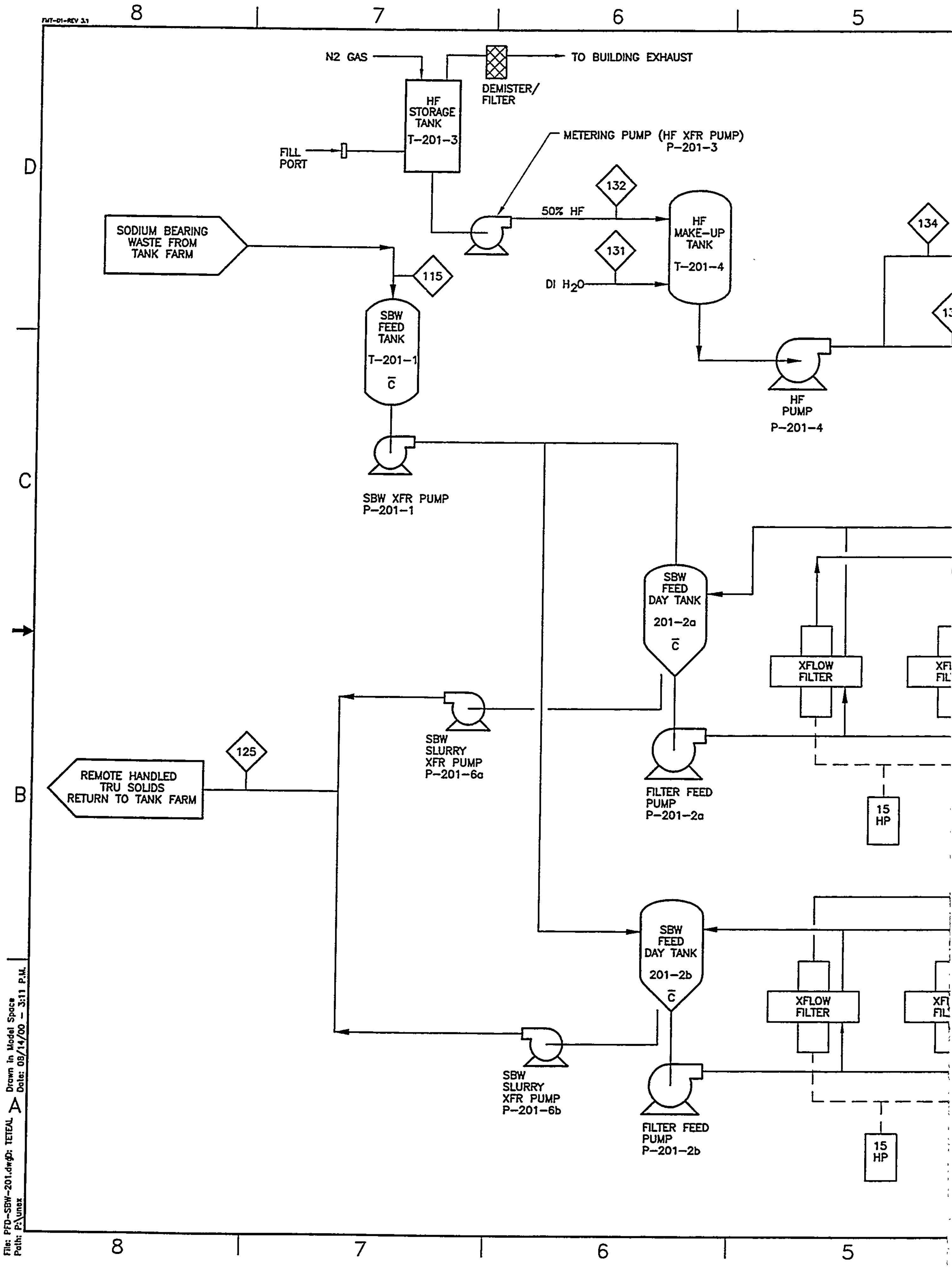
REVISIONS

REV	DESCRIPTION	EFFECTIVE DATE:

September 12, 2000



SUBCONTRACT NO.	INEEL
REQUESTER:	MODIFIED UNEX BLOCK FLOW DIAGRAM (NO ACTINIDE REMOVAL)
DESIGN:	
DRAWN:	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CL, ORG. 090; DWG- ; REV
EFFECTIVE DATE:	SCALE: NONE; SHEET 1 OF 1


FMT-01-REV 3.1
8
7
6
5
D
C
B
A
N2 GAS
TO BUILDING EXHAUST
HF STORAGE TANK T-201-3
DEMISTER/ FILTER
FILL PORT
METERING PUMP (HF XFR PUMP) P-201-3
132
50% HF
HF MAKE-UP TANK T-201-4
134
131
DI H2O
SODIUM BEARING WASTE FROM TANK FARM
115
SBW FEED TANK T-201-1 C̄
HF PUMP P-201-4
SBW XFR PUMP P-201-1
SBW FEED DAY TANK 201-2a C̄
XFLOW FILTER
SBW SLURRY XFR PUMP P-201-6a
125
REMOTE HANDLED TRU SOLIDS RETURN TO TANK FARM
FILTER FEED PUMP P-201-2a
15 HP
SBW FEED DAY TANK 201-2b C̄
XFLOW FILTER
SBW SLURRY XFR PUMP P-201-6b
FILTER FEED PUMP P-201-2b
15 HP
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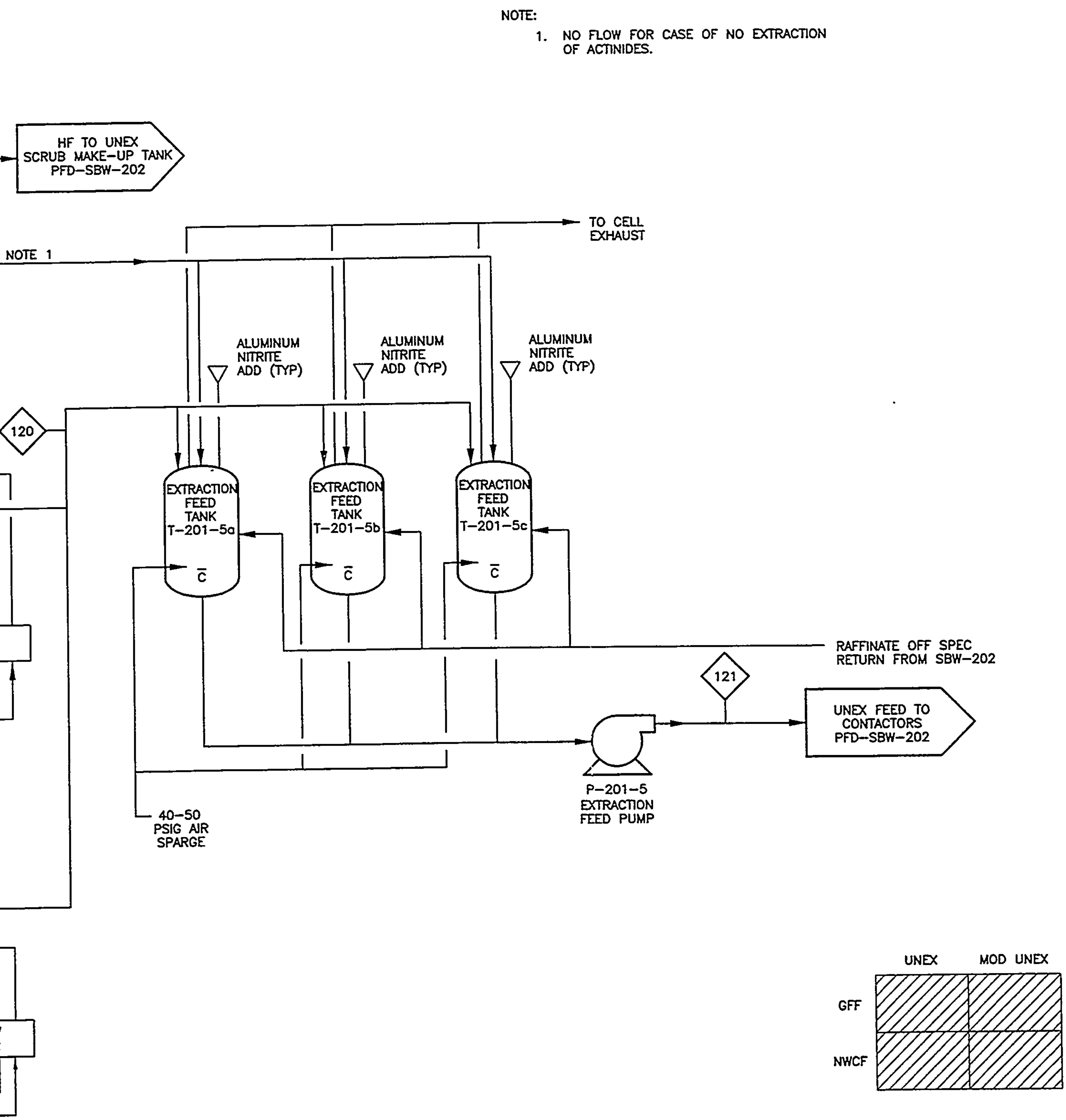
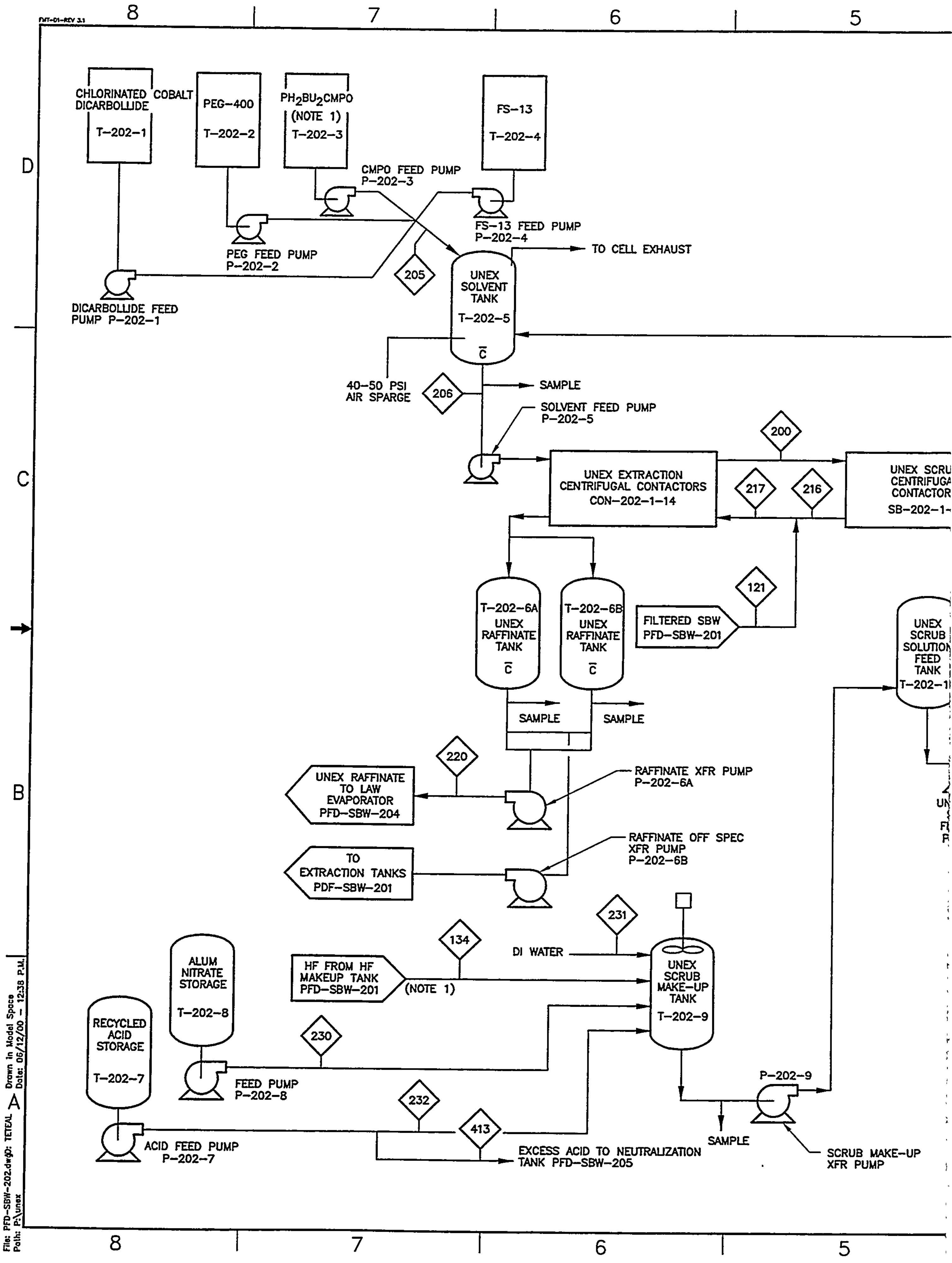
Drawn in Model Space
Date: 08/14/00 - 3:11 P.M.

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL
NO SCALE	REQUESTER: DESIGN: C. BARNES DRAWN: D. BRONSON PROJECT NO. SPEC CODE	INTEC WASTE TREATMENT FACILITY (UNEX) SODIUM BEARING WASTE FEED FILTRATION PROCESS FLOW DIAGRAM
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE · INDEX CODE NUMBER: AREA 200, TYPE, CL, DRG 090 · DWG- PFD-SBW-201 · REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NONE · SHEET P-1



CHLORINATED COBALT DICARBOLLIDE
T-202-1
PEG-400
T-202-2
PH_2BU_2CMPO
(NOTE 1)
T-202-3
FS-13
T-202-4
CMPO FEED PUMP
P-202-3
FS-13 FEED PUMP
P-202-4
PEG FEED PUMP
P-202-2
205
TO CELL EXHAUST
UNEX SOLVENT TANK
T-202-5
DICARBOLLIDE FEED PUMP P-202-1
40-50 PSI AIR SPARGE
206
SAMPLE
SOLVENT FEED PUMP
P-202-5
200
UNEX EXTRACTION CENTRIFUGAL CONTACTORS
CON-202-1-14
217
216
UNEX SCRU CENTRIFUGA CONTACTOR
SB-202-1-
121
T-202-6A
UNEX RAFFINATE TANK
T-202-6B
UNEX RAFFINATE TANK
FILTERED SBW
PFD-SBW-201
UNEX SCRUB SOLUTION FEED TANK
T-202-1
SAMPLE
SAMPLE
220
RAFFINATE XFR PUMP
P-202-6A
UNEX RAFFINATE TO LAW EVAPORATOR
PFD-SBW-204
RAFFINATE OFF SPEC XFR PUMP
P-202-6B
TO EXTRACTION TANKS
PDF-SBW-201
231
134
DI WATER
ALUM NITRATE STORAGE
T-202-8
HF FROM HF MAKEUP TANK
PFD-SBW-201
(NOTE 1)
UNEX SCRUB MAKE-UP TANK
T-202-9
RECYCLED ACID STORAGE
T-202-7
230
FEED PUMP
P-202-8
P-202-9
232
413
ACID FEED PUMP
P-202-7
EXCESS ACID TO NEUTRALIZATION TANK PFD-SBW-205
SAMPLE
SCRUB MAKE-UP XFR PUMP
8
7
6
5
D
C
B
A
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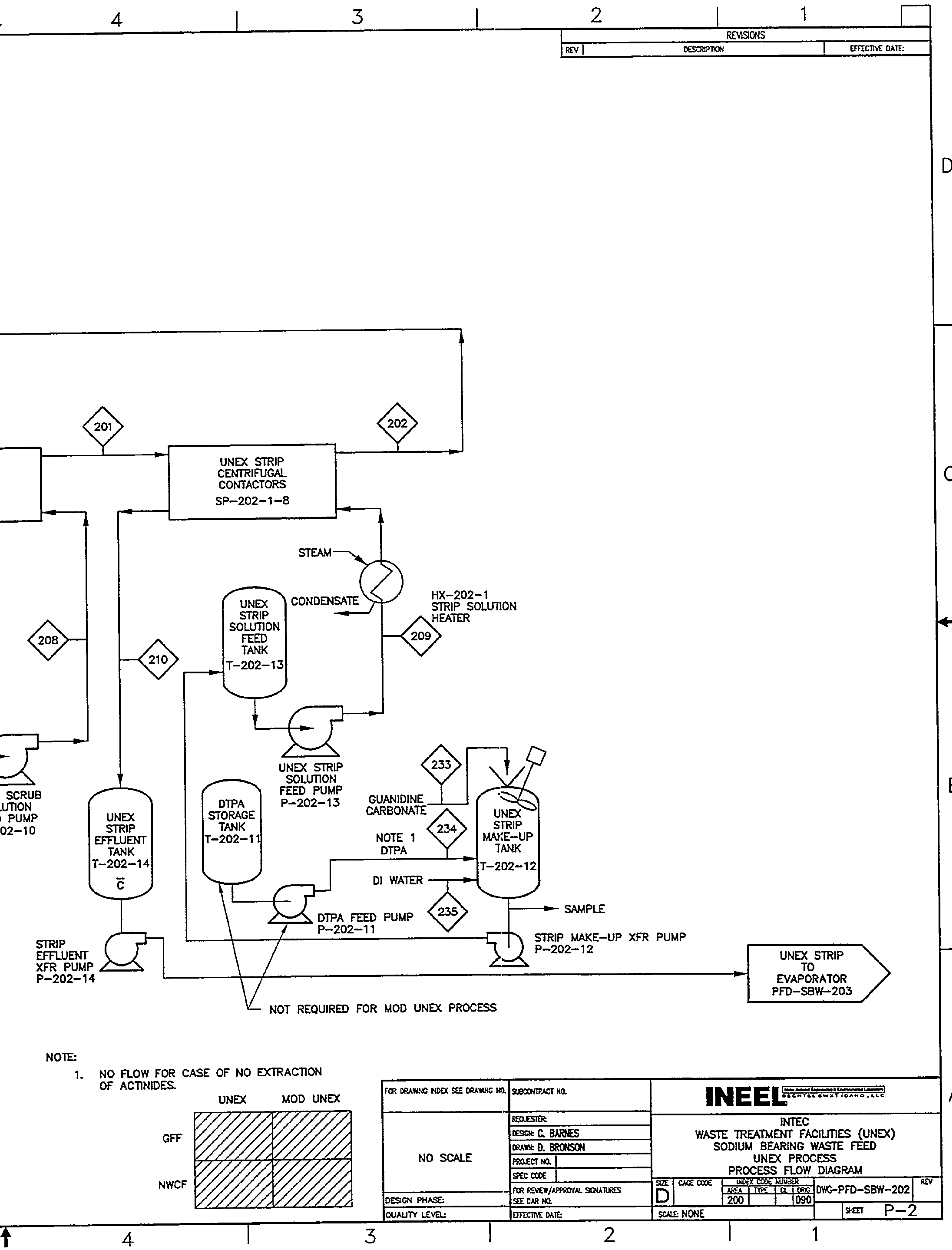
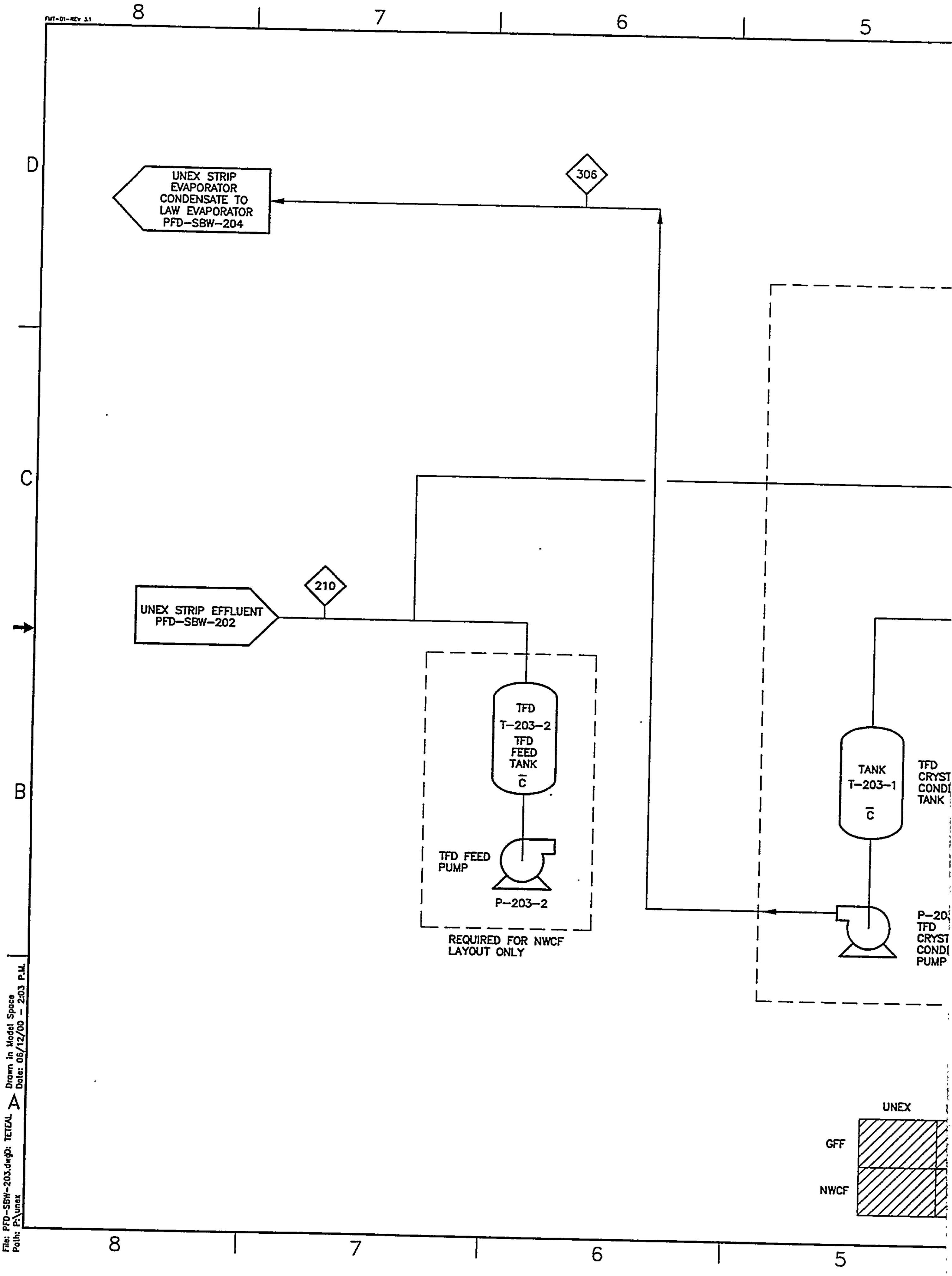
Path: P:\unex
Drawn in Model Space
Date: 06/12/00 - 12:38 P.M.


REVISIONS
REV
DESCRIPTION
EFFECTIVE DATE:
201
202
UNEX STRIP CENTRIFUGAL CONTACTORS SP-202-1-8
STEAM
CONDENSATE
HX-202-1 STRIP SOLUTION HEATER
209
208
210
UNEX STRIP SOLUTION FEED TANK T-202-13
UNEX STRIP SOLUTION FEED PUMP P-202-13
233
234
235
GUANIDINE CARBONATE
NOTE 1 DTPA
DI WATER
UNEX STRIP MAKE-UP TANK T-202-12
SAMPLE
STRIP MAKE-UP XFR PUMP P-202-12
DTPA STORAGE TANK T-202-11
DTPA FEED PUMP P-202-11
UNEX STRIP EFFLUENT TANK T-202-14
STRIP EFFLUENT XFR PUMP P-202-14
SCRUB
LUTION
PUMP
02-10
UNEX STRIP TO EVAPORATOR PFD-SBW-203
NOT REQUIRED FOR MOD UNEX PROCESS
NOTE:
1. NO FLOW FOR CASE OF NO EXTRACTION OF ACTINIDES.
UNEX
MOD UNEX
GFF
NWCF
FOR DRAWING INDEX SEE DRAWING NO.
SUBCONTRACT NO.
REQUESTER:
DESIGN: C. BARNES
DRAWN: D. BRONSON
PROJECT NO.
SPEC CODE
NO SCALE
DESIGN PHASE:
QUALITY LEVEL:
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:
INEEL
INTEC
WASTE TREATMENT FACILITIES (UNEX)
SODIUM BEARING WASTE FEED
UNEX PROCESS
PROCESS FLOW DIAGRAM
SIZE D
CAGE CODE
INDEX CODE NUMBER
AREA 200
TYPE
CL
ORIG 090
DWG-PFD-SBW-202
REV
SCALE: NONE
SHEET P-2


UNEX STRIP EVAPORATOR CONDENSATE TO LAW EVAPORATOR PFD-SBW-204
306
UNEX STRIP EFFLUENT PFD-SBW-202
210
TFD T-203-2 TFD FEED TANK C̄
TFD FEED PUMP
P-203-2
REQUIRED FOR NWCF LAYOUT ONLY
TANK T-203-1 C̄
TFD CRYST COND TANK
P-20
TFD CRYST COND PUMP
UNEX
GFF
NWCF
File: PFD-SBW-203.dwg D: TETEAL
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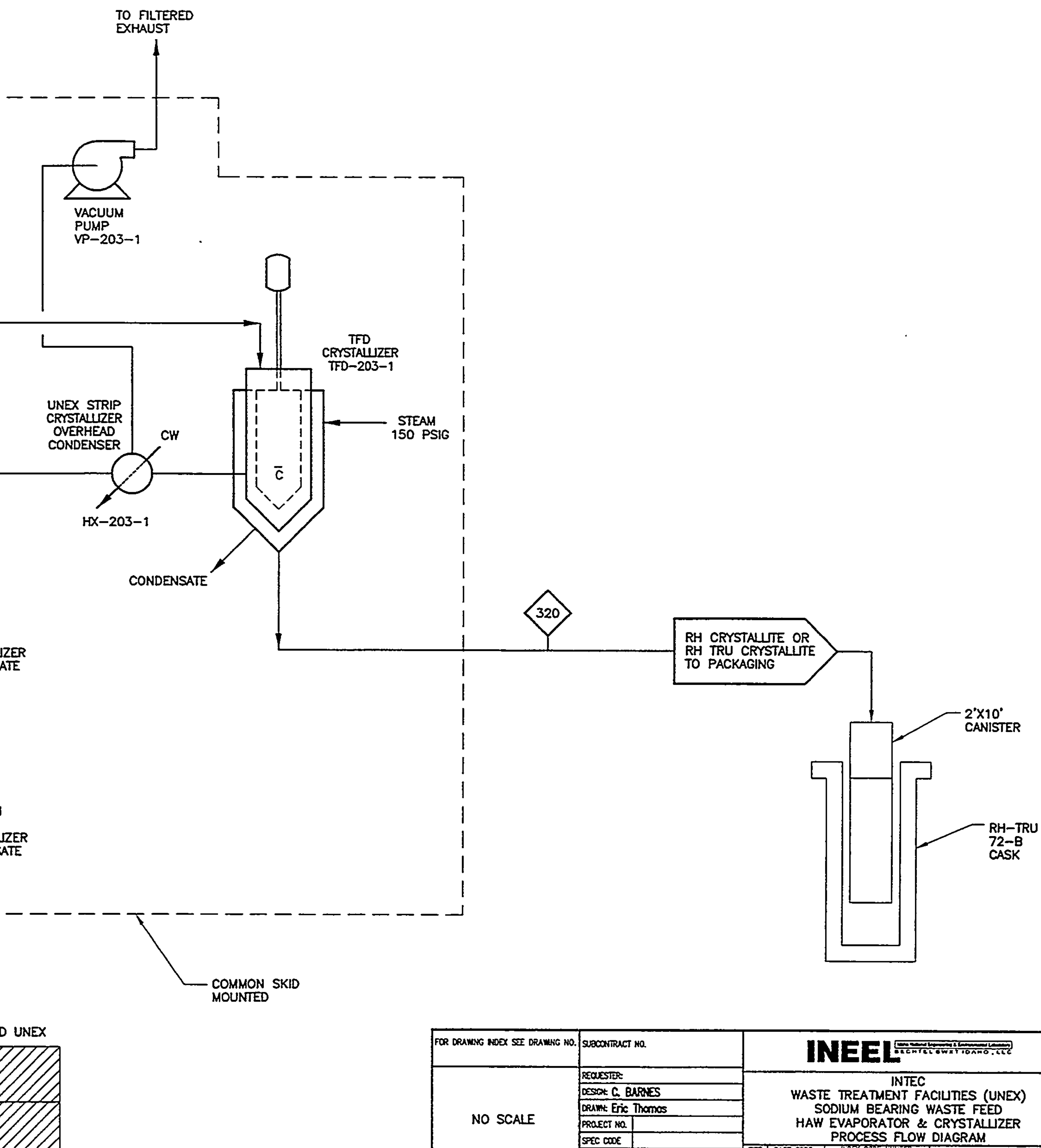
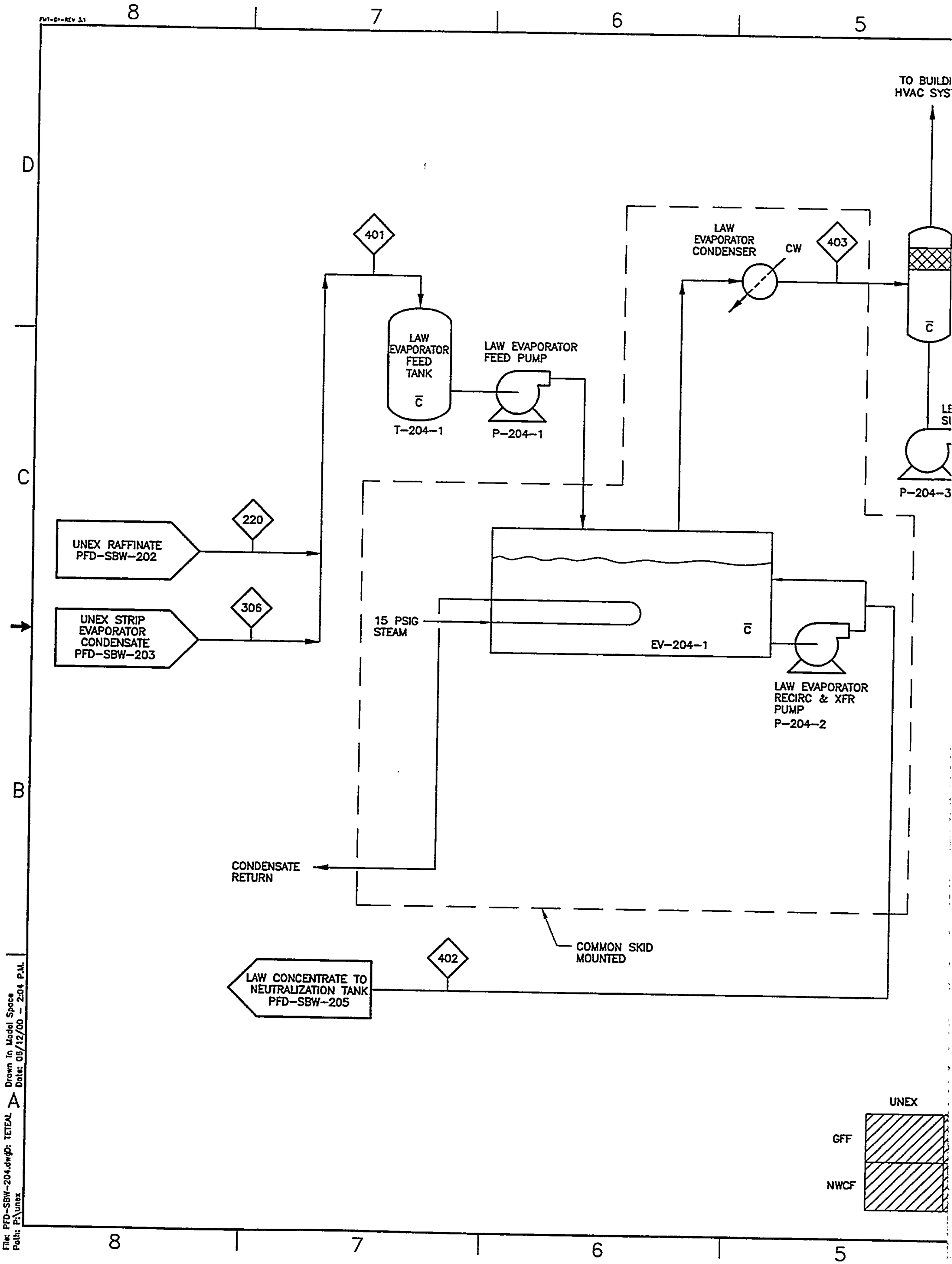
Drawn in Model Space
Date: 06/12/00 - 2:03 P.M.

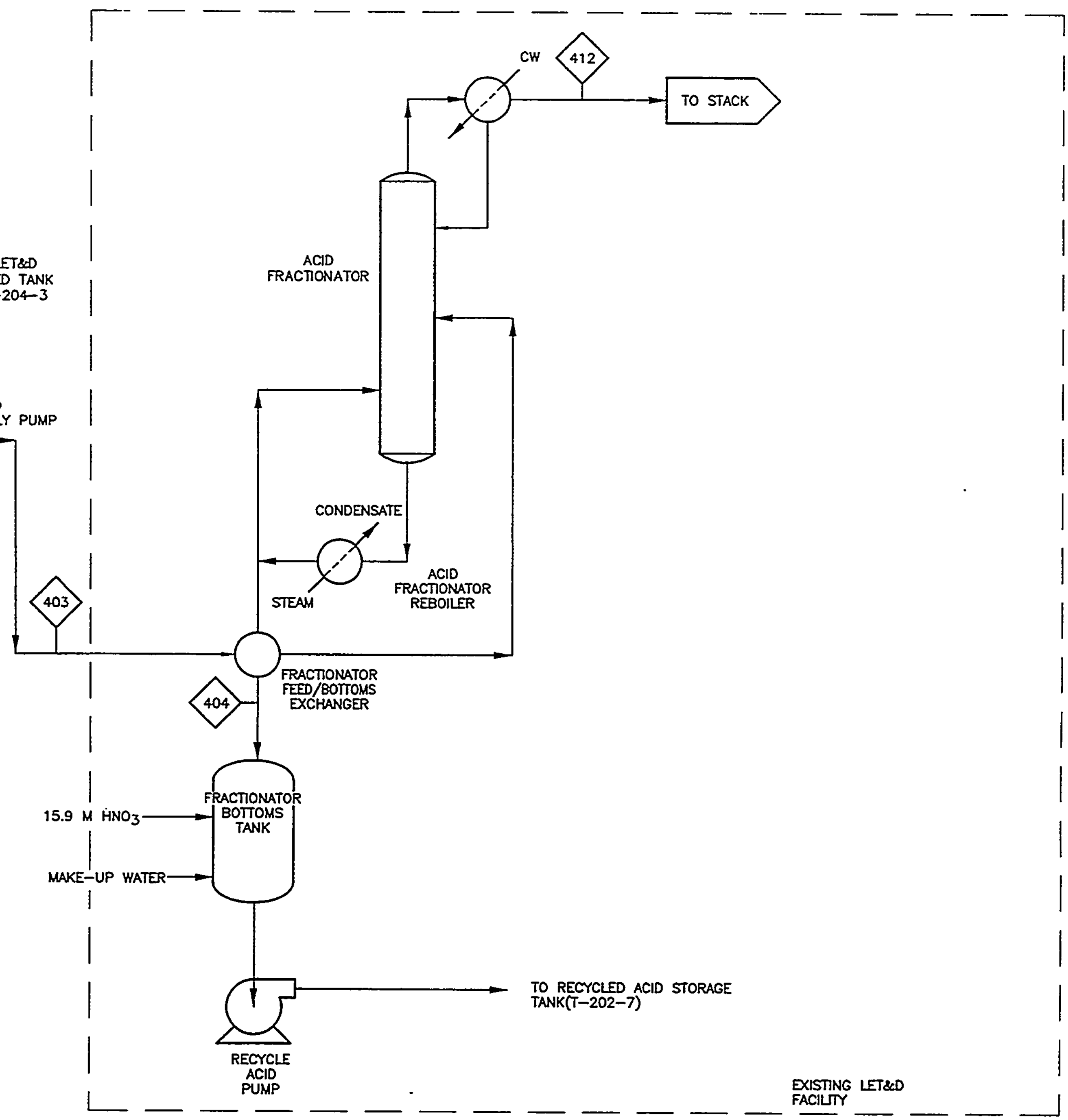
REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO, LLC
NO SCALE	REQUESTER: DESIGN: C. BARNES DRAWN: Eric Thomas PROJECT NO. SPEC CODE	INTEC WASTE TREATMENT FACILITIES (UNEX) SODIUM BEARING WASTE FEED HAW EVAPORATOR & CRYSTALLIZER PROCESS FLOW DIAGRAM
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE; INDEX CODE NUMBER: AREA 200, TYPE, CL, ORG 090; DWG-PFD-SBW-203; REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NONE; SHEET P-3



TO BUILDI
HVAC SYS
LAW EVAPORATOR CONDENSER
CW
403
401
LAW EVAPORATOR FEED TANK
C̄
T-204-1
LAW EVAPORATOR FEED PUMP
P-204-1
P-204-3
220
UNEX RAFFINATE PFD-SBW-202
306
UNEX STRIP EVAPORATOR CONDENSATE PFD-SBW-203
15 PSIG STEAM
EV-204-1
LAW EVAPORATOR RECIRC & XFR PUMP P-204-2
CONDENSATE RETURN
COMMON SKID MOUNTED
402
LAW CONCENTRATE TO NEUTRALIZATION TANK PFD-SBW-205
UNEX
GFF
NWCF
File: PFD-SBW-204.dwg ID: TETEAL Drawn In Model Space
Path: P:\unex Date: 06/12/00 - 2:04 P.M.



REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE

FOR DRAWING INDEX SEE DRAWING NO.

NO SCALE

DESIGN PHASE:

QUALITY LEVEL:

SUBCONTRACT NO.

REQUESTER:

DESIGN: C. BARNES

DRAWN: EM SNELL

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.

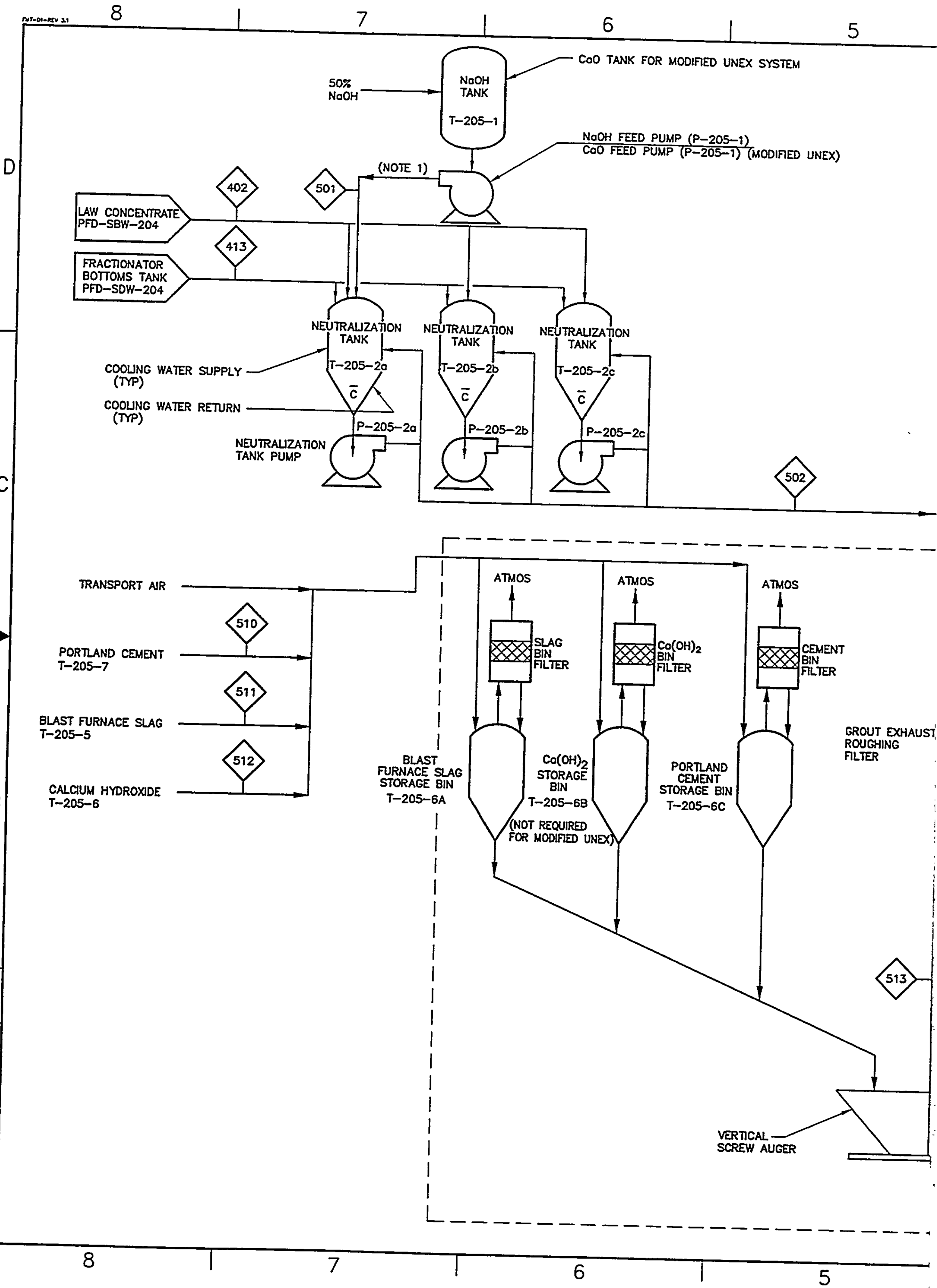
EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITIES (UNEX)
SODIUM BEARING WASTE FEED
LAW EVAPORATION AND FRACTIONATION
PROCESS FLOW DIAGRAM

SIZE D | CAGE CODE | INDEX CODE NUMBER: AREA 200, TYPE, CL, ORIG 090 | DWG-PFD-SBW-204 | REV

SCALE: NONE | SHEET P-4



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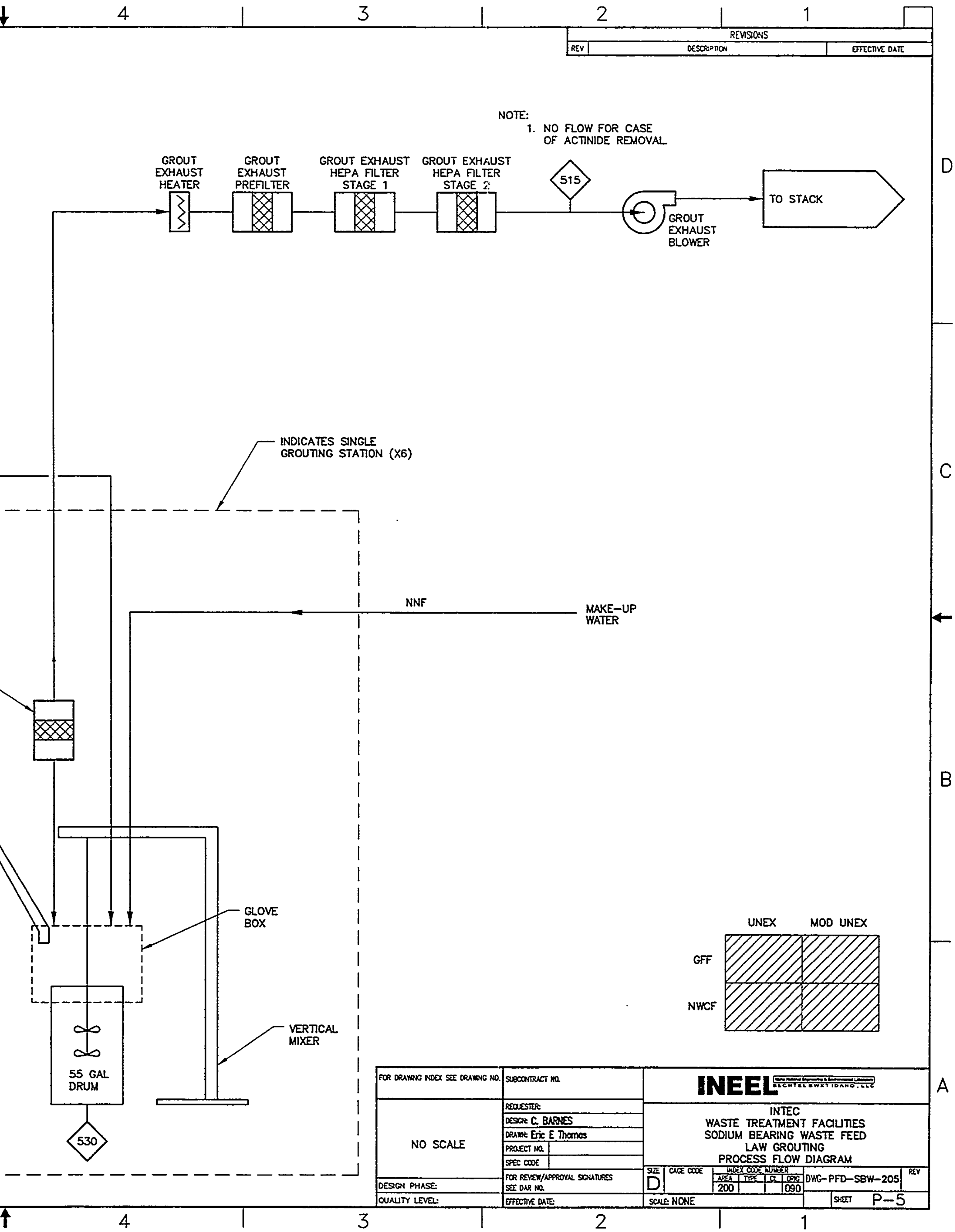
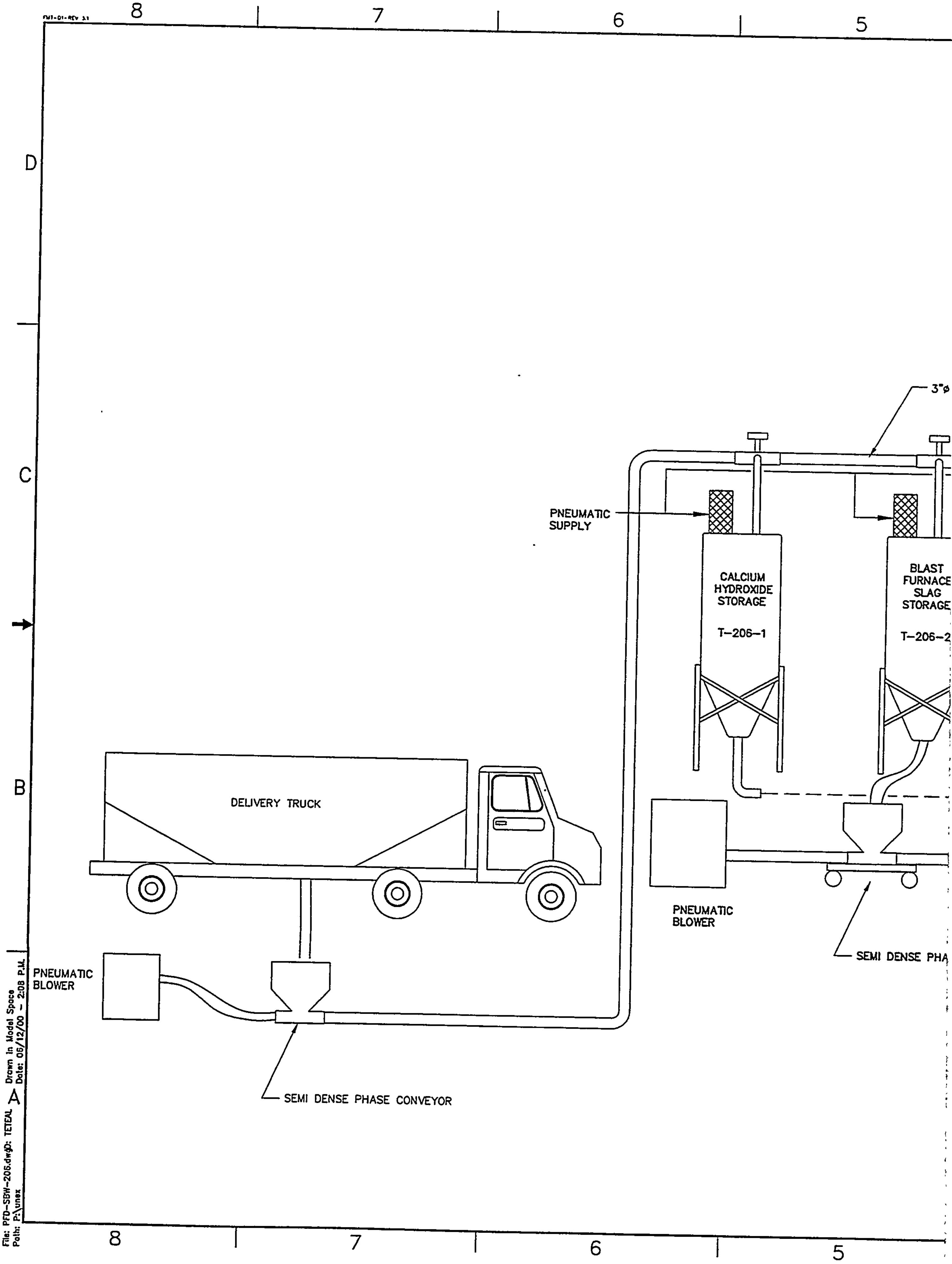
Path: P:\unex Date: 06/09/00 - 12:58 P.M.

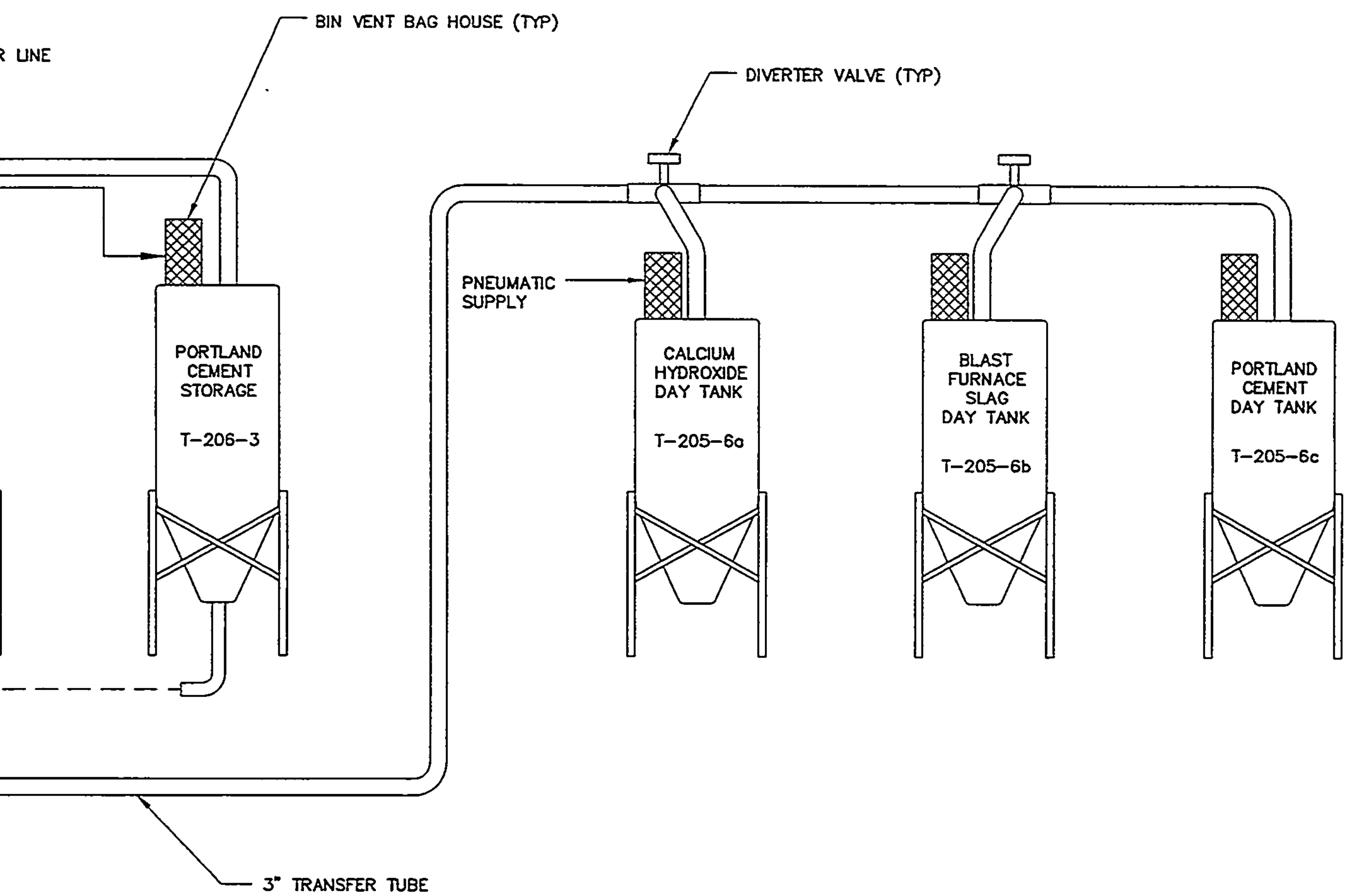

REVISIONS
REV
DESCRIPTION
EFFECTIVE DATE
NOTE:
1. NO FLOW FOR CASE OF ACTINIDE REMOVAL.
GROUT EXHAUST HEATER
GROUT EXHAUST PREFILTER
GROUT EXHAUST HEPA FILTER STAGE 1
GROUT EXHAUST HEPA FILTER STAGE 2
515
GROUT EXHAUST BLOWER
TO STACK
INDICATES SINGLE GROUTING STATION (X6)
NNF
MAKE-UP WATER
GLOVE BOX
VERTICAL MIXER
55 GAL DRUM
530
UNEX
MOD UNEX
GFF
NWCF
FOR DRAWING INDEX SEE DRAWING NO.
SUBCONTRACT NO.
INEEL
REQUESTER:
DESIGN: C. BARNES
DRAWN: Eric E Thomas
PROJECT NO.
SPEC CODE
NO SCALE
INTEC
WASTE TREATMENT FACILITIES
SODIUM BEARING WASTE FEED
LAW GROUTING
PROCESS FLOW DIAGRAM
DESIGN PHASE:
QUALITY LEVEL:
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:
SIZE D
CAGE CODE
INDEX CODE NUMBER
AREA 200
TYPE
CL
ORIG 090
DWG-PFD-SBW-205
REV
SCALE: NONE
SHEET P-5

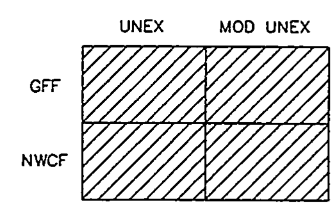


File: PFD-SBW-205.dwg O: TETEAL Drawn In Model Space
Path: P:\unex Date: 05/12/00 - 2:08 P.M.

REVISIONS

REV	DESCRIPTION	EFFECTIVE DATE





FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO, LLC
NO SCALE	REQUESTER:	INTEC
	DESIGN:	WASTE TREATMENT FACILITIES
	DRAWN: A L TETER	SODIUM BEARING WASTE FEED
	PROJECT NO.	LAW GROUTING
	SPEC CODE	PROCESS FLOW DIAGRAM
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE; INDEX CODE NUMBER: AREA 200, TYPE, CL, DRWG 090; DWG-PFD-SBW-206; REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NONE; SHEET P-6

Appendix C

Mass and Energy Balances

UNEX Process Material Balance

Sodium Bearing Waste			9/5/00		Rates based on 3 years operating time				Page 1a
PFD-SBW-	201	201	201, 202	201	201	201	201	201	202
Stream Number	115	120	121	125	131	132	133	134	200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return	Water to HF Tank	50% HF	3.3 M HF to Feed Adjustment	3.3 M HF to Scrub Makeup	UNEX Solvent to Scrub
Volume or Rate	298	298	328	12,061	834	107	30	11	445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
Hours per day	24	24	24	15.7	1	1	24	24	24
Days per year	200	200	200	Min/month	200	200	200	200	200
Specific Gravity	1.32	1.32	1.29	1.17	1.00	1.20	1.04	1.04	1.43
Temperature, C	25	25	25	25	25	25	25	25	25
Pressure, kPa	100	100	100	100	100	100	100	100	100
Liquid Composition	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Ag+1	3.20E-05	3.20E-05	2.91E-05	1.14E-05					2.17E-07
Al+3	6.15E-01	6.15E-01	5.59E-01	2.19E-01					4.29E-03
As+3	5.70E-05	5.70E-05	5.18E-05	2.03E-05					3.86E-07
B+3	2.05E-02	2.05E-02	1.87E-02	7.31E-03					1.39E-04
Ba+2	6.54E-05	6.54E-05	5.94E-05	2.33E-05					3.55E-05
Ca+2	5.95E-02	5.95E-02	5.41E-02	2.12E-02					1.99E-03
Cd+2	5.26E-03	5.26E-03	4.78E-03	1.87E-03					3.56E-05
Ce+4	2.28E-05	2.28E-05	2.08E-05	8.13E-06					1.53E-05
Cl-1	2.75E-02	2.75E-02	2.50E-02	9.79E-03					1.88E-04
CO3-2									
Cr+3	5.30E-03	5.30E-03	4.81E-03	1.88E-03					3.58E-05
Cs+1	8.85E-06	8.85E-06	8.04E-06	3.15E-06					5.98E-06
F-1	9.87E-02	9.87E-02	3.90E-01	3.51E-02		3.00E+01	3.30E+00	3.30E+00	3.67E-03
Fe+3	2.27E-02	2.27E-02	2.07E-02	8.09E-03					6.09E-04
H+1	2.92E+00	2.92E+00	2.95E+00	1.04E+00	1.00E-03	3.00E+01	3.30E+00	3.30E+00	2.30E-02
Hg+2	2.88E-03	2.88E-03	2.62E-03	1.03E-03					5.79E-06
K+1	1.75E-01	1.75E-01	1.59E-01	6.21E-02					1.64E-02
Mg+2									
Mn+2	1.69E-02	1.69E-02	1.53E-02	6.00E-03					1.14E-04
Mo+6	9.76E-04	9.76E-04	8.87E-04	3.47E-04					1.05E-04
Na+1	1.59E+00	1.59E+00	1.44E+00	5.66E-01					1.07E-02
Nb+5	8.07E-08	8.07E-08	7.34E-08	2.87E-08					5.46E-10
Nd+3	3.81E-05	3.81E-05	3.47E-05	1.36E-05					2.56E-05
Ni+2	2.61E-03	2.61E-03	2.38E-03	9.30E-04					1.77E-05
NO3-1	6.67E+00	6.67E+00	6.06E+00	2.37E+00	1.00E-03		8.90E-04	8.90E-04	8.95E-02
OH-1									
Pb+2	1.08E-03	1.08E-03	9.80E-04	3.84E-04					5.71E-04
Pd+3	4.51E-06	4.51E-06	4.10E-06	1.61E-06					3.05E-08
PO4-3	6.12E-03	6.12E-03	5.56E-03	2.18E-03					4.14E-05
Pr+3	1.06E-05	1.06E-05	9.68E-06	3.79E-06					7.15E-06
Ru+4	2.18E-05	2.18E-05	1.98E-05	7.74E-06					1.47E-07
Se+4	1.52E-05	1.52E-05	1.38E-05	5.40E-06					1.03E-07
Si+4									
Sn+4	4.21E-07	4.21E-07	3.83E-07	1.50E-07					2.85E-09
Sr+2	1.14E-05	1.14E-05	1.04E-05	4.06E-06					7.66E-06
SO4-2	4.99E-02	4.99E-02	4.53E-02	1.77E-02					3.37E-04
Zr+4	1.42E-02	1.42E-02	1.29E-02	5.06E-03					5.45E-03
UDS, g/l	3.10E+00	3.10E-01	2.82E-02	1.17E+02					2.10E-04
H2O	4.55E+01	4.55E+01	4.62E+01	4.87E+01		3.33E+01	5.14E+01	5.14E+01	5.55E-02
Oxygen									
Others									
TOC	6.98E-01	6.98E-01	6.34E-01	2.48E-01					4.72E-03

UNEX Process Material Balance

Sodium Bearing Waste			09/05/00		Activities decayed to 1/1/2008				Page 1b
Stream Number	115	120	121	125	131	132	133	134	200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return	Water to HF Tank	50% HF	3.3 M HF	3.3 M HF	UNEX Solvent to
Volume or Rate	298	298	328	12,061	834	107	30	11	445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
	(Liq. Only)	(w/ UDS)	(w/ UDS)						
Radionuclides	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter
Am-241	8.58E-05	8.58E-05	7.80E-05	3.05E-05					5.77E-05
Am-243	3.54E-08	3.54E-08	3.22E-08	1.26E-08					2.38E-08
Cm-242	3.14E-08	3.14E-08	2.85E-08	1.12E-08					2.10E-08
Cm-244	2.29E-06	2.29E-06	2.08E-06	8.14E-07					1.53E-06
Np-237	3.47E-06	3.82E-06	3.48E-06	1.23E-06					2.32E-06
Pu-238	5.99E-04	6.05E-04	5.50E-04	2.13E-04					4.02E-04
Pu-239	7.54E-05	7.61E-05	6.91E-05	2.68E-05					5.05E-05
Pu-240	1.73E-05	1.76E-05	1.60E-05	6.17E-06					1.16E-05
Pu-241	3.61E-04	3.66E-04	3.32E-04	1.28E-04					2.42E-04
Pu-242	2.08E-08	2.10E-08	1.91E-08	7.41E-09					1.40E-08
Th-230	1.25E-09	1.25E-09	1.14E-09	4.45E-10					8.38E-10
U-232	2.18E-09	2.18E-09	1.98E-09	7.77E-10					1.46E-09
U-233	5.83E-11	5.83E-11	5.30E-11	2.08E-11					3.91E-11
U-234	9.26E-07	9.27E-07	8.42E-07	3.29E-07					6.21E-07
U-235	2.60E-08	2.60E-08	2.36E-08	9.24E-09					1.74E-08
U-236	4.83E-08	4.83E-08	4.39E-08	1.72E-08					3.23E-08
U-238	1.59E-08	1.59E-08	1.45E-08	5.67E-09					1.07E-08
Ba-137m	3.93E-02	3.94E-02	3.58E-02	1.40E-02					2.66E-04
Ce-144	1.23E-08	1.23E-08	1.12E-08	4.38E-09					8.27E-09
Co-60	2.37E-05	2.37E-05	2.16E-05	8.44E-06					1.61E-07
Cs-134	1.64E-05	1.64E-05	1.49E-05	5.85E-06					1.11E-05
Cs-135	8.30E-07	8.30E-07	7.55E-07	2.95E-07					5.61E-07
Cs-137	4.17E-02	4.17E-02	3.79E-02	1.48E-02					2.82E-02
Eu-152	2.48E-06	2.48E-06	2.25E-06	8.81E-07					1.66E-06
Eu-154	1.47E-04	1.47E-04	1.34E-04	5.23E-05					9.87E-05
Eu-155	7.14E-05	7.14E-05	6.50E-05	2.54E-05					4.80E-05
Pm-147	7.46E-05	7.46E-05	6.78E-05	2.65E-05					5.05E-07
Pr-144									
Ni-63	4.79E-05	4.79E-05	4.36E-05	1.71E-05					3.24E-07
Ru-106	4.92E-08	4.92E-08	4.47E-08	1.75E-08					3.33E-10
Sb-125	5.93E-06	6.03E-06	5.48E-06	2.11E-06					4.01E-08
Sm-151	5.08E-04	5.08E-04	4.62E-04	1.81E-04					3.44E-06
Sr-90	3.83E-02	3.83E-02	3.49E-02	1.36E-02					2.57E-02
Tc-99	1.63E-05	1.76E-05	1.60E-05	5.79E-06					1.09E-07
Y-90	3.83E-02	3.83E-02	3.49E-02	1.36E-02					2.57E-02
H-3	3.56E-05	3.56E-05	3.23E-05	1.27E-05					2.41E-07
I-129	4.36E-07	4.36E-07	3.97E-07	1.55E-07					2.95E-09
Liquid only	Mole/liter	Mole/liter	Mole/liter	Mole/liter					Mole/liter
Am+4	1.04E-07	1.04E-07	9.43E-08	3.69E-08					6.97E-08
I	1.92E-05	1.92E-05	1.74E-05	6.82E-06					1.30E-07
Np+4	2.08E-05	2.08E-05	1.89E-05	7.38E-06					1.39E-05
Pu+4	5.57E-06	5.57E-06	5.07E-06	1.98E-06					3.74E-06
Tc+7	9.69E-06	9.69E-06	8.81E-06	3.45E-06					6.49E-08
U+4	2.54E-04	2.54E-04	2.31E-04	9.04E-05					1.70E-04

Sodium Bearing Waste			09/05/00						Page 1c
Stream Number	115	120	121	125	125	125	125		200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return	UDS Return	UDS Return	UDS Return		UNEX Solvent to
Volume or Rate	298	298	328	12,061	12,061	12,061	12,061		445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr		liters/hr
					Solids Composition				
Other Species	Mole/liter	Mole/liter	Mole/liter		Wt frac		Ci/kg		Mole/liter
Ac+3	3.35E-15	3.35E-15	3.04E-15	**Al+3**	1.80E-02	**Am-241**	5.14E-08	**Ac+3**	2.27E-17
At	6.67E-28	6.67E-28	6.06E-28	**B+3**	2.99E-02	**Np-237**	1.15E-03	**At**	4.51E-30
Be+2	2.11E-11	2.11E-11	1.92E-11	**Ca+2**	9.10E-03	**Pu-238**	1.96E-02	**Be+2**	1.43E-13
Bi+3	1.48E-17	1.48E-17	1.35E-17	**Cd+2**	1.62E-03	**Pu-239**	2.26E-03	**Bi+3**	1.00E-19
Br-1	3.88E-07	3.88E-07	3.53E-07	**Cl-1**	2.72E-02	**Pu-240**	7.24E-04	**Br-1**	2.63E-09
C+4				**Cr+3**	2.30E-03	**Pu-241**	1.48E-02	**C+4**	
Cf+3	2.19E-20	2.19E-20	1.99E-20	**Cu+2**	1.62E-03	**Pu-242**	5.74E-07	**Cf+3**	1.47E-20
Cm+3	1.05E-10	1.05E-10	9.57E-11	**F-1**	2.66E-02	**U-234**	3.09E-06	**Cm+3**	7.06E-11
Cu+2				**Fe+3**	2.49E-02	**U-235**	7.76E-08	**Cu+2**	
Dy+3	8.00E-10	8.00E-10	7.27E-10	**Hg+2**	5.88E-03	**U-236**	3.49E-08	**Dy+3**	5.41E-12
Er+3	1.32E-11	1.32E-11	1.20E-11	**K+1**	1.60E-02	**U-238**	1.50E-08	**Er+3**	8.90E-14
Eu+3	6.51E-07	6.51E-07	5.92E-07	**Li+1**	1.62E-03			**Eu+3**	4.38E-07
Fr+1	8.97E-23	8.97E-23	8.15E-23	**Mg+2**	1.62E-02	**Ba-137m**	1.06E-01	**Fr+1**	6.07E-25
Ga+3	2.44E-14	2.44E-14	2.22E-14	**Mn+2**	3.89E-03	**Ce-144**	3.10E-12	**Ga+3**	1.65E-16
Gd+3	3.31E-07	3.31E-07	3.01E-07	**Mo+6**	1.62E-02	**Co-60**	2.94E-05	**Gd+3**	2.24E-09
Ge+2	1.13E-08	1.13E-08	1.03E-08	**Na+1**	4.35E-02	**Cs-134**	6.86E-06	**Ge+2**	7.64E-11
Ho+3	3.40E-11	3.40E-11	3.09E-11	**Nb+5**	1.55E-03	**Cs-137**	1.12E-01	**Ho+3**	2.30E-13
In+3	1.74E-08	1.74E-08	1.58E-08	**Ni+2**	1.46E-02	**Eu-154**	1.62E-03	**In+3**	1.18E-10
La+3	1.15E-05	1.15E-05	1.05E-05	**Pb+2**	1.62E-03	**Eu-155**	2.03E-04	**La+3**	7.80E-08
Li+1	5.04E-11	5.04E-11	4.58E-11	**Pd+3**	9.69E-04	**Ru-106**	1.56E-08	**Li+1**	3.41E-13
Pa+4	9.09E-12	9.09E-12	8.26E-12	**PO4-3**	1.35E-01	**Sb-125**	3.28E-04	**Pa+4**	6.15E-14
Pm+3	4.55E-10	4.55E-10	4.14E-10	**Rh+3**	1.62E-03	**Sr-90**	1.19E-01	**Pm+3**	3.08E-12
Po+2	5.26E-18	5.26E-18	4.78E-18	**Ru+4**	1.62E-02	**Tc-99**	4.49E-03	**Po+2**	3.56E-20
Ra	5.75E-14	5.75E-14	5.23E-14	**Si+4**	4.09E-02	**Y-90**	1.19E-01	**Ra**	3.89E-16
Rb+3	7.02E-06	7.02E-06	6.38E-06	**Sn+4**	8.08E-03	**I-129**	9.57E-04	**Rb+3**	4.75E-08
Rh+3	4.66E-06	4.66E-06	4.24E-06	**SO4-2**	1.48E-01			**Rh+3**	3.16E-08
Sb+4	8.21E-08	8.21E-08	7.47E-08	**Ti+4**	1.62E-03			**Sb+4**	5.56E-10
Sm+3	7.32E-06	7.32E-06	6.65E-06	**Zn+2**	1.62E-03	**Tot TRU**	2.37E-02	**Sm+3**	4.95E-08
Tb+3	2.71E-09	2.71E-09	2.46E-09	**Zr+4**	1.39E-01			**Tb+3**	1.83E-11
Te+4	3.68E-06	3.68E-06	3.35E-06	**H2O**	7.12E-02			**Te+4**	2.49E-08
Th+4	2.63E-10	2.63E-10	2.39E-10	**O**	1.74E-01			**Th+4**	1.76E-10
Ti+4								**Ti+4**	
Tl+3	6.85E-20	6.85E-20	6.23E-20					**Tl+3**	4.64E-22
Tm+3	6.51E-15	6.51E-15	5.92E-15					**Tm+3**	4.41E-17
Y+3	8.76E-06	8.76E-06	7.97E-06					**Y+3**	5.93E-08
Yb+3	1.10E-15	1.10E-15	9.98E-16					**Yb+3**	
Zn+2								**Zn+2**	

UNEX Process Material Balance

Sodium Bearing Waste	09/05/00		Rates based on 3 years operating time						Page 2a
PFD-SBW-	202	202	202	202	202	202	202	202	202
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to Strip	UNEX Solvent to Wash	UNEX Solvent Make-up	UNEX Solvent to Extraction	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous Feed	Raffinate
Volume or Rate	445	445	0.58	445	117	148	148	117	445	445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
Hours per day	24	24	24	24	24	24	24	24	24	24
Days per year	200	200	200	200	200	200	200	200	200	200
Specific Gravity	1.42	1.42	1.42	1.42	1.01	1.01	1.02	1.02	1.22	1.21
Temperature, C	25	25	25	25	25	25	25	25	25	25
Pressure, kPa	100	100	100	100	100	100	100	100	100	100
Liquid Composition	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Ag+1	3.01E-10	1.91E-22		1.91E-22			9.03E-10	8.22E-07	2.17E-05	2.14E-05
Al+3	5.05E-04	1.73E-04		1.73E-04	5.00E-02		9.97E-04	6.44E-02	4.29E-01	4.25E-01
As+3	5.35E-10	3.41E-22		3.40E-22			1.61E-09	1.46E-06	3.86E-05	3.82E-05
B+3	1.93E-07	1.23E-19		1.23E-19			5.79E-07	5.27E-04	1.39E-02	1.38E-02
Ba+2	3.46E-05	2.43E-06		2.43E-06			9.64E-05	3.55E-06	4.47E-05	1.17E-05
Ca+2	1.94E-03	1.09E-06		1.09E-06			5.82E-03	1.99E-04	3.99E-02	3.79E-02
Cd+2	4.95E-08	3.14E-20		3.14E-20			1.48E-07	1.35E-04	3.56E-03	3.52E-03
Ce+4	1.53E-05	2.55E-23		2.55E-23			4.59E-05	1.54E-07	1.53E-05	3.39E-12
Cl-1	7.27E-06	4.62E-18		4.62E-18	7.02E-04		2.18E-05	1.39E-03	1.88E-02	1.86E-02
CO3-2						2.50E-01	2.43E-01			
Cr+3	4.98E-08	3.17E-20		3.16E-20			1.49E-07	1.36E-04	3.58E-03	3.55E-03
Cs+1	5.93E-06	3.33E-09		3.33E-09			1.78E-05	1.93E-07	5.98E-06	2.46E-09
F-1	3.00E-03	1.91E-15		1.91E-15	3.00E-01		9.00E-03	3.03E-01	3.67E-01	3.63E-01
Fe+3	5.94E-04	1.23E-04		1.23E-04			1.41E-03	6.09E-05	1.52E-02	1.48E-02
H+1	4.04E-03	9.50E-06		9.49E-06	4.01E-01	9.50E-04		4.73E-01	2.30E+00	2.28E+00
Hg+2	5.64E-06	3.96E-07		3.96E-07			1.57E-05	5.79E-07	1.93E-03	1.93E-03
K+1	1.60E-02	1.09E-04		1.08E-04			4.77E-02	1.64E-03	1.17E-01	1.01E-01
Mg+2										
Mn+2	1.59E-07	1.01E-19		1.01E-19			4.76E-07	4.33E-04	1.14E-02	1.13E-02
Mo+6	1.02E-04	6.44E-05		6.44E-05			1.14E-04	1.05E-05	6.57E-04	6.16E-04
Na+1	1.04E-02	2.14E-03		2.14E-03			2.47E-02	1.06E-03	1.07E+00	1.06E+00
Nb+5	7.59E-13	4.83E-25		4.82E-25			2.28E-12	2.07E-09	5.46E-08	5.41E-08
Nd+3	2.56E-05	4.26E-23		4.26E-23			7.67E-05	2.56E-07	2.56E-05	5.66E-12
Ni+2	2.46E-08	1.56E-20		1.56E-20			7.37E-08	6.71E-05	1.77E-03	1.75E-03
NO3-1	5.37E-02	3.57E-03		3.56E-03	2.51E-01	9.50E-04	1.51E-01	3.87E-01	4.57E+00	4.48E+00
OH-1										
Pb+2	5.56E-04	6.97E-06		6.97E-06			1.65E-03	5.71E-05	7.37E-04	1.73E-04
Pd+3	4.24E-11	2.70E-23		2.69E-23			1.27E-10	1.16E-07	3.05E-06	3.02E-06
PO4-3	5.75E-08	3.66E-20		3.66E-20			1.73E-07	1.57E-04	4.14E-03	4.10E-03
Pr+3	7.14E-06	1.19E-23		1.19E-23			2.14E-05	7.16E-08	7.15E-06	1.58E-12
Ru+4	2.05E-10	1.30E-22		1.30E-22			6.14E-10	5.59E-07	1.47E-05	1.46E-05
Se+4	1.43E-10	9.08E-23		9.07E-23			4.28E-10	3.90E-07	1.03E-05	1.02E-05
Si+4										
Sn+4	3.96E-12	2.52E-24		2.52E-24			1.19E-11	1.08E-08	2.85E-07	2.82E-07
Sr+2	7.65E-06	2.25E-17		2.25E-17			2.30E-05	1.43E-08	7.65E-06	1.24E-10
SO4-2	4.69E-07	2.98E-19		2.98E-19			1.41E-06	1.28E-03	3.37E-02	3.34E-02
Zr+4	4.09E-03	2.30E-06		2.29E-06			1.23E-02	5.16E-03	1.09E-02	5.45E-03
UDS, g/l	2.91E-07	1.85E-19		1.85E-19			8.73E-07	7.95E-04	2.10E-02	2.07E-02
H2O	5.55E-02	5.55E-02		5.55E-02	5.49E+01	5.50E+01	5.50E+01	5.49E+01	4.85E+01	4.85E+01
Oxygen										
DTPA	3.52E-35	2.54E-04		2.54E-04		2.54E-02	2.47E-02	9.61E-32	2.53E-32	2.54E-04
Guanidine+1	6.92E-34	5.00E-03		5.00E-03		5.00E-01	4.85E-01	1.89E-30	4.97E-31	5.00E-03
UNEX solvent, g/liter							1.00E+00	1.00E+00	2.63E-01	1.00E+00

Sodium Bearing Waste		09/05/00		Activities decayed to 1/1/2008						Page 2b
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to Strip	UNEX Solvent to Wash	UNEX Solvent Make-up	UNEX Solvent to Extraction	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous Feed	Raffinate
Volume or Rate	445	445	0.6	445	117	148	148	117	445	445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
									(w/ UDS)	(w/ UDS)
Radionuclides	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter
Am-241	5.75E-05						1.73E-04	5.77E-07	5.76E-05	2.34E-11
Am-243	2.37E-08						7.12E-08	2.38E-10	2.38E-08	5.26E-15
Cm-242	2.10E-08	5.75E-19		5.74E-19			6.31E-08	1.10E-11	2.10E-08	6.35E-20
Cm-244	1.53E-06	4.19E-17		4.18E-17			4.60E-06	7.98E-10	1.53E-06	4.63E-18
Np-237	2.32E-06	6.35E-17		6.34E-17			6.97E-06	1.21E-09	2.56E-06	2.39E-07
Pu-238	4.02E-04						1.21E-03	2.09E-07	4.06E-04	4.06E-06
Pu-239	5.05E-05						1.52E-04	2.63E-08	5.10E-05	4.68E-07
Pu-240	1.16E-05						3.48E-05	6.05E-09	1.18E-05	1.50E-07
Pu-241	2.42E-04						7.26E-04	1.26E-07	2.45E-04	3.07E-06
Pu-242	1.40E-08						4.19E-08	7.27E-12	1.41E-08	1.19E-10
Th-230	8.38E-10						2.51E-09	4.36E-13	8.38E-10	2.53E-21
U-232	1.46E-09						4.39E-09	7.62E-13	1.46E-09	4.42E-21
U-233	3.91E-11						1.17E-10	2.04E-14	3.91E-11	1.18E-22
U-234	6.21E-07	1.69E-17		1.69E-17			1.86E-06	3.23E-10	6.21E-07	6.40E-10
U-235	1.74E-08	4.75E-19		4.75E-19			5.22E-08	9.07E-12	1.74E-08	1.61E-11
U-236	3.23E-08	8.83E-19		8.82E-19			9.70E-08	1.68E-11	3.23E-08	7.24E-12
U-238	1.07E-08	2.92E-19		2.91E-19			3.20E-08	5.56E-12	1.07E-08	3.11E-12
							7.91E-02	8.60E-04	2.66E-02	3.30E-05
Ce-144	8.25E-09						2.48E-08	8.27E-11	8.27E-09	2.47E-15
Co-60	2.23E-10						6.69E-10	6.09E-07	1.61E-05	1.59E-05
Cs-134	1.10E-05	6.19E-09		6.18E-09			3.30E-05	3.59E-07	1.11E-05	6.00E-09
Cs-135	5.57E-07	3.13E-10		3.12E-10			1.67E-06	1.81E-08	5.61E-07	2.31E-10
Cs-137	2.80E-02	1.57E-05		1.57E-05			8.38E-02	9.11E-04	2.82E-02	3.49E-05
Eu-152	1.66E-06						4.98E-06	1.66E-08	1.66E-06	3.68E-13
Eu-154	9.85E-05						2.95E-04	9.87E-07	9.90E-05	3.37E-07
Eu-155	4.79E-05						1.44E-04	4.80E-07	4.80E-05	4.21E-08
Pm-147	7.01E-10						2.10E-09	1.92E-06	5.05E-05	5.00E-05
Pr-144										
Ni-63	4.51E-10						1.35E-09	1.23E-06	3.24E-05	3.21E-05
Ru-106	4.62E-13						1.39E-12	1.26E-09	3.33E-08	3.29E-08
Sb-125	5.57E-11						1.67E-10	1.52E-07	4.08E-06	4.04E-06
Sm-151	4.78E-09						1.43E-08	1.31E-05	3.44E-04	3.41E-04
Sr-90	2.57E-02	7.56E-14		7.55E-14			7.70E-02	4.78E-05	2.57E-02	2.50E-05
Tc-99	1.06E-07	7.20E-10		7.19E-10			3.16E-07	1.09E-08	1.18E-05	1.17E-05
Y-90	2.57E-02	7.56E-14		7.55E-14			7.70E-02	4.78E-05	2.57E-02	2.50E-05
H-3	3.34E-10						1.00E-09	9.14E-07	2.41E-05	2.38E-05
I-129	4.10E-12						1.23E-11	1.12E-08	2.95E-07	2.92E-07
Liquid only	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Am+4	6.95E-08						2.09E-07	6.97E-10	6.97E-08	1.54E-14
I	1.80E-10						5.40E-10	4.92E-07	1.30E-05	1.28E-05
Np+4	1.39E-05	3.80E-16		3.80E-16			4.17E-05	7.25E-09	1.39E-05	4.20E-17
Pu+4	3.74E-06						1.12E-05	1.95E-09	3.73E-06	6.89E-22
Tc+7	6.32E-08	4.29E-10		4.29E-10			1.88E-07	6.49E-09	6.49E-06	6.43E-06
U+4	1.70E-04	4.65E-15		4.65E-15			5.11E-04	8.87E-08	1.70E-04	5.14E-16

UNEX Process Material Balance

Sodium Bearing Waste	09/05/00								Page 2c
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to	UNEX Solvent to	UNEX Solvent	UNEX Solvent to	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous	Raffinate
Volume or Rate	445	445	0.6	445	117	148	148	117	445	445
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
Other Species	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Ac+3								8.60E-17	2.27E-15	2.24E-15
At										
Be+2	1.98E-16						5.95E-16	5.42E-13	1.43E-11	1.41E-11
Bi+3								3.81E-19	1.00E-17	9.94E-18
Br-1	3.65E-12						1.09E-11	9.96E-09	2.63E-07	2.60E-07
C+4										
Cf+										
Cm+3	7.06E-11						2.12E-10	3.68E-14	7.05E-11	
Cu+2										
Dy+3	7.52E-15						2.26E-14	2.05E-11	5.41E-10	5.36E-10
Er+3	1.24E-16						3.71E-16	3.38E-13	8.90E-12	8.81E-12
Eu+3	4.37E-07						1.31E-06	4.38E-09	4.38E-07	9.67E-14
Fr+1										
Ga+3	2.29E-19						6.88E-19	6.26E-16	1.65E-14	1.63E-14
Gd+3	3.11E-12						9.33E-12	8.49E-09	2.24E-07	2.22E-07
Ge+2	1.06E-13						3.19E-13	2.90E-10	7.64E-09	7.57E-09
Ho+3	3.19E-16						9.58E-16	8.72E-13	2.30E-11	2.28E-11
In+3	1.64E-13						4.91E-13	4.47E-10	1.18E-08	1.17E-08
La+3	1.08E-10						3.25E-10	2.96E-07	7.80E-06	7.72E-06
Li+1	4.74E-16						1.42E-15	1.30E-12	3.41E-11	3.38E-11
Pa+4	8.55E-17						2.56E-16	2.33E-13	6.15E-12	6.09E-12
Pm+3	4.28E-15						1.28E-14	1.17E-11	3.08E-10	3.05E-10
Po+2								1.35E-19	3.56E-18	3.53E-18
Ra	5.41E-19						1.62E-18	1.48E-15	3.89E-14	3.85E-14
b+3	6.60E-11						1.98E-10	1.80E-07	4.75E-06	4.70E-06
n+3	4.39E-11						1.32E-10	1.20E-07	3.16E-06	3.13E-06
Sb+4	7.72E-13						2.32E-12	2.11E-09	5.56E-08	5.50E-08
Sm+3	6.88E-11						2.06E-10	1.88E-07	4.95E-06	4.90E-06
b+3	2.54E-14						7.63E-14	6.95E-11	1.83E-09	1.81E-09
e+4	3.46E-11						1.04E-10	9.46E-08	2.49E-06	2.47E-06
Th+4	1.76E-10						5.29E-10	9.18E-14	1.76E-10	
Ti+4										
Tl+3										
Tm+3							1.84E-19	1.67E-16	4.41E-15	4.36E-15
Y+3	8.24E-11						2.47E-10	2.25E-07	5.93E-06	5.87E-06
Yb+3								2.82E-17	7.43E-16	7.36E-16
Zn+2										

UNEX Process Material Balance

Sodium Bearing Waste		09/05/00		Rates based on 3 years operating time						Page 3
PFD-SBW-	202	202	202	202	202	202	202	202	202	202
Stream Number	230	231	232	233	234	235	236	237	238	239
Stream Name	50% Aluminum Nitrate	Scrub Make-up Water	Scrub Make-up Acid	Guanidine Carbonate	DTPA	Strip Make-up Water	FS-13	CMPO	PEG-400	Chlor. Cobalt Dicarbol.
Volume or Rate	1.5	86.4	2.9	6.7	1.3	140.9	11,942	100	821	509
Units	liters/hr	liters/hr	liters/hr	kg/hr	liters/hr	liters/hr	liters	kg	liters	kg
Hours per day	24	24	24	24	24	24	(UNEX solvent chemicals include make-up			
Days per year	200	200	200	200	200	200	plus initial inventory of 12 hrs circirculation)			
Specific Gravity	1.54	1.00	1.13	0.58	1.10	1.00	1.41	???	1.10	???
Temperature, C	25	25	25	25	25	25	25	25	25	25
Pressure, kPa	100	100	100	100	100	100	100	100	100	100
Liquid Composition	Mole/liter	Mole/liter	Mole/liter	Wt frac	Mole/liter	Mole/liter	Wt frac	Wt frac	Wt frac	Wt frac
Al+3	4.00E+00									
Cl-1			2.81E-02							
F-1			1.09E-01							
H+1		1.00E-03	4.14E+00			1.00E-03				
NO3-1	1.20E+01	1.00E-03	4.00E+00			1.00E-03				
DTPA					2.80E+00					
Guanidine Carbonate				1.00E+00						
FS-13							1.00E+00			
CMPO								1.00E+00		
PEG-400									1.00E+00	
ChCoDiC										1.00E+00
H2O	4.72E+01	5.55E+01		5.58E+01		5.55E+01				

UNEX Process Material Balance

Sodium Bearing Waste		9/5/00			Rates based on 3 years operating time					Page 4a
PFD-SBW-	203	203	204	204	204	204	204	204	204	204
Stream Number	306	320	401	402	403	404	405	410	412	413
Stream Name	UNEX Stri Evaporator Cond.	Dried RH Waste	LAW Evap. Feed	LAW Evap. Bottoms	LAW Evap. Overhead	Recov'd HNO3	Fraction-ator Ovhd	Total Recycle Water	Excess Water Vap to Stack	Excess Acid to Grouting
Volume or Rate	147	11	593	246	352	7.5	345	267	97.3	5
Units	liters/hr	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Hours per day	24	24	24	24	24	24	24	24	24	24
Days per year	200	200	200	200	200	200	200	200	200	200
Specific Gravity	1.00	0.58	1.16	1.35	1.00	1.13	1.00	1.00		1.13
Temperature, C			25	0				25		25
Pressure, kPa	100	100	100	100	100	100	100	100		100
Composition	Mole/liter	Wt frac	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole frac	Mole/liter
Ag+1		1.26E-09	1.61E-05	3.87E-05						
Al+3		3.48E-04	3.19E-01	7.67E-01						
As+3		1.56E-09	2.87E-05	6.90E-05						
B+3		8.11E-08	1.03E-02	2.49E-02						
Ba+2		1.72E-04	8.79E-06	2.11E-05						
Ca+2		3.02E-03	2.85E-02	6.85E-02						
Cd+2		2.16E-07	2.65E-03	6.37E-03						
Ce+4		5.09E-05	2.55E-12	6.13E-12						
Cl-1		1.00E-05	1.40E-02	3.28E-02	5.91E-04	2.79E-02				2.79E-02
CO3-2		1.88E-01								
Cr+3		1.01E-07	2.67E-03	6.41E-03						
Cs+1		3.06E-05	1.85E-09	4.45E-09						
F-1		2.22E-03	2.73E-01	6.53E-01	2.30E-03	1.08E-01				1.08E-01
Fe+3		1.02E-03	1.11E-02	2.67E-02						
H+1	5.99E-06	2.05E-04	1.71E+00	3.98E+00	8.85E-02	4.14E+00	1.00E-03	1.00E-03		4.14E+00
Hg+2		4.09E-05	1.45E-03	3.48E-03	1.28E-10					
K+1		2.42E-02	7.60E-02	1.83E-01						
Mg+2										
Mn+2		3.39E-07	8.49E-03	2.04E-02						
Mo+6		1.41E-04	4.63E-04	1.11E-03						
Na+1		7.35E-03	7.94E-01	1.91E+00						
Nb+5		2.74E-12	4.07E-08	9.77E-08						
Nd+3		1.00E-04	4.26E-12	1.02E-11						
Ni+2		5.60E-08	1.32E-03	3.16E-03						
NO3-1	5.99E-06	1.24E-01	3.37E+00	7.98E+00	8.56E-02	4.00E+00	1.00E-03	1.00E-03		4.00E+00
OH-1										
Pb+2		4.42E-03	1.30E-04	3.13E-04						
Pd+3		1.70E-10	2.27E-06	5.46E-06						
PO4-3		2.12E-07	3.08E-03	7.41E-03						
Pr+3		3.85E-05	1.19E-12	2.86E-12						
Ru+4		1.01E-09	1.10E-05	2.63E-05						
Se+4		4.38E-10	7.65E-06	1.84E-05						
Si+4										
Sn+4		1.83E-11	2.12E-07	5.10E-07						
Sr+2		2.61E-05	9.32E-11	2.24E-10						
SO4-2		1.75E-06	2.51E-02	6.04E-02						
Zr+4		1.45E-02	4.10E-03	9.85E-03						
UDS, g/l		1.13E-08	1.56E-02	3.75E-02						
H2O	5.55E+01	1.00E-01	5.02E+01	4.10E+01	5.54E+01	4.83E+01	5.55E+01	4.83E+01	1.00E+00	4.83E+01
Oxygen										
Crystallization additives										
DTPA		1.26E-01	1.91E-04	4.59E-04						
Guanidine+1		3.71E-01	3.75E-03	9.03E-03						
UNEX solvent, g/liter		1.30E-02	7.52E-01	1.81E+00						
Other organic, g/liter		2.03E-02	3.63E-01	8.74E-01						

UNEX Process Material Balance

Sodium Bearing Waste			9/5/00							Page 4b
Stream Number	306	320	401	402	403	404	405	410	412	413
Stream Name	UNEX Stri Evaporator Cond.	Dried RH Waste	LAW Evap. Feed	LAW Evap. Bottoms	LAW Evap. Overhead	Recov'd HNO3	Fraction-ator Ovhd	Total Recycle Water	Excess Water Vap to Stack	Excess Acid to Grouting
Volume or Rate	147	11	593	246	352	7	345	267	97	5
Units	liters/hr	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Radionuclides	Ci/liter	Ci/kg	Ci/liter	Ci/liter						
Am-241		2.23E-03	1.76E-11	4.23E-11						
Am-243		9.22E-07	3.95E-15	9.50E-15						
Cm-242		8.18E-07	4.78E-20	1.15E-19						
Cm-244		5.96E-05	3.48E-18	8.36E-18						
Np-237		9.03E-05	1.80E-07	4.32E-07						
Pu-238		1.56E-02	3.05E-06	7.33E-06						
Pu-239		1.96E-03	3.52E-07	8.46E-07						
Pu-240		4.51E-04	1.13E-07	2.71E-07						
Pu-241		9.40E-03	2.31E-06	5.55E-06						
Pu-242		5.43E-07	8.95E-11	2.15E-10						
Th-230		3.26E-08		4.57E-21						
U-232		5.68E-08		7.98E-21						
U-233		1.52E-09		2.13E-22						
U-234		2.41E-05	4.81E-10	1.16E-09						
U-235		6.76E-07	1.21E-11	2.91E-11						
U-236		1.26E-06	5.44E-12	1.31E-11						
U-238		4.15E-07	2.33E-12	5.61E-12						
Ba-137m		1.02E+00	2.48E-05	5.96E-05						
Ce-144		3.21E-07	1.86E-15	4.46E-15						
Co-60		8.67E-09	1.20E-05	2.87E-05						
Cs-134		4.28E-04	4.51E-09	1.08E-08						
Cs-135		2.16E-05	1.74E-10	4.18E-10						
Cs-137		1.09E+00	2.63E-05	6.31E-05						
Eu-152		6.45E-05	2.76E-13	6.64E-13						
Eu-154		3.83E-03	2.53E-07	6.08E-07						
Eu-155		1.86E-03	3.17E-08	7.61E-08						
Pm-147		2.73E-08	3.76E-05	9.03E-05						
Pr-144										
Ni-63		1.75E-08	2.41E-05	5.80E-05						
Ru-106		1.80E-11	2.48E-08	5.95E-08						
Sb-125		2.17E-09	3.04E-06	7.30E-06						
Sm-151		1.86E-07	2.56E-04	6.15E-04						
Sr-90		9.98E-01	1.88E-05	4.52E-05						
Tc-99		4.10E-06	8.81E-06	2.12E-05						
Y-90		9.98E-01	1.88E-05	4.52E-05						
H-3		1.30E-08	1.79E-05	4.31E-05						
I-129		1.59E-10	2.20E-07	8.87E-07						
Liquid only	Mole/liter	Wt frac	Mole/liter	Mole/liter						
Am+4		6.51E-07	1.16E-14	2.78E-14						
I		9.03E-10	9.65E-06	2.32E-05						
Np+4		1.28E-04	3.16E-17	7.59E-17						
Pu+4		3.47E-05	5.18E-22	1.25E-21						
Tc+7		2.42E-07	4.83E-06	1.16E-05						
U+4		1.57E-03	3.86E-16	9.29E-16						

UNEX Process Material Balance

Sodium Bearing Waste			09/05/00							Page 4c
Stream Number	306	320	401	402	403	404	405	410	412	413
Stream Name	UNEX Stri Evaporator Cond.	Dried RH Waste	LAW Evap. Feed	LAW Evap. Bottoms	LAW Evap. Overhead	Recov'd HNO3	Fraction-ator Ovhd	Total Recycle Water	Excess Water Vap to Stack	Excess Acid to Grouting
Volume or Rate	147	11	593	246	352	7	345	267	97	5
Units	liters/hr	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Other Species		wt frac	Mole/liter	Mole/liter						
Ac+3		2.8E-19	1.7E-15	4.1E-15						
At										
Be+2		6.9E-17	1.1E-11	2.6E-11						
Bi+3			7.5E-18	1.8E-17						
Br-1		1.1E-11	2.0E-07	4.7E-07						
C+4										
Cf+3		1.4E-19	3.3E-32	8.0E-32						
Cm+3		6.8E-10	1.6E-22	3.9E-22						
Cu+2										
Dy+3		4.7E-14	4.0E-10	9.7E-10						
Er+3		8.0E-16	6.6E-12	1.6E-11						
Eu+3		2.6E-06	7.3E-14	1.7E-13						
Fr+1										
Ga+3		6.2E-19	1.2E-14	3.0E-14						
Gd+3		1.9E-11	1.7E-07	4.0E-07						
Ge+2		3.0E-13	5.7E-09	1.4E-08						
Ho+3		2.0E-15	1.7E-11	4.1E-11						
In+3		7.3E-13	8.8E-09	2.1E-08						
La+3		3.7E-10	5.8E-06	1.4E-05						
Li+1		1.3E-16	2.5E-11	6.1E-11						
Pa+4		7.7E-16	4.6E-12	1.1E-11						
Pm+3		2.4E-14	2.3E-10	5.5E-10						
Po+2			2.7E-18	6.4E-18						
Ra		4.7E-18	2.9E-14	7.0E-14						
Rb+3		3.6E-10	3.5E-06	8.5E-06						
Rh+3		1.8E-10	2.3E-06	5.6E-06						
Sb+4		3.7E-12	4.1E-08	9.9E-08						
Sm+3		4.0E-10	3.7E-06	8.9E-06						
Tb+3		1.6E-13	1.4E-09	3.3E-09						
Te+4		1.9E-10	1.9E-06	4.5E-06						
Th+4		1.6E-09								
Ti+4										
Tl+3										
Tm+3		4.0E-19	3.3E-15	7.9E-15						
Y+3		4.6E-10	4.4E-06	1.1E-05						
Yb+3		6.9E-20	5.5E-16	1.3E-15						
Zn+2										

Sodium Bearing Waste			09/05/00		Rates based on 3 years operating time					Page 5a
PFD-SBW-	205	205	205	205	205	205	205	205	205	
Stream Number	501	502	510	511	512	514	515	516	530	
Stream Name	50 wt % NaOH	Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Hydroxid 0	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste	
Volume or Rate	52	297	37	334	60	1.1	98	1.1	842	
Units	liters/hr	liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr	
Hours per day	24	24	24	24	24	24	24	24	24	
Days per year	200	200	200	200	200	200	200	200	200	
Specific Gravity	1.53	1.38	1.50	1.10	0.90				1.63	
Temperature, C	25	25	25	25	25	25		25	25	
Pressure, kPa	100	100	100	100	100	100		100	100	
Composition	Mole/liter	Mole/liter				g/sm3	g/sm3		wt frac	
Ag+1		3.21E-05				9.66E-06	1.31E-13		1.22E-06	
Al+3		6.37E-01				4.78E-02	6.49E-10		6.07E-03	
As+3		5.72E-05				1.19E-05	1.62E-13		1.51E-06	
B+3		2.06E-02				6.21E-04	8.42E-12		8.20E-05	
Ba+2		1.75E-05				6.71E-06	9.09E-14		8.50E-07	
Ca+2		5.68E-02				6.34E-03	8.60E-11		8.06E-04	
Cd+2		5.28E-03				1.65E-03	2.24E-11		2.10E-04	
Ce+4		5.08E-12				1.21E-12	1.64E-20		1.53E-13	
Cl-1		2.72E-02				2.69E-03	3.64E-11		3.44E-04	
CO3-2										
Cr+3		5.32E-03				7.70E-04	1.04E-11		9.80E-05	
Cs+1		3.69E-09				1.37E-09	1.85E-17		1.73E-10	
F-1		5.42E-01				2.87E-02	3.88E-10		3.64E-03	
Fe+3		2.21E-02				3.44E-03	4.66E-11		4.39E-04	
H+1										
Hg+2		2.89E-03				1.61E-03	2.19E-11		2.05E-04	
K+1		1.52E-01				1.65E-02	2.24E-10		2.10E-03	
Mg+2										
Mn+2		1.69E-02				2.59E-03	3.51E-11		3.29E-04	
Mo+6		9.23E-04				2.47E-04	3.34E-12		3.31E-05	
Na+1	1.91E+01	4.90E+00				3.14E-01	4.25E-09		3.98E-02	
Nb+5		8.11E-08				2.10E-08	2.84E-16		1.72E-07	
Nd+3		8.49E-12				2.39E-12	3.24E-20		3.03E-13	
Ni+2		2.62E-03				4.29E-04	5.82E-12		5.60E-05	
NO3-1		6.62E+00				1.14E+00	1.55E-08		1.45E-01	
OH-1	1.91E+01	2.00E-13				9.48E-15	1.28E-22		1.99E-02	
Pb+2		2.60E-04				1.50E-04	2.03E-12		1.92E-05	
Pd+3		4.53E-06				1.30E-06	1.76E-14		2.71E-07	
PO4-3		6.15E-03				1.63E-03	2.20E-11		2.21E-04	
Pr+3		2.37E-12				9.17E-13	1.24E-20		1.16E-13	
Ru+4		2.19E-05				7.77E-06	1.05E-13		2.76E-06	
Se+4		1.53E-05				3.35E-06	4.55E-14		4.25E-07	
Si+4									4.49E-06	
Sn+4		4.23E-07				1.40E-07	1.90E-15		9.05E-07	
Sr+2		1.86E-10				4.54E-11	6.15E-19		5.76E-12	
SO4-2		5.01E-02				1.34E-02	1.82E-10		1.72E-03	
Zr+4		8.17E-03				2.08E-03	2.81E-11		2.79E-04	
UDS, g/l									1.10E-05	
H2O	4.23E+01	4.50E+01							2.63E-01	
Oxygen										
DTPA		3.81E-04				4.17E-04	5.65E-12		5.29E-05	
Guanidine+1		7.49E-03				1.23E-03	1.67E-11		1.56E-04	
UNEX solvent		1.50E+00				4.18E-03	5.66E-11		5.30E-04	
Other organic		7.25E-01				2.02E-03	2.74E-11		2.56E-04	

UNEX Process Material Balance

Sodium Bearing Waste			09/05/00						Page 5b	
Stream Number	501	502	510	511	512	514	515	516	530	
Stream Name	50 wt % NaOH	Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Hydroxid	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste	
Volume or Rate	52	297	37	334	60	1.1	98	1.1	842	
Units	liters/hr	liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr	
Radionuclides		Ci/liter				Ci/sm3	Ci/sm3		Ci/kg	
Am-241		3.51E-11				9.77E-14			1.24E-11	
Am-243		7.88E-15				2.20E-17			2.78E-15	
Cm-242		9.52E-20							3.36E-20	
Cm-244		6.94E-18							2.45E-18	
Np-237		3.58E-07				9.98E-10	1.35E-17		1.26E-07	
Pu-238		6.08E-06				1.69E-08	2.30E-16		2.15E-06	
Pu-239		7.02E-07				1.96E-09	2.65E-17		2.48E-07	
Pu-240		2.25E-07				6.27E-10	8.50E-18		7.95E-08	
Pu-241		4.60E-06				1.28E-08	1.74E-16		1.62E-06	
Pu-242		1.79E-10				4.98E-13			6.30E-11	
Th-230		3.79E-21				1.06E-23			1.34E-21	
U-232		6.62E-21				1.84E-23			2.34E-21	
U-233		1.77E-22				4.93E-25			6.25E-23	
U-234		9.60E-10				2.67E-12			3.39E-10	
U-235		2.41E-11				6.73E-14			8.52E-12	
U-236		1.09E-11				3.02E-14			3.83E-12	
U-238		4.66E-12				1.30E-14			1.64E-12	
Ba-137m		4.94E-05				1.38E-07	1.87E-15		1.74E-05	
Ce-144		3.70E-15				1.03E-17			1.31E-15	
Co-60		2.38E-05				6.64E-08	9.00E-16		8.41E-06	
Cs-134		8.99E-09				2.51E-11	3.40E-19		3.17E-09	
Cs-135		3.46E-10				9.65E-13	1.31E-20		1.22E-10	
Cs-137		5.24E-05				1.46E-07	1.98E-15		1.85E-05	
Eu-152		5.51E-13				1.53E-15	2.08E-23		1.95E-13	
Eu-154		5.05E-07				1.41E-09	1.91E-17		1.78E-07	
Eu-155		6.31E-08				1.76E-10	2.38E-18		2.23E-08	
Pm-147		7.49E-05				2.09E-07	2.83E-15		2.64E-05	
Pr-144										
Ni-63		4.81E-05				1.34E-07	1.82E-15		1.70E-05	
Ru-106		4.94E-08				1.38E-10	1.86E-18		1.74E-08	
Sb-125		6.06E-06				1.69E-08	2.29E-16		2.14E-06	
Sm-151		5.11E-04				1.42E-06	1.93E-14		1.80E-04	
Sr-90		3.75E-05				1.04E-07	1.42E-15		1.32E-05	
Tc-99		1.76E-05				4.89E-08	6.63E-16		6.20E-06	
Y-90		3.75E-05				1.04E-07	1.42E-15		1.32E-05	
H-3		3.57E-05				9.95E-08	1.35E-15		1.26E-05	
I-129		4.38E-07				1.22E-09	1.65E-17		2.60E-07	
Liquid only		Mole/liter				g/sm3	g/sm3		wt frac	
Am+4		2.31E-14				1.55E-14	2.10E-22		1.97E-15	
I		1.92E-05				6.91E-06	9.37E-14		8.77E-07	
Np+4		6.30E-17				4.16E-17	5.63E-25		5.27E-18	
Pu+4		1.03E-21				6.88E-22	9.32E-30		8.72E-23	
Tc+7		9.64E-06				2.66E-06	3.60E-14		3.37E-07	
U+4		7.71E-16				5.11E-16	6.93E-24		6.48E-17	

Sodium Bearing Waste		9/5/00							Page 5c
Stream Number	501	502	510	511	512	514	515	516	530
Stream Name	50 wt % NaOH	Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Hydroxide	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste
Volume or Rate	52	297	37	334	60	1	98	1	842
Units	liters/hr	liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr
Ac+3		3.36E-15				2.13E-15			2.70E-16
At									0.00E+00
Be+2		2.12E-11				5.32E-13			6.74E-14
Bi+3		1.49E-17				8.67E-18			1.10E-18
Br-1		3.90E-07				8.67E-08	1.18E-15		1.10E-08
C+4									
Cf+3									
Cm+3									
Cu+2									1.77E-07
Dy+3		8.03E-10				3.64E-10	4.93E-18		4.61E-11
Er+3		1.32E-11				6.15E-12			7.80E-13
Eu+3		1.45E-13				6.14E-14			7.78E-15
Fr+1									
Ga+3		2.45E-14				4.75E-15			6.03E-16
Gd+3		3.32E-07				1.45E-07	1.97E-15		1.85E-08
Ge+2		1.13E-08				2.29E-09	3.11E-17		2.91E-10
Ho+3		3.41E-11				1.57E-11	2.12E-19		1.99E-12
In+3		1.75E-08				5.60E-09	7.58E-17		7.10E-10
La+3		1.16E-05				2.86E-06	3.88E-14		3.63E-07
Li+1		5.06E-11				9.79E-13			1.77E-07
Pa+4		9.13E-12				5.88E-12			7.45E-13
Pm+3		4.57E-10				1.85E-10	2.50E-18		2.34E-11
Po+2		5.29E-18				3.08E-18			3.90E-19
Ra		5.78E-14				3.64E-14			4.61E-15
Rb+3		7.05E-06				2.75E-06	3.73E-14		3.49E-07
Rh+3		4.68E-06				1.39E-06	1.88E-14		3.54E-07
Sb+4		8.25E-08				2.80E-08	3.79E-16		3.55E-09
Sm+3		7.35E-06				3.08E-06	4.17E-14		3.90E-07
Tb+3		2.72E-09				1.20E-09	1.63E-17		1.53E-10
Te+4		3.70E-06				1.45E-06	1.97E-14		1.84E-07
Th+4									
Ti+4									1.77E-07
Tl+3									
Tm+3		6.54E-15				3.08E-15			3.90E-16
Y+3		8.80E-06				3.54E-06	4.79E-14		4.48E-07
Yb+3		1.10E-15				5.32E-16			6.74E-17
Zn+2									1.77E-07
			Wt frac	Wt frac	Wt frac	Mole frac	Mole frac	Mole frac	Wt frac
Portland cement			1.00E+00						4.42E-02
Blast furnace slag				1.00E+00					3.97E-01
Calcium hydroxide					1.00E+00				7.18E-02
N2						7.66E-01	8.30E-03	0.79	
O2						2.04E-01	2.21E-03	0.21	
H2O						3.06E-02	9.89E-01		

Modified UNEX Process Material Balance

Sodium Bearing Waste			9/12/00		Rates based on 3 years operating time				Page 1a
PFD-SBW-	201	201	201, 202	201					202
Stream Number	115	120	121	125					200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return					UNEX Solvent to Scrub
Volume or Rate	298	298	298	12,061					381
Units	liters/hr	liters/hr	liters/hr	liters/hr					liters/hr
Hours per day	24	24	24	15.7					24
Days per year	200	200	200	Min/month					200
Specific Gravity	1.32	1.32	1.32	1.17					1.42
Temperature, C	25	25	25	25					25
Pressure, kPa	100	100	100	100					100
Liquid Composition	Mole/liter	Mole/liter	Mole/liter	Mole/liter					Mole/liter
Ag+1	3.20E-05	3.20E-05	3.20E-05	1.14E-05					2.59E-07
Al+3	6.15E-01	6.15E-01	6.15E-01	2.19E-01					4.97E-03
As+3	5.70E-05	5.70E-05	5.70E-05	2.03E-05					4.60E-07
B+3	2.05E-02	2.05E-02	2.05E-02	7.31E-03					1.66E-04
Ba+2	6.54E-05	6.54E-05	6.54E-05	2.33E-05					4.22E-05
Ca+2	5.95E-02	5.95E-02	5.95E-02	2.12E-02					2.38E-03
Cd+2	5.26E-03	5.26E-03	5.26E-03	1.87E-03					4.25E-05
Ce+4	2.28E-05	2.28E-05	2.28E-05	8.13E-06					1.85E-07
Cl-1	2.75E-02	2.75E-02	2.75E-02	9.79E-03					2.36E-04
CO3-2									
Cr+3	5.30E-03	5.30E-03	5.30E-03	1.88E-03					4.28E-05
Cs+1	8.85E-06	8.85E-06	8.85E-06	3.15E-06					7.12E-06
F-1	9.87E-02	9.87E-02	9.87E-02	3.51E-02					8.50E-04
Fe+3	2.27E-02	2.27E-02	2.27E-02	8.09E-03					1.84E-04
H+1	2.92E+00	2.92E+00	2.92E+00	1.04E+00					2.56E-02
Hg+2	2.88E-03	2.88E-03	2.88E-03	1.03E-03					6.92E-06
K+1	1.75E-01	1.75E-01	1.75E-01	6.21E-02					1.96E-02
Mg+2									
Mn+2	1.69E-02	1.69E-02	1.69E-02	6.00E-03					1.36E-04
Mo+6	9.76E-04	9.76E-04	9.76E-04	3.47E-04					7.89E-06
Na+1	1.59E+00	1.59E+00	1.59E+00	5.66E-01					1.27E-02
Nb+5	8.07E-08	8.07E-08	8.07E-08	2.87E-08					6.52E-10
Nd+3	3.81E-05	3.81E-05	3.81E-05	1.36E-05					3.08E-07
Ni+2	2.61E-03	2.61E-03	2.61E-03	9.30E-04					2.11E-05
NO3-1	6.67E+00	6.67E+00	6.67E+00	2.37E+00					7.91E-02
OH-1									
Pb+2	1.08E-03	1.08E-03	1.08E-03	3.84E-04					6.79E-04
Pd+3	4.51E-06	4.51E-06	4.51E-06	1.61E-06					3.65E-08
PO4-3	6.12E-03	6.12E-03	6.12E-03	2.18E-03					4.95E-05
Pr+3	1.06E-05	1.06E-05	1.06E-05	3.79E-06					8.60E-08
Ru+4	2.18E-05	2.18E-05	2.18E-05	7.74E-06					1.76E-07
Se+4	1.52E-05	1.52E-05	1.52E-05	5.40E-06					1.23E-07
Si+4									
Sn+4	4.21E-07	4.21E-07	4.21E-07	1.50E-07					3.40E-09
Sr+2	1.14E-05	1.14E-05	1.14E-05	4.06E-06					9.14E-06
SO4-2	4.99E-02	4.99E-02	4.99E-02	1.77E-02					4.03E-04
Zr+4	1.42E-02	1.42E-02	1.42E-02	5.06E-03					1.15E-04
UDS, g/l	3.10E+00	3.10E-01	3.10E-01	1.17E+02					2.50E-04
H2O	4.55E+01	4.55E+01	4.55E+01	4.87E+01					5.55E-02
Oxygen									
Others									
TOC	6.98E-01	6.98E-01	6.98E-01	2.48E-01					5.64E-03

Modified UNEX Process Material Balance

Sodium Bearing Waste			09/12/00						Page 1b
Stream Number	115	120	121	125					200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return					UNEX Solvent to
Volume or Rate	298	298	298	12,061					381
Units	liters/hr	liters/hr	liters/hr	liters/hr					liters/hr
	(Liq. Only)	(w/ UDS)	(w/ UDS)						
Radionuclides	Ci/liter	Ci/liter	Ci/liter	Ci/liter					Ci/liter
Am-241	8.58E-05	8.58E-05	8.58E-05	3.05E-05					6.93E-07
Am-243	3.54E-08	3.54E-08	3.54E-08	1.26E-08					2.86E-10
Cm-242	3.14E-08	3.14E-08	3.14E-08	1.12E-08					2.54E-10
Cm-244	2.29E-06	2.29E-06	2.29E-06	8.14E-07					1.85E-08
Np-237	3.47E-06	3.82E-06	3.82E-06	1.23E-06					2.80E-08
Pu-238	5.99E-04	6.05E-04	6.05E-04	2.13E-04					4.84E-06
Pu-239	7.54E-05	7.61E-05	7.61E-05	2.68E-05					6.09E-07
Pu-240	1.73E-05	1.76E-05	1.76E-05	6.17E-06					1.40E-07
Pu-241	3.61E-04	3.66E-04	3.66E-04	1.28E-04					2.92E-06
Pu-242	2.08E-08	2.10E-08	2.10E-08	7.41E-09					1.68E-10
Th-230	1.25E-09	1.25E-09	1.25E-09	4.45E-10					1.01E-11
U-232	2.18E-09	2.18E-09	2.18E-09	7.77E-10					1.76E-11
U-233	5.83E-11	5.83E-11	5.83E-11	2.08E-11					4.71E-13
U-234	9.26E-07	9.27E-07	9.27E-07	3.29E-07					7.48E-09
U-235	2.60E-08	2.60E-08	2.60E-08	9.24E-09					2.10E-10
U-236	4.83E-08	4.83E-08	4.83E-08	1.72E-08					3.90E-10
U-238	1.59E-08	1.59E-08	1.59E-08	5.67E-09					1.29E-10
Ba-137m	3.93E-02	3.94E-02	3.94E-02	1.40E-02					3.18E-04
Ce-144	1.23E-08	1.23E-08	1.23E-08	4.38E-09					9.94E-11
Co-60	2.37E-05	2.37E-05	2.37E-05	8.44E-06					1.92E-07
Cs-134	1.64E-05	1.64E-05	1.64E-05	5.85E-06					1.32E-05
Cs-135	8.30E-07	8.30E-07	8.30E-07	2.95E-07					6.68E-07
Cs-137	4.17E-02	4.17E-02	4.17E-02	1.48E-02					3.36E-02
Eu-152	2.48E-06	2.48E-06	2.48E-06	8.81E-07					2.00E-08
Eu-154	1.47E-04	1.47E-04	1.47E-04	5.23E-05					1.19E-06
Eu-155	7.14E-05	7.14E-05	7.14E-05	2.54E-05					5.77E-07
Pm-147	7.46E-05	7.46E-05	7.46E-05	2.65E-05					6.03E-07
Pr-144									
Ni-63	4.79E-05	4.79E-05	4.79E-05	1.71E-05					3.87E-07
Ru-106	4.92E-08	4.92E-08	4.92E-08	1.75E-08					3.97E-10
Sb-125	5.93E-06	6.03E-06	6.03E-06	2.11E-06					4.79E-08
Sm-151	5.08E-04	5.08E-04	5.08E-04	1.81E-04					4.11E-06
Sr-90	3.83E-02	3.83E-02	3.83E-02	1.36E-02					3.07E-02
Tc-99	1.63E-05	1.76E-05	1.76E-05	5.79E-06					1.30E-07
Y-90	3.83E-02	3.83E-02	3.83E-02	1.36E-02					3.07E-02
H-3	3.56E-05	3.56E-05	3.56E-05	1.27E-05					2.88E-07
I-129	4.36E-07	4.36E-07	4.36E-07	1.55E-07					3.52E-09
Liquid only	Mole/liter	Mole/liter	Mole/liter	Mole/liter					Mole/liter
Am+4	1.04E-07	1.04E-07	1.04E-07	3.69E-08					8.38E-10
I	1.92E-05	1.92E-05	1.92E-05	6.82E-06					1.55E-07
Np+4	2.08E-05	2.08E-05	2.08E-05	7.38E-06					1.68E-07
Pu+4	5.57E-06	5.57E-06	5.57E-06	1.98E-06					4.50E-08
Tc+7	9.69E-06	9.69E-06	9.69E-06	3.45E-06					7.75E-08
U+4	2.54E-04	2.54E-04	2.54E-04	9.04E-05					2.05E-06

Modified UNEX Process Material Balance

Sodium Bearing Waste			09/12/00						Page 1c
Stream Number	115	120	121	125	125		125		200
Stream Name	Sodium Bearing Waste	Filtered SBW	UNEX Feed	UDS Return	UDS Return		UDS Return		UNEX Solvent to
Volume or Rate	298	298	298	12,061	12,061		12,061		381
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr		liters/hr		liters/hr
Other Species	Mole/liter	Mole/liter	Mole/liter		Wt frac		Ci/kg		Mole/liter
Ac+3	3.35E-15	3.35E-15	3.35E-15	**Al+3**	1.80E-02	**Am-241**	5.14E-08	**Ac+3**	2.71E-17
At	6.67E-28	6.67E-28	6.67E-28	**B+3**	2.99E-02	**Np-237**	1.15E-03	**At**	5.39E-30
Be+2	2.11E-11	2.11E-11	2.11E-11	**Ca+2**	9.10E-03	**Pu-238**	1.96E-02	**Be+2**	1.70E-13
Bi+3	1.48E-17	1.48E-17	1.48E-17	**Cd+2**	1.62E-03	**Pu-239**	2.26E-03	**Bi+3**	1.20E-19
Br-1	3.88E-07	3.88E-07	3.88E-07	**Cl-1**	2.72E-02	**Pu-240**	7.24E-04	**Br-1**	3.14E-09
C+4				**Cr+3**	2.30E-03	**Pu-241**	1.48E-02	**C+4**	
Cf+3	2.19E-20	2.19E-20	2.19E-20	**Cu+2**	1.62E-03	**Pu-242**	5.74E-07	**Cf+3**	1.77E-22
Cm+3	1.05E-10	1.05E-10	1.05E-10	**F-1**	2.66E-02	**U-234**	3.09E-06	**Cm+3**	8.51E-13
Cu+2				**Fe+3**	2.49E-02	**U-235**	7.76E-08	**Cu+2**	
Dy+3	8.00E-10	8.00E-10	8.00E-10	**Hg+2**	5.88E-03	**U-236**	3.49E-08	**Dy+3**	6.47E-12
Er+3	1.32E-11	1.32E-11	1.32E-11	**K+1**	1.60E-02	**U-238**	1.50E-08	**Er+3**	1.06E-13
Eu+3	6.51E-07	6.51E-07	6.51E-07	**Li+1**	1.62E-03			**Eu+3**	5.26E-09
Fr+1	8.97E-23	8.97E-23	8.97E-23	**Mg+2**	1.62E-02	**Ba-137m**	1.06E-01	**Fr+1**	
Ga+3	2.44E-14	2.44E-14	2.44E-14	**Mn+2**	3.89E-03	**Ce-144**	3.10E-12	**Ga+3**	1.97E-16
Gd+3	3.31E-07	3.31E-07	3.31E-07	**Mo+6**	1.62E-02	**Co-60**	2.94E-05	**Gd+3**	2.67E-09
Ge+2	1.13E-08	1.13E-08	1.13E-08	**Na+1**	4.35E-02	**Cs-134**	6.86E-06	**Ge+2**	9.13E-11
Ho+3	3.40E-11	3.40E-11	3.40E-11	**Nb+5**	1.55E-03	**Cs-137**	1.12E-01	**Ho+3**	2.74E-13
In+3	1.74E-08	1.74E-08	1.74E-08	**Ni+2**	1.46E-02	**Eu-154**	1.62E-03	**In+3**	1.41E-10
La+3	1.15E-05	1.15E-05	1.15E-05	**Pb+2**	1.62E-03	**Eu-155**	2.03E-04	**La+3**	9.31E-08
Li+1	5.04E-11	5.04E-11	5.04E-11	**Pd+3**	9.69E-04	**Ru-106**	1.56E-08	**Li+1**	4.08E-13
Pa+4	9.09E-12	9.09E-12	9.09E-12	**PO4-3**	1.35E-01	**Sb-125**	3.28E-04	**Pa+4**	7.35E-14
Pm+3	4.55E-10	4.55E-10	4.55E-10	**Rh+3**	1.62E-03	**Sr-90**	1.19E-01	**Pm+3**	3.68E-12
Po+2	5.26E-18	5.26E-18	5.26E-18	**Ru+4**	1.62E-02	**Tc-99**	4.49E-03	**Po+2**	4.25E-20
Ra	5.75E-14	5.75E-14	5.75E-14	**Si+4**	4.09E-02	**Y-90**	1.19E-01	**Ra**	4.65E-16
Rb+3	7.02E-06	7.02E-06	7.02E-06	**Sn+4**	8.08E-03	**I-129**	9.57E-04	**Rb+3**	5.67E-08
Rh+3	4.66E-06	4.66E-06	4.66E-06	**SO4-2**	1.48E-01			**Rh+3**	3.77E-08
Sb+4	8.21E-08	8.21E-08	8.21E-08	**Ti+4**	1.62E-03			**Sb+4**	6.64E-10
Sm+3	7.32E-06	7.32E-06	7.32E-06	**Zn+2**	1.62E-03	**Tot TRU**	2.37E-02	**Sm+3**	5.91E-08
Tb+3	2.71E-09	2.71E-09	2.71E-09	**Zr+4**	1.39E-01			**Tb+3**	2.19E-11
Te+4	3.68E-06	3.68E-06	3.68E-06	**H2O**	7.12E-02			**Te+4**	2.98E-08
Th+4	2.63E-10	2.63E-10	2.63E-10	**O**	1.74E-01			**Th+4**	2.12E-12
Ti+4								**Ti+4**	
Tl+3	6.85E-20	6.85E-20	6.85E-20					**Tl+3**	
Tm+3	6.51E-15	6.51E-15	6.51E-15					**Tm+3**	5.26E-17
Y+3	8.76E-06	8.76E-06	8.76E-06					**Y+3**	7.08E-08
Yb+3	1.10E-15	1.10E-15	1.10E-15						
Zn+2									

Modified UNEX Process Material Balance

Sodium Bearing Waste		09/12/00			Rates based on 3 years operating time				Page 2a
PFD-SBW-	202	202	202	202	202	202	202	202	202
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to Strip	UNEX Solvent to Wash	UNEX Solvent Make-up	UNEX Solvent to Extraction	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous Feed	Raffinate
Volume or Rate	381	381	0.5	381	76	127	127	76	381	381
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
Hours per day	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
Days per year	200	200	200	200	200	200	200	200	200	200
Specific Gravity	1.42	1.42	1.42	1.42	1.03	1.00	1.02	1.04	1.26	1.26
Temperature, C	25	25	25	25	25	25	25	25	25	25
Pressure, kPa	100	100	100	100	100	100	100	100	100	100
Liquid Composition	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Ag+1	6.14E-10	3.91E-22		3.90E-22			1.84E-09	1.29E-06	2.59E-05	2.56E-05
Al+3	1.18E-05	4.04E-06		4.04E-06			2.33E-05	2.48E-02	4.97E-01	4.92E-01
As+3	1.09E-09	6.95E-22		6.95E-22			3.28E-09	2.30E-06	4.60E-05	4.56E-05
B+3	3.94E-07	2.51E-19		2.50E-19			1.18E-06	8.28E-04	1.66E-02	1.64E-02
B[illegible]2	4.13E-05	2.90E-06		2.90E-06			1.15E-04	4.22E-06	5.32E-05	1.39E-05
Ca+2	2.33E-03	1.31E-06		1.31E-06			7.00E-03	2.38E-04	4.76E-02	4.53E-02
Cd+2	1.01E-07	6.42E-20		6.42E-20			3.03E-07	2.12E-04	4.25E-03	4.21E-03
Ce+4	4.38E-10	2.79E-22		2.78E-22			1.32E-09	9.21E-07	1.85E-05	1.83E-05
Cl-1	7.06E-05	4.49E-17		4.49E-17	7.02E-03		2.12E-04	7.85E-03	2.36E-02	2.34E-02
CO3-2						2.50E-01				
Cr+3	1.02E-07	6.46E-20		6.46E-20			3.05E-07	2.14E-04	4.28E-03	4.24E-03
Cs+1	7.08E-06	3.97E-09		3.97E-09			2.12E-05	2.30E-07	7.12E-06	1.08E-08
F-1	2.74E-04	1.74E-16		1.74E-16	2.72E-02		8.21E-04	3.01E-02	8.50E-02	8.41E-02
Fe+3	4.36E-07	2.77E-19		2.77E-19			1.31E-06	9.16E-04	1.84E-02	1.82E-02
H+1	1.04E-02	9.59E-06		9.58E-06	1.03E+00	9.59E-04	3.21E-02	1.11E+00	2.56E+00	2.53E+00
Hg+2	6.78E-06	4.77E-07		4.76E-07			1.89E-05	6.92E-07	2.31E-03	2.30E-03
K+1	1.92E-02	1.30E-04		1.30E-04			5.73E-02	1.96E-03	1.40E-01	1.21E-01
Mg+2										
Mn+2	3.24E-07	2.06E-19		2.06E-19			9.71E-07	6.80E-04	1.36E-02	1.35E-02
Mo+6	1.87E-08	1.19E-20		1.19E-20			5.62E-08	3.93E-05	7.89E-04	7.81E-04
Na+1	1.25E-02	2.58E-03		2.57E-03			2.97E-02	1.27E-03	1.27E+00	1.26E+00
Nb+5	1.55E-12	9.85E-25		9.85E-25			4.65E-12	3.25E-09	6.52E-08	6.46E-08
Nd+3	7.32E-10	4.65E-22		4.65E-22			2.20E-09	1.54E-06	3.08E-05	3.05E-05
Ni[illegible]	5.02E-08	3.19E-20		3.19E-20			1.50E-07	1.05E-04	2.11E-03	2.09E-03
N[illegible]	4.79E-02	2.76E-03		2.75E-03	1.00E+00	9.59E-04	1.36E-01	1.16E+00	5.57E+00	5.49E+00
O[illegible]										
Pb+2	6.65E-04	8.34E-06		8.33E-06			1.97E-03	6.79E-05	8.76E-04	2.06E-04
Pd+3	8.66E-11	5.51E-23		5.50E-23			2.60E-10	1.82E-07	3.65E-06	3.61E-06
PO4-3	1.17E-07	7.47E-20		7.46E-20			3.52E-07	2.47E-04	4.95E-03	4.90E-03
Pr+3	2.04E-10	1.30E-22		1.30E-22			6.13E-10	4.29E-07	8.60E-06	8.52E-06
Ru+4	4.18E-10	2.66E-22		2.65E-22			1.25E-09	8.77E-07	1.76E-05	1.74E-05
Se+4	2.91E-10	1.85E-22		1.85E-22			8.74E-10	6.12E-07	1.23E-05	1.22E-05
Si+4										
Sn+4	8.09E-12	5.14E-24		5.14E-24			2.43E-11	1.70E-08	3.40E-07	3.37E-07
Sr+2	9.14E-06	1.36E-11		1.36E-11			2.74E-05	1.70E-08	9.14E-06	5.07E-11
SO4-2	9.57E-07	6.09E-19		6.08E-19			2.87E-06	2.01E-03	4.03E-02	3.99E-02
Zr+4	2.73E-07	1.74E-19		1.74E-19			8.20E-07	5.74E-04	1.15E-02	1.14E-02
UDS, g/l	5.94E-07	3.78E-19		3.78E-19			1.78E-06	1.25E-03	2.50E-02	2.48E-02
H2O	5.55E-02	5.55E-02		5.55E-02	5.46E+01	5.55E+01	5.55E+01	5.46E+01	4.73E+01	4.73E+01
Oxygen										
DTPA										

Modified UNEX Process Material Balance

Sodium Bearing Waste			36781			Activities decayed to 1/1/2008				Page 2b
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to Strip	UNEX Solvent to Wash	UNEX Solvent Make-up	UNEX Solvent to Extraction	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous Feed	Raffinate
Volume or Rate	381	381		381	76	127	127	76	381	381
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
									(w/ UDS)	(w/ UDS)
Radionuclides	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter	Ci/liter
Am-241	1.65E-09						4.94E-09	3.46E-06	6.93E-05	6.86E-05
Am-243	6.80E-13						2.04E-12	1.43E-09	2.86E-08	2.83E-08
Cm-242	6.02E-13						1.81E-12	1.27E-09	2.54E-08	2.51E-08
Cm-244	4.39E-11						1.32E-10	9.22E-08	1.85E-06	1.83E-06
Np-237	6.65E-11						2.00E-10	1.40E-07	3.08E-06	3.05E-06
Pu-238	1.15E-08						3.45E-08	2.42E-05	4.89E-04	4.84E-04
Pu-239	1.45E-09						4.34E-09	3.04E-06	6.14E-05	6.08E-05
Pu-240	3.33E-10						9.98E-10	6.98E-07	1.42E-05	1.40E-05
Pu-241	6.93E-09						2.08E-08	1.46E-05	2.95E-04	2.92E-04
Pu-242	4.00E-13						1.20E-12	8.40E-10	1.70E-08	1.68E-08
Th-230	2.40E-14						7.20E-14	5.04E-11	1.01E-09	1.00E-09
U-232	4.19E-14						1.26E-13	8.80E-11	1.76E-09	1.75E-09
U-233	1.12E-15						3.36E-15	2.35E-12	4.71E-11	4.67E-11
U-234	1.78E-11						5.33E-11	3.73E-08	7.49E-07	7.41E-07
U-235	4.98E-13						1.50E-12	1.05E-09	2.10E-08	2.08E-08
U-236	9.26E-13						2.78E-12	1.95E-09	3.90E-08	3.86E-08
U-238	3.06E-13						9.17E-13	6.42E-10	1.29E-08	1.27E-08
Ba-137m	3.15E-02	1.77E-05		1.77E-05			9.44E-02	1.02E-03	3.17E-02	7.39E-05
Ce-144	2.36E-13						7.09E-13	4.96E-10	9.94E-09	9.85E-09
Co-60	4.55E-10						1.37E-09	9.56E-07	1.92E-05	1.90E-05
Cs-134	1.31E-05	7.38E-09		7.38E-09			3.94E-05	4.27E-07	1.32E-05	2.18E-08
Cs-135	6.64E-07	3.73E-10		3.72E-10			1.99E-06	2.16E-08	6.68E-07	1.02E-09
Cs-137	3.33E-02	1.87E-05		1.87E-05			1.00E-01	1.08E-03	3.36E-02	7.83E-05
Eu-152	4.75E-11						1.43E-10	9.98E-08	2.00E-06	1.98E-06
Eu-154	2.82E-09						8.46E-09	5.92E-06	1.19E-04	1.18E-04
Eu-155	1.37E-09						4.11E-09	2.88E-06	5.77E-05	5.72E-05
Pm-147	1.43E-09						4.30E-09	3.01E-06	6.03E-05	5.97E-05
Pr-144										
Ni-63	9.20E-10						2.76E-09	1.93E-06	3.87E-05	3.84E-05
Ru-106	9.44E-13						2.83E-12	1.98E-09	3.97E-08	3.93E-08
Sb-125	1.14E-10						3.41E-10	2.39E-07	4.87E-06	4.82E-06
Sm-151	9.76E-09						2.93E-08	2.05E-05	4.11E-04	4.07E-04
Sr-90	3.07E-02	4.57E-08		4.57E-08			9.20E-02	5.71E-05	3.07E-02	2.89E-05
Tc-99	1.28E-07	8.65E-10		8.64E-10			3.80E-07	1.30E-08	1.41E-05	1.40E-05
Y-90	3.07E-02	4.57E-08		4.57E-08			9.20E-02	5.71E-05	3.07E-02	2.89E-05
H-3	6.83E-10						2.05E-09	1.43E-06	2.88E-05	2.85E-05
I-129	8.37E-12						2.51E-11	1.76E-08	3.52E-07	3.49E-07
Liquid only	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Am+4	1.99E-12						5.97E-12	4.18E-09	8.38E-08	8.30E-08
I	3.68E-10						1.10E-09	7.72E-07	1.55E-05	1.53E-05
Np+4	3.98E-10						1.19E-09	8.36E-07	1.68E-05	1.66E-05
Pu+4	1.07E-10						3.21E-10	2.25E-07	4.50E-06	4.46E-06
Tc+7	7.60E-08	5.15E-10		5.15E-10			2.26E-07	7.75E-09	7.75E-06	7.68E-06
U+4	4.88E-09						1.46E-08	1.02E-05	2.05E-04	2.03E-04

Modified UNEX Process Material Balance

Sodium Bearing Waste			09/12/00							Page 2c
Stream Number	201	202	205	206	208	209	210	216	217	220
Stream Name	UNEX Solvent to	UNEX Solvent to	UNEX Solvent	UNEX Solvent to	Scrub Feed	Strip Feed	Strip Effluent	Scrub Effluent	Extraction Aqueous	Raffinate
Volume or Rate	381	381	0.5	381	76	127	127	76	381	381
Units	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr
Other Species	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter
Ac+3										2.71E-15
At										
Be+2	4.05E-16						1.21E-15		8.50E-13	1.70E-11
Bi+3	2.85E-22								5.98E-19	1.20E-17
Br-1	7.45E-12						2.23E-11		1.56E-08	3.14E-07
C+4										
Cf+3	4.21E-25									
Cm+3	2.02E-15						6.06E-15		4.24E-12	8.51E-11
Cu+2										
Dy+3	1.54E-14						4.61E-14		3.23E-11	6.47E-10
Er+3	2.52E-16						7.57E-16		5.30E-13	1.06E-11
Eu+3	1.25E-11						3.75E-11		2.63E-08	5.26E-07
Fr+1										
Ga+3	4.68E-19						1.40E-18		9.83E-16	1.97E-14
Gd+3	6.35E-12						1.90E-11		1.33E-08	2.67E-07
Ge+2	2.17E-13						6.50E-13		4.55E-10	9.13E-09
Ho+3	6.52E-16						1.96E-15		1.37E-12	2.74E-11
In+3	3.34E-13						1.00E-12		7.02E-10	1.41E-08
La+3	2.21E-10						6.63E-10		4.64E-07	9.31E-06
Li+1	9.68E-16						2.90E-15		2.03E-12	4.08E-11
Pa+4	1.75E-16						5.24E-16		3.66E-13	7.35E-12
Pm+3	8.74E-15						2.62E-14		1.83E-11	3.68E-10
Po+2									2.12E-19	4.25E-18
Ra	1.10E-18						3.31E-18		2.32E-15	4.65E-14
Rb+3	1.35E-10						4.04E-10		2.83E-07	5.67E-06
Rh+3	8.95E-11						2.69E-10		1.88E-07	3.77E-06
Sb+4	1.58E-12						4.73E-12		3.31E-09	6.64E-08
Sm+3	1.40E-10						4.21E-10		2.95E-07	5.91E-06
Tb+3	5.19E-14						1.56E-13		1.09E-10	2.19E-09
Te+4	7.07E-11						2.12E-10		1.48E-07	2.98E-06
Th+4	5.05E-15						1.51E-14		1.06E-11	2.12E-10
Ti+4										
Tl+3										
Tm+3	1.25E-19						3.75E-19		2.63E-16	5.26E-15
Y+3	1.68E-10						5.05E-10		3.53E-07	7.08E-06
Yb+3	2.11E-20								4.43E-17	8.88E-16
Zn+2										

Modified UNEX Process Material Balance

Sodium Bearing Waste		09/12/00		Rates based on 3 years operating time					Page 3
PFD-SBW-	202	202	202	202	202	202	202		203
Stream Number	231	232	233	235	236	238	239		306
Stream Name	Scrub Make-up Water	Scrub Make-up Acid	Guanidine Carbonate	Strip Make-up Water	FS-13	PEG-400	Chlor. Cobalt Dicarbol.		UNEX Strip Evaporator Condensate
Volume or Rate	57.1	19.0	5.7	121.7	10,211	813	437		125
Units	liters/hr	liters/hr	kg/hr	liters/hr	liters	liters	kg		liters/hr
Hours per day	24	24	24	24	(UNEX solvent chemicals include make-up				24
Days per year	200	200	200	200	plus initial inventory of 12 hrs circirculation)				200
Specific Gravity	1.00	1.13	0.58	1.00	1.41	1.10	???		1.00
Temperature, C	25	25	25	25	25	25	25		
Pressure, kPa	100	100	100	100	100	100	100		100
Liquid Composition	Mole/liter	Mole/liter	Wt frac	Mole/liter	Wt frac	Wt frac	Wt frac		Mole/liter
Al+3									
Cl-1		2.81E-02							
F-1		1.09E-01							
H+1	1.00E-03	4.14E+00		1.00E-03					3.87E-05
NO3-1	1.00E-03	4.00E+00		1.00E-03					3.87E-05
DTPA									
Guanidine Carbonate			1.00E+00						
FS-13					1.00E+00				
CMPO									
PEG-400						1.00E+00			
ChCoDiC							1.00E+00		
H2O	5.55E+01			5.55E+01					5.55E+01

Modified UNEX Process Material Balance

Sodium Bearing Waste			9/12/00		Rates based on 3 years operating time				Page 4a
PFD-SBW-	203	204	204	204	204	204	204	204	204
Stream Number	320	401	402	403	404	405	410	412	414
Stream Name	Dried RH Waste	LAW Evaporator Feed	LAW Evaporator Bottoms	LAW Evaporator Overhead	Recov'd HNO3	Fractionator Overhead	Total Recycle Water	Excess Water Vapo to Stack	Make-up 15.9 Acid Grouting
Volume or Rate	8.0	498	245	260	12.4	248	183	80.2	2
Units	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Hours per day	24	24	24	24	24	24	24	24	24
Days per year	200	200	200	200	200	200	200	200	200
Specific Gravity	0.58	1.19	1.35	1.01	1.13	1.00	1.00	0.00	1.41
Temperature, C		25					25		25
Pressure, kPa	100	100	100	100	100	100	100		100
Composition	Wt frac	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole/liter	Mole frac	Mole/liter
Ag+1	3.08E-09	1.92E-05	3.89E-05						
Al+3	9.73E-06	3.69E-01	7.48E-01						
As+3	3.81E-09	3.42E-05	6.93E-05						
B+3	1.98E-07	1.23E-02	2.50E-02						
Ba+2	2.45E-04	1.04E-05	2.11E-05						
Ca+2	4.35E-03	3.39E-02	6.88E-02						
Cd+2	5.28E-07	3.15E-03	6.40E-03						
Ce+4	1.74E-09	1.37E-05	2.78E-05						
Cl-1	1.16E-04	1.75E-02	3.36E-02	1.76E-03	3.68E-02				
CO3-2	2.25E-01								
Cr+3	2.46E-07	3.18E-03	6.44E-03						
Cs+1	4.37E-05	8.11E-09	1.65E-08						
F-1	2.42E-04	6.31E-02	1.27E-01	6.03E-04	1.27E-02				
Fe+3	1.13E-06	1.36E-02	2.76E-02						
H+1	5.43E-04	1.89E+00	3.63E+00	1.94E-01	4.05E+00	1.00E-03	1.00E-03		1.59E+01
Hg+2	5.88E-05	1.72E-03	3.50E-03	6.97E-11					
K+1	3.47E-02	9.04E-02	1.83E-01						
Mg+2									
Mn+2	8.27E-07	1.01E-02	2.05E-02						
Mo+6	8.35E-08	5.85E-04	1.19E-03						
Na+1	1.06E-02	9.46E-01	1.92E+00						
Nb+5	6.69E-12	4.84E-08	9.82E-08						
Nd+3	3.44E-09	2.29E-05	4.64E-05						
Ni+2	1.37E-07	1.57E-03	3.18E-03						
NO3-1	1.34E-01	4.11E+00	8.14E+00	1.92E-01	4.00E+00	1.00E-03	1.00E-03		1.59E+01
OH-1									
Pb+2	6.33E-03	1.54E-04	3.13E-04						
Pd+3	4.14E-10	2.70E-06	5.49E-06						
PO4-3	5.19E-07	3.67E-03	7.44E-03						
Pr+3	1.32E-09	6.38E-06	1.29E-05						
Ru+4	2.48E-09	1.30E-05	2.65E-05						
Se+4	1.07E-09	9.10E-06	1.85E-05						
Si+4									
Sn+4	4.46E-11	2.53E-07	5.12E-07						
Sr+2	3.72E-05	3.80E-11	7.70E-11						
SO4-2	4.27E-06	2.99E-02	6.06E-02						
Zr+4	1.16E-06	8.53E-03	1.73E-02						
UDS, g/l	2.76E-08	1.86E-02	3.77E-02						
H2O	1.00E-01	4.94E+01	4.10E+01	5.52E+01	4.84E+01	5.55E+01	4.84E+01	1.00E+00	4.84E+01
Oxygen									
Crystallization additives									
DTPA									
Guanidine+1	4.44E-01	3.74E-03	7.59E-03						
UNEX solv, g/liter	1.55E-02	7.49E-01	1.52E+00						
Other org, g/liter	2.43E-02	4.30E-01	8.73E-01						

Modified UNEX Process Material Balance

Sodium Bearing Waste									Page 4b
Stream Number	320	401	402	403	404	405	410	412	414
Stream Name	Dried RH Waste	LAW Evaporator Feed	LAW Evaporator Bottoms	LAW Evaporator Overhead	Recov'd HNO3	Fractionator Overhead	Total Recycle Water	Excess Water Vapo to Stack	Make-up 15.9 Acid Grouting
Volume or Rate	8	498	245	260	12	248	183	80	2
Units	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Radionuclides	Ci/kg	Ci/liter	Ci/liter						
Am-241	7.65E-08	5.14E-05	1.04E-04						
Am-243	3.16E-11	2.12E-08	4.31E-08						
Cm-242	2.80E-11	1.88E-08	3.82E-08						
Cm-244	2.04E-09	1.37E-06	2.78E-06						
Np-237	3.09E-09	2.29E-06	4.65E-06						
Pu-238	5.35E-07	3.63E-04	7.36E-04						
Pu-239	6.72E-08	4.56E-05	9.25E-05						
Pu-240	1.55E-08	1.05E-05	2.13E-05						
Pu-241	3.22E-07	2.19E-04	4.44E-04						
Pu-242	1.86E-11	1.26E-08	2.55E-08						
Th-230	1.12E-12		1.52E-09						
U-232	1.95E-12		2.65E-09						
U-233	5.20E-14		7.09E-11						
U-234	8.26E-10	5.56E-07	1.13E-06						
U-235	2.32E-11	1.56E-08	3.16E-08						
U-236	4.30E-11	2.89E-08	5.87E-08						
U-238	1.42E-11	9.55E-09	1.94E-08						
Ba-137m	1.46E+00	5.58E-05	1.13E-04						
Ce-144	1.10E-11	7.38E-09	1.50E-08						
Co-60	2.12E-08	1.42E-05	2.89E-05						
Cs-134	6.11E-04	1.64E-08	3.32E-08						
Cs-135	3.08E-05	7.61E-10	1.54E-09						
Cs-137	1.55E+00	5.91E-05	1.20E-04						
Eu-152	2.21E-09	1.48E-06	3.01E-06						
Eu-154	1.31E-07	8.84E-05	1.79E-04						
Eu-155	6.37E-08	4.28E-05	8.69E-05						
Pm-147	6.66E-08	4.47E-05	9.07E-05						
Pr-144									
Ni-63	4.28E-08	2.87E-05	5.83E-05						
Ru-106	4.39E-11	2.95E-08	5.98E-08						
Sb-125	5.29E-09	3.62E-06	7.33E-06						
Sm-151	4.54E-07	3.05E-04	6.18E-04						
Sr-90	1.43E+00	2.21E-05	4.49E-05						
Tc-99	5.89E-06	1.05E-05	2.13E-05						
Y-90	1.43E+00	2.21E-05	4.49E-05						
H-3	3.17E-08	2.13E-05	4.33E-05						
I-129	3.89E-10	2.61E-07	8.91E-07						
Liquid only	Wt frac	Mole/liter	Mole/liter						
Am+4	2.23E-11	6.22E-08	1.26E-07						
I	2.20E-09	1.15E-05	2.33E-05						
Np+4	4.39E-09	1.24E-05	2.52E-05						
Pu+4	1.19E-09	3.34E-06	6.78E-06						
Tc+7	3.47E-07	5.75E-06	1.17E-05						
U+4	5.39E-08	1.52E-04	3.09E-04						

Modified UNEX Process Material Balance

Sodium Bearing Waste		09/12/00							Page 4c
Stream Number	320	401	402	403	404	405	410	412	414
Stream Name	Dried RH Waste	LAW Evaporator Feed	LAW Evaporator Bottoms	LAW Evaporator Overhead	Recov'd HNO3	Fractionator Overhead	Total Recycle Water	Excess Water Vapo to Stack	Make-up 15.9 Acid Grouting
Volume or Rate	8.0	498	245	260	12.4	248	183	80.2	2
Units	kg/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	liters/hr	sm3/hr	liters/hr
Other Species	wt frac	Mole/liter	Mole/liter						
Ac+3	6.78E-19	2.01E-15	4.07E-15						
At									
Be+2	1.70E-16	1.26E-11	2.56E-11						
Bi+3	0.00E+00	8.89E-18	1.80E-17						
Br-1	2.77E-11	2.33E-07	4.72E-07						
C+4									
Cf+3									
Cm+3	2.32E-14	6.31E-11	1.28E-10						
Cu+2									
Dy+3	1.16E-13	4.80E-10	9.73E-10						
Er+3	1.96E-15	7.88E-12	1.60E-11						
Eu+3	8.83E-11	3.91E-07	7.92E-07						
Fr+1									
Ga+3	1.52E-18	1.46E-14	2.96E-14						
Gd+3	4.64E-11	1.98E-07	4.02E-07						
Ge+2	7.32E-13	6.77E-09	1.37E-08						
Ho+3	5.00E-15	2.04E-11	4.13E-11						
In+3	1.78E-12	1.04E-08	2.12E-08						
La+3	9.14E-10	6.91E-06	1.40E-05						
Li+1	3.12E-16	3.02E-11	6.13E-11						
Pa+4	1.87E-15	5.45E-12	1.11E-11						
Pm+3	5.89E-14	2.73E-10	5.53E-10						
Po+2		3.16E-18	6.40E-18						
Ra	1.16E-17	3.45E-14	6.99E-14						
Rb+3	8.77E-10	4.21E-06	8.54E-06						
R[illegible]3	4.43E-10	2.80E-06	5.67E-06						
S[illegible]	8.92E-12	4.92E-08	9.99E-08						
S[illegible]	9.81E-10	4.39E-06	8.90E-06						
T[illegible]	3.84E-13	1.62E-09	3.29E-09						
T[illegible]	4.63E-10	2.21E-06	4.48E-06						
Ti[illegible]	5.44E-14	1.58E-10	3.20E-10						
T[illegible]									
T[illegible]									
T[illegible]	9.81E-19	3.90E-15	7.92E-15						
Y[illegible]	1.13E-09	5.25E-06	1.07E-05						
Y[illegible]3	1.70E-19	6.58E-16	1.34E-15						
Zn+2									

Modified UNEX Process Material Balance

Sodium Bearing Waste		09/12/00		Rates based on 3 years operating time					Page 5a
PFD-SBW-		205	205	205	205	205	205	205	205
Stream Number		502	510	511	512	514	515	516	530
Stream Name		Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Oxide	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste
Volume or Rate		245	19	47	76	1.1	81	1.1	473
Units		liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr
Hours per day		24	24	24	24	24	24	24	24
Days per year		200	200	200	200	200	200	200	200
Specific Gravity		1.35	1.50	1.10	0.90				1.40
Temperature, C		25	25	25	25	25		25	25
Pressure, kPa		100	100	100	100	100		100	100
Composition		Mole/liter				g/sm3	g/sm3		wt frac
Ag+1		3.89E-05				9.66E-06	1.59E-13		2.19E-06
Al+3		7.48E-01				4.64E-02	7.62E-10		1.05E-02
As+3		6.93E-05				1.19E-05	1.96E-13		2.70E-06
B+3		2.50E-02				6.21E-04	1.02E-11		1.46E-04
Ba+2		2.11E-05				6.68E-06	1.10E-13		1.51E-06
Ca+2		6.88E-02				6.34E-03	1.04E-10		1.44E-03
Cd+2		6.40E-03				1.65E-03	2.72E-11		3.75E-04
Ce+4		2.78E-05				5.46E-06	8.96E-14		1.24E-06
Cl-1		3.36E-02				2.74E-03	4.50E-11		6.26E-04
CO3-2									
Cr+3		6.44E-03				7.70E-04	1.26E-11		1.75E-04
Cs+1		1.65E-08				5.03E-09	8.26E-17		1.14E-09
F-1		1.27E-01				5.56E-03	9.13E-11		1.26E-03
Fe+3		2.76E-02				3.55E-03	5.83E-11		8.09E-04
H+1		3.63E+00				8.42E-03	1.38E-10		1.91E-03
Hg+2		3.50E-03				1.61E-03	2.65E-11		3.66E-04
K+1		1.83E-01				1.65E-02	2.71E-10		3.74E-03
Mg+2									
Mn+2		2.05E-02				2.59E-03	4.26E-11		5.88E-04
Mo+6		1.19E-03				2.62E-04	4.30E-12		6.25E-05
Na+1	19.06	1.92E+00				1.01E-01	1.66E-09		2.30E-02
Nb+5		9.82E-08				2.10E-08	3.44E-16		3.08E-07
Nd+3		4.64E-05				1.08E-05	1.77E-13		2.44E-06
Ni+2		3.18E-03				4.29E-04	7.04E-12		1.00E-04
NO3-1		8.14E+00				1.16E+00	1.91E-08		2.63E-01
OH-1	19.06								6.32E-06
Pb+2		3.13E-04				1.49E-04	2.45E-12		3.41E-05
Pd+3		5.49E-06				1.30E-06	2.13E-14		4.84E-07
PO4-3		7.44E-03				1.63E-03	2.67E-11		3.95E-04
Pr+3		1.29E-05				4.14E-06	6.79E-14		9.37E-07
Ru+4		2.65E-05				7.77E-06	1.28E-13		4.93E-06
Se+4		1.85E-05				3.35E-06	5.51E-14		7.60E-07
Si+4									8.02E-06
Sn+4		5.12E-07				1.40E-07	2.30E-15		1.62E-06
Sr+2		7.70E-11				1.55E-11	2.55E-19		3.51E-12
SO4-2		6.06E-02				1.34E-02	2.20E-10		3.06E-03
Zr+4		1.73E-02				3.63E-03	5.96E-11		8.50E-04
UDS, g/l		3.77E-02							1.96E-05
H2O	42.32	4.10E+01					see below		3.85E-01
Oxygen		9.95E-01							
DTPA									
Guanidine+1		7.59E-03				1.03E-03	1.69E-11		2.34E-04
UNEX solvent		1.52E+00				3.50E-03	5.74E-11		7.92E-04
Other organic		8.73E-01				2.01E-03	3.30E-11		4.55E-04

Modified UNEX Process Material Balance

Sodium Bearing Waste			09/12/00						
Stream Number		502	510	511	512	514	515	516	Page 5b 530
Stream Name		Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Oxide	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste
Volume or Rate		245	19	47	76	1.1	81	1.1	473
Units		liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr
Radionuclides		Ci/liter				Ci/sm3	Ci/sm3		Ci/kg
Am-241		1.04E-04				2.40E-07			5.41E-05
Am-243		4.31E-08				9.91E-11			2.23E-08
Cm-242		3.82E-08							1.98E-08
Cm-244		2.78E-06							1.44E-06
Np-237		4.65E-06				1.07E-08	1.76E-16		2.41E-06
Pu-238		7.36E-04				1.69E-06	2.78E-14		3.82E-04
Pu-239		9.25E-05				2.13E-07	3.49E-15		4.80E-05
Pu-240		2.13E-05				4.91E-08	8.06E-16		1.11E-05
Pu-241		4.44E-04				1.02E-06	1.68E-14		2.30E-04
Pu-242		2.55E-08				5.88E-11			1.32E-08
Th-230		1.52E-09				3.50E-12			7.88E-10
U-232		2.65E-09				6.10E-12			1.38E-09
U-233		7.09E-11				1.63E-13			3.68E-11
U-234		1.13E-06				2.59E-09			5.84E-07
U-235		3.16E-08				7.27E-11			1.64E-08
U-236		5.87E-08				1.35E-10			3.04E-08
U-238		1.94E-08				4.46E-11			1.00E-08
Ba-137m		1.13E-04				2.60E-07	4.27E-15		5.87E-05
Ce-144		1.50E-08				3.44E-11			7.76E-09
Co-60		2.89E-05				6.64E-08	1.09E-15		1.50E-05
Cs-134		3.32E-08				7.63E-11	1.25E-18		1.72E-08
Cs-135		1.54E-09				3.55E-12	5.83E-20		8.01E-10
Cs-137		1.20E-04				2.76E-07	4.53E-15		6.22E-05
Eu-152		3.01E-06				6.93E-09	1.14E-16		1.56E-06
Eu-154		1.79E-04				4.12E-07	6.77E-15		9.29E-05
Eu-155		8.69E-05				2.00E-07	3.28E-15		4.50E-05
Pm-147		9.07E-05				2.09E-07	3.43E-15		4.70E-05
Pr-144									
Ni-63		5.83E-05				1.34E-07	2.20E-15		3.02E-05
Ru-106		5.98E-08				1.38E-10	2.26E-18		3.10E-08
Sb-125		7.33E-06				1.69E-08	2.77E-16		3.80E-06
Sm-151		6.18E-04				1.42E-06	2.33E-14		3.21E-04
Sr-90		4.49E-05				1.03E-07	1.70E-15		2.33E-05
Tc-99		2.13E-05				4.89E-08	8.03E-16		1.10E-05
Y-90		4.49E-05				1.03E-07	1.70E-15		2.33E-05
H-3		4.33E-05				9.95E-08	1.63E-15		2.24E-05
I-129		8.91E-07				2.05E-09	3.36E-17		4.62E-07
Liquid only		Mole/liter				g/sm3	g/sm3		wt frac
Am+4		1.26E-07				6.99E-08	1.15E-15		1.58E-08
I		2.33E-05				6.91E-06	1.13E-13		1.57E-06
Np+4		2.52E-05				1.38E-05	2.26E-13		3.12E-06
Pu+4		6.78E-06				3.73E-06	6.12E-14		8.44E-07
Tc+7		1.17E-05				2.66E-06	4.36E-14		6.02E-07
U+4		3.09E-04				1.69E-04	2.78E-12		3.83E-05

Sodium Bearing Waste		09/12/00							Page 5c
Stream Number		502	510	511	512	514	515	516	530
Stream Name		Grout Mix Tank Feed	Portland Cement	Blast Furnace Slag	Calcium Oxide	Grout Mix Tank Vent Gas	Stack Gas	Mix Tank Air	Grouted LAW Waste
Volume or Rate		245	19	47	76	1.1	81	1.1	473
Units		liters/hr	kg/hr	kg/hr	kg/hr	sm3/hr	sm3/hr	sm3/hr	kg/hr
Radionuclides		Ci/liter				Ci/sm3	Ci/sm3		Ci/kg
Am-241		1.04E-04				2.40E-07			5.41E-05
Am-243		4.31E-08				9.91E-11			2.23E-08
Cm-242		3.82E-08							1.98E-08
Cm-244		2.78E-06							1.44E-06
Np-237		4.65E-06				1.07E-08	1.76E-16		2.41E-06
Pu-238		7.36E-04				1.69E-06	2.78E-14		3.82E-04
Pu-239		9.25E-05				2.13E-07	3.49E-15		4.80E-05
Pu-240		2.13E-05				4.91E-08	8.06E-16		1.11E-05
Pu-241		4.44E-04				1.02E-06	1.68E-14		2.30E-04
Pu-242		2.55E-08				5.88E-11			1.32E-08
Th-230		1.52E-09				3.50E-12			7.88E-10
U-232		2.65E-09				6.10E-12			1.38E-09
U-233		7.09E-11				1.63E-13			3.68E-11
U-234		1.13E-06				2.59E-09			5.84E-07
U-235		3.16E-08				7.27E-11			1.64E-08
U-236		5.87E-08				1.35E-10			3.04E-08
U-238		1.94E-08				4.46E-11			1.00E-08
Ba-137m		1.13E-04				2.60E-07	4.27E-15		5.87E-05
Ce-144		1.50E-08				3.44E-11			7.76E-09
Co-60		2.89E-05				6.64E-08	1.09E-15		1.50E-05
Cs-134		3.32E-08				7.63E-11	1.25E-18		1.72E-08
Cs-135		1.54E-09				3.55E-12	5.83E-20		8.01E-10
Cs-137		1.20E-04				2.76E-07	4.53E-15		6.22E-05
Eu-152		3.01E-06				6.93E-09	1.14E-16		1.56E-06
Eu-154		1.79E-04				4.12E-07	6.77E-15		9.29E-05
Eu-155		8.69E-05				2.00E-07	3.28E-15		4.50E-05
Pm-147		9.07E-05				2.09E-07	3.43E-15		4.70E-05
Pr-144									
Ni-63		5.83E-05				1.34E-07	2.20E-15		3.02E-05
Ru-106		5.98E-08				1.38E-10	2.26E-18		3.10E-08
Sb-125		7.33E-06				1.69E-08	2.77E-16		3.80E-06
Sm-151		6.18E-04				1.42E-06	2.33E-14		3.21E-04
Sr-90		4.49E-05				1.03E-07	1.70E-15		2.33E-05
Tc-99		2.13E-05				4.89E-08	8.03E-16		1.10E-05
Y-90		4.49E-05				1.03E-07	1.70E-15		2.33E-05
H-3		4.33E-05				9.95E-08	1.63E-15		2.24E-05
I-129		8.91E-07				2.05E-09	3.36E-17		4.62E-07
Liquid only		Mole/liter				g/sm3	g/sm3		wt frac
Am+4		1.26E-07				6.99E-08	1.15E-15		1.58E-08
I		2.33E-05				6.91E-06	1.13E-13		1.57E-06
Np+4		2.52E-05				1.38E-05	2.26E-13		3.12E-06
Pu+4		6.78E-06				3.73E-06	6.12E-14		8.44E-07
Tc+7		1.17E-05				2.66E-06	4.36E-14		6.02E-07
U+4		3.09E-04				1.69E-04	2.78E-12		3.83E-05

Appendix C – Mass and Energy Balances

ENERGY BALANCES

Energy balances were performed on all major processing equipment requiring significant amounts of energy. The major processes that were evaluated include evaporation, crystallization, and neutralization. The energy requirements were determined for these processes in both the UNEX and Modified UNEX scenarios.

The following assumptions were made for purposes of simplification of the energy balance for the crystallization process, or Thin Film Dryer, in both the UNEX and Modified UNEX processes:

- Operation at constant pressure
- Overhead stream is saturated steam
- Bottom stream is liquid water
- Open system
- No shaft work
- Negligible kinetic and potential energy
- 95% quality steam at 150 psi
- Cooling water at 50°C and capacity for a 25°C temperature rise

Table C-1 provides the heating and cooling process requirements for operation of the TFD (TFD-203-1). (Values for power are given on a yearly basis.)

Table C-1 Crystallization Process Requirements

Process	Heating		Cooling	
	Power (kW)	Steam (lb/hr)	Power (kW)	Cooling Water (lb/hr)
UNEX	105.0	300.0	-1.93	73.3
Modified UNEX	89.2	254.9	-1.64	62.3

The following assumptions were made for purposes of simplification of the energy balance for the low activity waste (LAW) evaporation process), in both the UNEX and Modified UNEX processes:

- Operation at constant pressure
- Overhead stream is saturated steam
- Bottom stream is liquid water
- Open system
- No shaft work
- Negligible kinetic and potential energy
- 95% quality steam at 15 psi
- Cooling water at 50°C and 20°C temperature rise

Table C-2 provides the heating and cooling process requirements for operation of the LAW evaporator (EV-204-1). (Values for power are given on a yearly basis.)

Table C-2 LAW Evaporation (EV-204-1) Process Requirements

Process	Heating		Cooling	
	Power (kW)	Steam (lb/hr)	Power (kW)	Cooling Water (lb/hr)
UNEX	266.7	832.6	-4.62	175.2
Modified UNEX	200.4	594.2	-3.40	129.0

The following assumptions were made for purposes of simplification of the energy balance for the neutralization process, in both the UNEX and Modified UNEX processes:

- Operation at constant pressure
- Neutralization reaction is

$$H^+ + OH^- \rightarrow H_2O$$

- Neutralization occurs in a 1:1 ratio
  - UNEX: 1 mole NaOH required to neutralize 1 mole of H^+
  - Modified UNEX: 1 mole CaOH required to neutralize 1 mole H^+
- Cooling water at 50°C

Table C-3 provides the cooling requirements for neutralization. (Values for power are given on a yearly basis.)

Table C-3 Neutralization Process Requirements

Process	Cooling	
	Power (kW)	Cooling Water (lb/hr)
UNEX	-15.48	587.0
Modified UNEX	-14.22	539.3

TABLE 1
UNIVERSAL SOLVENT EXTRACTION
FEASIBILITY STUDY

NORMAL POWER LOADS
UNEX PROCESS

LOAD	kVA
General Building Lighting	
Steam Plant	
3,120 Sq. Ft @ 1.5 Watts per sq. Ft = 6240 Watts	6.2
Thin Film Dryer Area	
6,775 Sq. Ft. @ 1.0 Watt per Sq. Ft. = 6,775 Watts	6.8
3,137 Sq. Ft. @ 1.5 Watts per Sq. Ft. = 4,705 Watts	4.7
4,277 Sq. Ft. @ 2.0 Watts per Sq. Ft. =8,554 Watts	8.6
1,800 Sq. Ft. @ 3.0 Watts per Sq. Ft. =5,400 Watts	5.4
Process Building	
52,109 Sq. Ft. @ 0.75 Watts per Sq. Ft. =39,142 Watts	39.1
31,460 Sq. Ft. @ 1.0 Watt per Sq. Ft. = 31,460 Watts	31.5
2,850 Sq. Ft. @ 1.5 Watts per Sq. Ft. = 4,275 Watts	4.3
54,150 Sq. Ft. @ 2.0 Watts per Sq. Ft. = 108,300 Watts	108.3
4,000 Sq. Ft. @ 3.0 Watts per Sq. Ft. = 12,000 Watts	12.0
Total Lighting	226.9
Miscellaneous Loads	
Steam Plant	
3,120 Sq. Ft. @ 1.0 Watt per Sq. Ft = 3,120 Watts	3.1
Thin film Dryer Area	
4,257 Sq. Ft. @ 0.5 Watts per Sq. Ft = 2,129 Watts	2.1
4,381 Sq. Ft. @ 1.0 Watt per Sq. Ft = 4,381 Watts	4.4
1,494 Sq. Ft. @ 2.0 Watts per Sq. Ft = 2,988 Watts	3.0
1,580 Sq. Ft. @ 3.0 Watts per Sq. Ft = 4,740 Watts	4.7
Process Building	
52,190 Sq. Ft. @ 0.5 Watts per Sq. Ft = 26,095 Watts	26.1
17,690 Sq. Ft. @ 1.0 Watt per Sq. Ft = 17,690Watts	17.7
13,750 Sq. Ft. @ 2.0 Watts per Sq. Ft = 27,500 Watts	27.5
58,150 Sq. Ft. @ 3.0 Watts per Sq. Ft = 174,450Watts	174.5
Total Miscellaneous	263.1
HVAC Loads:	
Supply Fan Motors - 370 HP	370
Exhaust Fan Motors – 755 HP	750
Chillers – 1,019 HP	1,019
Process Equipment:	
Miscellaneous Equipment – 300 HP	300
Total Connected kVA	**2,929**

TABLE 2
UNIVERSAL SOLVENT EXTRACTION
FEASIBILITY STUDY

STANDBY POWER LOADS
UNEX PROCESS

LOAD	kVA
General Building Lighting 15% of Total Lighting	34.0
Miscellaneous Loads 20% of Total Misc Loads	52.6
HVAC Loads: Exhaust Fan Motors – 480 HP	480
Process Equipment: 25% of Miscellaneous Equipment – 75 HP	75
Total Connected kVA	**642**

TABLE 3

UNIVERSAL SOLVENT EXTRACTION

FEASIBILITY STUDY

NORMAL POWER LOADS

MODIFIED UNEX PROCESS

LOAD	kVA
General Building Lighting	
Steam Plant	
3,120 Sq. Ft @ 1.5 Watts per sq. Ft = 6240 Watts	6.2
Thin Film Dryer Area	
6,775 Sq. Ft. @ 1.0 Watt per Sq. Ft. = 6,775 Watts	6.8
3,137 Sq. Ft. @ 1.5 Watts per Sq. Ft. = 4,705 Watts	4.7
4,277 Sq. Ft. @ 2.0 Watts per Sq. Ft. =8,554 Watts	8.6
1,800 Sq. Ft. @ 3.0 Watts per Sq. Ft. =5,400 Watts	5.4
Process Building	
52,109 Sq. Ft. @ 0.75 Watts per Sq. Ft. =39,142 Watts	39.1
31,460 Sq. Ft. @ 1.0 Watt per Sq. Ft. = 31,460 Watts	31.5
2,850 Sq. Ft. @ 1.5 Watts per Sq. Ft. = 4,275 Watts	4.3
54,150 Sq. Ft. @ 2.0 Watts per Sq. Ft. = 108,300 Watts	108.3
4,000 Sq. Ft. @ 3.0 Watts per Sq. Ft. = 12,000 Watts	12.0
Total Lighting	226.9
Miscellaneous Loads	
Steam Plant	
3,120 Sq. Ft. @ 1.0 Watt per Sq. Ft = 3,120 Watts	3.1
Thin film Dryer Area	
4,257 Sq. Ft. @ 0.5 Watts per Sq. Ft = 2,129 Watts	2.1
4,381 Sq. Ft. @ 1.0 Watt per Sq. Ft = 4,381 Watts	4.4
1,494 Sq. Ft. @ 2.0 Watts per Sq. Ft = 2,988 Watts	3.0
1,580 Sq. Ft. @ 3.0 Watts per Sq. Ft = 4,740 Watts	4.7
Process Building	
52,190 Sq. Ft. @ 0.5 Watts per Sq. Ft = 26,095 Watts	26.1
17,690 Sq. Ft. @ 1.0 Watt per Sq. Ft = 17,690Watts	17.7
13,750 Sq. Ft. @ 2.0 Watts per Sq. Ft = 27,500 Watts	27.5
58,150 Sq. Ft. @ 3.0 Watts per Sq. Ft = 174,450Watts	174.5
Total Miscellaneous	263.1
HVAC Loads:	
Supply Fan Motors - 315 HP	315
Exhaust Fan Motors – 575 HP	575
Chillers – 1,024 HP	1,024
Process Equipment:	
Miscellaneous Equipment – 300 HP	300
Total Connected kVA	**2,704**

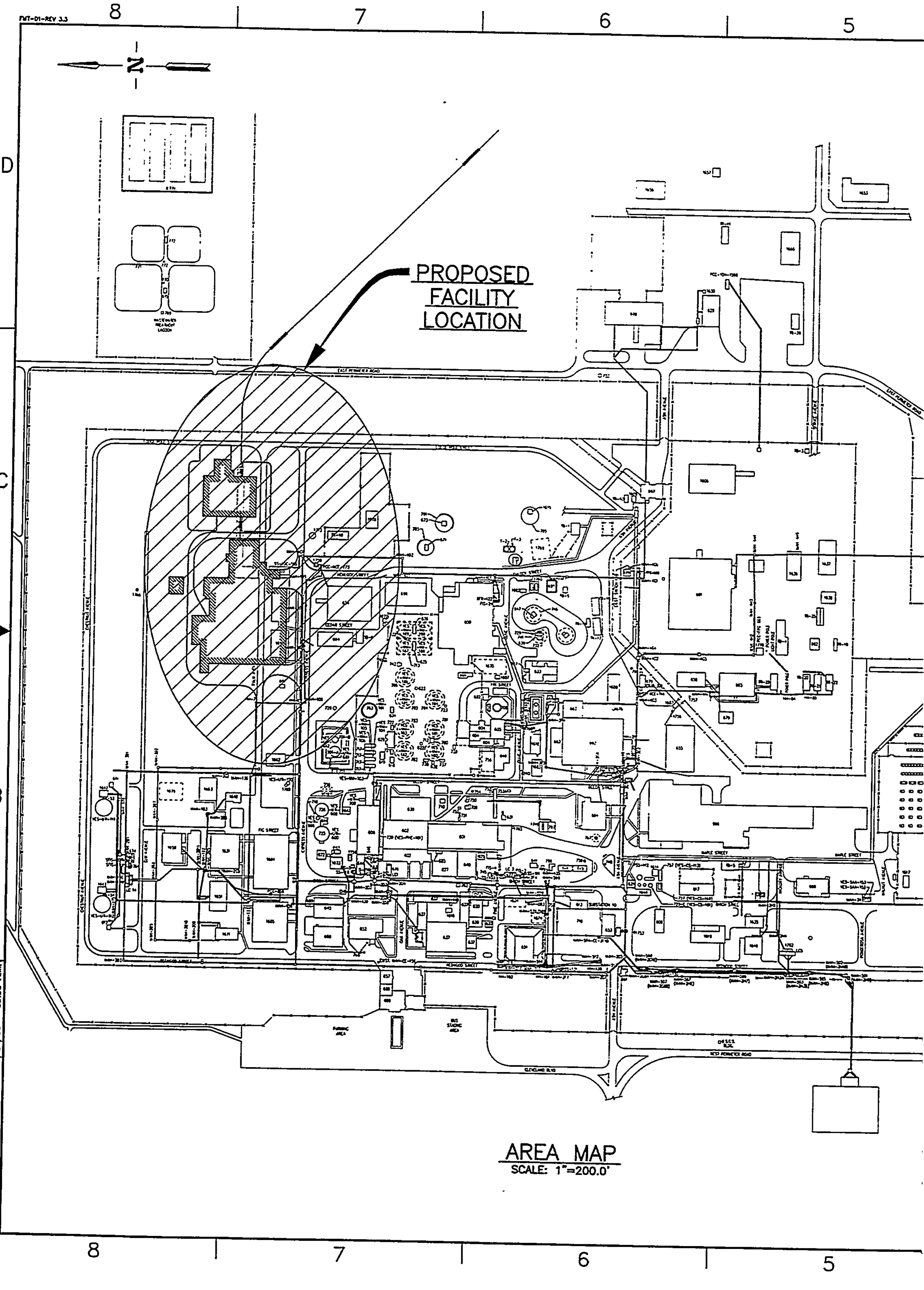
TABLE 4
UNIVERSAL SOLVENT EXTRACTION
FEASIBILITY STUDY

STANDBY POWER LOADS
MODIFIED UNEX PROCESS

LOAD	kVA
General Building Lighting 15% of Total Lighting	34.0
Miscellaneous Loads 20% of Total Misc Loads	52.6
HVAC Loads: Exhaust Fan Motors – 330 HP	330
Process Equipment: 25% of Miscellaneous Equipment – 75 HP	75
Total Connected kVA	**492**

Appendix D

Facility Drafting



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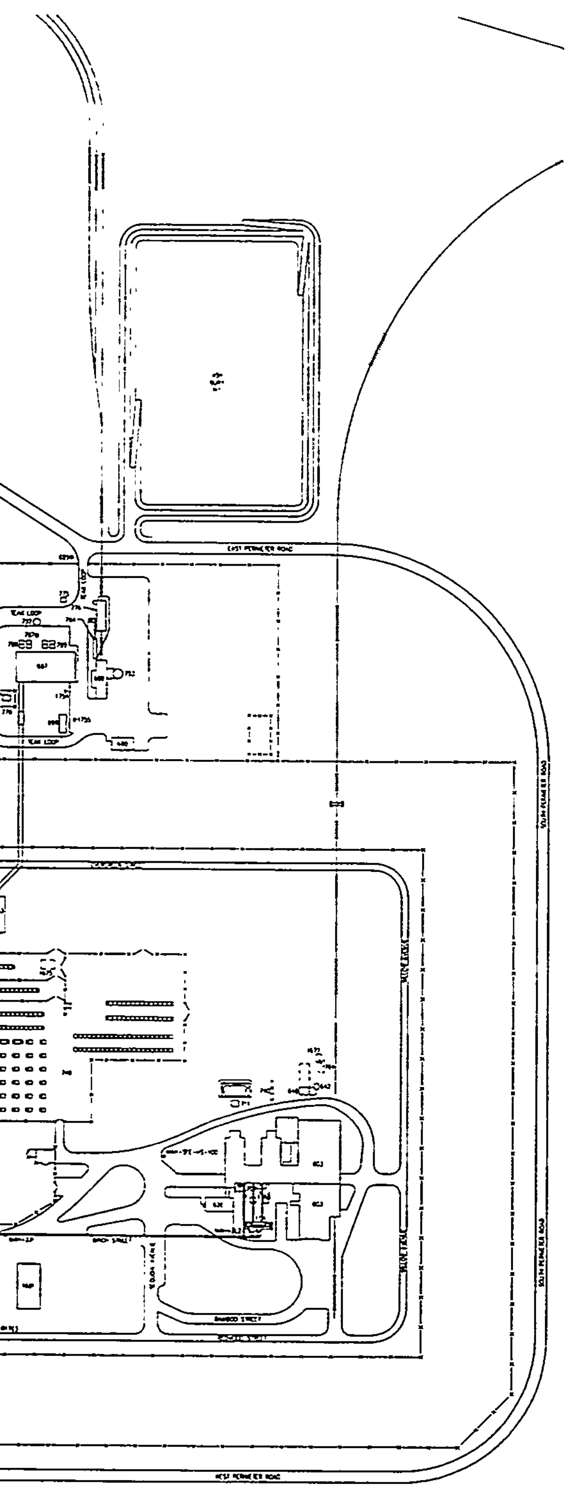

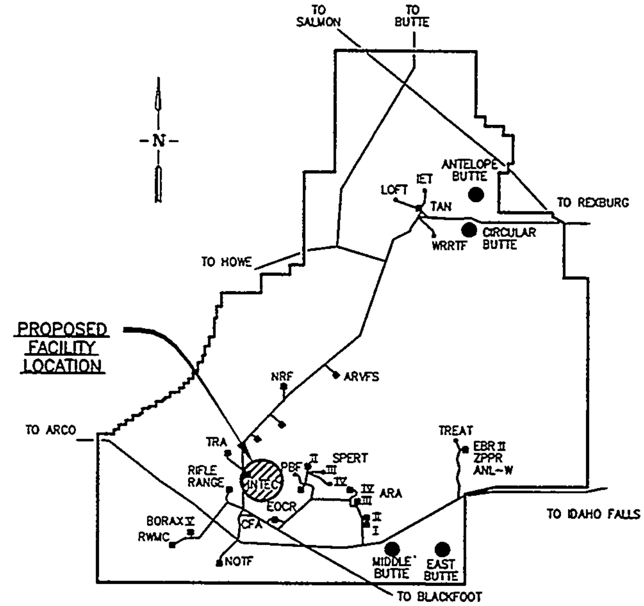

SITE MAP
SCALE: NONE

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DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA 200, TYPE 0100, CL 01, ORG 090; DWG- ; REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NOTED; SHEET T-1

DRAWING INDEX

PAGE NO.	DWG NO.	A-E DWG NO.	REV	DRAWING TITLE
1		T-1		SITE MAP AND AREA MAP
2		T-2		DRAWING INDEX
3		U-1		SBW FEED & UDS RETURN LINES
4		U-2		COOLING WATER LINE & DEMIN WATER LINE
5		U-3		POTABLE WATER LINE
6		U-4		SANITARY SEWER LINE
7		U-5		HIGH PRESSURE AIR
8		U-6		FIRE WATER LINE
9		U-7		STORM DRAIN
10		U-8		SBW & USD LINES
11		A-0		PERSPECTIVE VIEW
12		A-1		SECOND BASEMENT FLOOR PLAN
13		A-2		FIRST BASEMENT FLOOR PLAN
14		A-3		UNEX OPTION FIRST FLOOR PLAN
15		A-3M		MODIFIED UNEX OPTION FIRST FLOOR PLAN
16		A-4		SECOND FLOOR PLAN
17		A-5		THIRD FLOOR PLAN
18		A-6		FOURTH FLOOR PLAN
19		A-7		FIFTH FLOOR PLAN
20		A-8		SIXTH FLOOR PLAN
21		A-9		ROOF PLAN
22		A-10		STAIR ROOF PLAN
23		A-11		SOUTH EXTERIOR ELEVATION
24		A-12		NORTH EXTERIOR ELEVATION
25		A-13		BUIDING CROSS SECTION C-C
26		P-7		EQUIPMENT FLOW LAYOUT
27		P-8		BUILDING SECTIONS
28		P-9		ELEVATION
29		P-10		FLOOR PLAN
30		P-11		FLOOR PLAN
31		P-12		FLOOR PLAN
32		P-13		FLOOR PLAN
33		P-14		ELEVATION
34		E-1		ONE LINE DIAGRAM
35		E-2		ONE LINE DIAGRAM
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37		E-4		ONE LINE DIAGRAM
38		E-5		DUCT BANK RELOCATION PLAN

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REVISIONS

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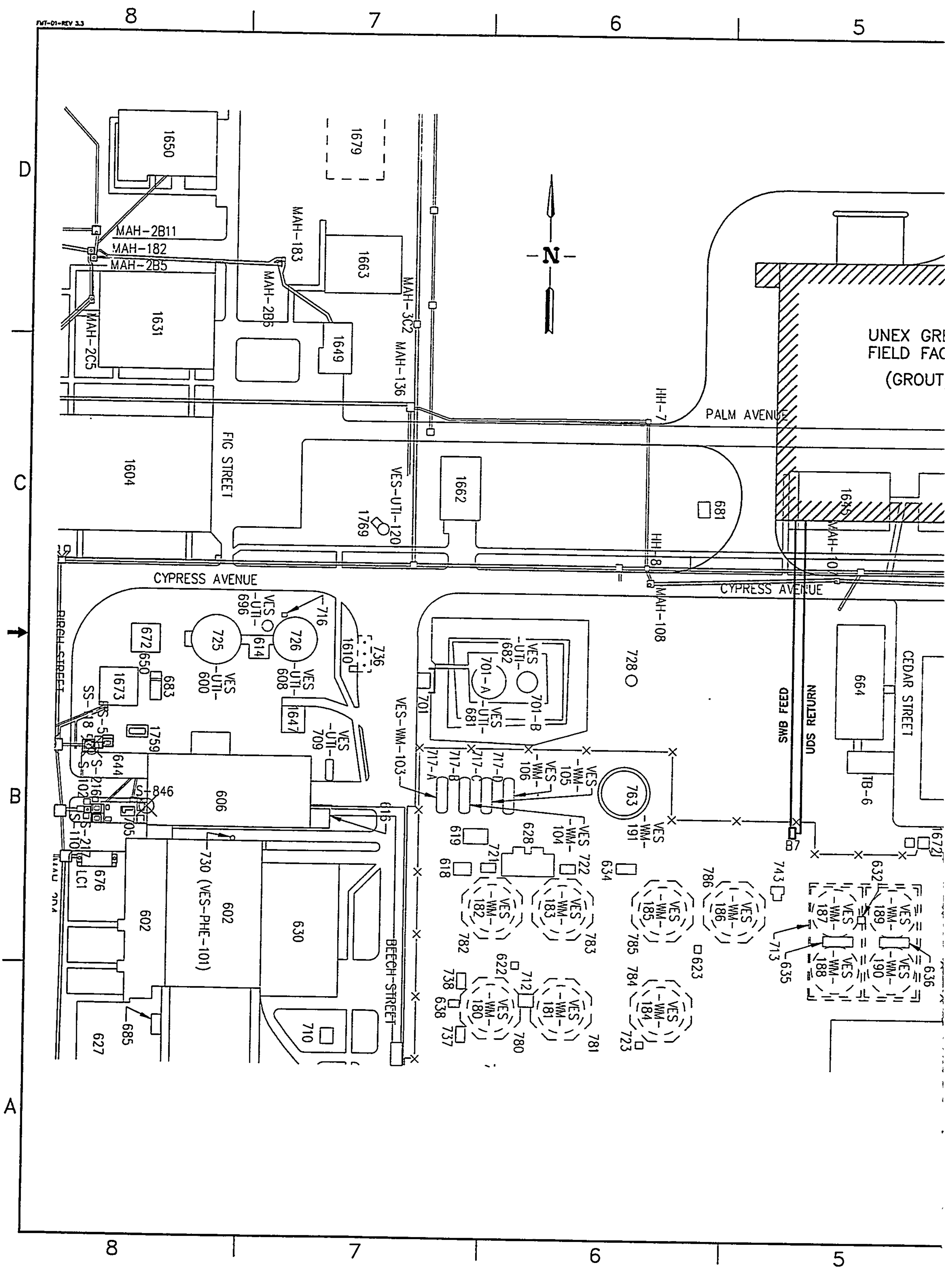
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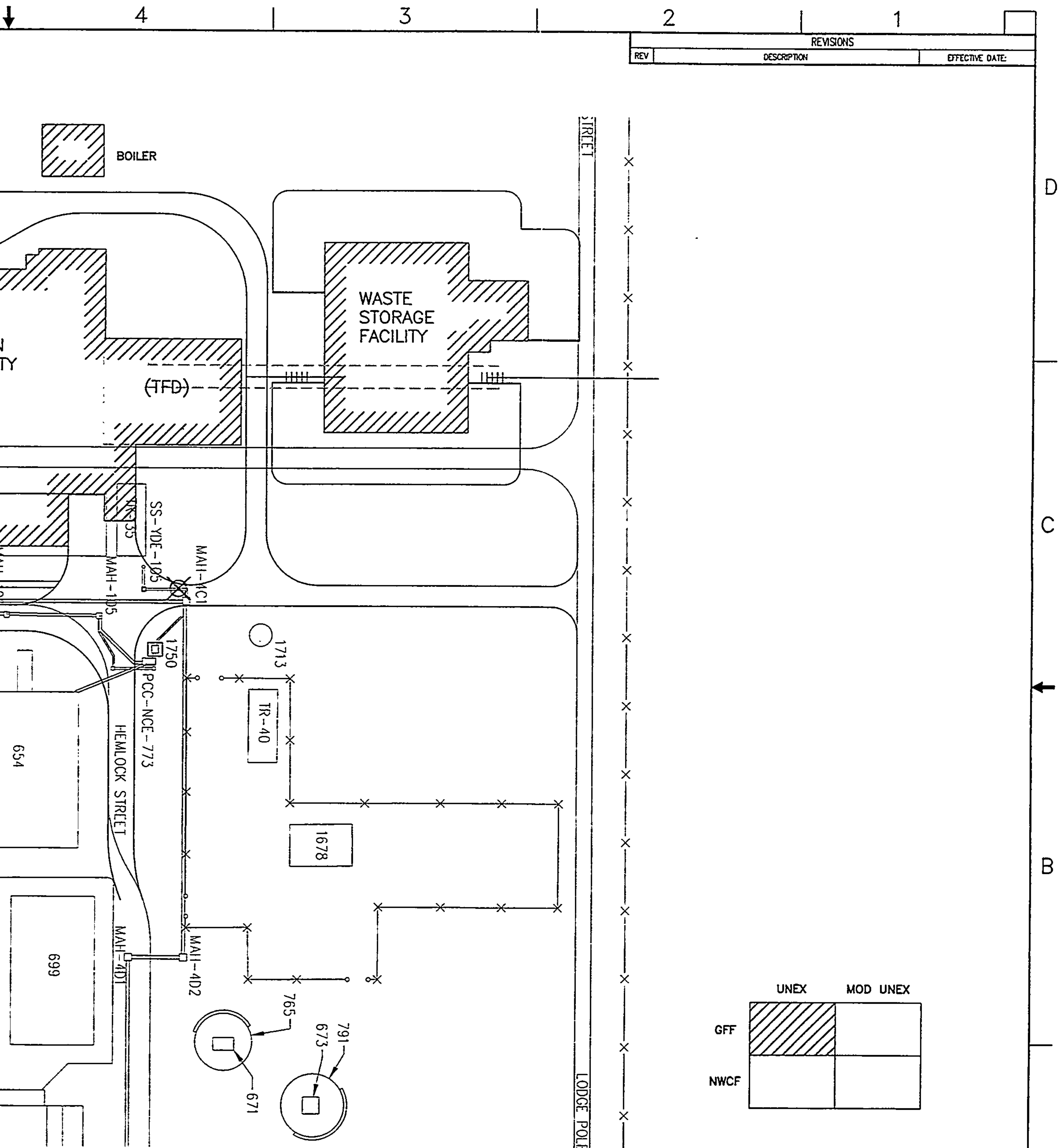

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	PROJECT NO.	SODIUM BEARING WASTE FEED FILTRATION
	SPEC CODE	SBW FEED & UDS RETURN LINES
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA · TYPE · CL · ORG 090 · DWG- · REV
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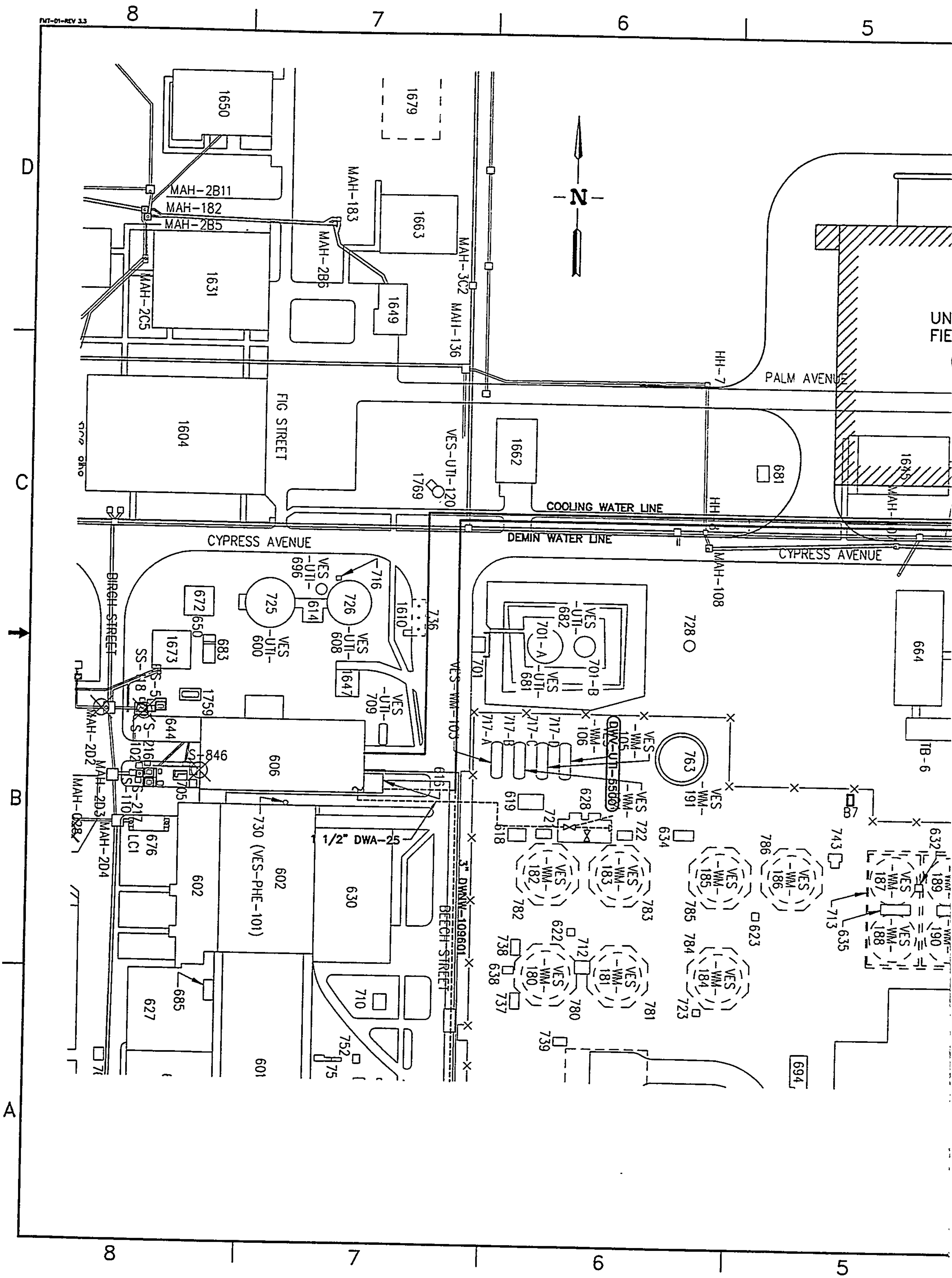
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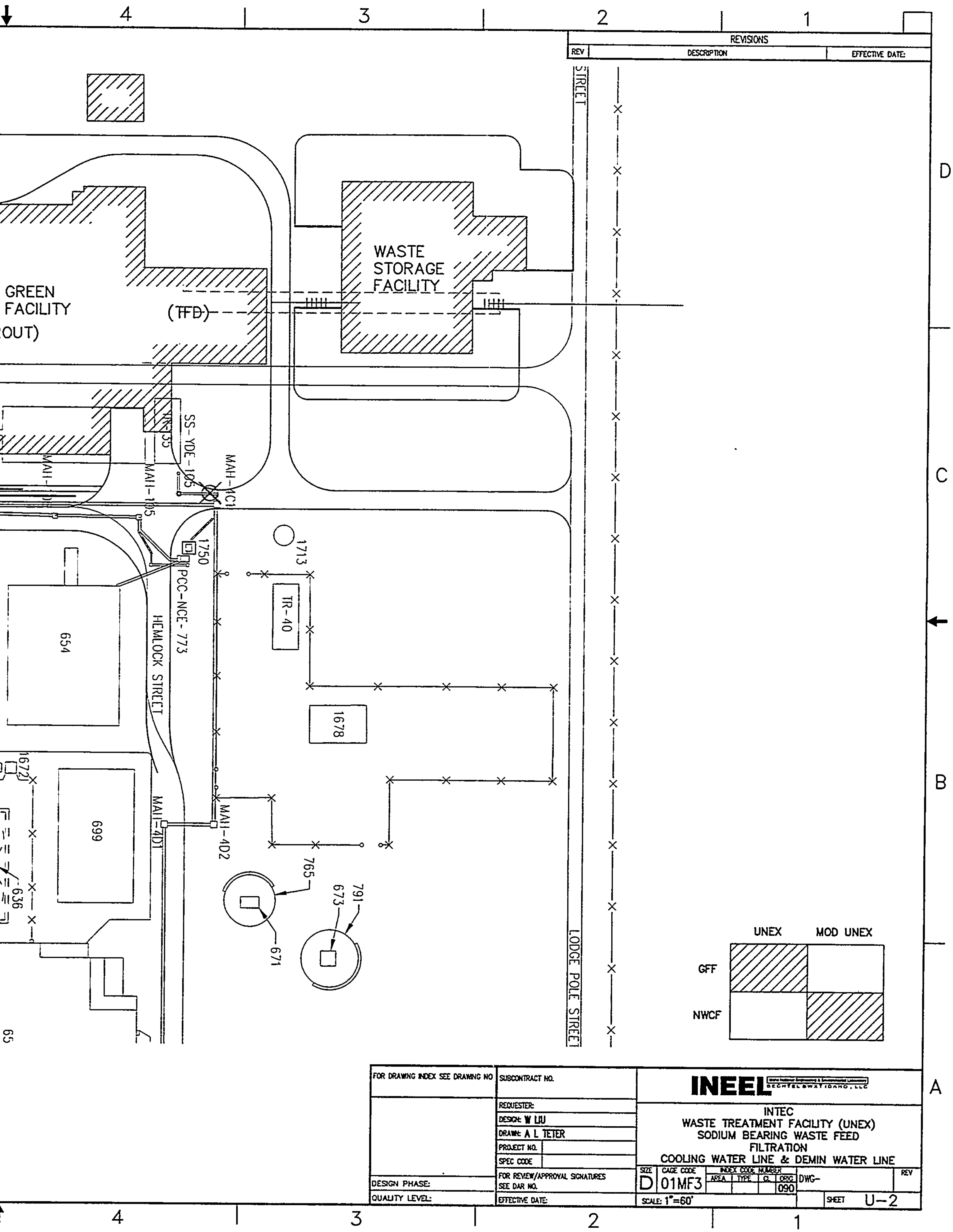

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SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:
DESIGN PHASE:
QUALITY LEVEL:
INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
COOLING WATER LINE & DEMIN WATER LINE
SIZE D
CAGE CODE 01MF3
INDEX CODE NUMBER
AREA TYPE CL ORG 090
DWG-
REV
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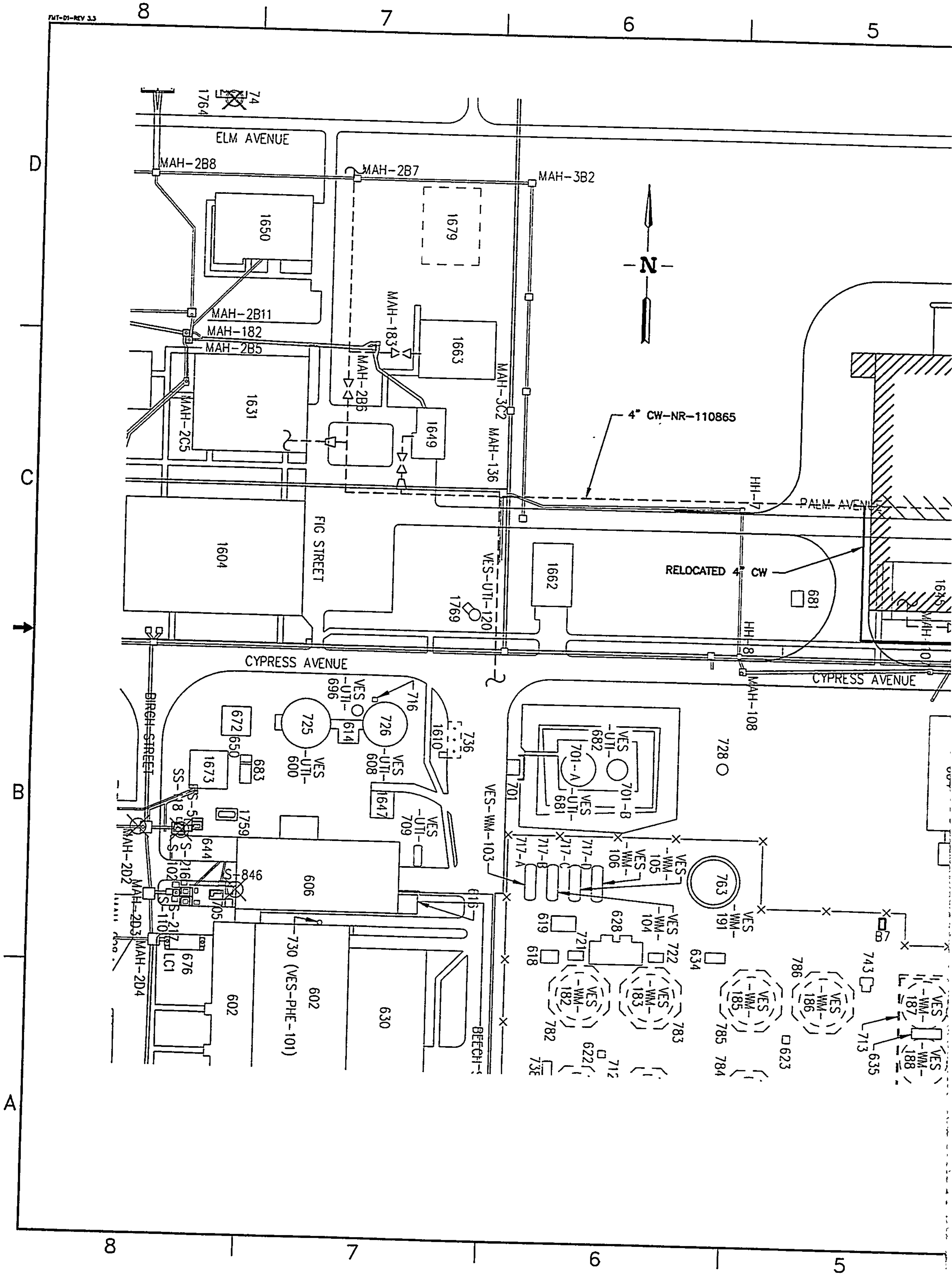

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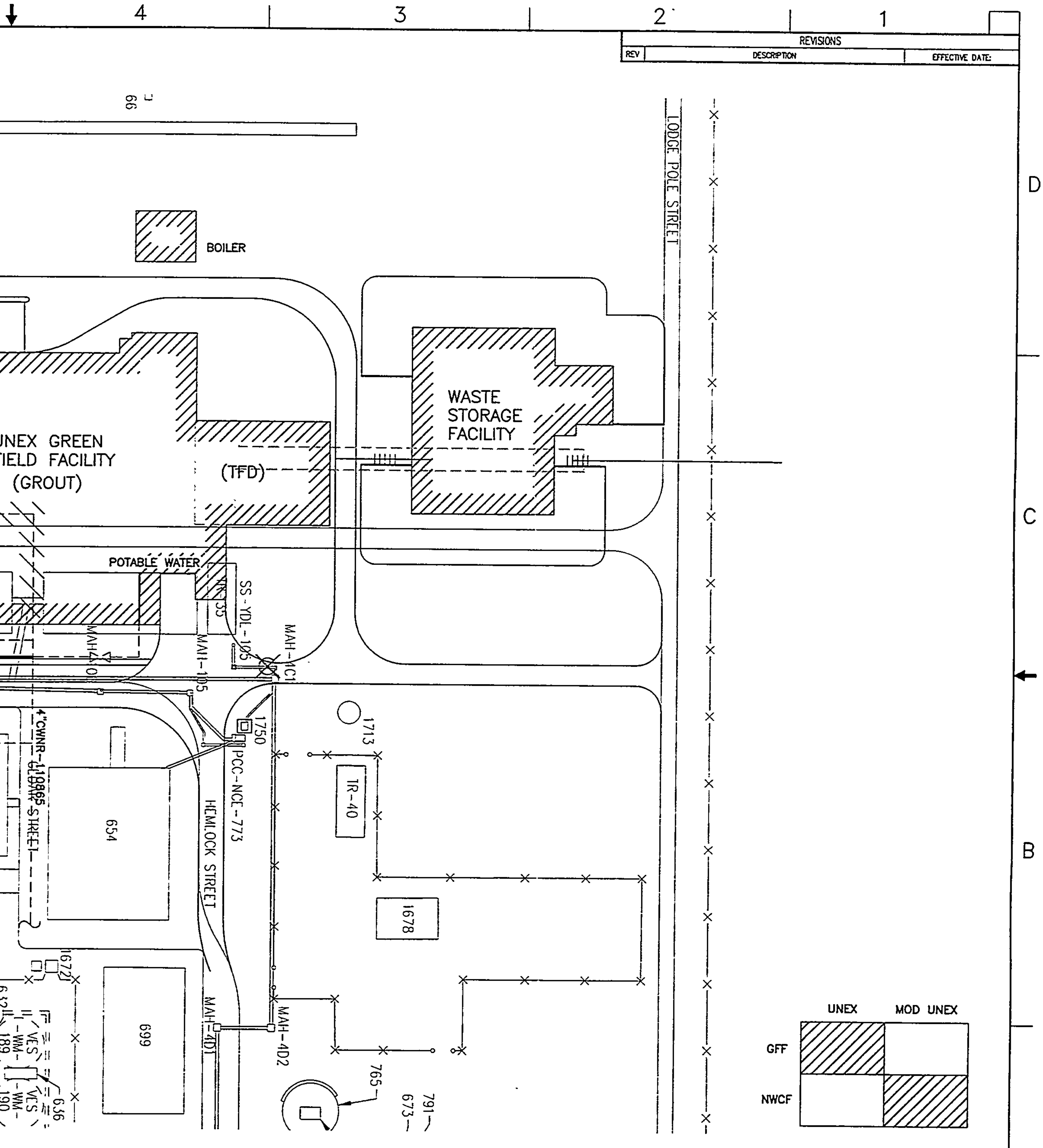

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	PROJECT NO.	FILTRATION
	SPEC CODE	POTABLE WATER LINE
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D — CAGE CODE 01MF3 — INDEX CODE NUMBER: AREA, TYPE, CL, ORG 090 — DWG- — REV
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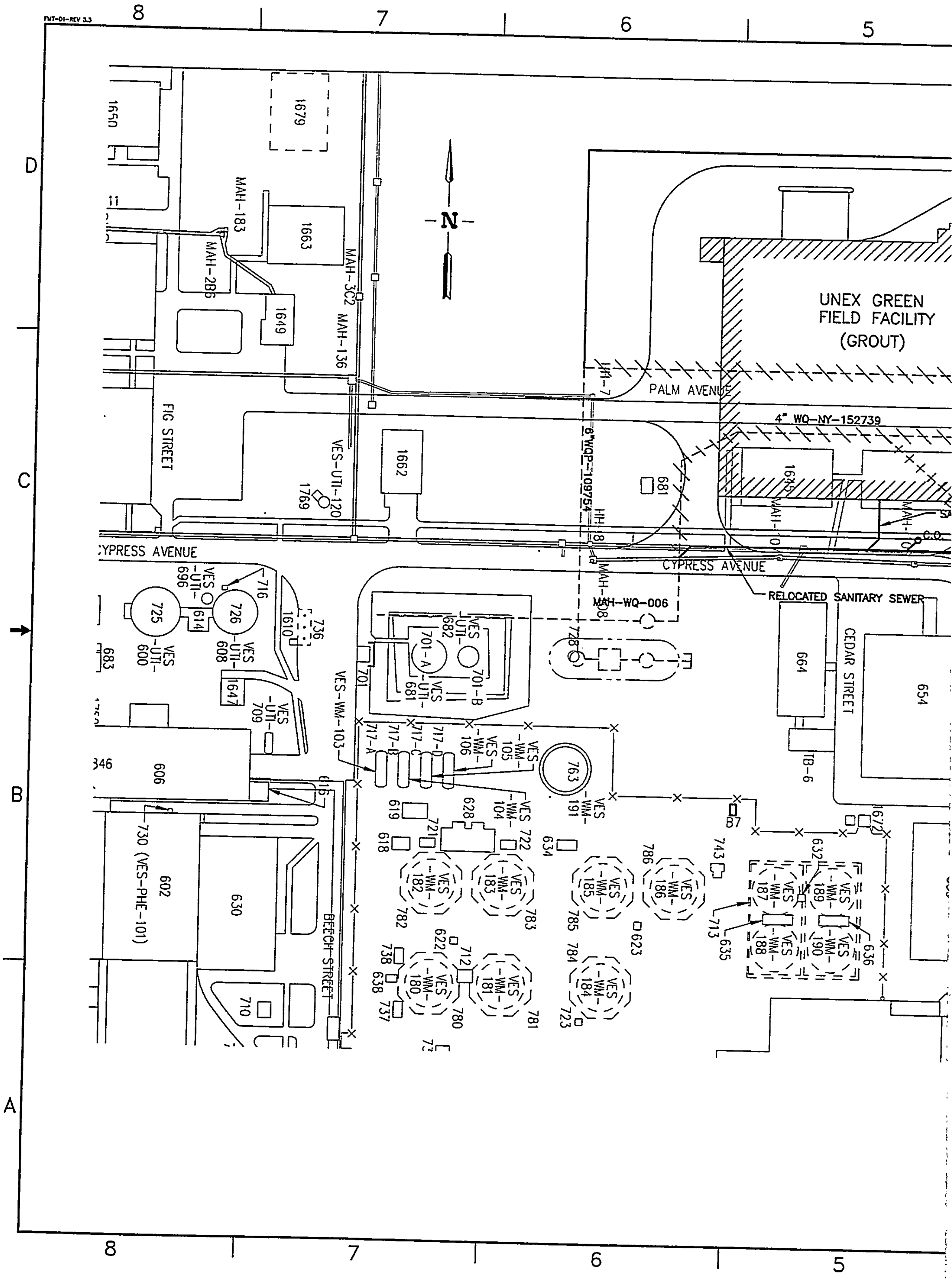

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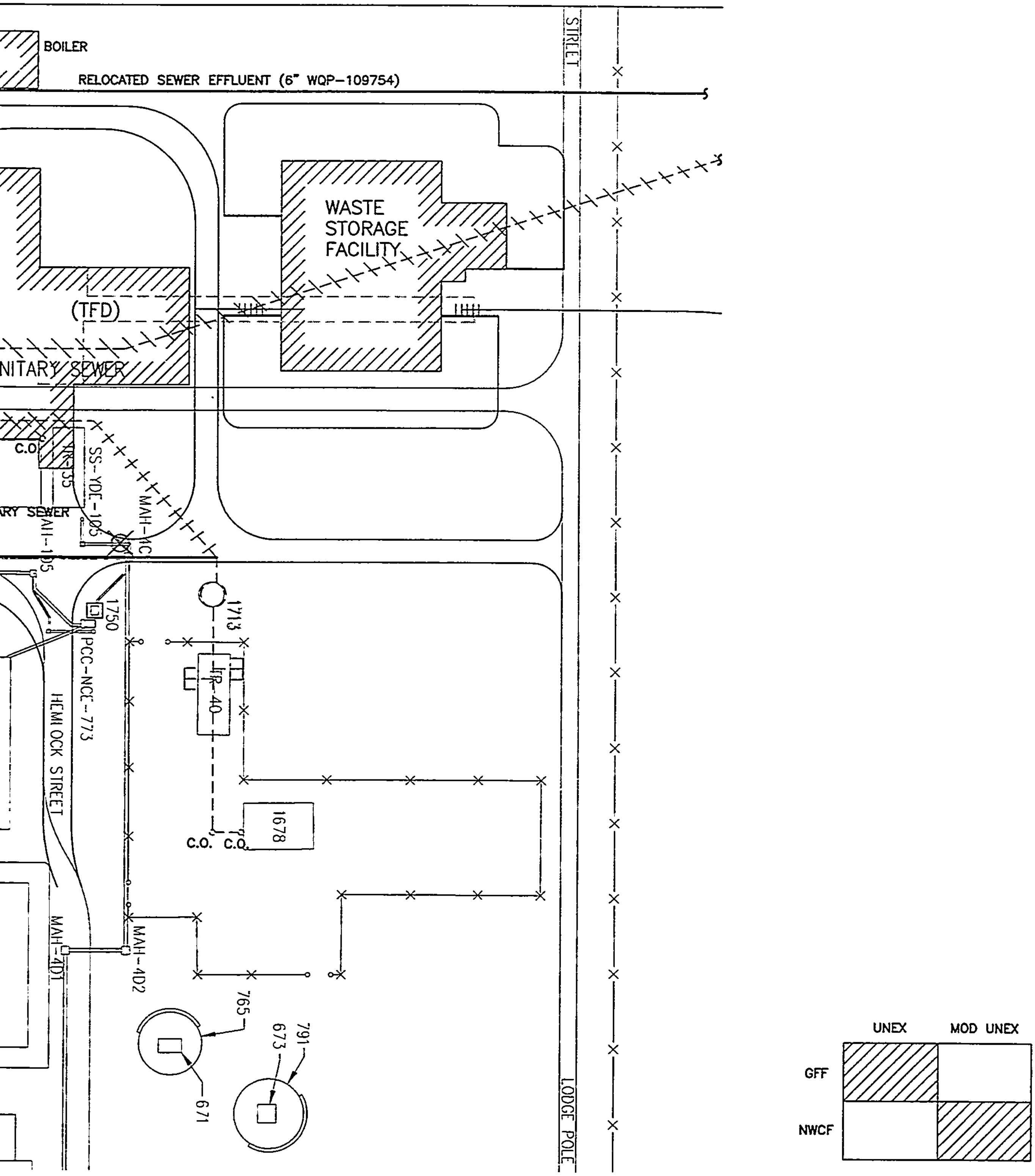

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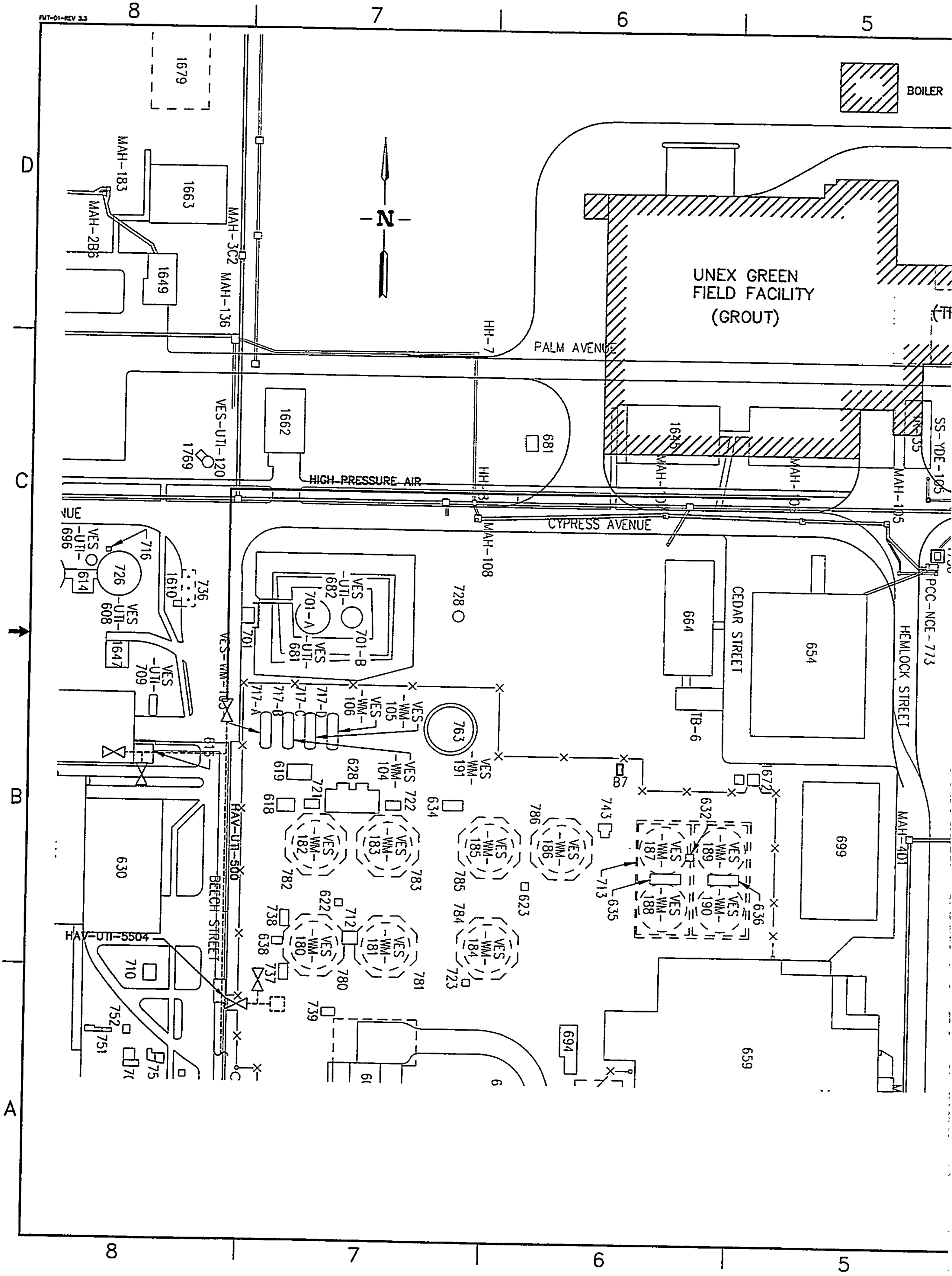
	DRAWN: A L TETER	SODIUM BEARING WASTE FEED
	PROJECT NO.	FILTRATION
	SPEC CODE	SANITARY SEWER LINE
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D, CAGE CODE 01MF3, INDEX CODE NUMBER: AREA, TYPE, CL, ORIG 090, DWG-, REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: 1"=60', SHEET U-4



FMT-01-REV 3.3
8
7
6
5
D
C
B
A
BOILER
UNEX GREEN
FIELD FACILITY
(GROUT)
PALM AVENUE
HIGH PRESSURE AIR
CYPRESS AVENUE
CEDAR STREET
HEMLOCK STREET
BEECH STREET
N
1679
1663
1649
1662
1769
681
1610
1647
664
654
699
630
710
659
694
763
728
701
701-A
701-B
MAH-183
MAH-2B6
MAH-3C2
MAH-136
MAH-108
MAH-105
MAH-4D1
HH-7
VES-UTI-120
VES-WM-103
HAV-UTI-500
HAV-UTI-5504
SS-YDE-105
PCC-NCE-773
TB-6
VES-UTI-682
VES-UTI-681
VES-UTI-696
VES-UTI-608
VES-UTI-709
VES-WM-105
VES-WM-106
VES-WM-104
VES-WM-191
VES-WM-182
VES-WM-183
VES-WM-185
VES-WM-186
VES-WM-187
VES-WM-188
VES-WM-189
VES-WM-190
VES-WM-180
VES-WM-181
VES-WM-184
717-A
717-B
717-C
717-D
716
726
614
736
619
618
628
721
722
634
743
786
632
1672
713
635
636
782
783
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784
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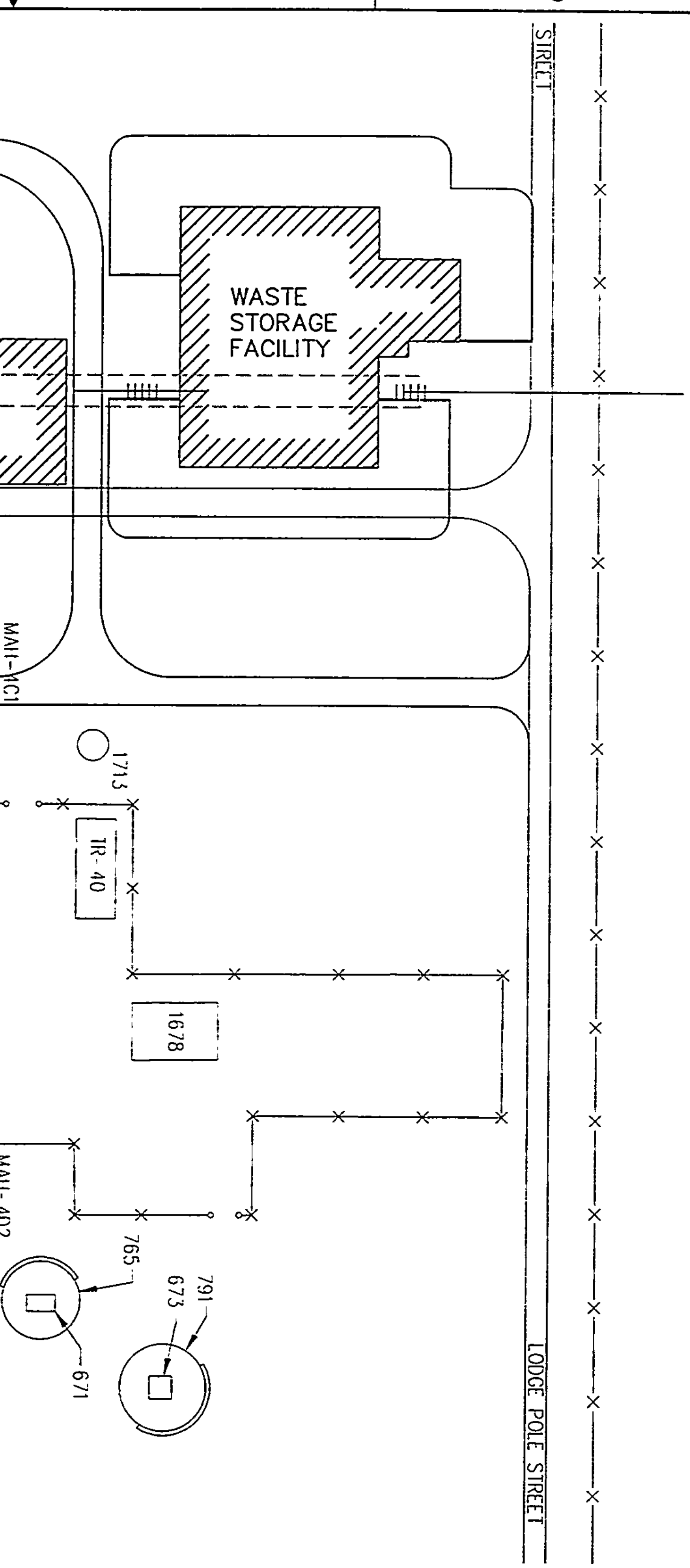
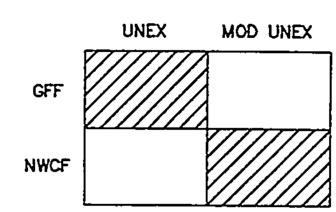
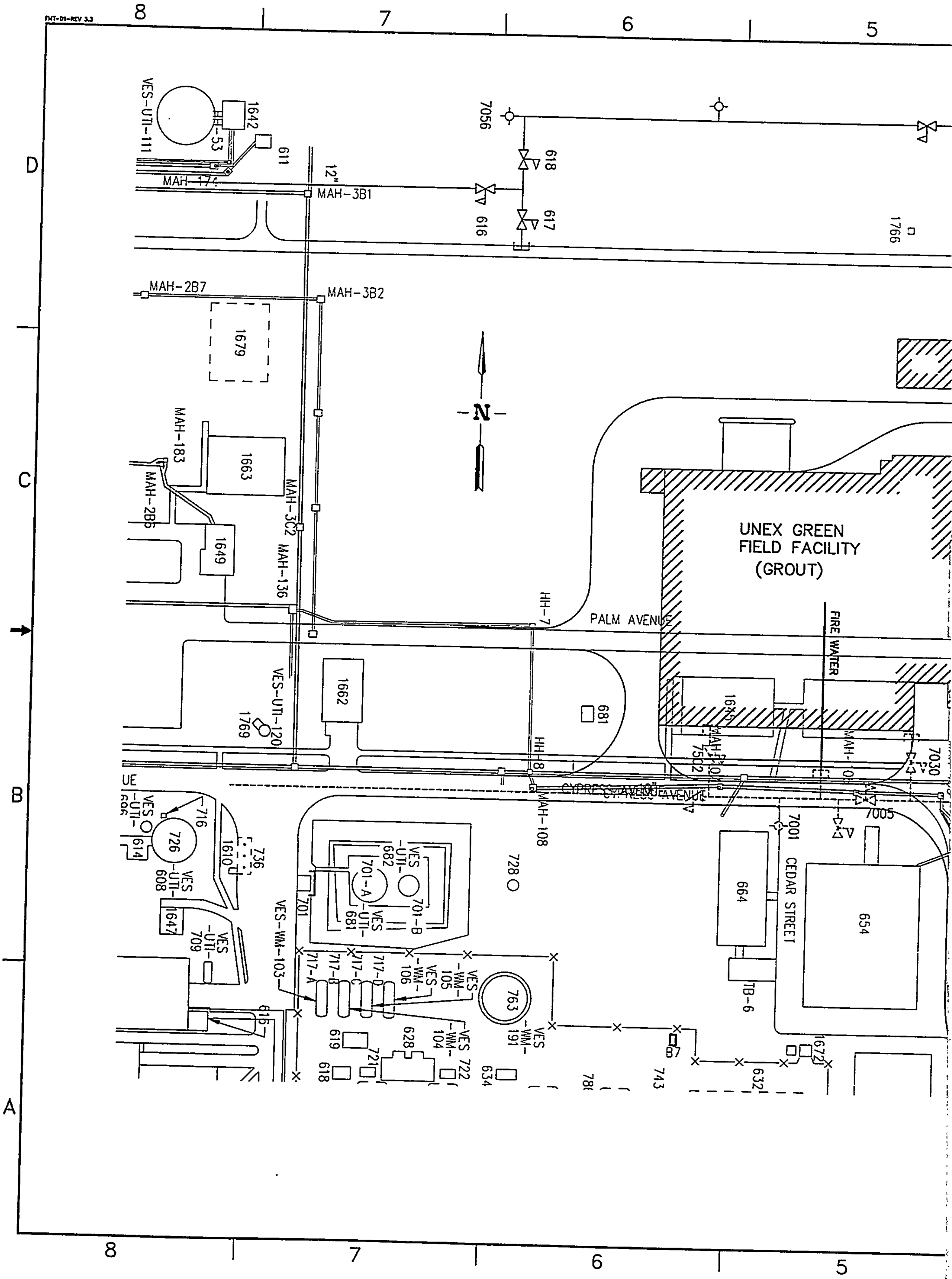
622
712
738
638
737
780
781
723
739
752
751
B7



REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

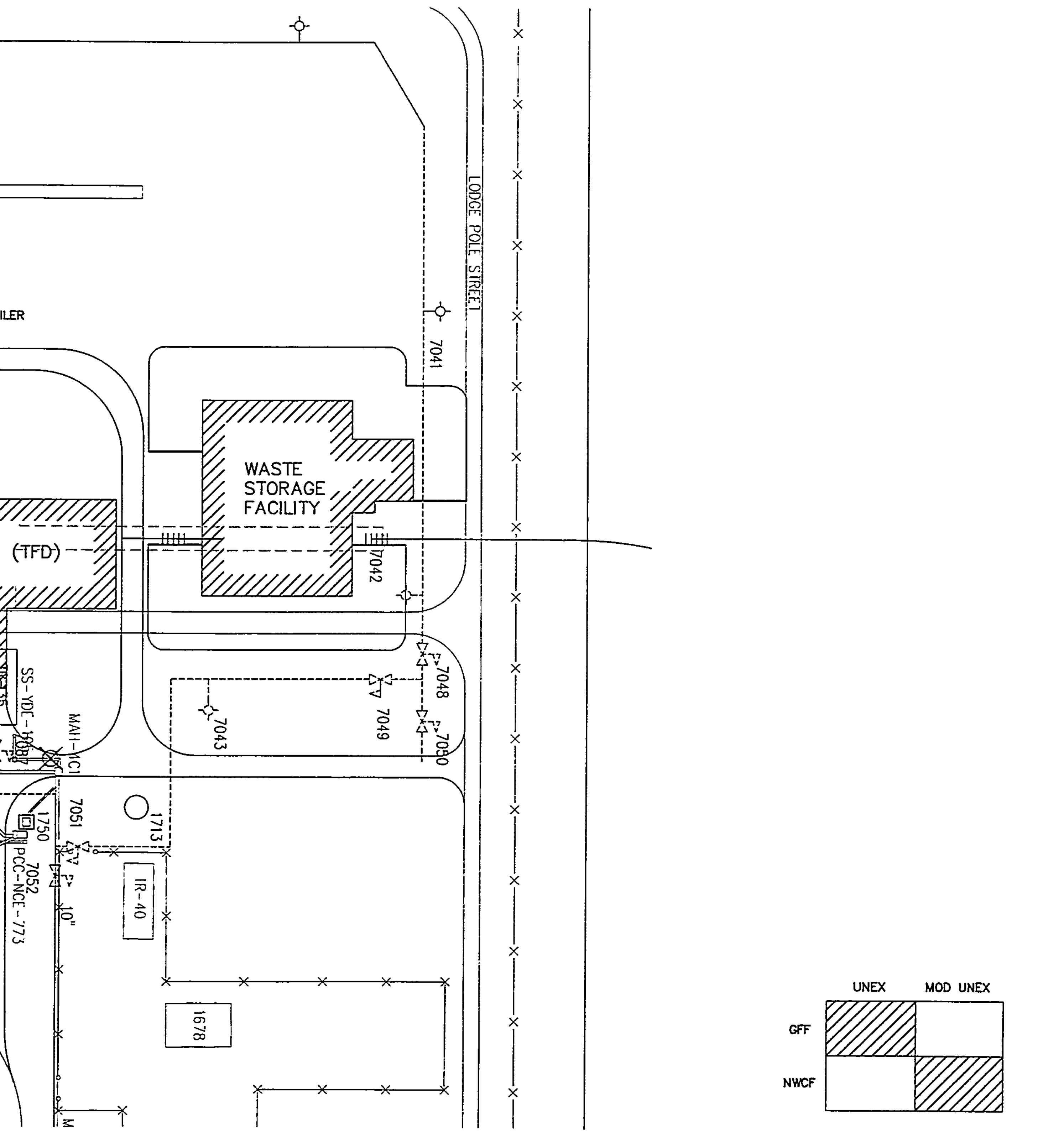


FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL
	REQUESTER: DESIGN: W LIU DRAWN: A L TETER PROJECT NO. SPEC CODE	INTEC WASTE TREATMENT FACILITY (UNEX) SODIUM BEARING WASTE FEED FILTRATION HIGH PRESSURE AIR
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA / TYPE / CL / ORG 090 · DWG- · REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: 1"=60' · SHEET U-5



FMT-01-REV 3.3
8
7
6
5
D
C
B
A
VES-UTI-111
1642
H-53
611
MAH-174
12"
MAH-3B1
7056
618
616
617
1766
MAH-2B7
MAH-3B2
1679
N
MAH-183
1663
MAH-2B5
MAH-3C2
1649
MAH-136
HH-7
PALM AVENUE
UNEX GREEN
FIELD FACILITY
(GROUT)
FIRE WATER
1662
VES-UTI-120
1769
681
HH-8
7502
MAH-108
CYPRESS AVENUE
7030
7005
7001
CEDAR STREET
664
654
TB-6
716
726
1610
736
VES-UTI-608
614
1647
VES-UTI-709
701
VES-UTI-682
701-A
701-B
VES-UTI-681
728
VES-WM-103
717-A
717-B
717-C
717-D
VES-WM-106
VES-WM-105
763
VES-WM-191
VES-WM-104
615
619
628
721
722
618
634
B7
1672
743
632

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.
	REQUESTER:
	DESIGN: W LIU
	DRAWN: A L TETER
	PROJECT NO.
	SPEC CODE
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
QUALITY LEVEL:	EFFECTIVE DATE:

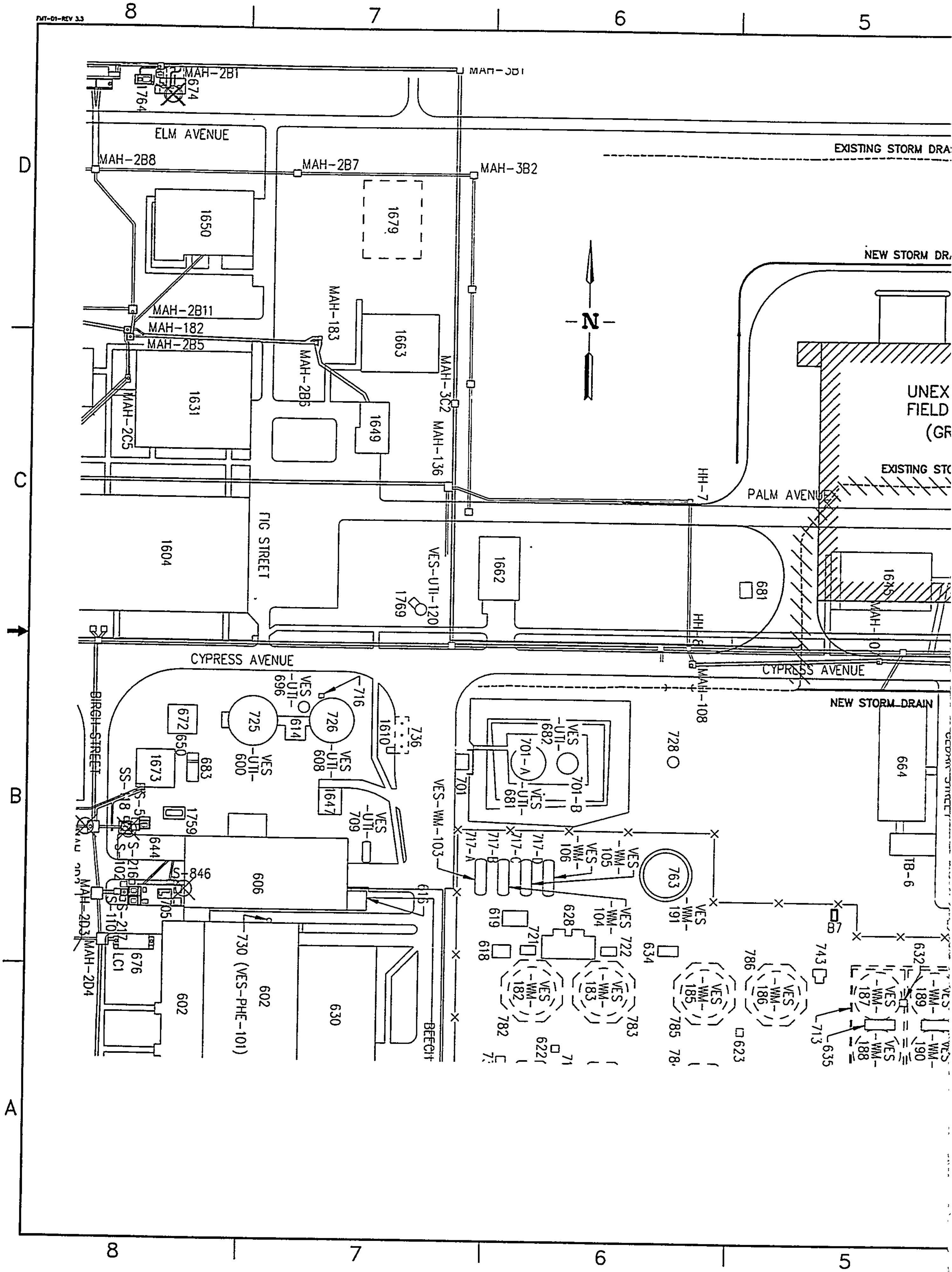
INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
FIRE WATER LINE

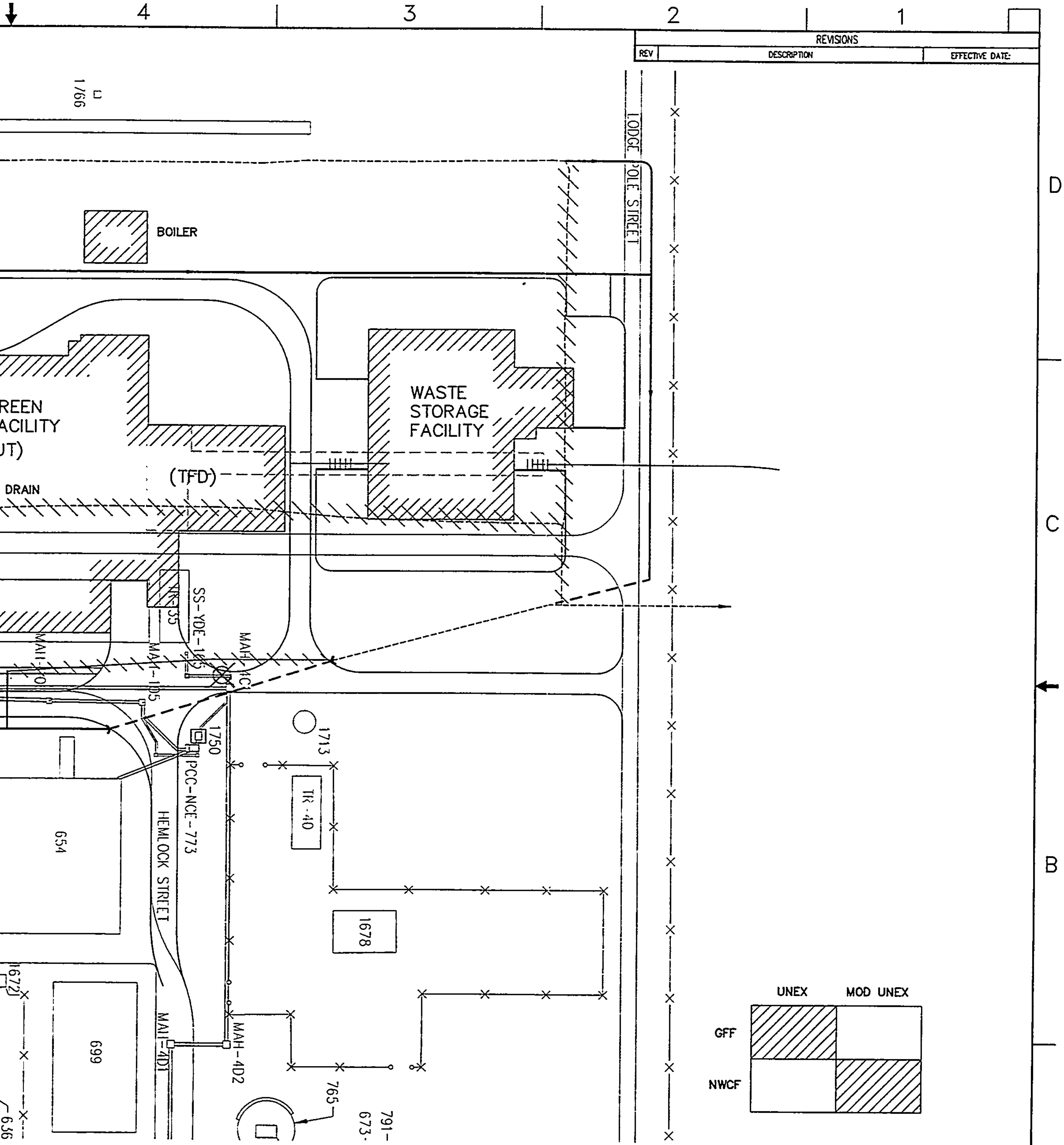
SIZE	CAGE CODE	INDEX CODE NUMBER AREA	TYPE	CL	ORG	DWG-	REV
D	01MF3				090		

SCALE: 1"=60' SHEET U-6

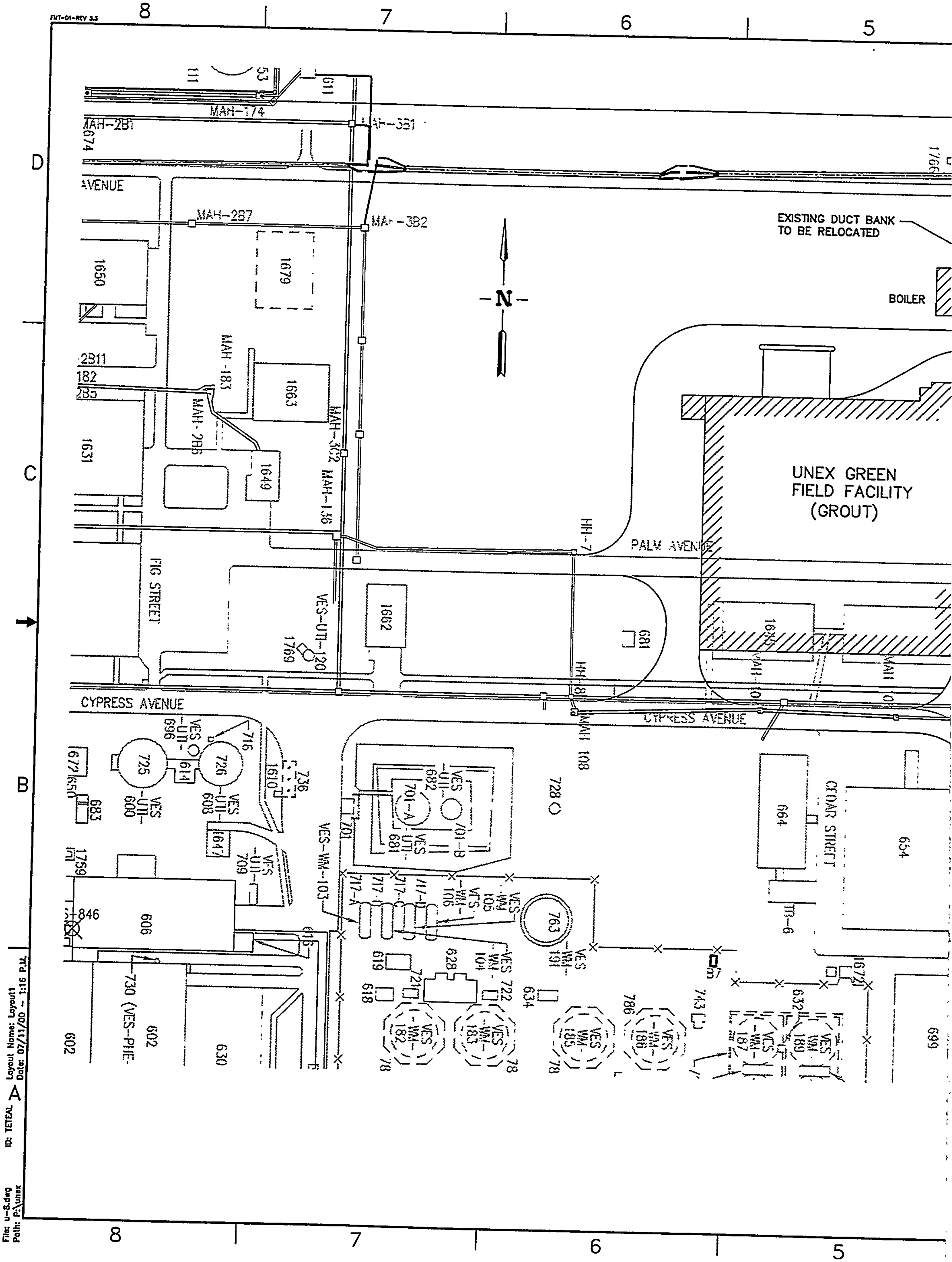
FMT-01-REV 3.3



8
7
6
5
D
C
B
A
MAH-2B1
1764
674
ELM AVENUE
MAH-2B8
MAH-2B7
MAH-3B2
1650
1679
NEW STORM DRA
MAH-2B11
MAH-182
MAH-2B5
MAH-183
1663
MAH-2B6
MAH-3C2
MAH-136
1631
MAH-2C5
1649
N
EXISTING STO
PALM AVENUE
HH-7
1604
FIG STREET
VES-UTI-120
1769
1662
681
CYPRESS AVENUE
MAH-108
NEW STORM DRAIN
BIRCH STREET
672
650
725
VES-UTI-600
726
VES-UTI-608
VES-UTI-696
716
614
1610
736
683
1673
1647
VES-UTI-709
1759
728
VES-UTI-682
701-A
701-B
VES-UTI-681
701
VES-WM-103
717-A
717-B
717-C
717-D
VES-WM-106
VES-WM-105
VES-WM-104
763
VES-WM-191
664
TB-6
B7
606
S-846
644
MAH-2D3
MAH-2D4
705
615
730 (VES-PHE-101)
676
LC1
602
630
619
628
618
721
722
634
VES-WM-182
VES-WM-183
782
783
VES-WM-185
VES-WM-186
785
786
743
623
622
VES-WM-187
VES-WM-188
VES-WM-189
VES-WM-190
632
713
635
BEECH

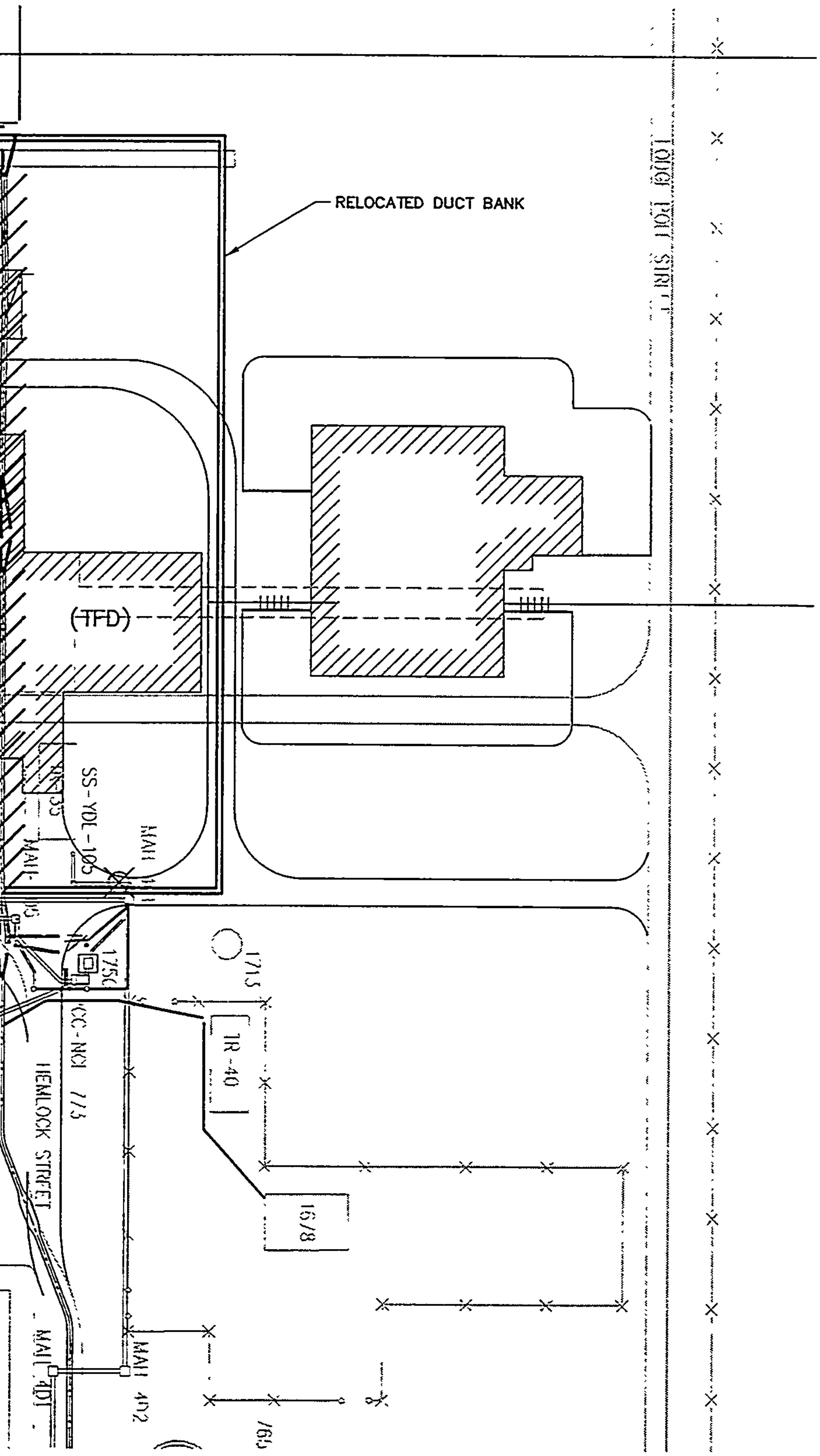


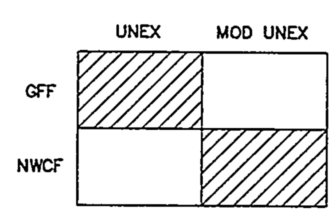
FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL
NO SCALE	REQUESTER:	INTEC
	DESIGN: W LIU	WASTE TREATMENT FACILITY (UNEX)
	DRAWN: A L TETER	SODIUM BEARING WASTE FEED
	PROJECT NO.	FILTRATION
	SPEC CODE	STORM DRAIN
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, CL, ORIG 090 · DWG- · REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NONE · SHEET U-7



8
7
6
5
D
C
B
A
EXISTING DUCT BANK TO BE RELOCATED
BOILER
UNEX GREEN FIELD FACILITY (GROUT)
PALM AVENUE
CYPRESS AVENUE
FIG STREET
CEDAR STREET
AVENUE
MAH-174
MAH-2B1
MAH-3B1
MAH-2B7
MAH-3B2
MAH-183
MAH-2B6
MAH-3C2
MAH-136
HH-7
HH-8
MAH-108
VES-UTI-120
VES-WM-103
1650
1679
1663
1631
1649
1662
1769
681
664
654
606
602
630
699
725
726
728
763
846

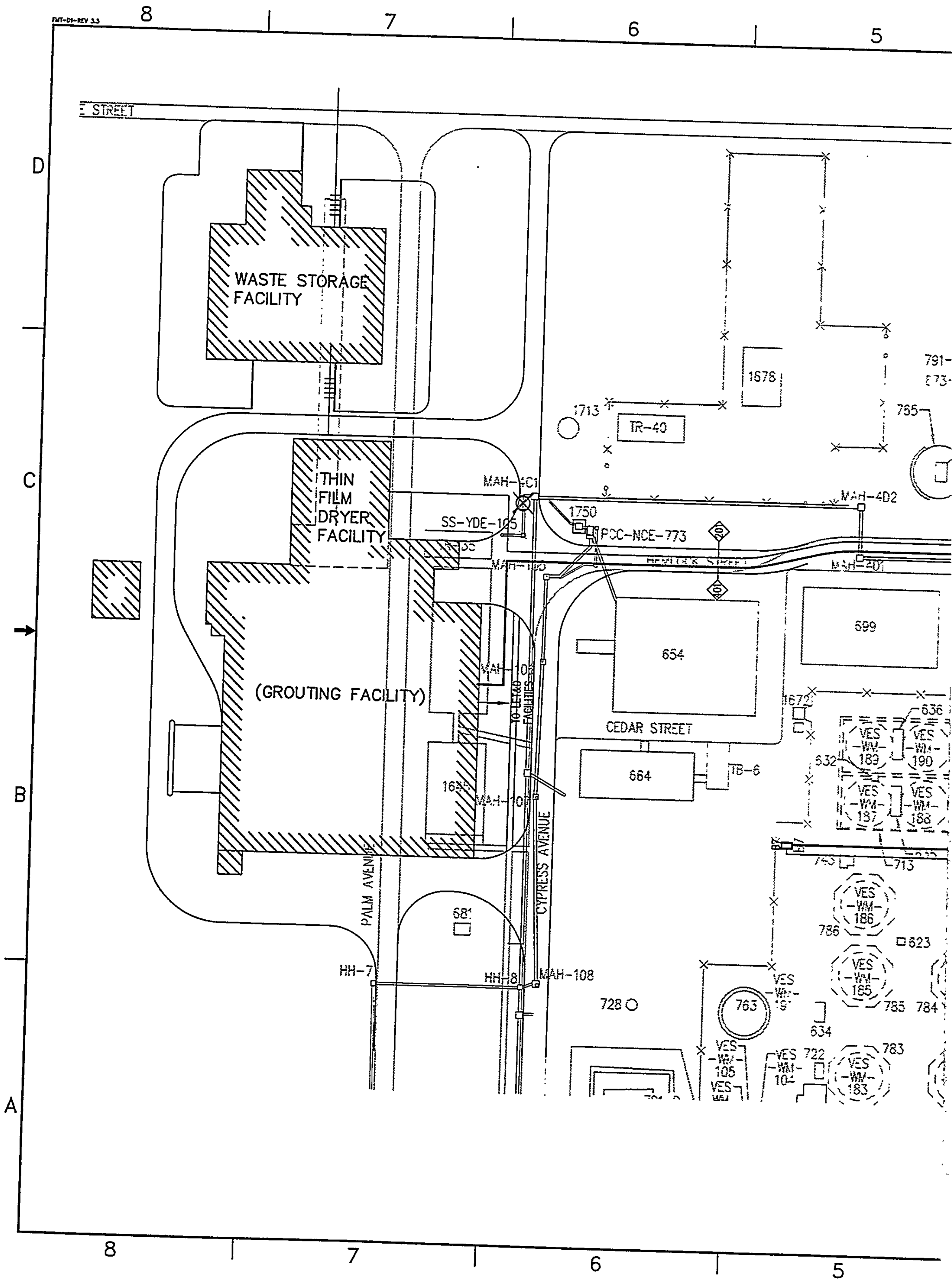
REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



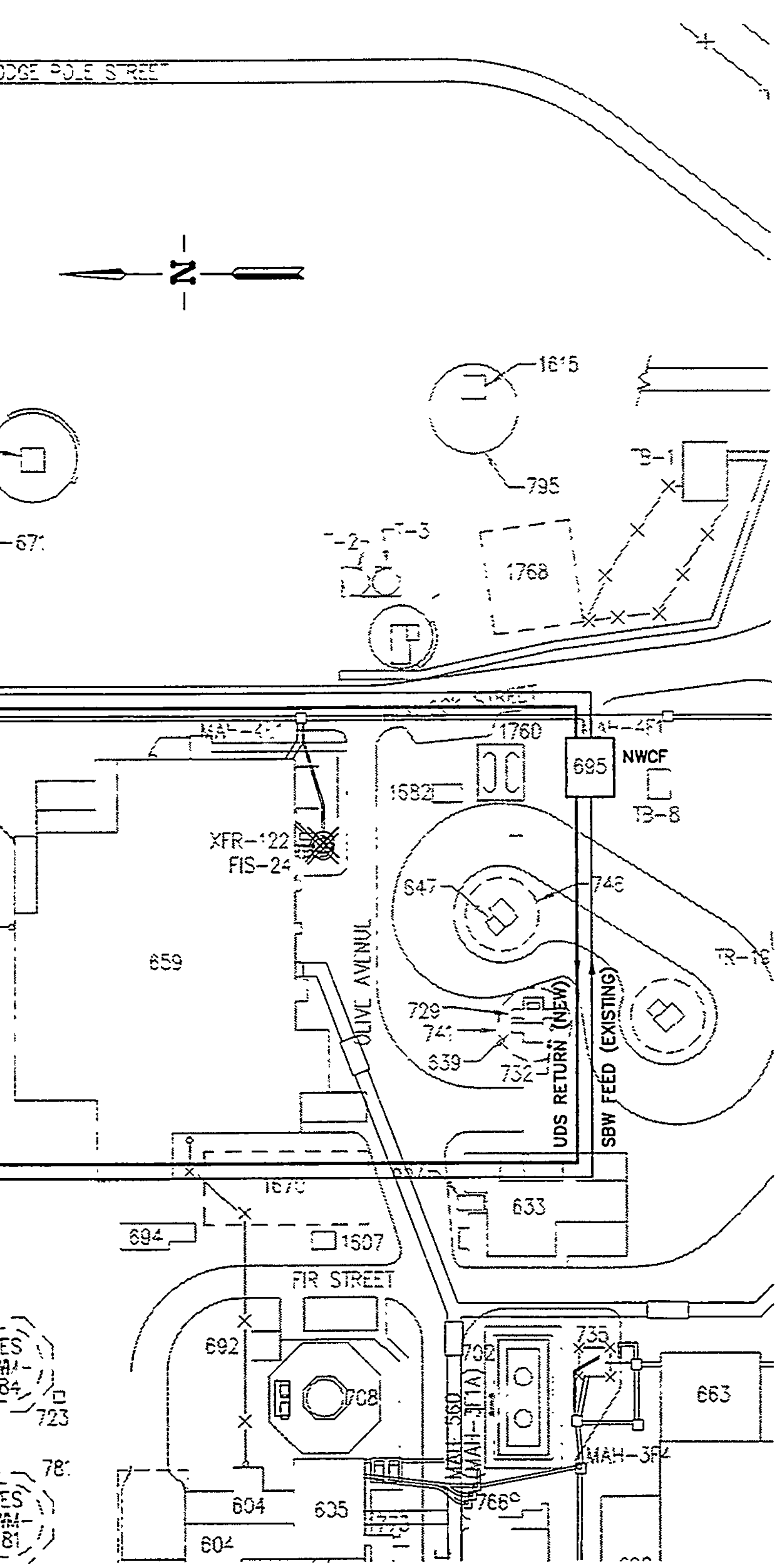


SUBCONTRACT NO.	INEEL
REQUESTER:	INTEC WASTE TREATMENT FACILITY (UNEX) SODIUM BEARING WASTE FEED FILTRATION
DESIGN: W LIU	
DRAWN: A L TETER	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, CL, ORIG 090 · DWG- · REV
EFFECTIVE DATE:	SCALE: 1"= 60' · SHEET U-8

FMT-D1-REV 3.3


8
7
6
5
D
C
B
A
STREET
WASTE STORAGE FACILITY
THIN FILM DRYER FACILITY
(GROUTING FACILITY)
PALM AVENUE
CYPRESS AVENUE
CEDAR STREET
HEMLOCK STREET
TO LET&D FACILITIES
MAH-401
MAH-402
MAH-201
MAH-106
MAH-107
MAH-108
SS-YDE-105
PCC-NCE-773
HH-7
HH-8
1713
TR-40
1678
1750
654
699
664
TB-6
1672
636
632
VES-WM-189
VES-WM-190
VES-WM-187
VES-WM-188
VES-WM-186
VES-WM-185
VES-WM-183
VES-WM-105
VES-WM-104
713
786
623
785
784
783
763
634
722
728
681
791
785
20
40

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



	UNEX	MOD UNEX
GFF		
NWCF		

SUBCONTRACT NO.	INEEL
REQUESTER:	INTEC WASTE TREATMENT FACILITY (UNEX) SODIUM BEARING WASTE FEED FILTRATION SBW & USD LINES
DESIGN: W LIU	
DRAWN: A L TETER	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE: D · CAGE CODE: 01MF3 · INDEX CODE NUMBER: AREA / TYPE / CL / ORG 1090 · DWG- · REV
EFFECTIVE DATE:	SCALE: NONE · SHEET U-8

FMT-01-REV 3.3

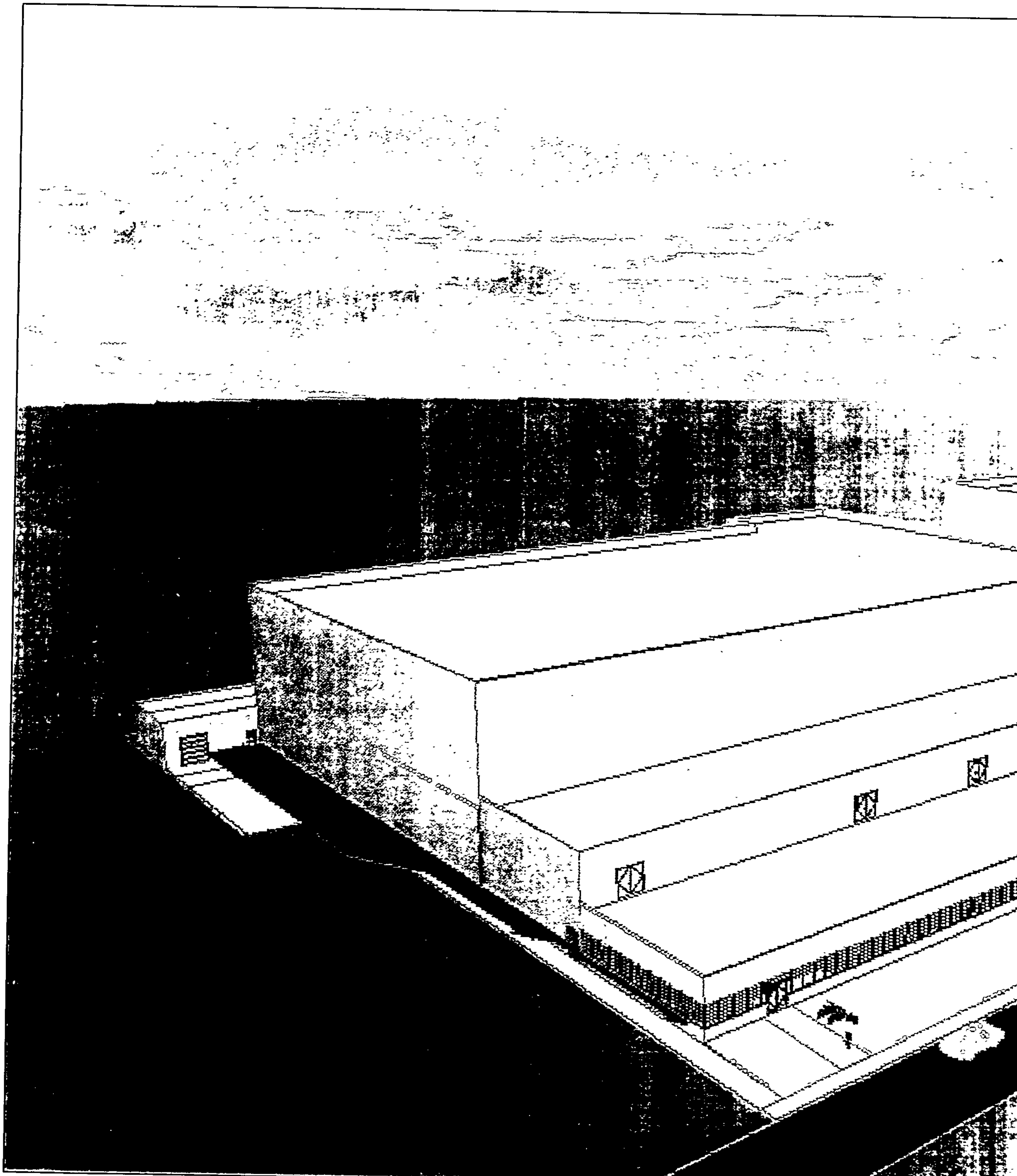
8 | 7 | 6 | 5

D

C

B

A

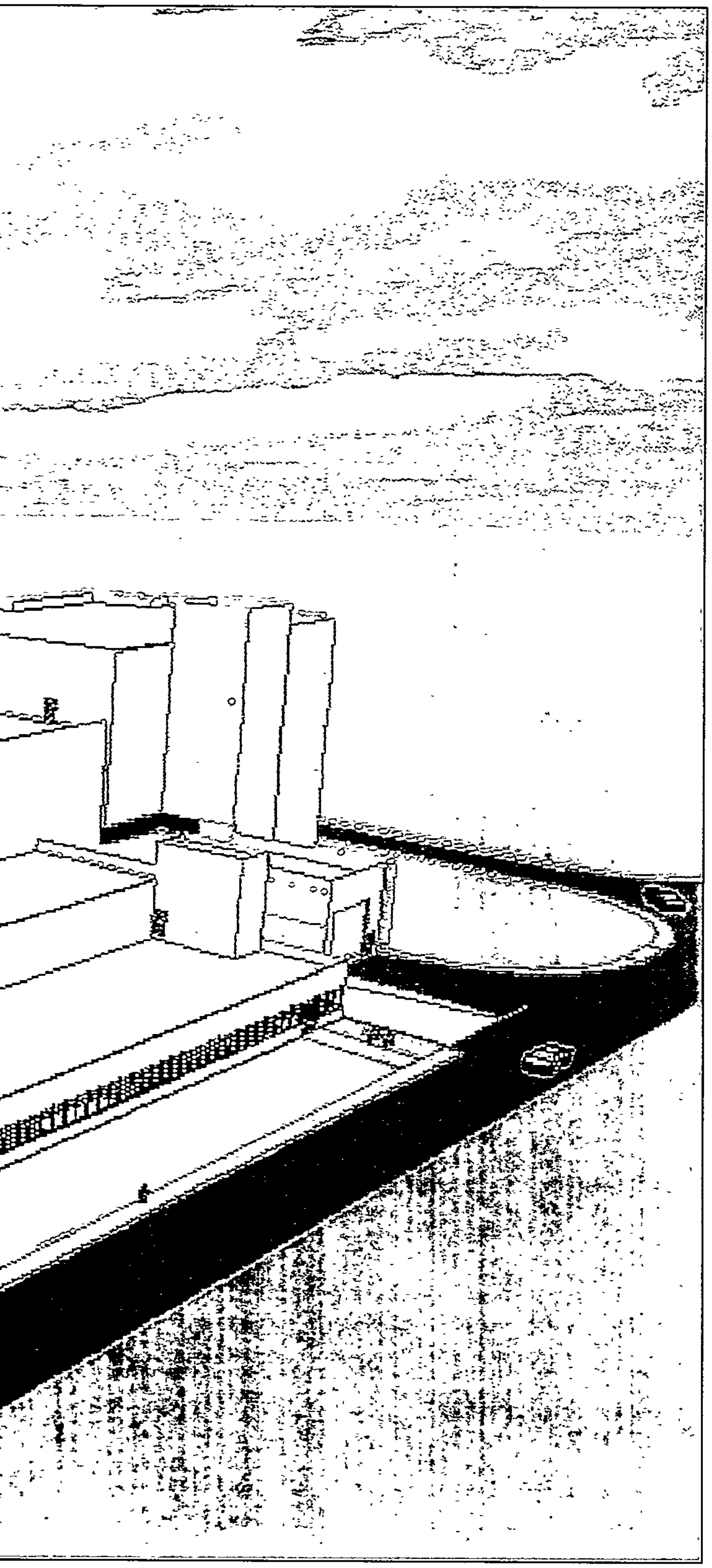


PERSPECTIVE VIEW

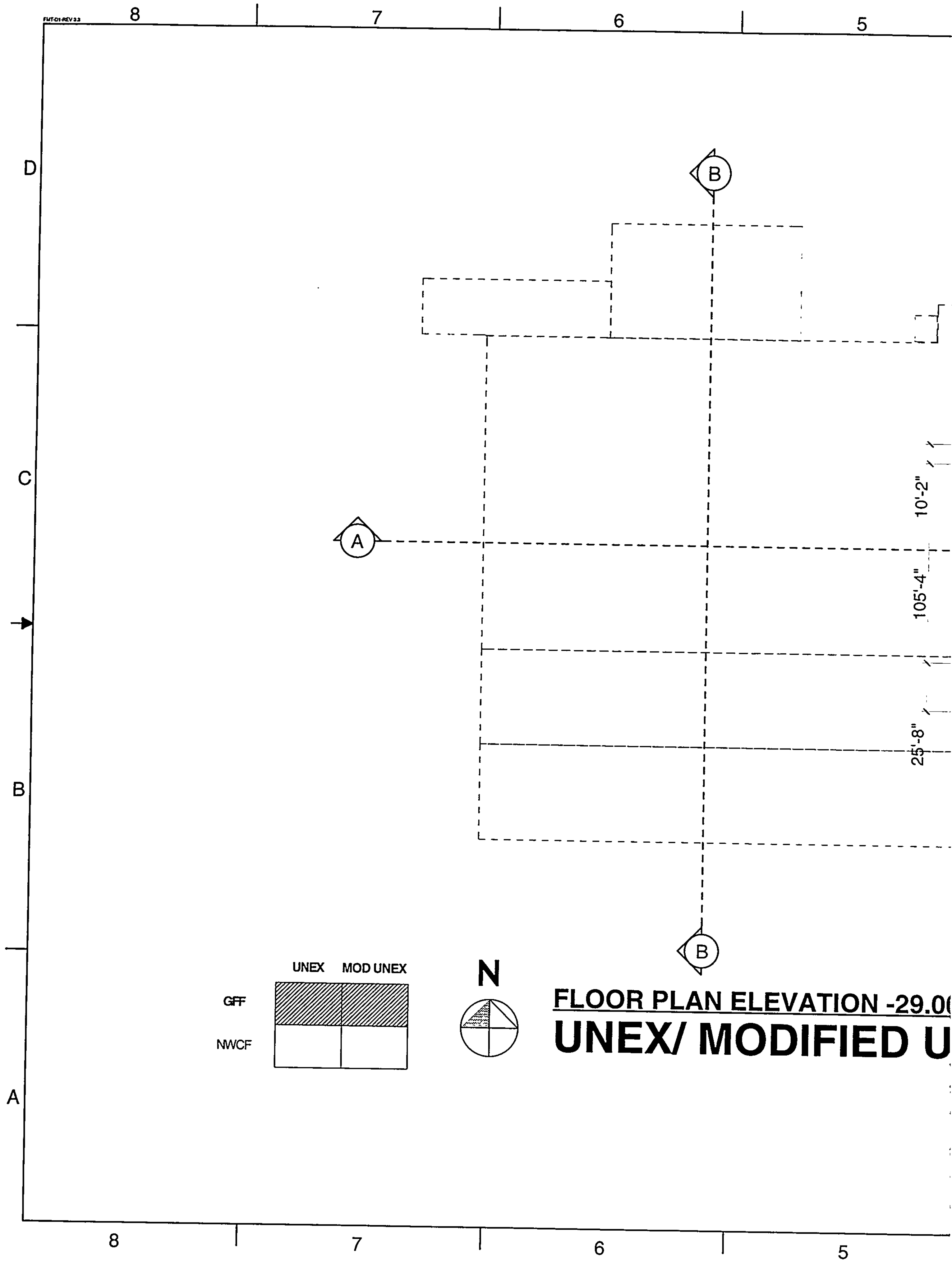
8 | 7 | 6 | 5

File: UNEX-1.dwg ID: KSK Layout Name: Layout 1
Path: P:\INTEC\UNEX Date: 08/21/00 - 4:03 P.M.

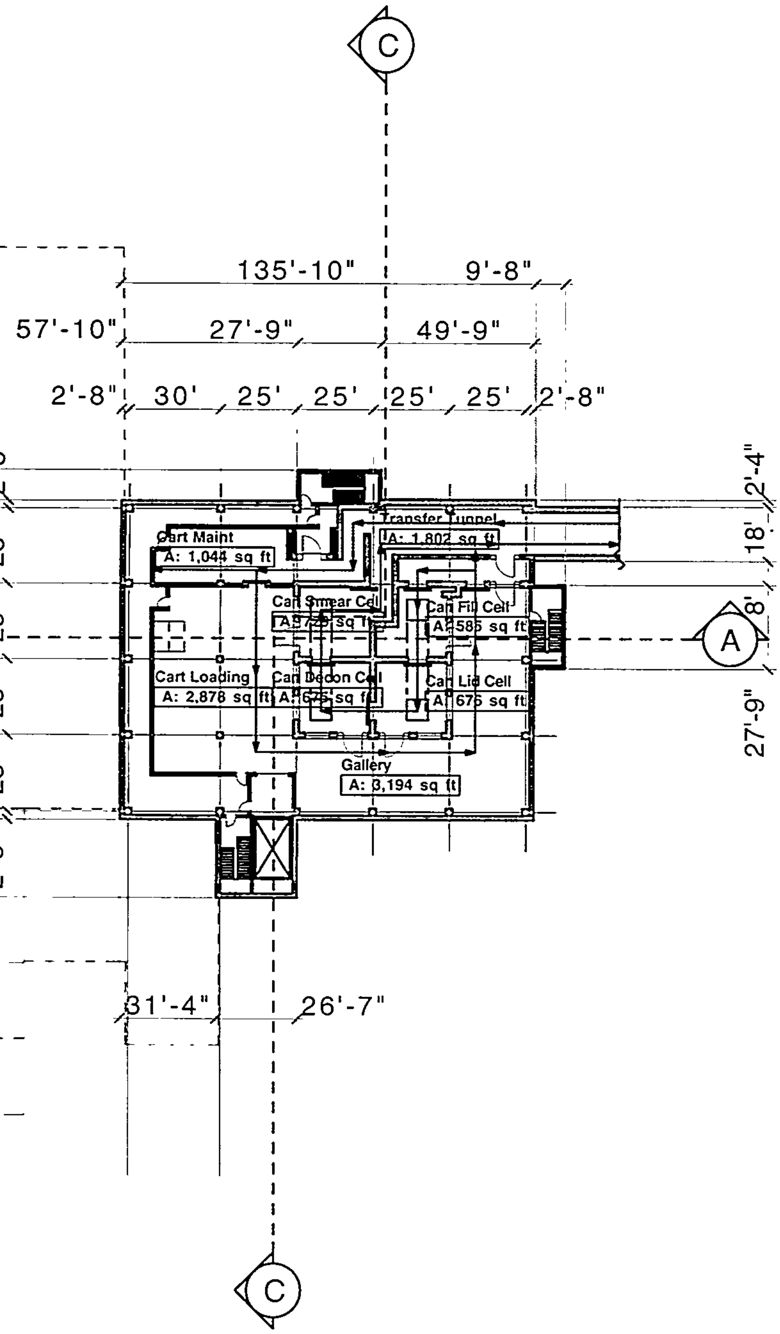
REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO, LLC
NO SCALE	REQUESTER:	INTEC
	DESIGN: R.E. JOHNSON	WASTE TREATMENT FACILITY
	DRAWN:	UNEX/MODIFIED UNEX SEPARATION
	PROJECT NO.	GREEN FIELD DESIGN STUDY
	SPEC CODE	PERSPECTIVE VIEW
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE: D; CAGE CODE: 01MF3; INDEX CODE NUMBER: AREA 200, TYPE, CL 00, ORIG 090; DWG– ; REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: NONE; SHEET A–0



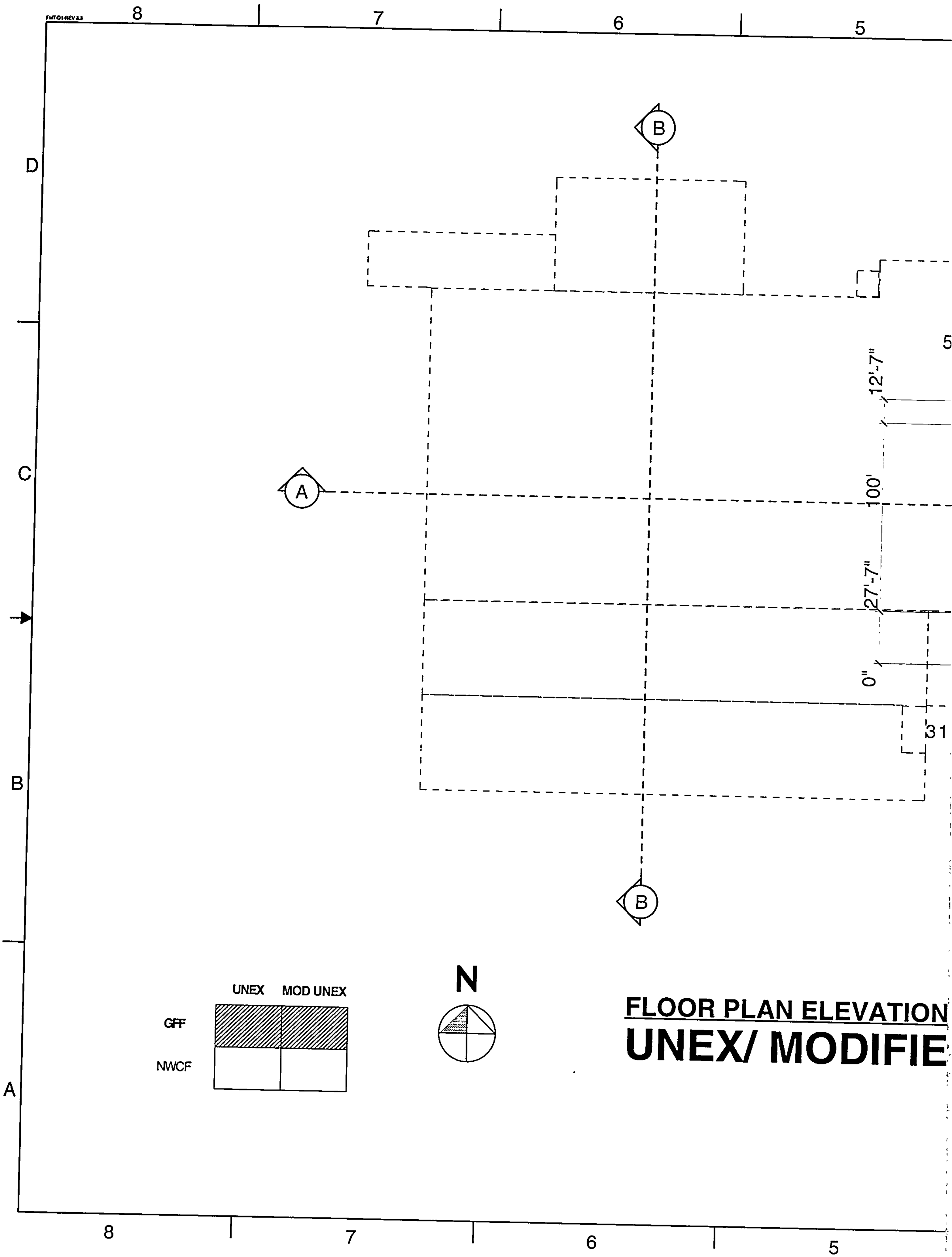
FMT-01-REV 3.3
8
7
6
5
D
C
B
A
10'-2"
105'-4"
25'-8"
UNEX
MOD UNEX
GFF
NWCF
N
FLOOR PLAN ELEVATION -29.0
UNEX/ MODIFIED U



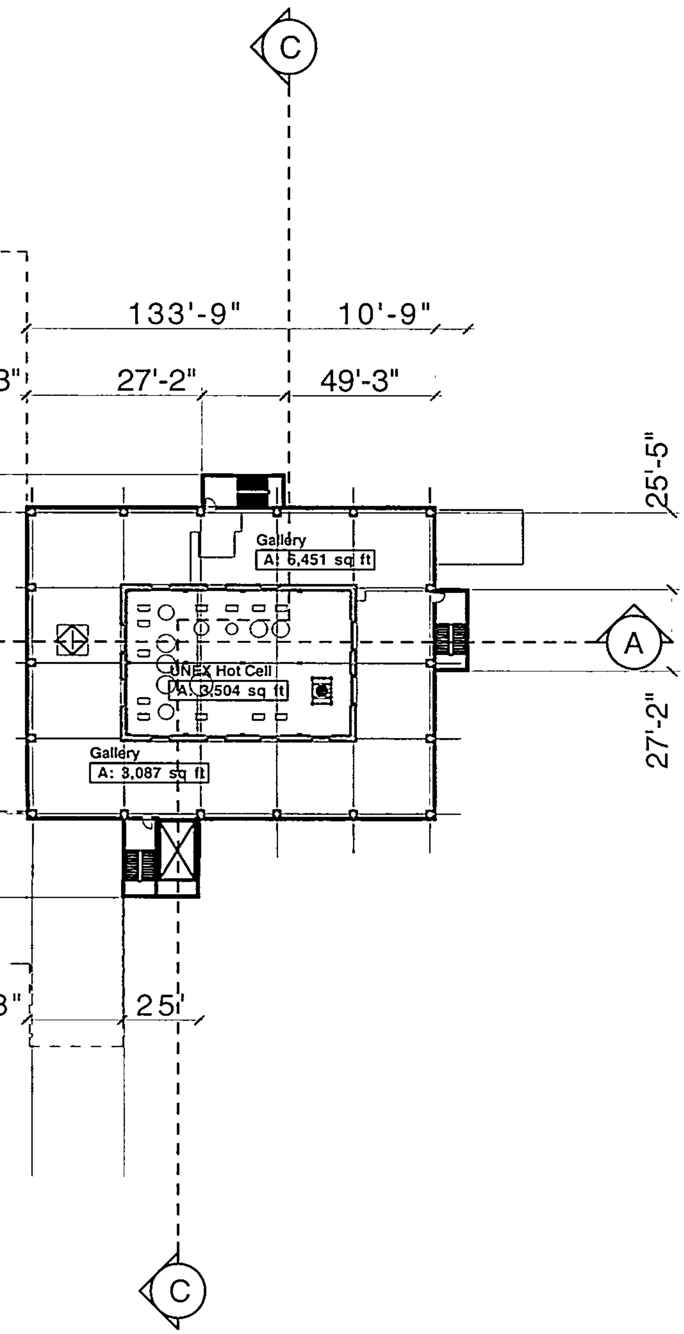
NEX SECOND BASEMENT PLAN

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE

SUBCONTRACT NO	INEEL
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	SECOND BASEMENT FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, CL, OBG. 090 · DWG- · REV
EFFECTIVE DATE.	SCALE: 1" = 30' · CFP · SHEET A-1



FMT-D1-REV 3.3
8
7
6
5
D
C
B
A
B
A
12'-7"
100'
27'-7"
0"
31
5
UNEX
MOD UNEX
GFF
NWCF
N
FLOOR PLAN ELEVATION
UNEX/ MODIFIE

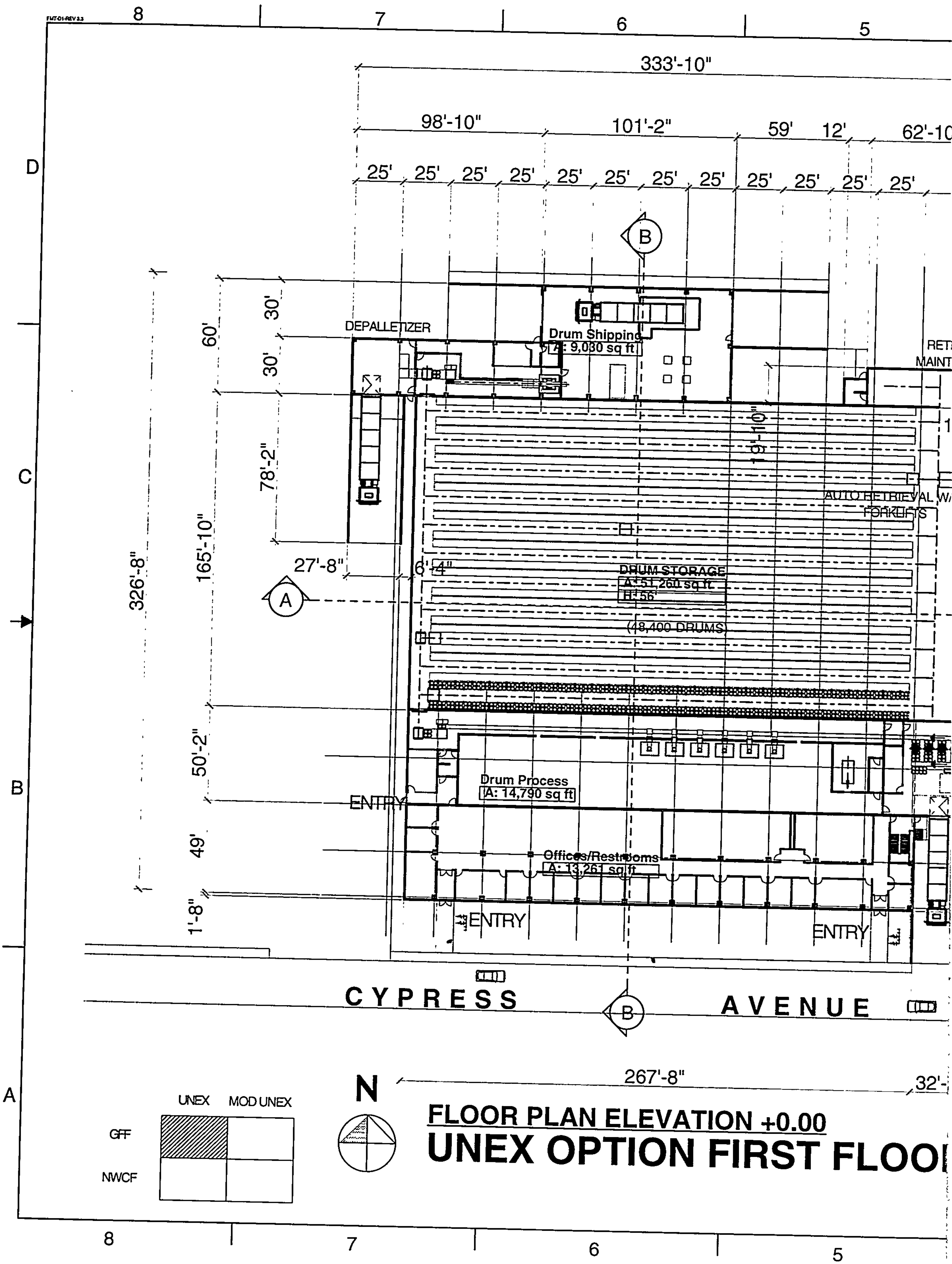


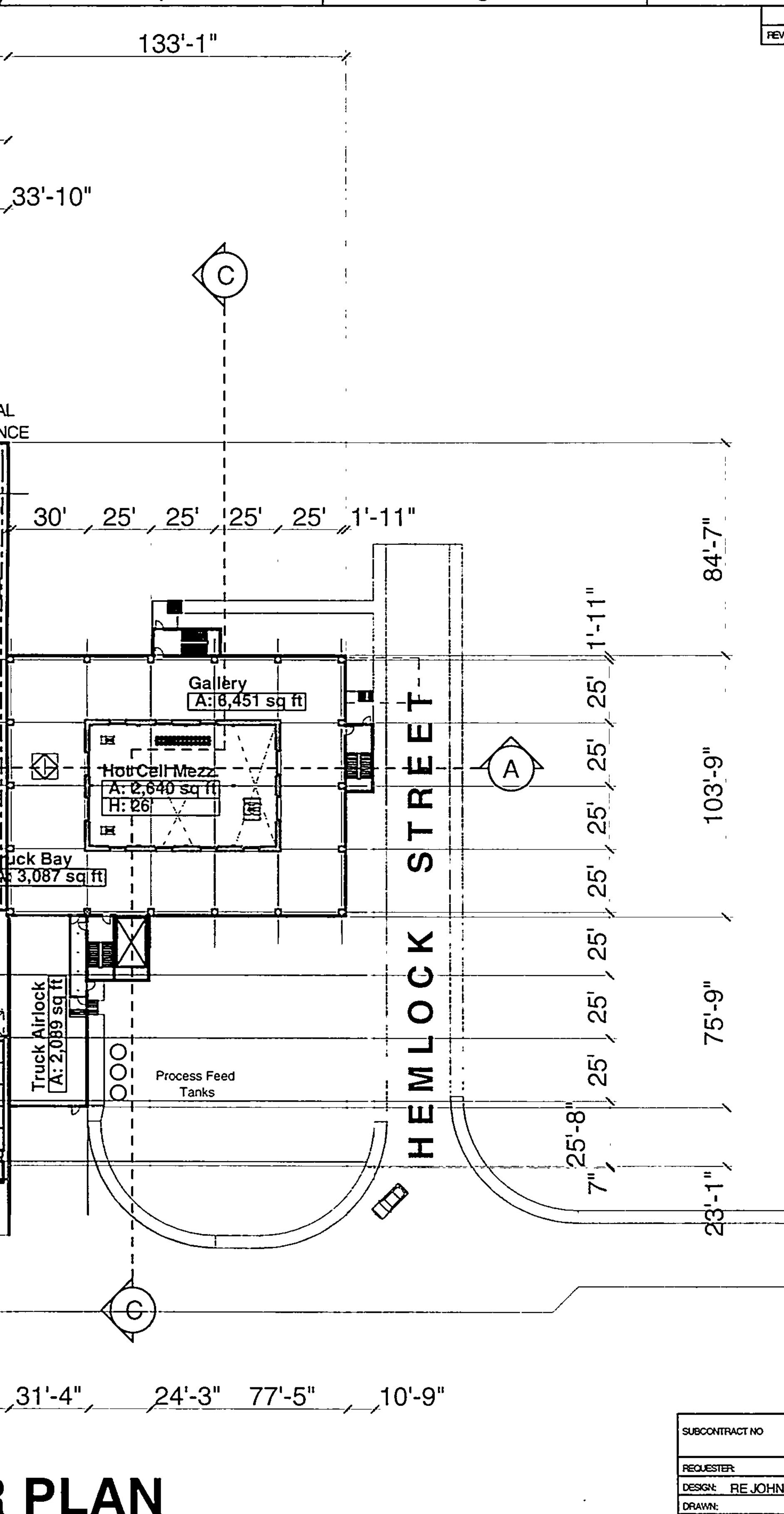
13.00

D UNEX FIRST BASEMENT PLAN

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	FIRST BASEMENT FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CL, CBG 090; DWG-; REV
EFFECTIVE DATE:	SCALE: 1" = 30'; CFP; SHEET A-2


8
7
6
5
D
C
B
A
333'-10"
98'-10"
101'-2"
59'
12'
25'
DEPALLETIZER
Drum Shipping
A: 9,030 sq ft
60'
30'
30'
78'-2"
19'-10"
165'-10"
326'-8"
27'-8"
6'-4"
FORKLIFTS
DRUM STORAGE
A: 51,260 sq ft
H: 56'
(48,400 DRUMS)
50'-2"
Drum Process
A: 14,790 sq ft
ENTRY
49'
Offices/Restrooms
A: 13,261 sq ft
1'-8"
ENTRY
ENTRY
CYPRESS AVENUE
267'-8"
N
UNEX
MOD UNEX
GFF
NWCF
FLOOR PLAN ELEVATION +0.00
UNEX OPTION FIRST FLOO



REVISIONS

REV	DESCRIPTION	EFFECTIVE DATE:

SUBCONTRACT NO

REQUESTER:

DESIGN: RE JOHNSON, RA

DRAWN:

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO

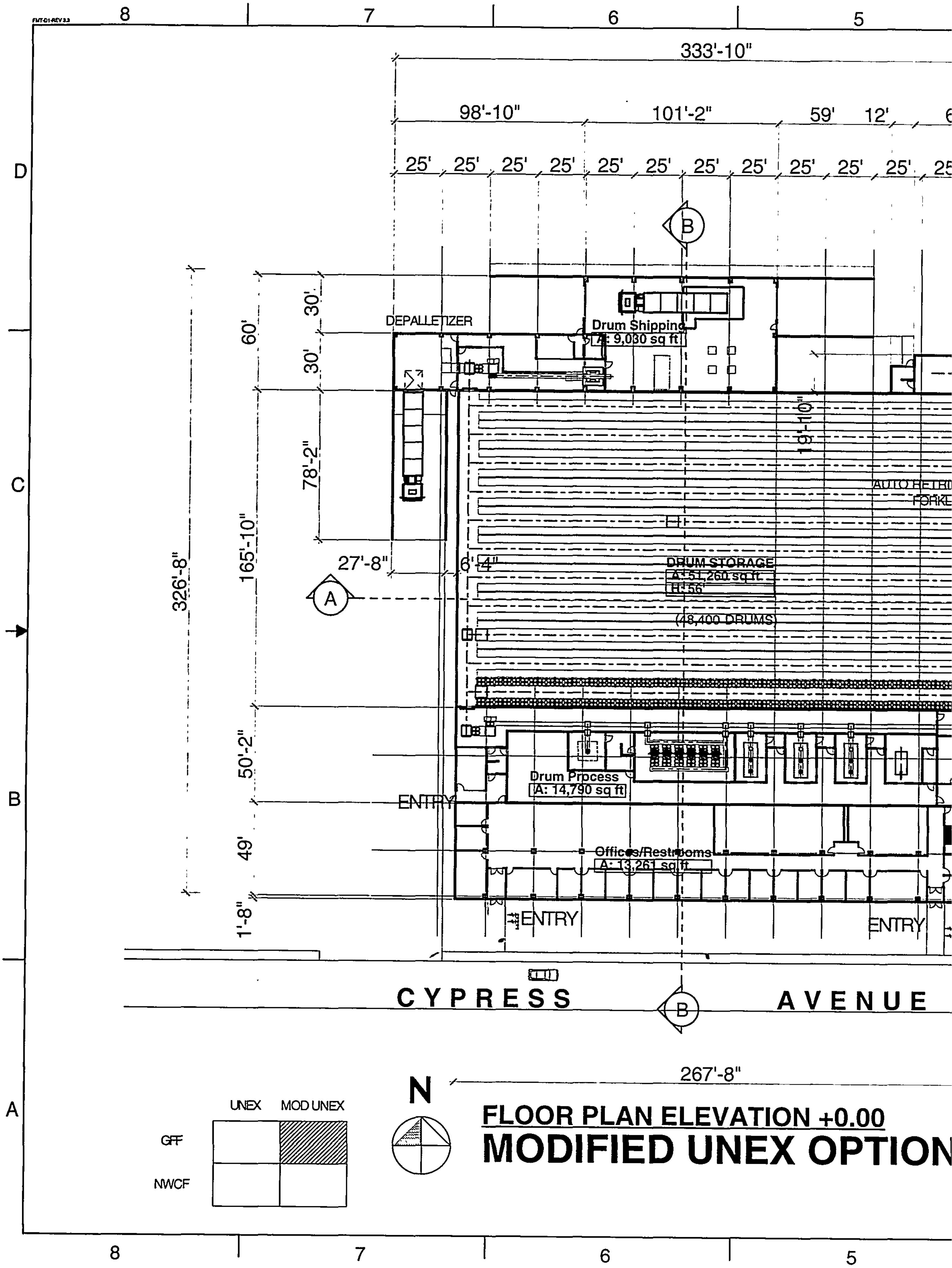
EFFECTIVE DATE:

INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO LLC

INTEC
WASTE TREATMENT FACILITY
UNEX/ MODIFIED UNEX SEPARATION
GREEN FIELD DESIGN STUDY
UNEX OPTION FIRST FLOOR PLAN

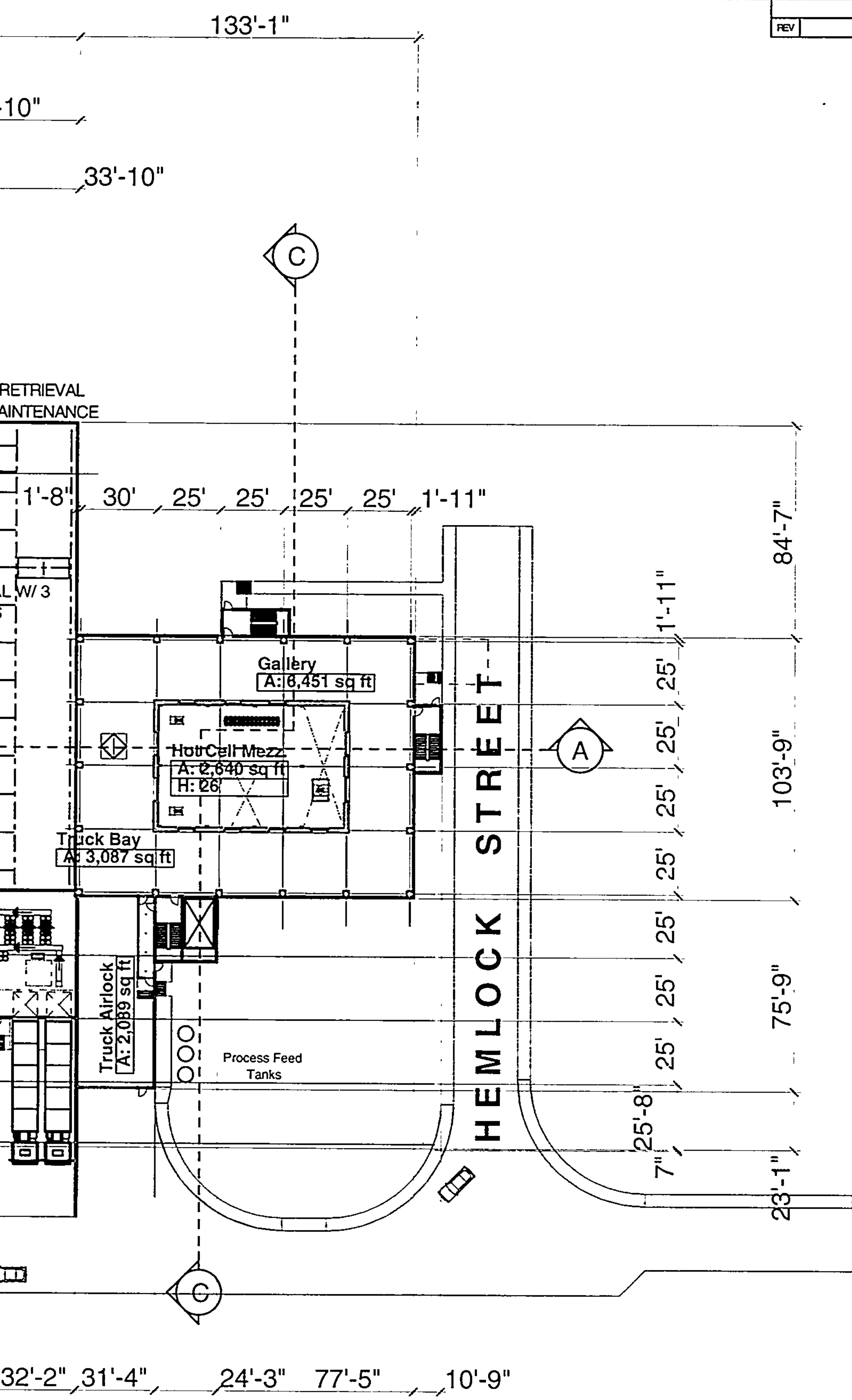
SIZE	CAGE CODE	INDEX CODE NUMBER AREA	TYPE	CI	OBG	DWG-	REV
D	01MF3				090		

SCALE: 1" = 30'   CFP   SHEET A-3



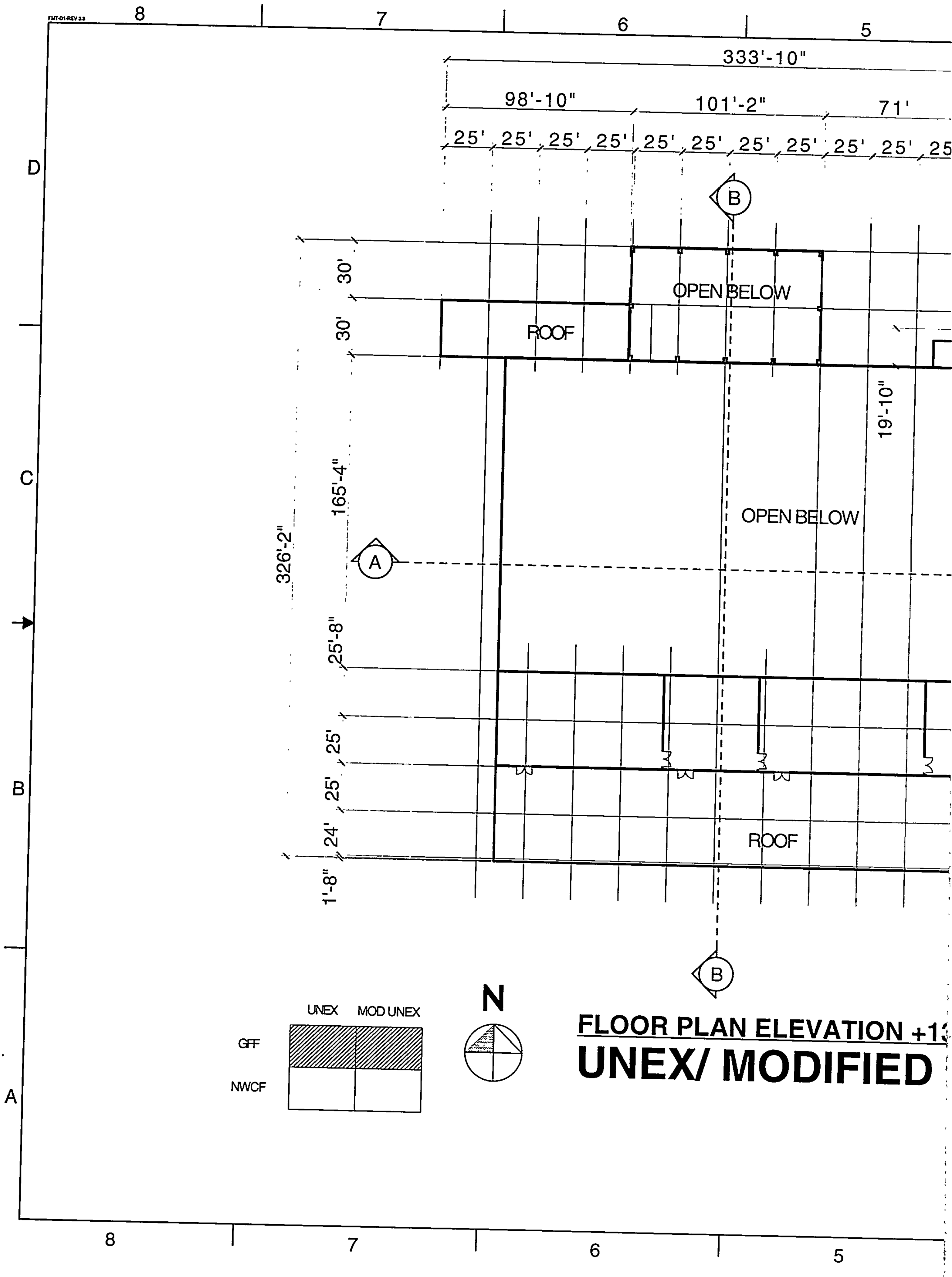
333'-10"
98'-10"
101'-2"
59'
12'
25'
DEPALLETIZER
Drum Shipping
A: 9,030 sq ft
30'
60'
78'-2"
19'-10"
165'-10"
326'-8"
27'-8"
6'-4"
DRUM STORAGE
A: 51,260 sq ft
H: 56'
(48,400 DRUMS)
AUTO RETRI
FORKL
Drum Process
A: 14,790 sq ft
50'-2"
ENTRY
49'
Offices/Restrooms
A: 13,261 sq ft
1'-8"
ENTRY
ENTRY
CYPRESS AVENUE
267'-8"
N
UNEX
MOD UNEX
GFF
NWCF
FLOOR PLAN ELEVATION +0.00
MODIFIED UNEX OPTION

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

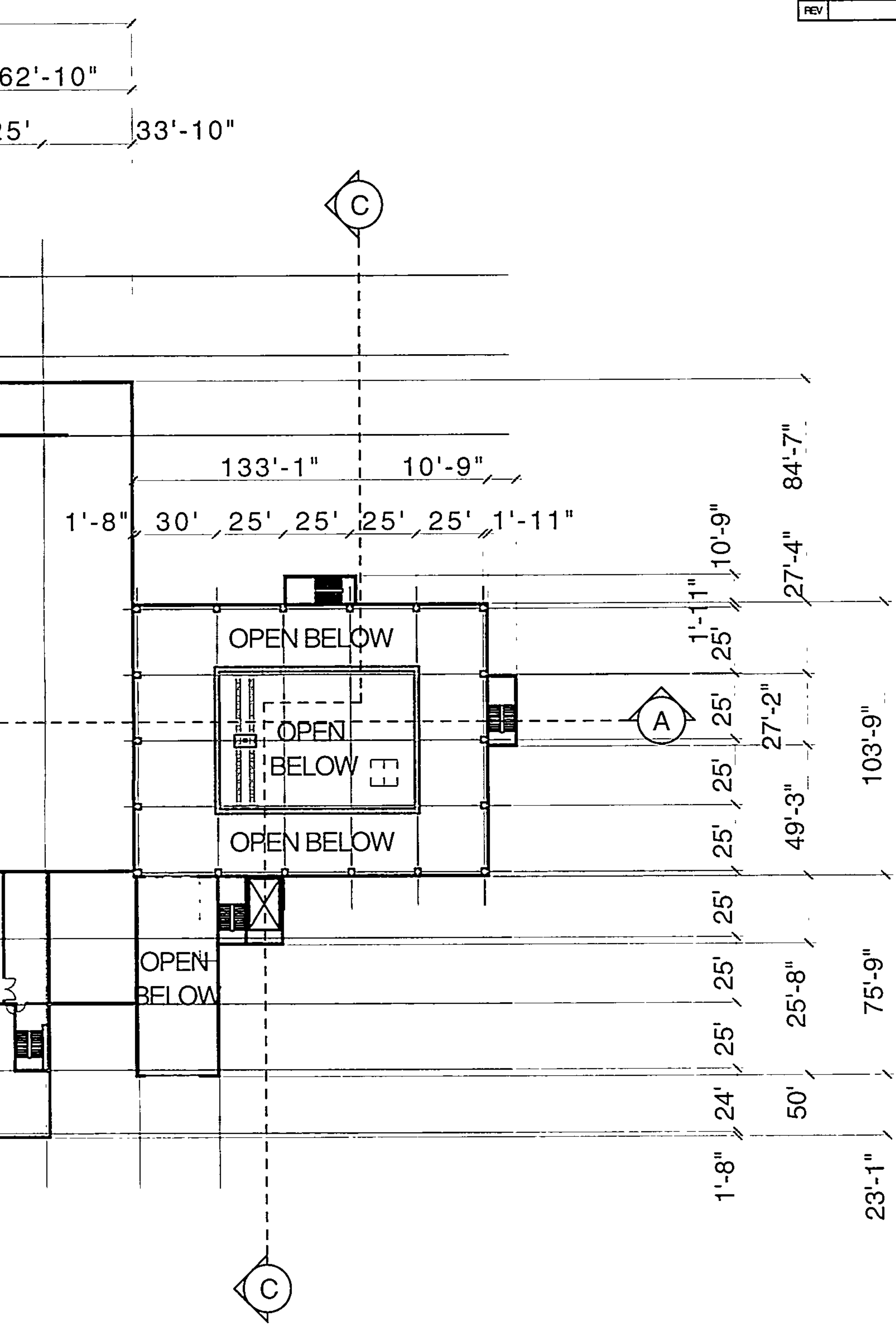


FIRST FLOOR PLAN

SUBCONTRACT NO	INEEL BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	MODIFIED UNEX OPTION FIRST FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER AREA TYPE CL CBG 090; DWG-; REV
EFFECTIVE DATE:	SCALE: 1" = 30'; CPP; SHEET A-3m



333'-10"
98'-10"
101'-2"
71'
25' 25' 25' 25' 25' 25' 25' 25' 25' 25' 25
30'
30'
165'-4"
326'-2"
25'-8"
25'
25'
24'
1'-8"
19'-10"
OPEN BELOW
ROOF
OPEN BELOW
ROOF
A
B
B
UNEX
MOD UNEX
GFF
NWCF
N
FLOOR PLAN ELEVATION +1
UNEX/ MODIFIED
8 7 6 5
D C B A

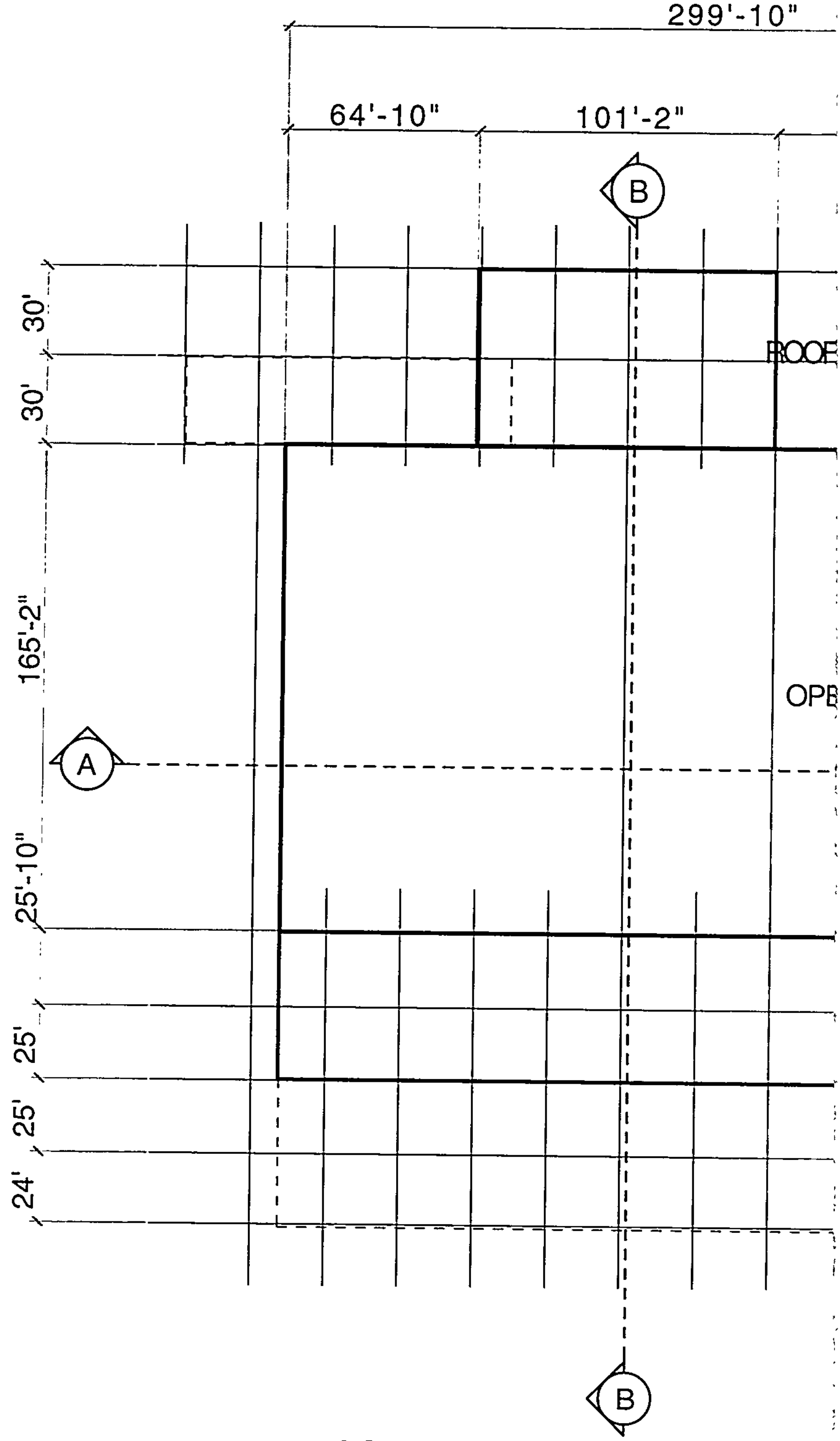


00

UNEX SECOND FLOOR PLAN

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

SUBCONTRACT NO.	INEEL
REQUESTER:	INTEC WASTE TREATMENT FACILITY UNEX/ MODIFIED UNEX SEPARATION GREEN FIELD DESIGN STUDY SECOND FLOOR PLAN
DESIGN: RE JOHNSON, RA	
DRAWN:	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, CI, ORG. 090 · DWG- · REV
EFFECTIVE DATE.	SCALE: 1" = 30' · CFP · SHEET A-4



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GFF		
NWCF		

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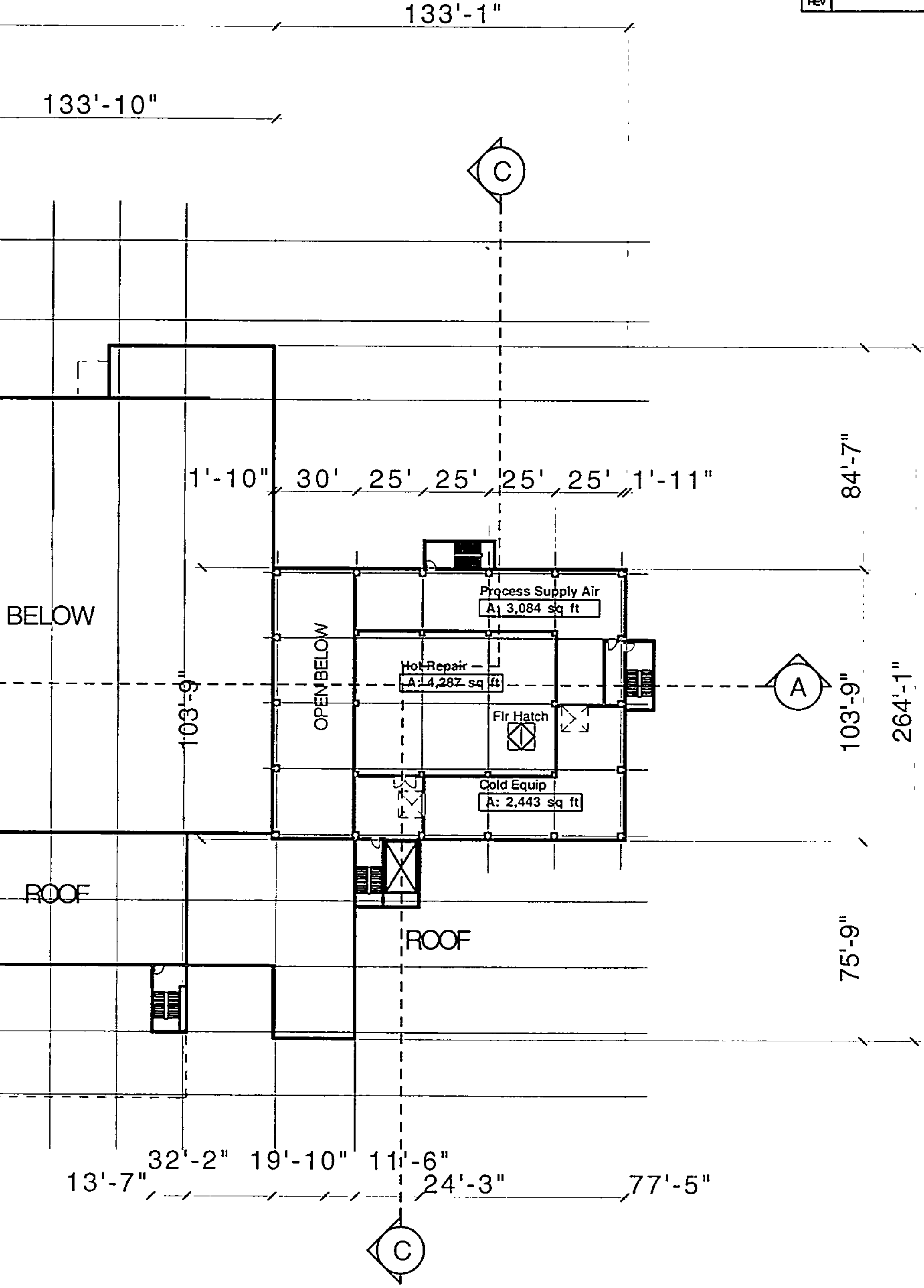
FLOOR PLAN ELEV

UNEX/ MOD

REV	DESCRIPTION	EFFECTIVE DATE:



ATION +13.00

IFIED UNEX THIRD FLOOR PLAN

SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	THIRD FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CI, OBG 090; DWG-; REV
EFFECTIVE DATE.	SCALE: 1" = 30'; CFP; SHEET A-5

FMT-01-REV 3.3

8 7 6 5

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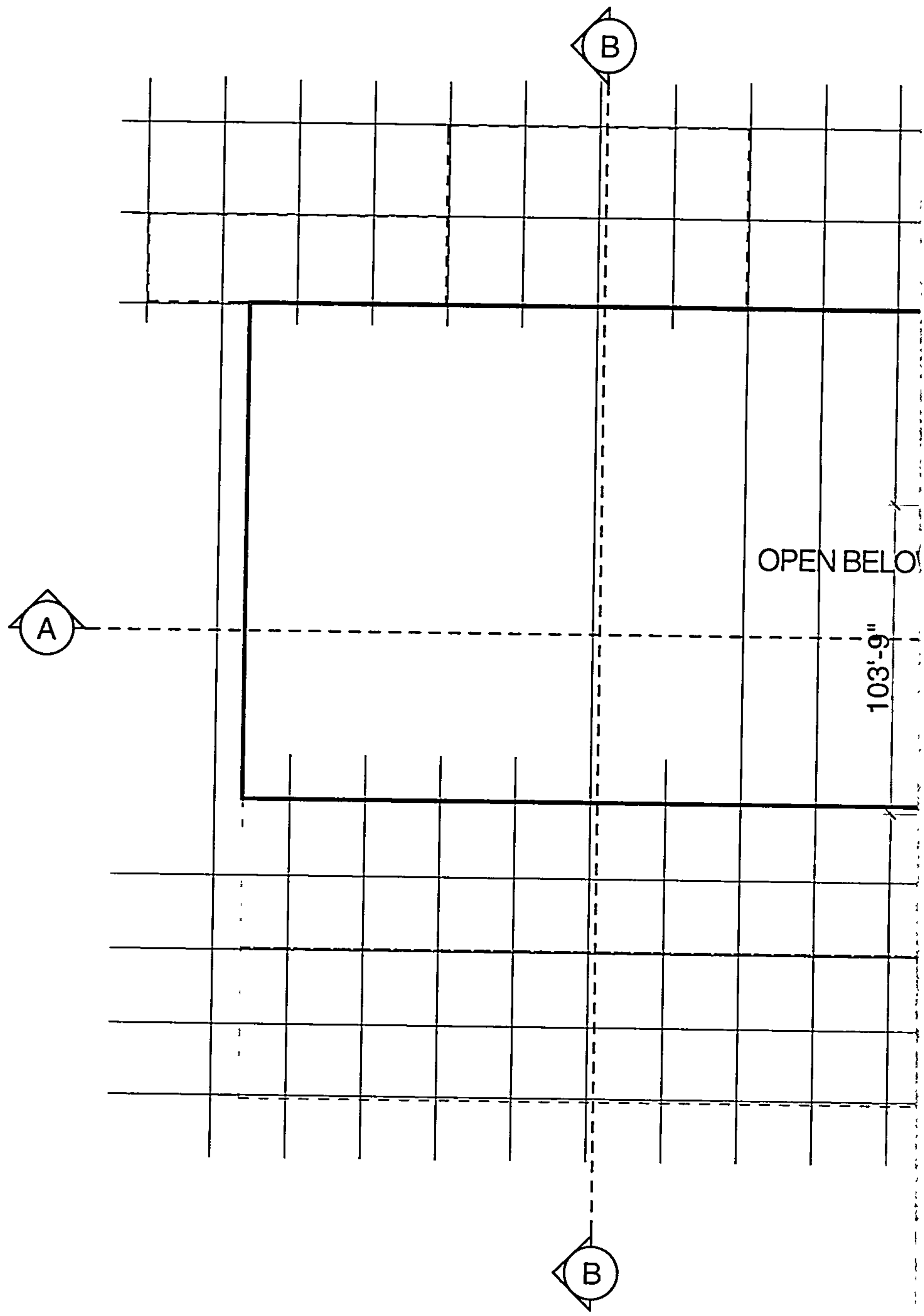

	UNEX	MOD UNEX
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NWCF		

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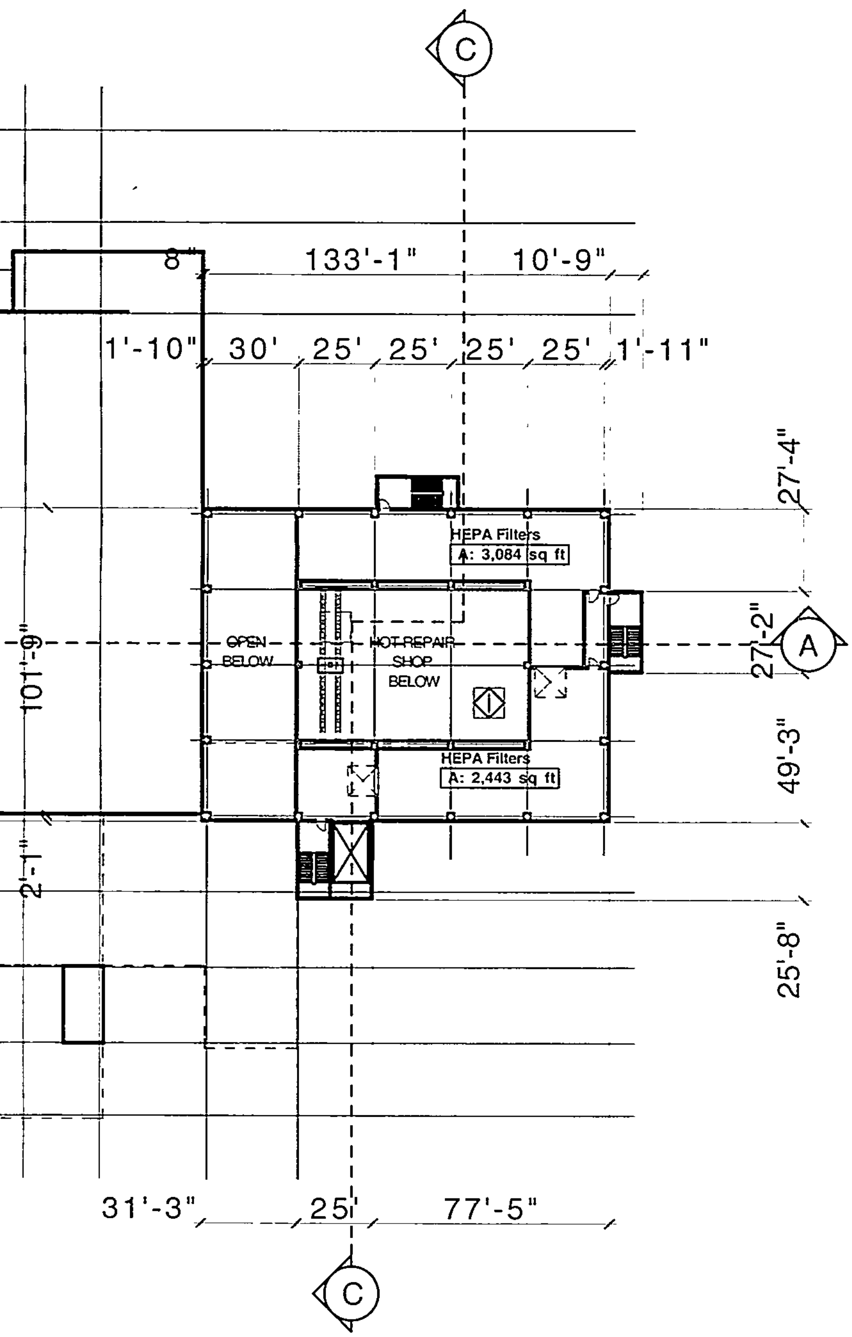
FLOOR PLAN ELEVA

UNEX/ MODI

8 7 6 5

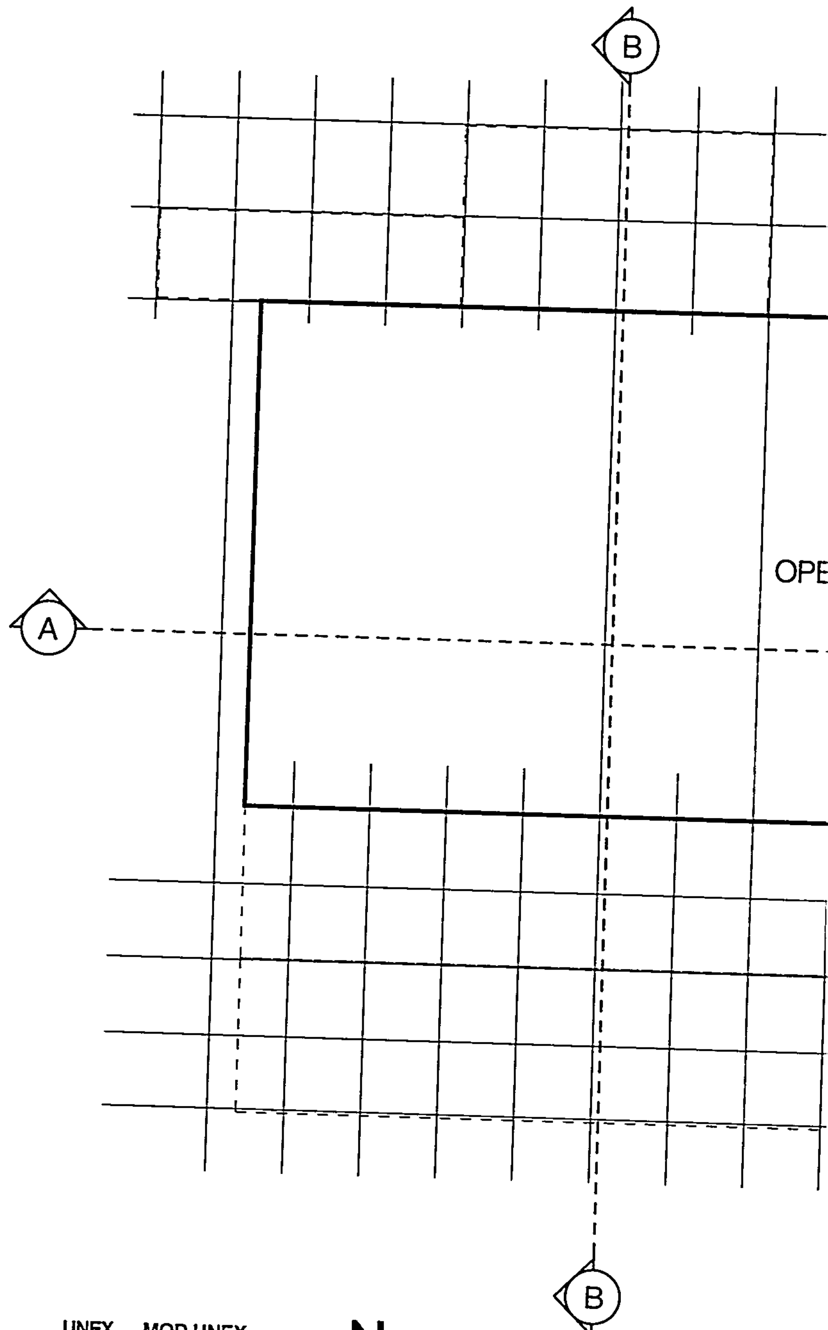
REV	REVISIONS DESCRIPTION	EFFECTIVE DATE:



TION +39.00

FIED UNEX FOURTH FLOOR PLAN

SUBCONTRACT NO.	INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	FOURTH FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CI, ORG 090; DWG-; REV
EFFECTIVE DATE.	SCALE: 1" = 30'; CFP; SHEET A-6



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GFF		
NWCF		

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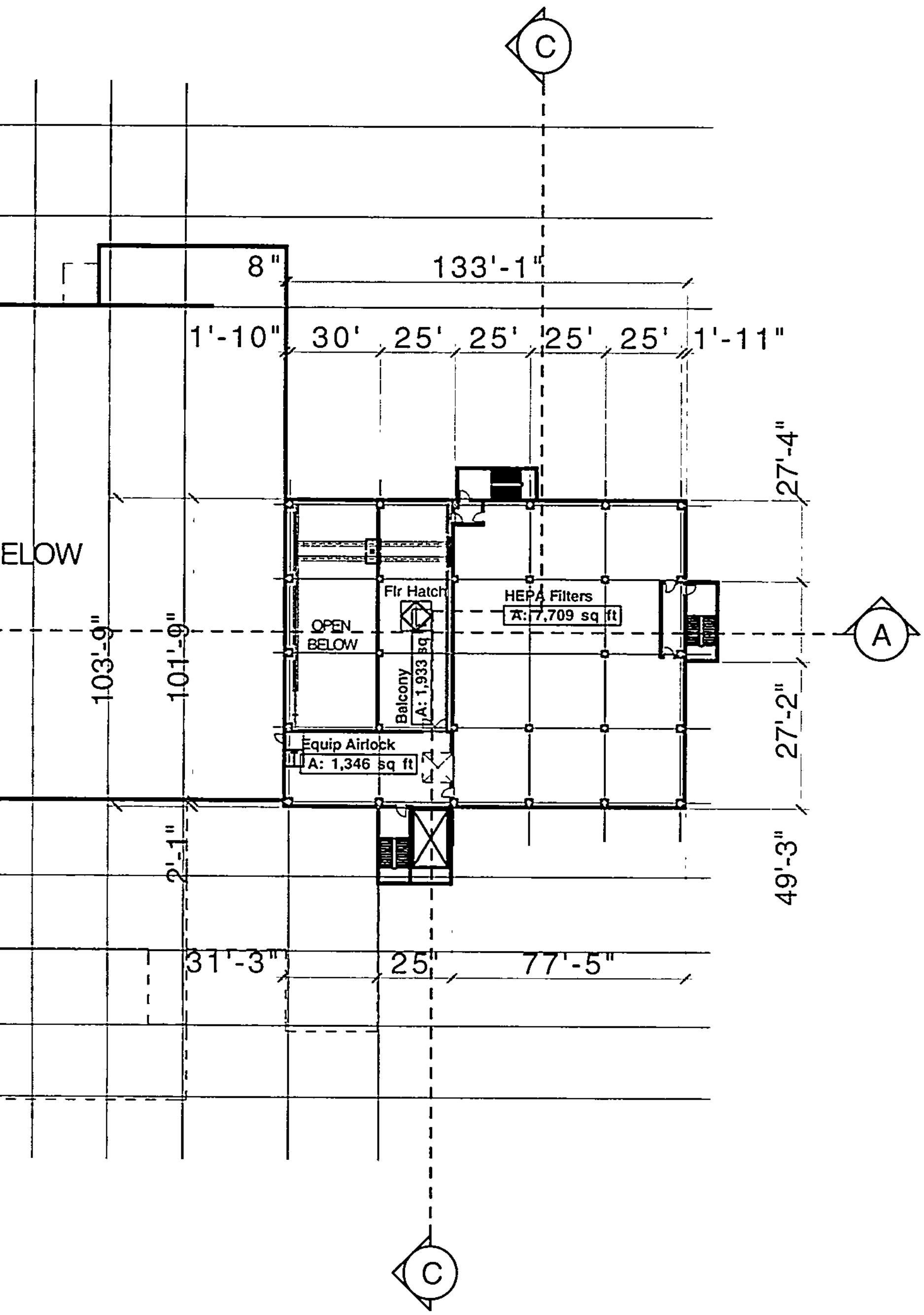
FLOOR PLAN ELE

UNEX/ MOI

4	3	2	1

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



D

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B

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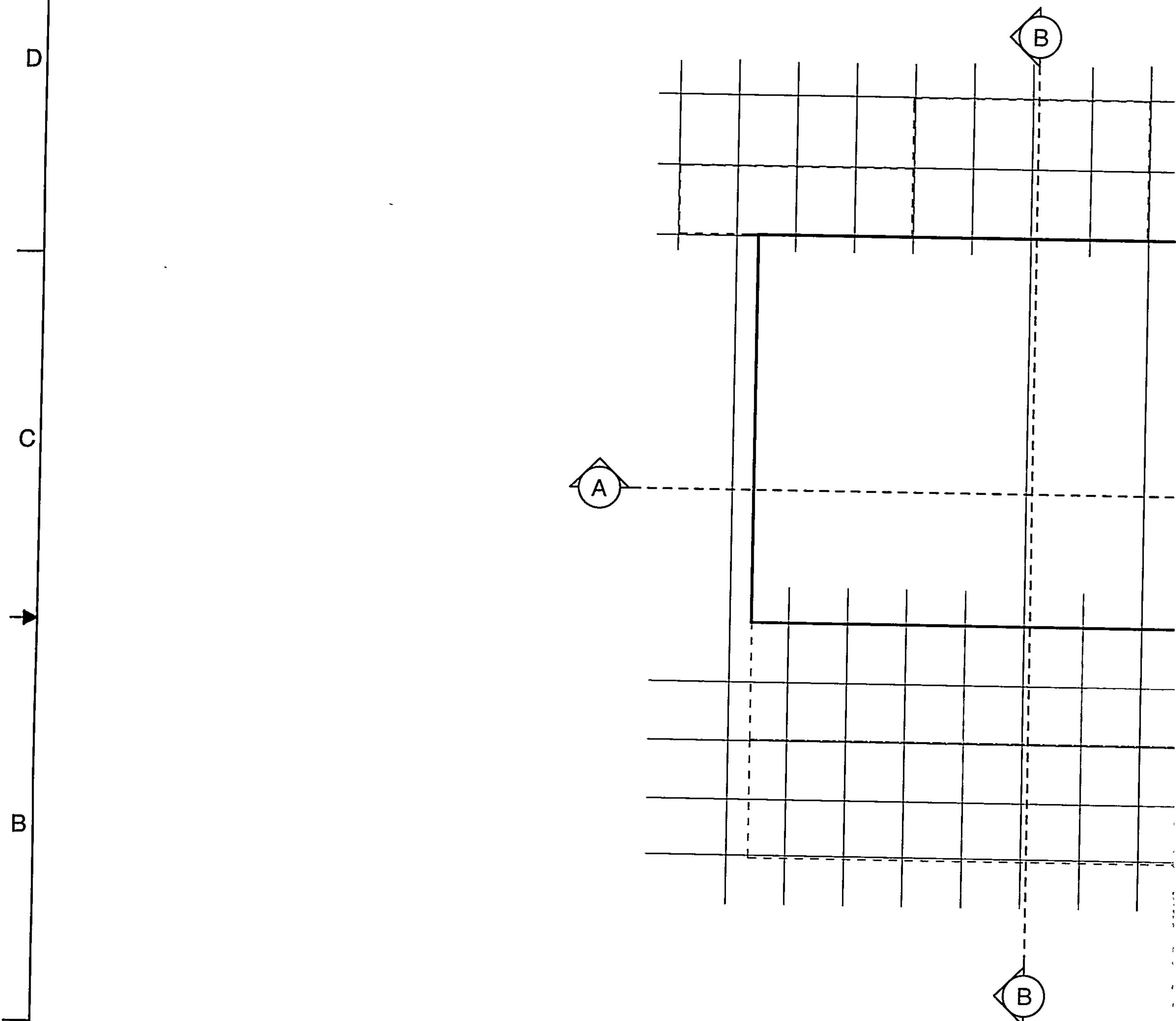
ATION +52.00

IFIED UNEX FIFTH FLOOR PLAN

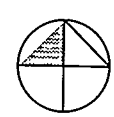
SUBCONTRACT NO.	INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO LLC
REQUESTER:	
DESIGN: RE JOHNSON, RA	INTEC WASTE TREATMENT FACILITY UNEX/ MODIFIED UNEX SEPARATION GREEN FIELD DESIGN STUDY FIFTH FLOOR PLAN
DRAWN:	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CL, ORG. 090; DWG-; REV
EFFECTIVE DATE:	SCALE: 1" = 30'; CPP; SHEET A-7

4	3	2	1

8	7	6	5



	UNEX	MOD UNEX
GFF		
NWCF		



FLOOR PLAN EL

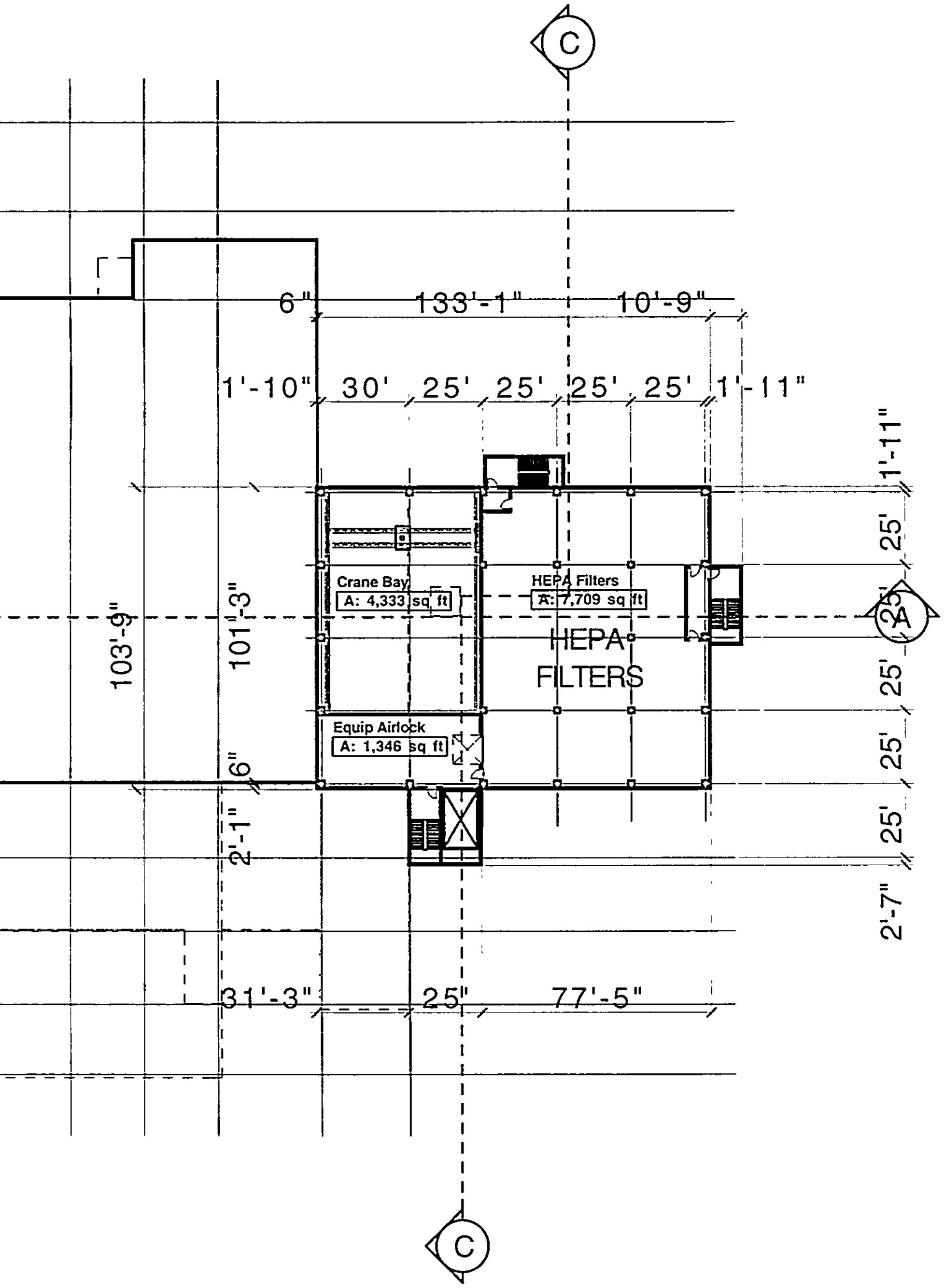
UNEX/ MO

8	7	6	5

4	3	2	1

REVISIONS

REV	DESCRIPTION	EFFECTIVE DATE:



D

C

B

A

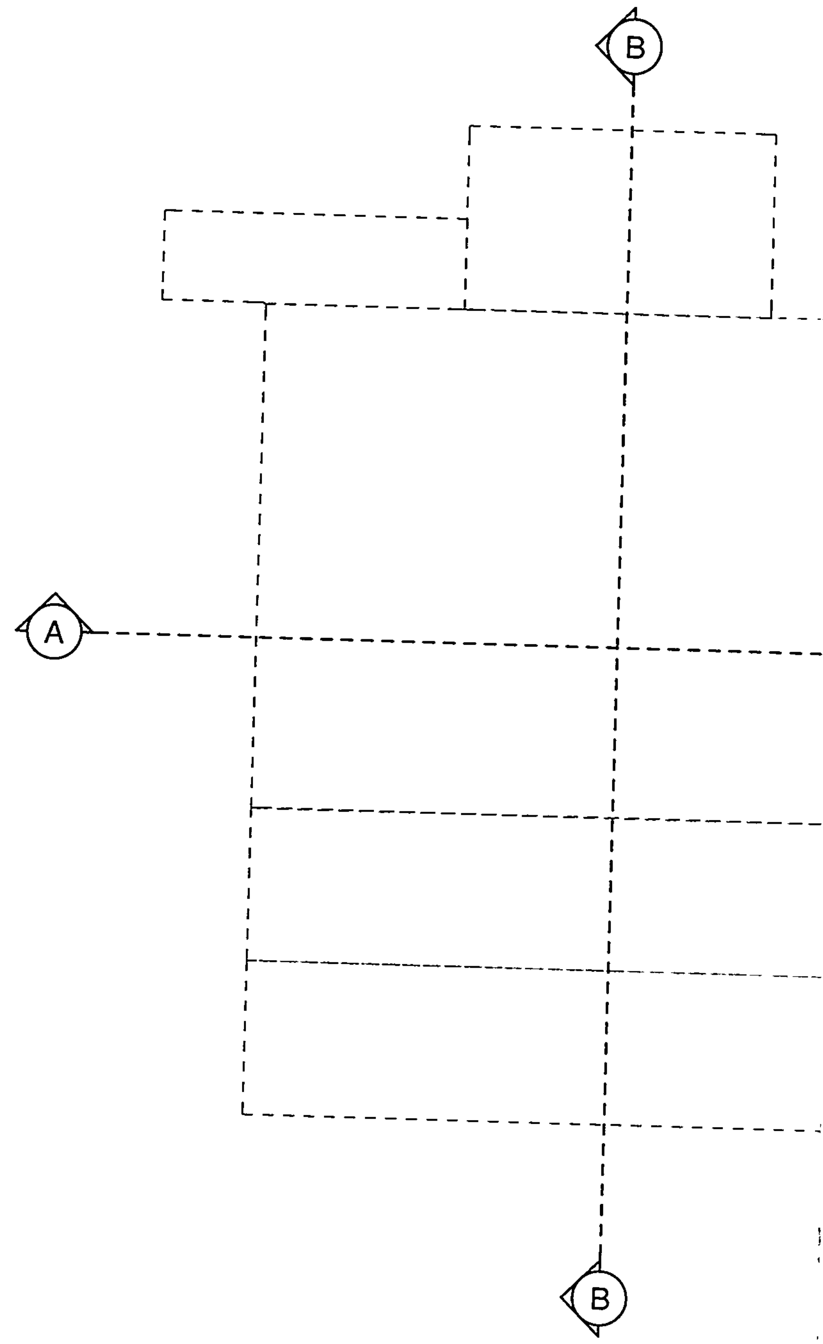
VATION +65.00

DIFIED UNEX SIXTH FLOOR PLAN

SUBCONTRACT NO.	INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN:	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	SIXTH FLOOR PLAN
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA · TYPE · CI · OBG 090 · DWG- · REV
EFFECTIVE DATE:	SCALE: 1" = 30' · CPP · SHEET A-8

4	3	2	1

FMT-01-REV 3.3



	UNEX	MOD UNEX
GFF		
NWCF		

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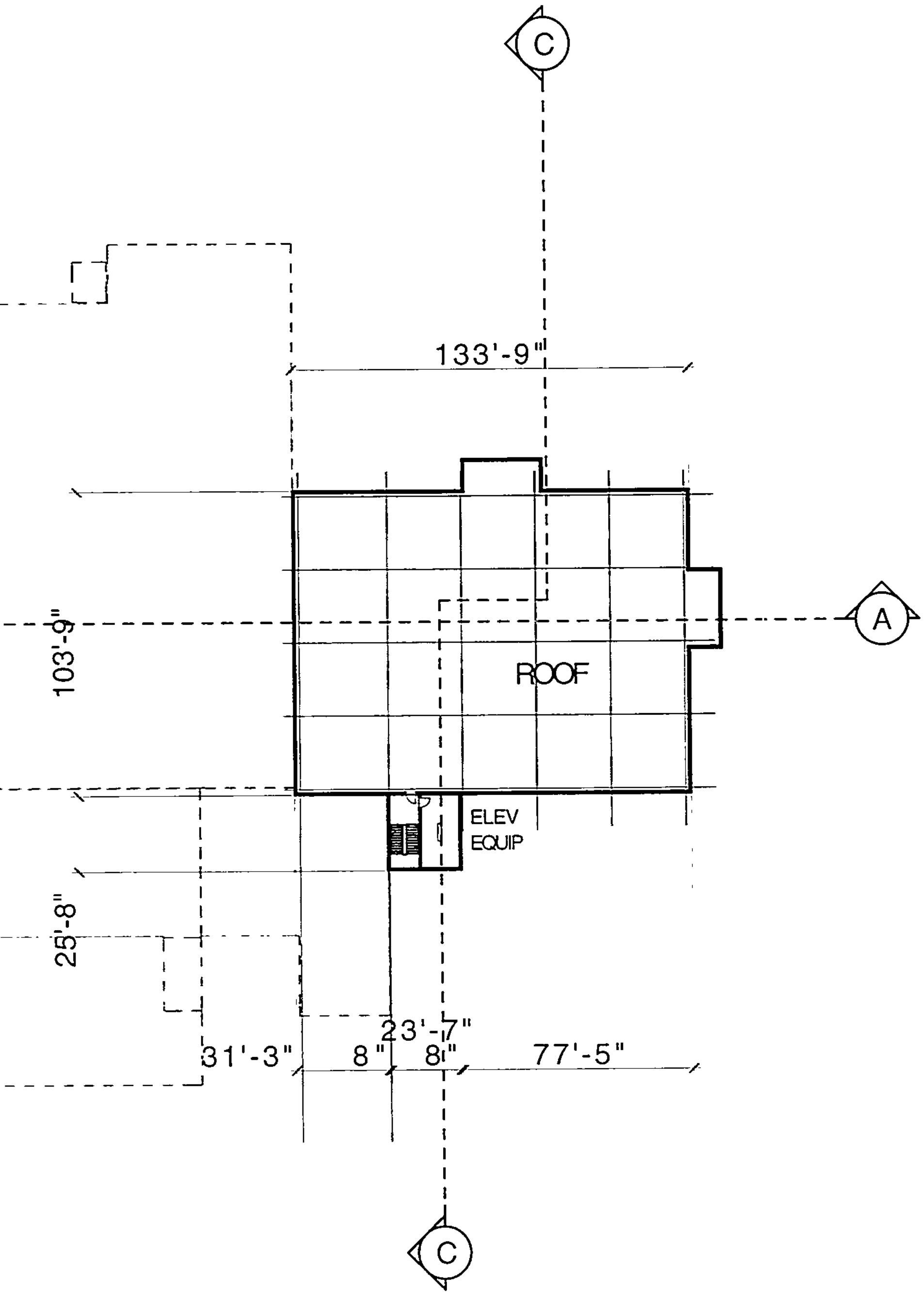
FLOOR PLAN

UNEX/ M

REV	REVISIONS DESCRIPTION	EFFECTIVE DATE:



LEVATION +78.00

ODIFIED UNEX ROOF PLAN

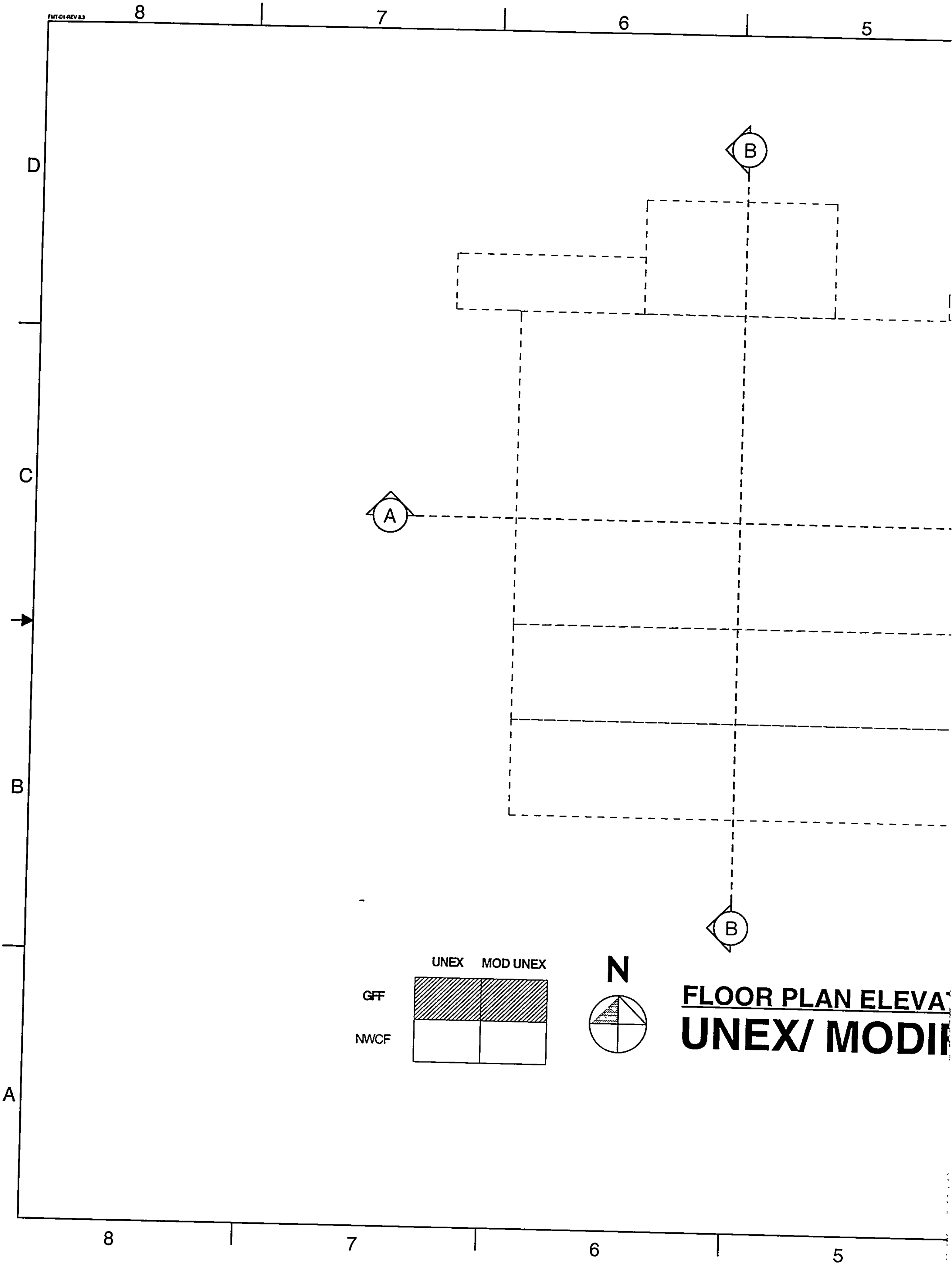
SUBCONTRACT NO.

INEEL
BECHTEL BWXT IDAHO LLC

REQUESTER:
DESIGN: RE JOHNSON, RA
DRAWN:
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

INTEC
WASTE TREATMENT FACILITY
UNEX/ MODIFIED UNEX SEPARATION
GREEN FIELD DESIGN STUDY
ROOF PLAN

SIZE: D
CAGE CODE: 01MF3
INDEX CODE NUMBER: AREA TYPE CL OBG 090
DWG-
REV
SCALE: 1" = 30'
CFP
SHEET A-9



8
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MOD UNEX
GFF
NWCF
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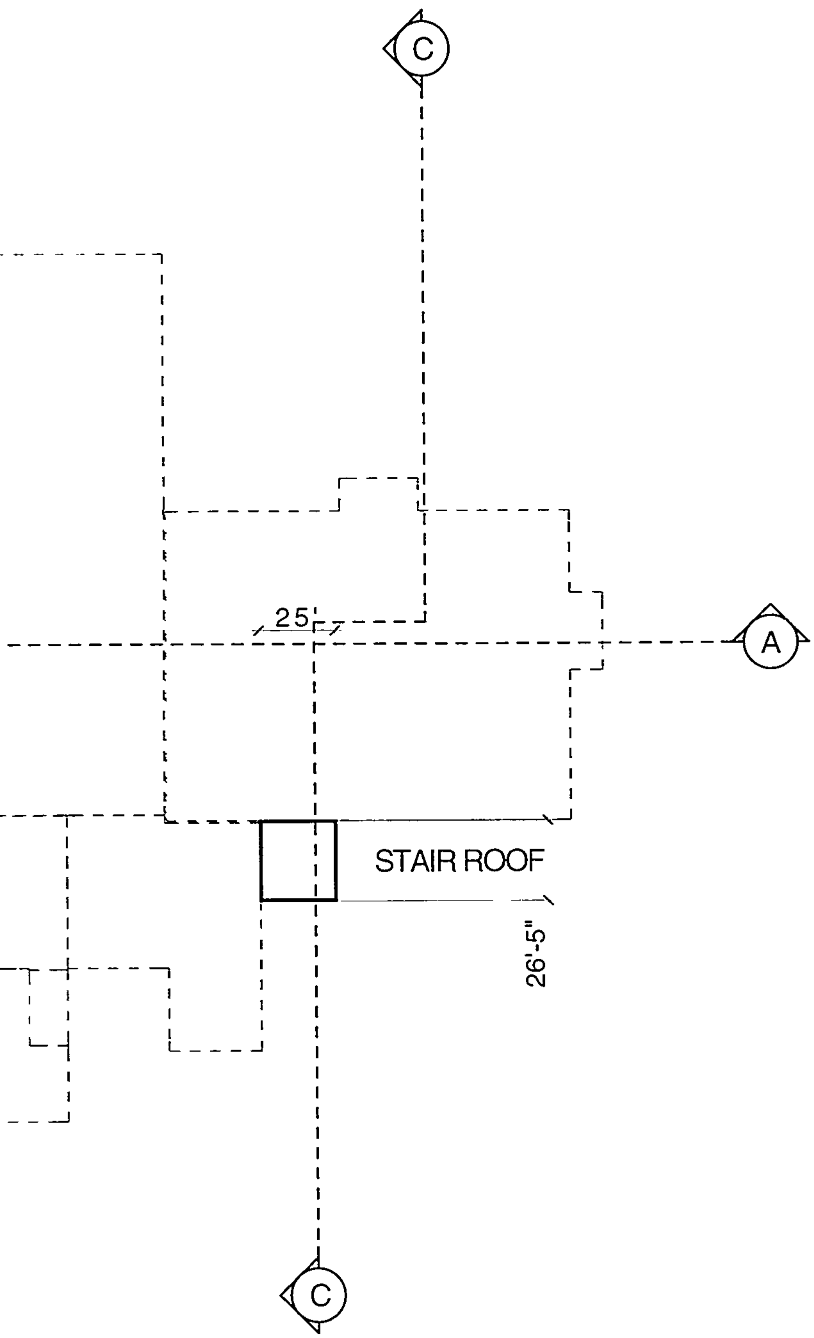
FLOOR PLAN ELEVA
UNEX/ MODI

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



ON +91.00

IED UNEX STAIR ROOF PLAN

SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC WASTE TREATMENT FACILITY UNEX/ MODIFIED UNEX SEPARATION GREEN FIELD DESIGN STUDY STAIR ROOF PLAN
DESIGN: RE JOHNSON, RA	
DRAWN:	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE 01MF3; INDEX CODE NUMBER: AREA, TYPE, CL, ORIG 090; DWG-; REV
EFFECTIVE DATE.	SCALE: 1" = 30'; CFP; SHEET A-10

8 7 6 5

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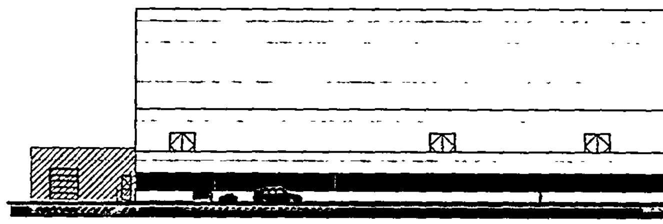
C



B

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GFF		
NWCF		

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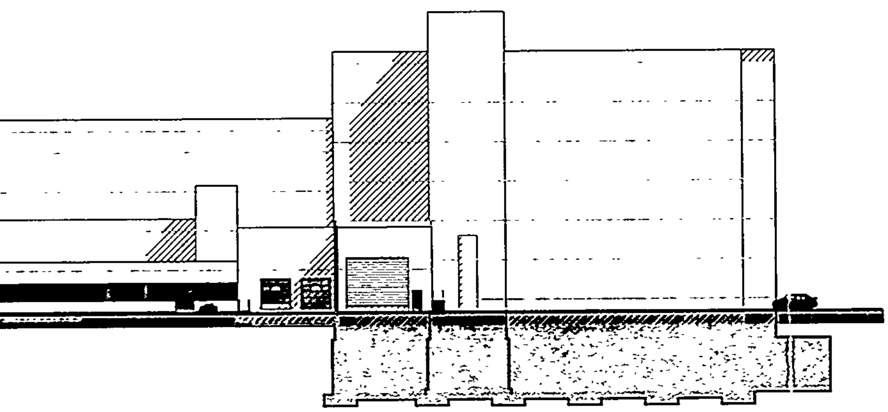
8 7 6 5

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE



UNEX SOUTH EXTERIOR ELEVATION

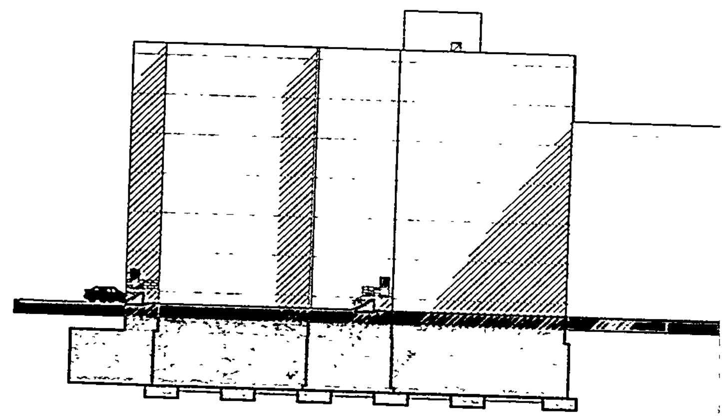
SUBCONTRACT NO	INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC WASTE TREATMENT FACILITY UNEX/MODIFIED UNEX SEPARATION GREEN FIELD DESIGN STUDY SOUTH EXTERIOR ELEVATION
DESIGN: RE JOHNSON, RA	
DRAWN:	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA · TYPE · CL · CBG 090 · DWG- · REV
EFFECTIVE DATE:	SCALE: 1" = 30' · CPP · SHEET A-11

FMT-D1-REV 3.3

8 7 6 5

D

C



B

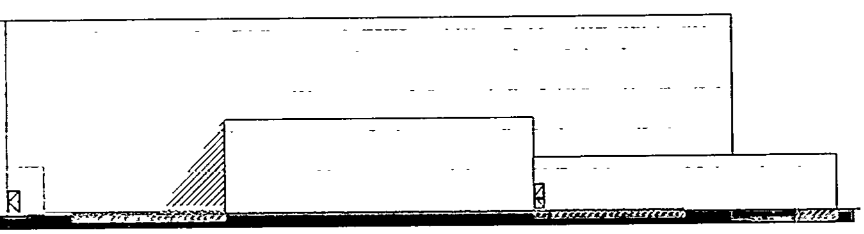
	UNEX	MOD UNEX
GFF		
NWCF		

UNEX/ MODIFIED

A

8 7 6 5

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



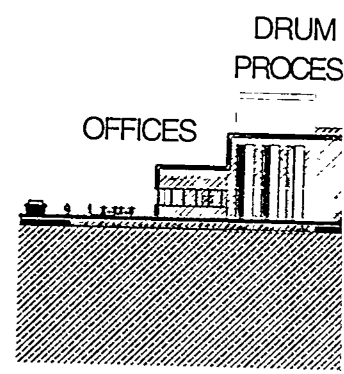
UNEX NORTH EXTERIOR ELEVATION

SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO LLC
REQUESTER:	INTEC
DESIGN: RE JOHNSON, RA	WASTE TREATMENT FACILITY
DRAWN.	UNEX/ MODIFIED UNEX SEPARATION
PROJECT NO.	GREEN FIELD DESIGN STUDY
SPEC CODE	NORTH EXTERIOR ELEVATION
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D CAGE CODE 01MF3 INDEX CODE NUMBER AREA TYPE CI ORG. 090 DWG- REV
EFFECTIVE DATE.	SCALE: 1" = 30' CFP SHEET A-12

8 7 6 5

D

C



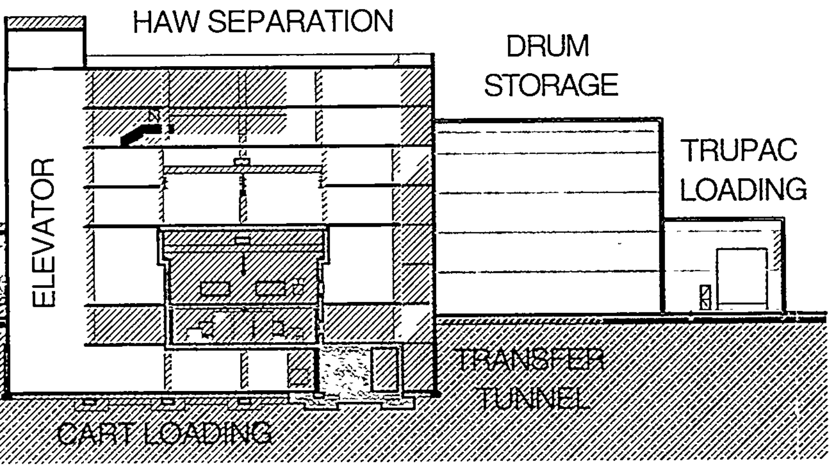
B

	UNEX	MOD UNEX
GFF		
NWCF		

UNEX/ MO

A

8 7 6 5



DIFIED UNEX CROSS SECTION C-C

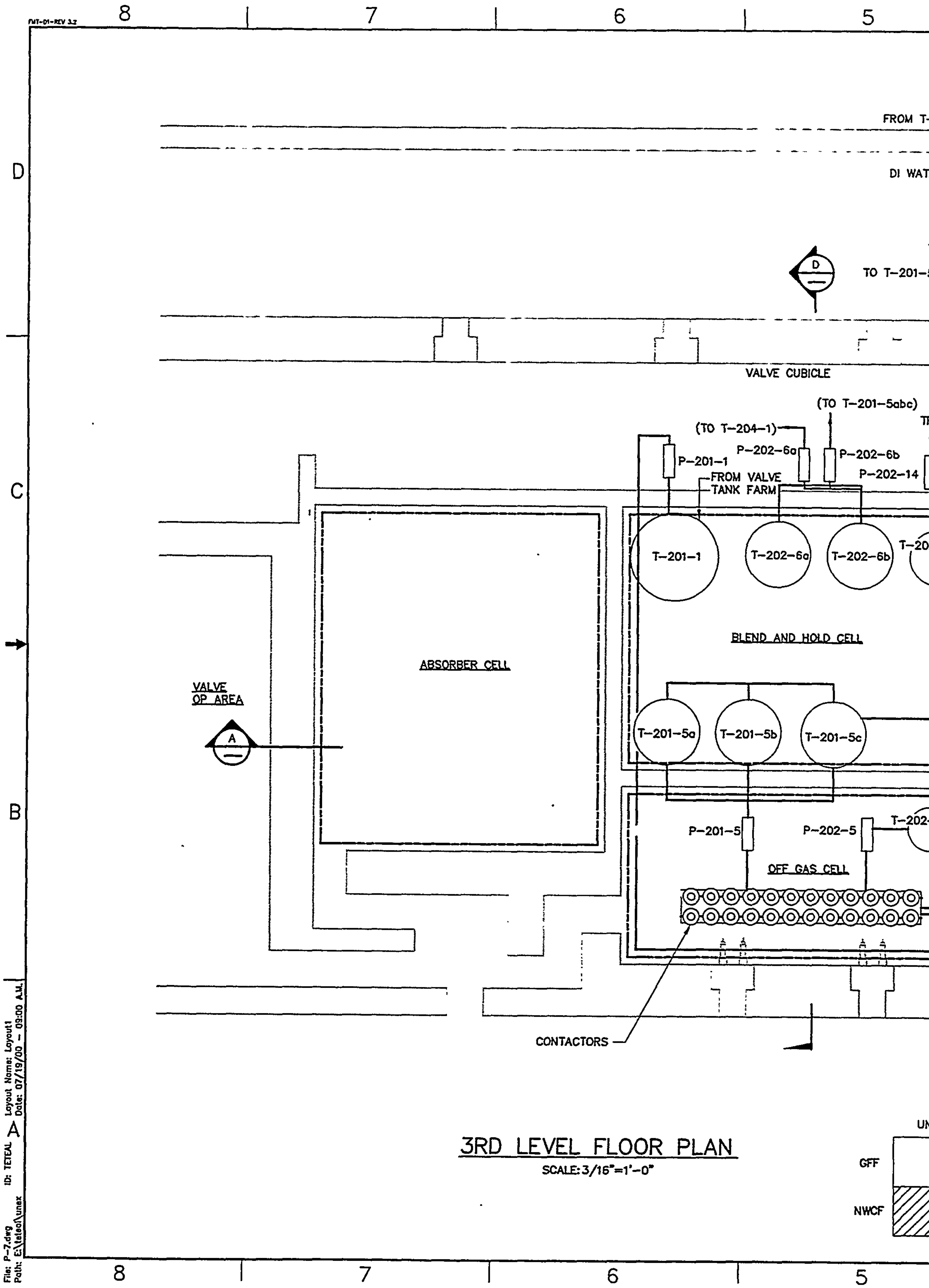
REVISIONS	
REV	DESCRIPTION	EFFECTIVE DATE

SUBCONTRACT NO.
REQUESTER:
DESIGN: RE JOHNSON, RA
DRAWN:
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO
EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITY
UNEX/ MODIFIED UNEX SEPARATION
GREEN FIELD DESIGN STUDY
BUILDING CROSS SECTION C-C

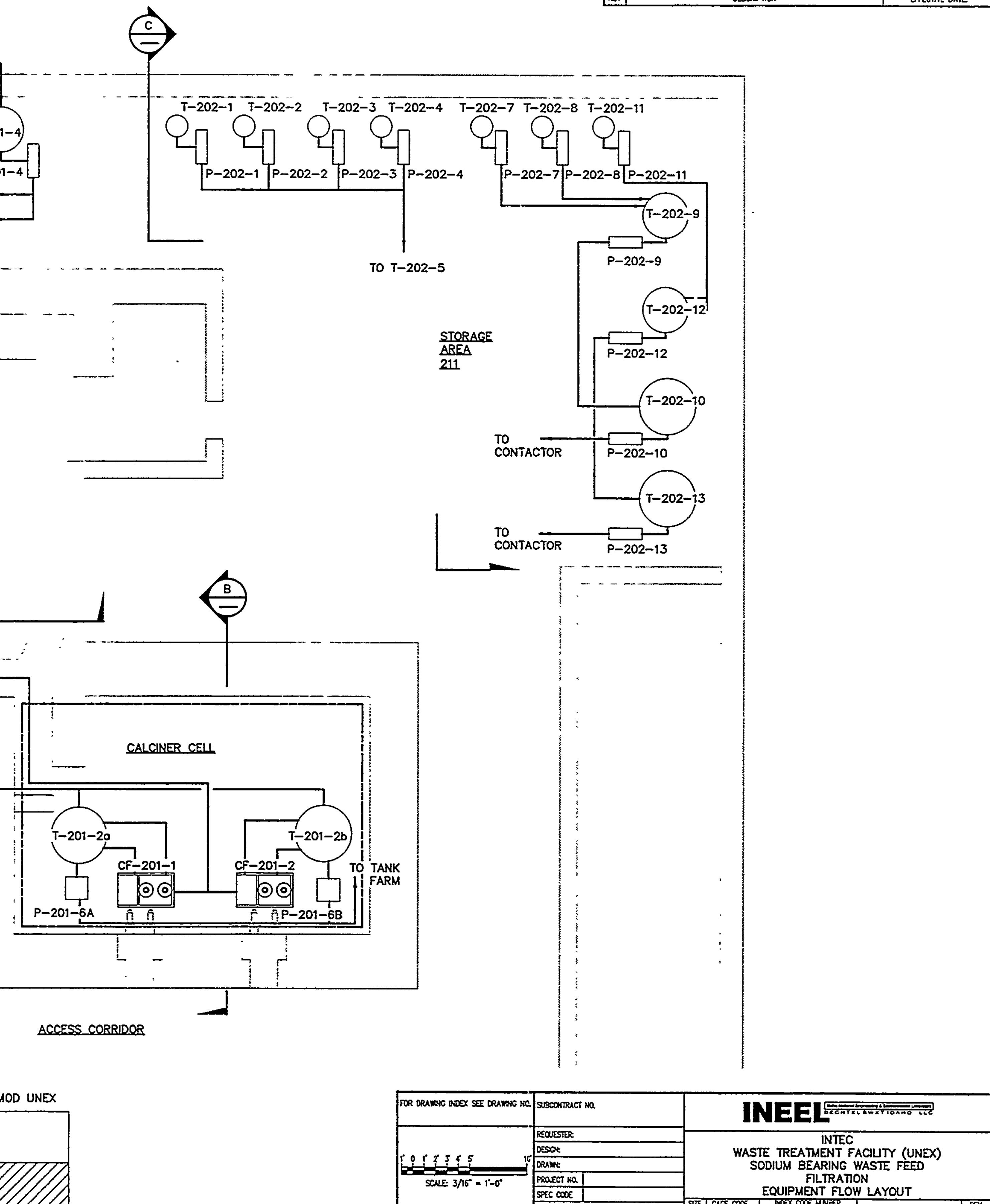
SIZE D | CAGE CODE 01MF3 | INDEX CODE NUMBER: AREA, TYPE, CL, ORG 090 | DWG- | REV
SCALE: 1" = 30' | CFP | SHEET A-13



3RD LEVEL FLOOR PLAN

SCALE: 3/16"=1'-0"

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.
SCALE: 3/16" = 1'-0"	REQUESTER:
	DESIGN:
	DRAWN:
	PROJECT NO.
	SPEC CODE
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
QUALITY LEVEL:	EFFECTIVE DATE:

INEEL BECHTEL BWXT IDAHO LLC

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
EQUIPMENT FLOW LAYOUT

SIZE	CAGE CODE	INDEX CODE NUMBER AREA	TYPE	CL	ORG		REV
D					090	DWG-	

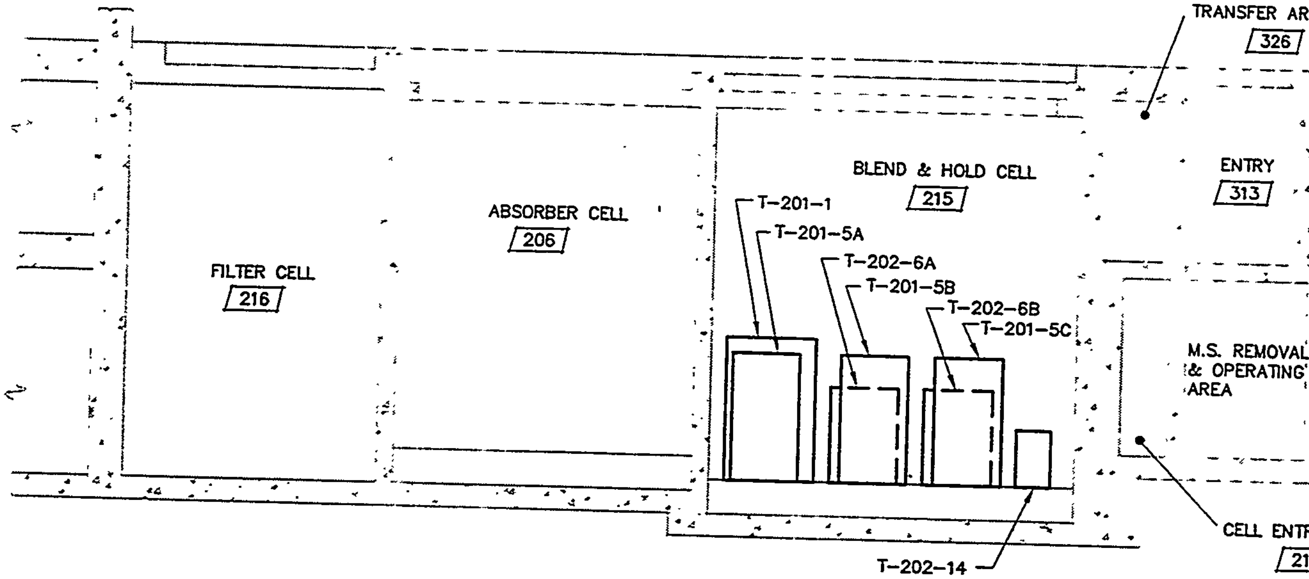
SCALE: NONE

SHEET P-7

FMT-01-REV 3.2

8 7 6 5

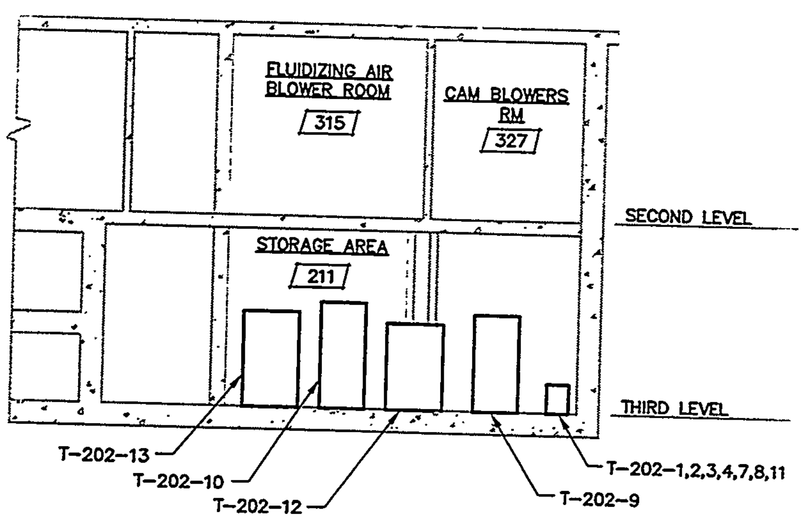
D

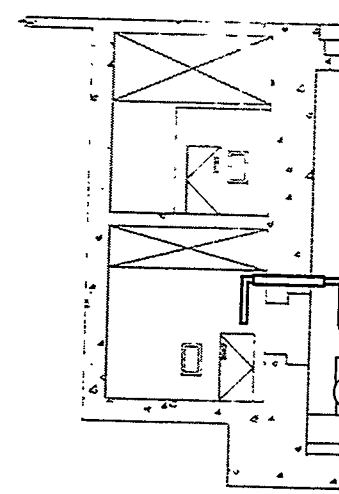


C

PARTIAL BUILDING SECTION (A/XX)
SCALE: 1/8"=1'-0"

B





PARTIAL BUILDING SECTION (C/XX)
SCALE: 1/8"=1'-0"

PAR
SCALE:

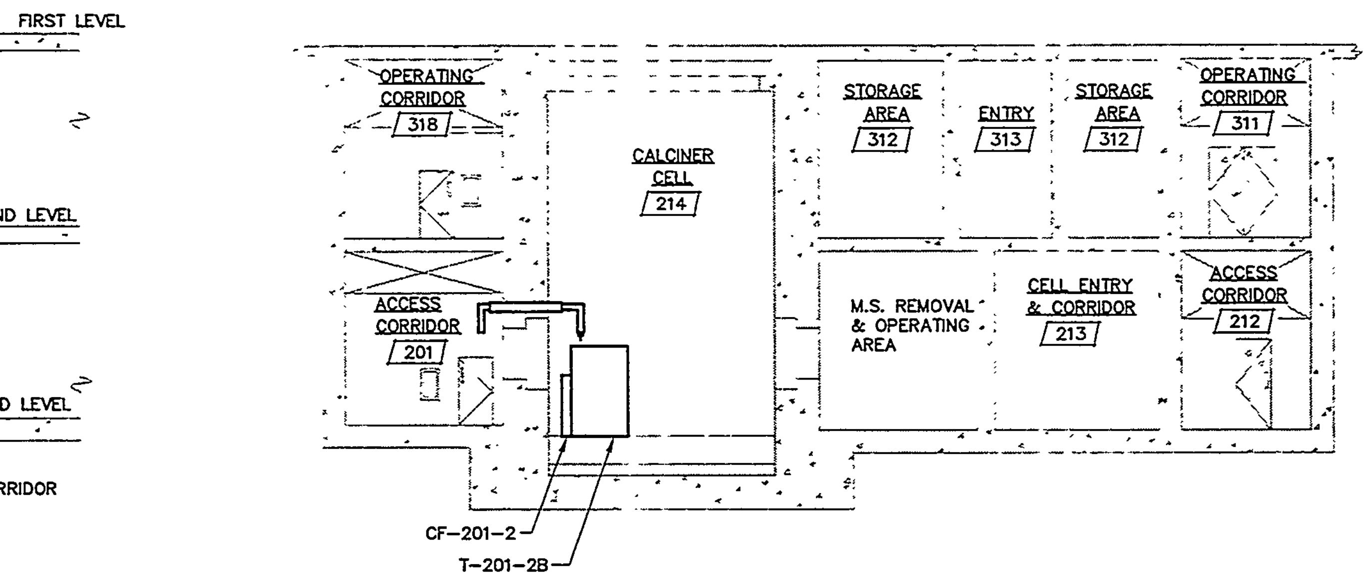
A

File: P-8.dwg
Path: P:\unex
ID: TETEAL
Layout Name: Layout1
Date: 08/13/00 - 10:19 A.M.

8 7 6 5

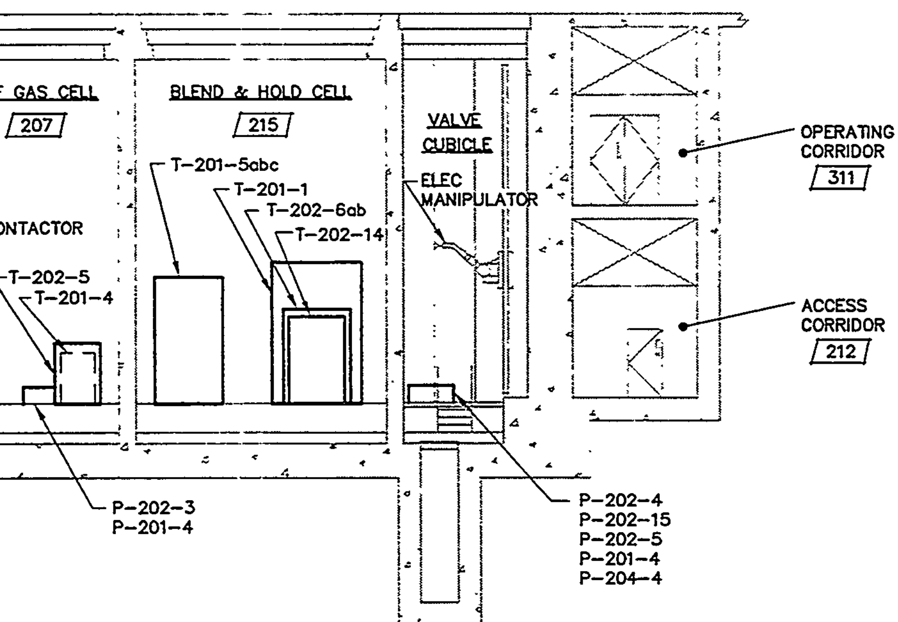
REV	DESCRIPTION	EFFECTIVE DATE:

REVISIONS



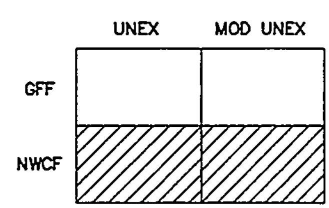
PARTIAL BUILDING SECTION (B/XX)

SCALE: 1/8"=1'-0"



TIAL BUILDING SECTION (D/XX)

8"=1'-0"



FOR DRAWING INDEX SEE DRAWING NO.

SUBCONTRACT NO.

SCALE: 1/8" = 1'-0"

REQUESTER:
DESIGN: S MCBRIDE
DRAWN: A L TETER
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

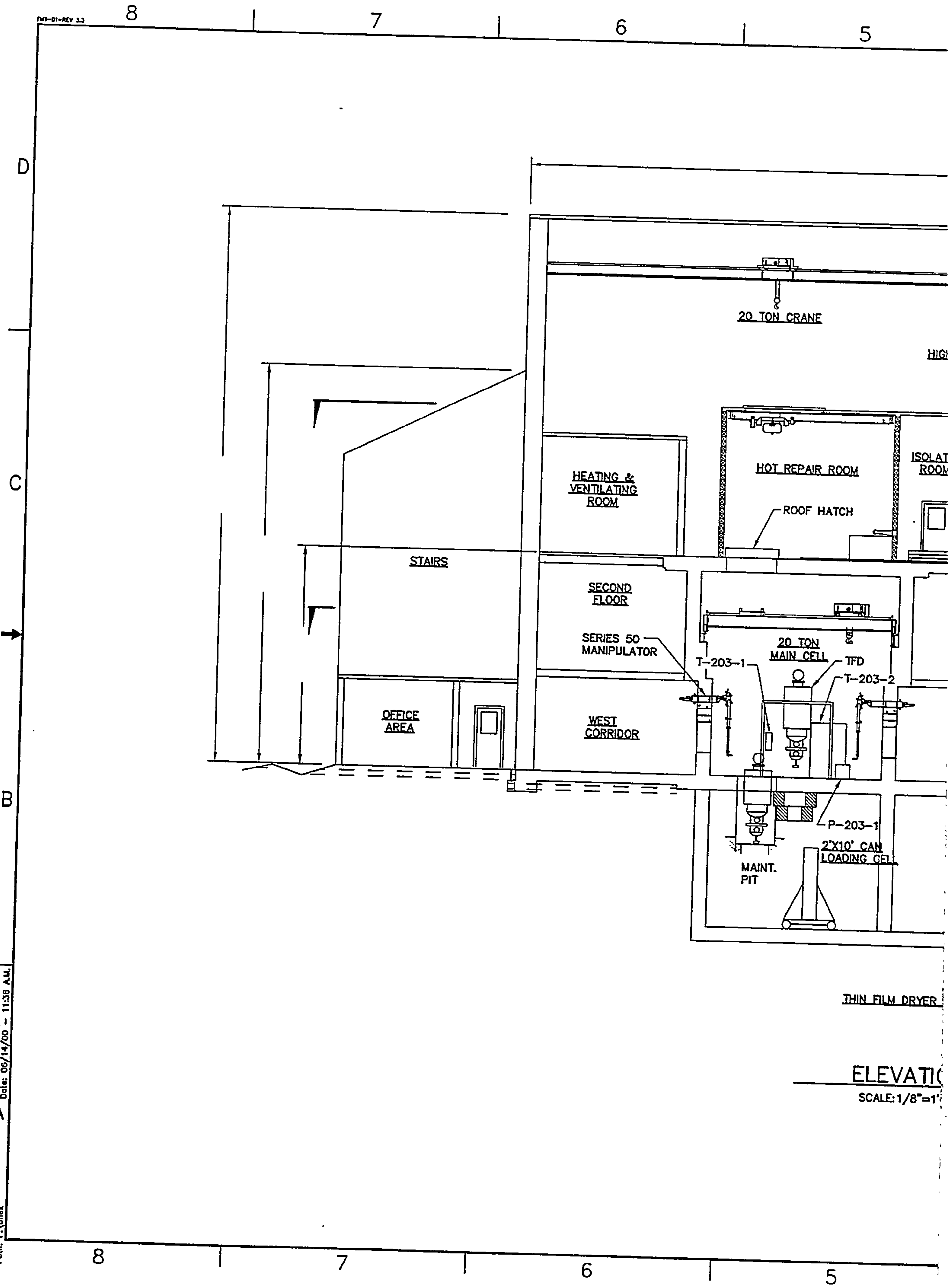
DESIGN PHASE:
QUALITY LEVEL:

INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
BUILDING SECTIONS

SIZE D | CAGE CODE | INDEX CODE NUMBER: AREA | TYPE | CL | ORG 090 | DWG- | REV

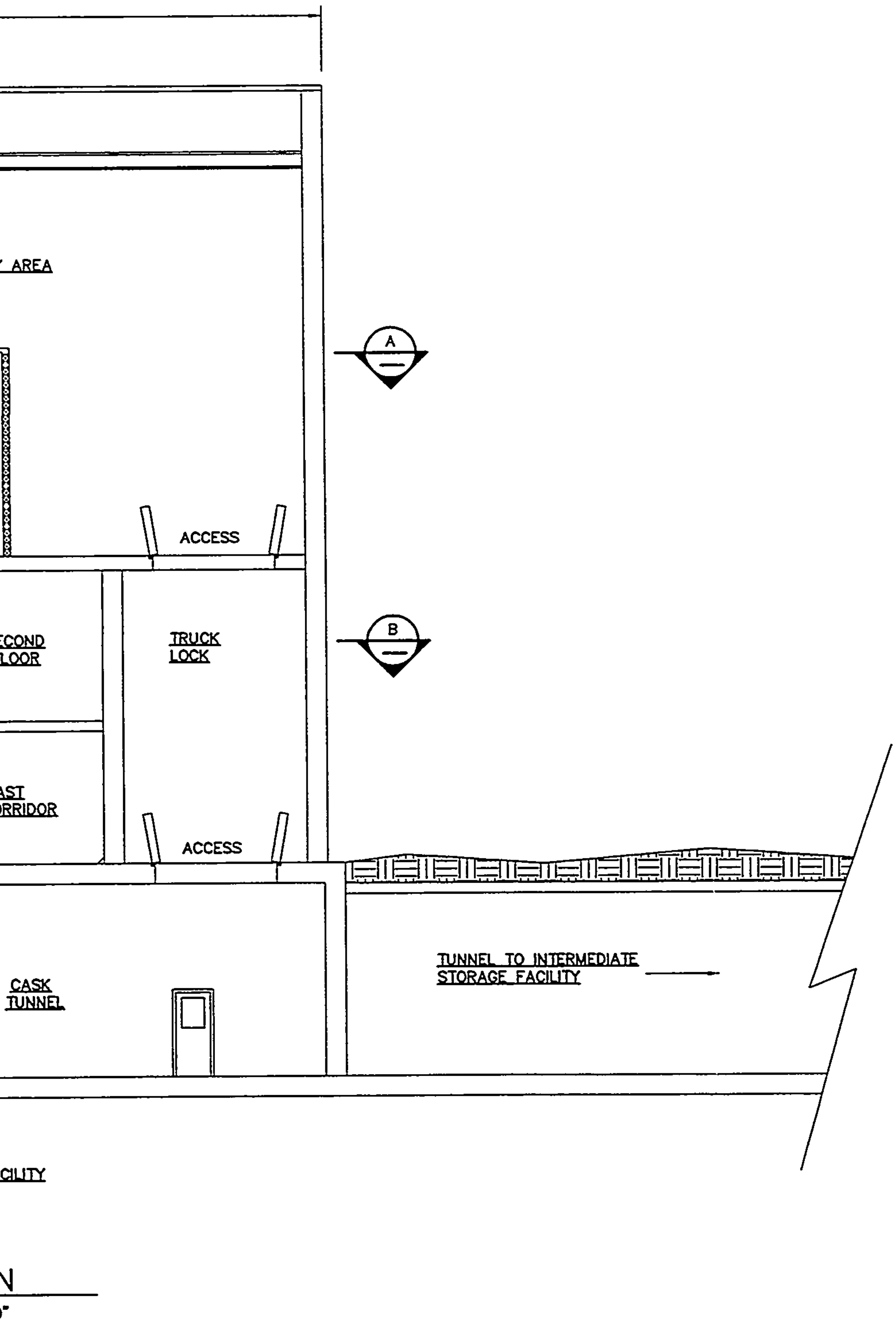
SCALE: NONE | SHEET P-8



File: P-9.DWG Path: P:\unex ID: TETEAL Layout Name: Layout1 Date: 06/14/00 - 11:36 A.M.

REV	DESCRIPTION	EFFECTIVE DATE

REVISIONS



	UNEX	MOD UNEX
GFF		
NWCF		

FOR DRAWING INDEX SEE DRAWING NO.

SCALE: 1/8" = 1'-0"

DESIGN PHASE:

QUALITY LEVEL:

SUBCONTRACT NO.

REQUESTER:

DESIGN:

DRAWN:

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.

EFFECTIVE DATE:

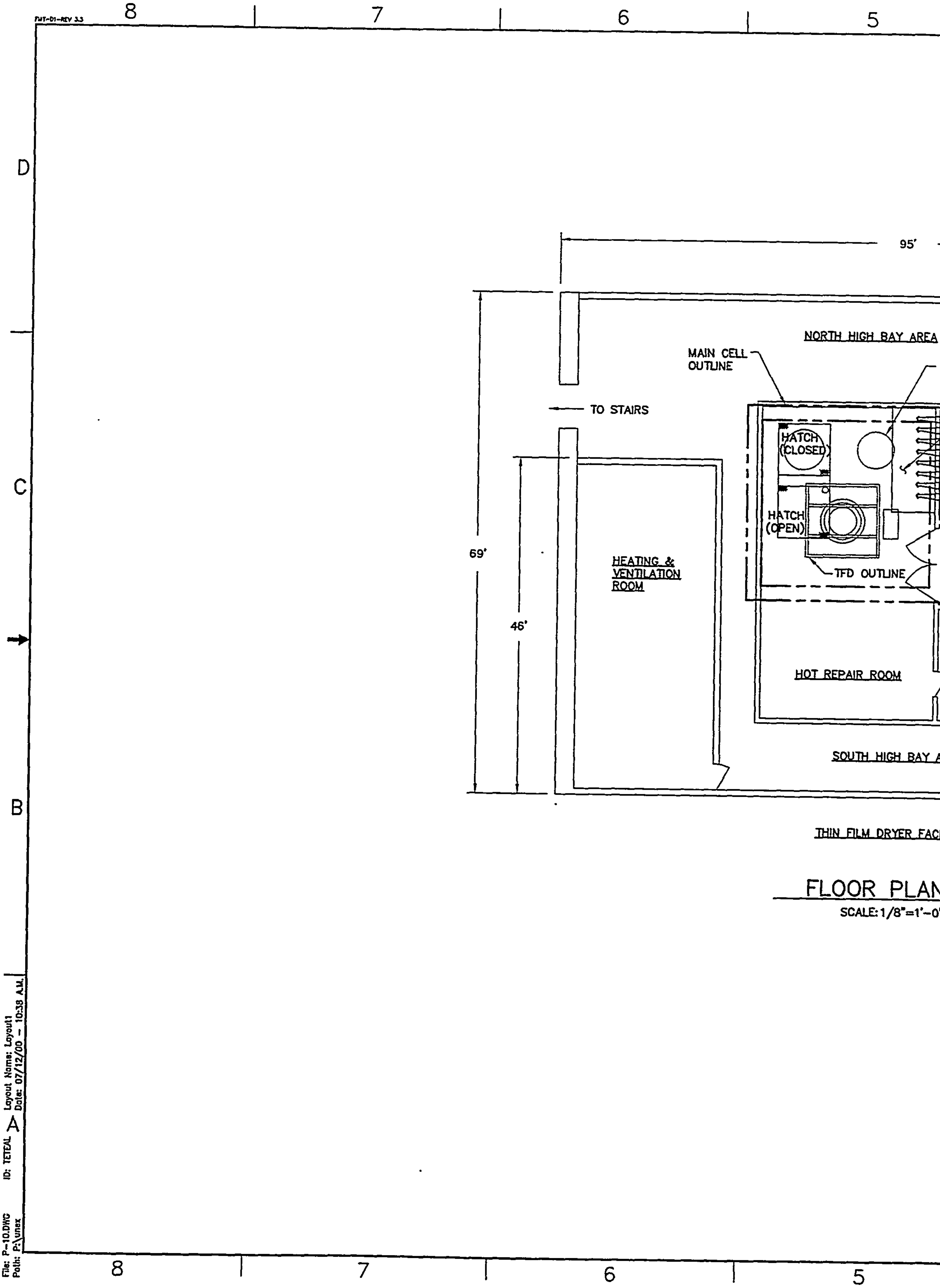
INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
ELEVATION

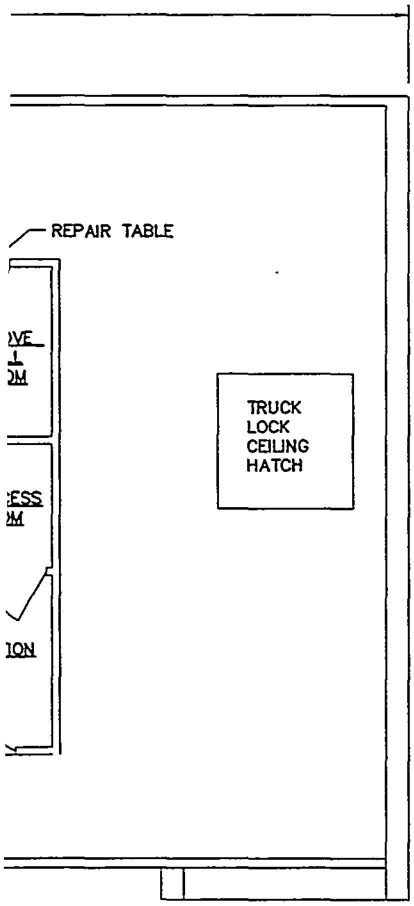
SIZE	CAGE CODE	AREA	TYPE	CL	ORG	DWG-	REV
D	01MF3				090		

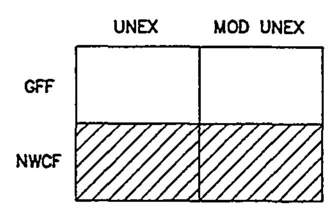
SCALE: NONE

SHEET P-9


FMT-D1-REV 3.3
8
7
6
5
D
C
B
A
95'
69'
46'
NORTH HIGH BAY AREA
MAIN CELL OUTLINE
TO STAIRS
HATCH (CLOSED)
HATCH (OPEN)
TFD OUTLINE
HEATING & VENTILATION ROOM
HOT REPAIR ROOM
SOUTH HIGH BAY A
THIN FILM DRYER FAC
FLOOR PLAN
SCALE: 1/8"=1'-0
File: P-10.DWG
Path: P:\unex
ID: TETEAL
Layout Name: Layout1
Date: 07/12/00 - 10:38 A.M.

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE.





FOR DRAWING INDEX SEE DRAWING NO.

SUBCONTRACT NO.

INEEL

REQUESTER:
DESIGN:
DRAWN:
PROJECT NO.
SPEC CODE

SCALE: 1/8" = 1'-0"

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
FLOOR PLAN

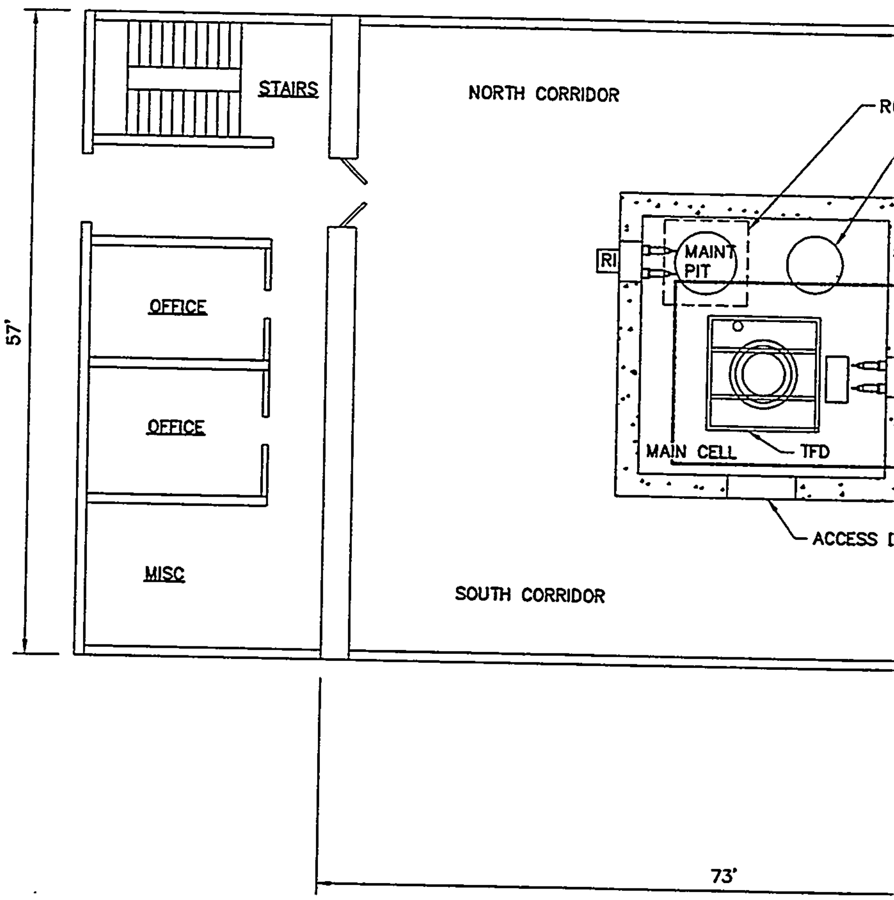
DESIGN PHASE:
QUALITY LEVEL:

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

SIZE	CAGE CODE	AREA	TYPE	CL	ORG	DWG-	REV
D	01MF3				090		

SCALE: NONE

SHEET P-10

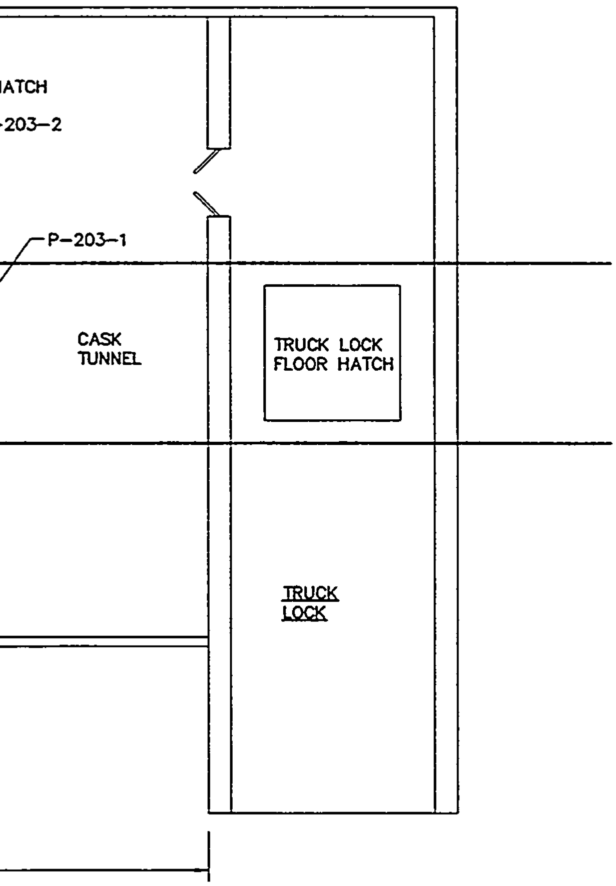


THIN FILM DRYER FACILITY

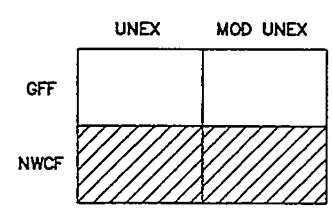
FLOOR PLAN B

SCALE: 1/8"=1'-0"

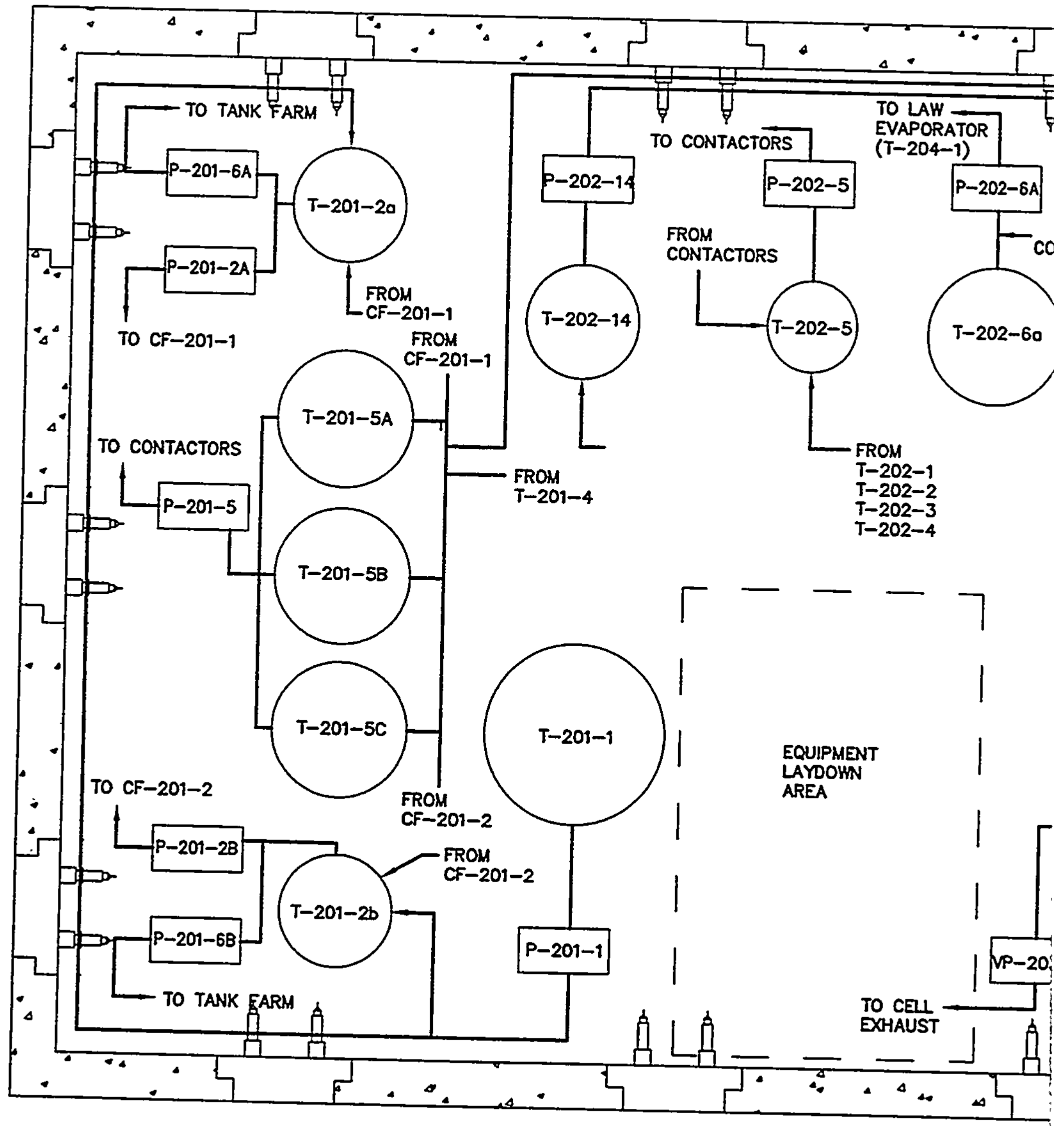
FNT-D1-REV 3.3
File: SECB-B.dwg
Path: P:\unex
ID: TETEAL
Layout Name: Layout1
Date: 06/09/00 - 1:07 P.M.



REV	DESCRIPTION	EFFECTIVE DATE:



FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO, LLC
SCALE: 1/8" = 1'-0"	REQUESTER: DESIGN: DRAWN: A L TETER PROJECT NO. SPEC CODE	INTEC WASTE TREATMENT FACILITY (UNEX) SODIUM BEARING WASTE FEED FILTRATION FLOOR PLAN
DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, CL, ORG 090 · DWG- · REV
QUALITY LEVEL:	EFFECTIVE DATE:	SCALE: 1"=60' · SHEET P-11

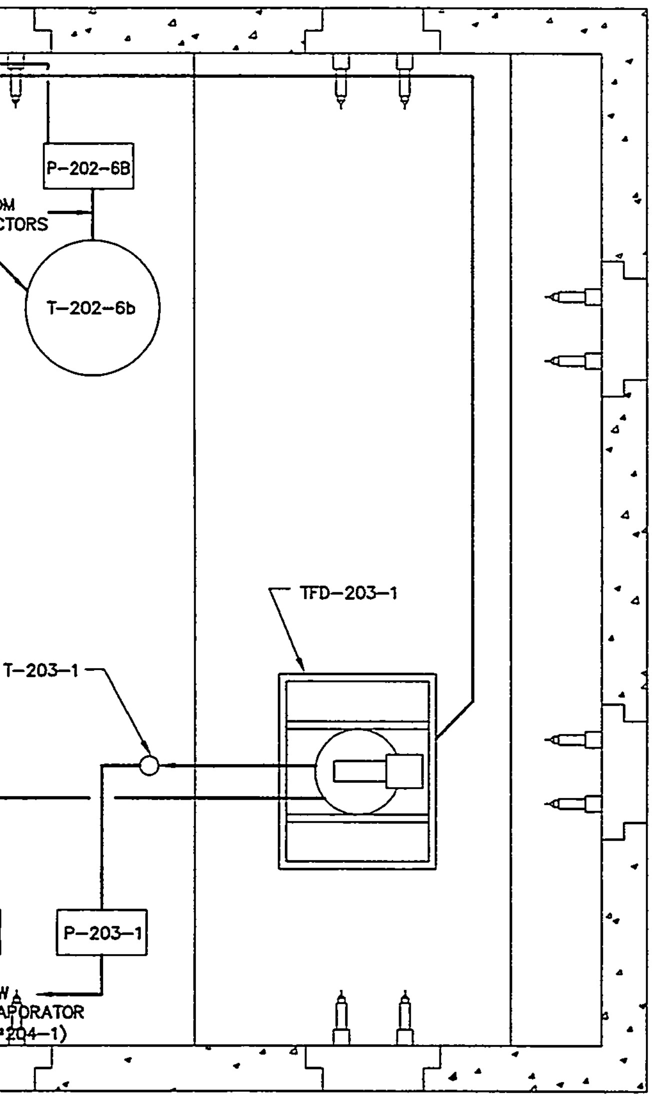


FLOOR PLAN

1/4"=1'-0"

File: P-12.DWG Path: P:\unex ID: TETEAL Layout Name: Layout1 Date: 06/13/00 - 10:12 A.M.

FMT-01-REV 3.3



	UNEX	MOD UNEX
GFF		
NWCF		

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

FOR DRAWING INDEX SEE DRAWING NO.

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DESIGN PHASE:

QUALITY LEVEL:

SUBCONTRACT NO.

REQUESTER:

DESIGN:

DRAWN:

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.

EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
FLOOR PLAN

SIZE	CAGE CODE	AREA	TYPE	CL	ORG	DWG-	REV
D	01MF3				090		

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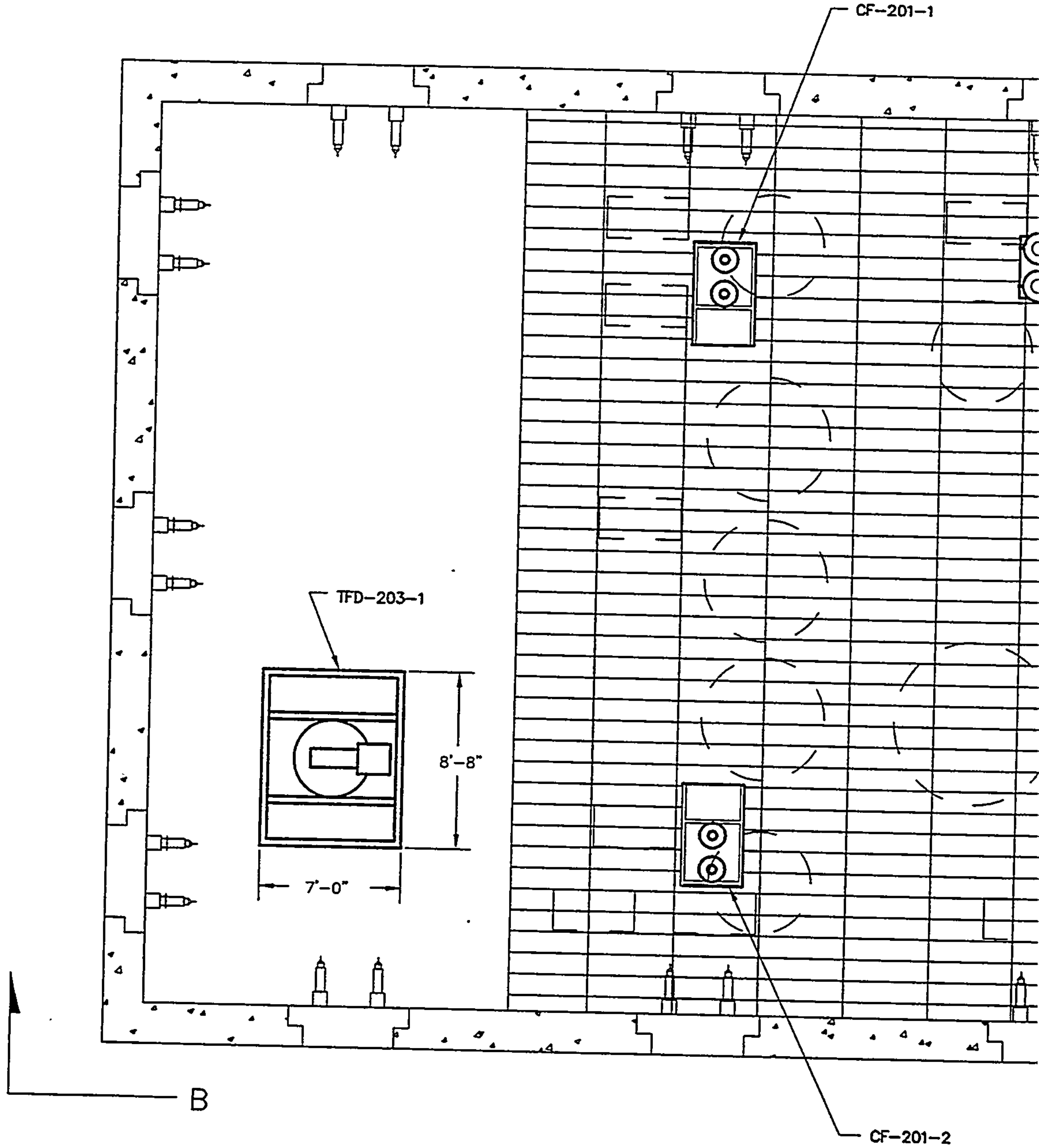
SHEET P-12

FMT-D1-REV 3.3



FLOOR PLAN

1/4"=1'-0"

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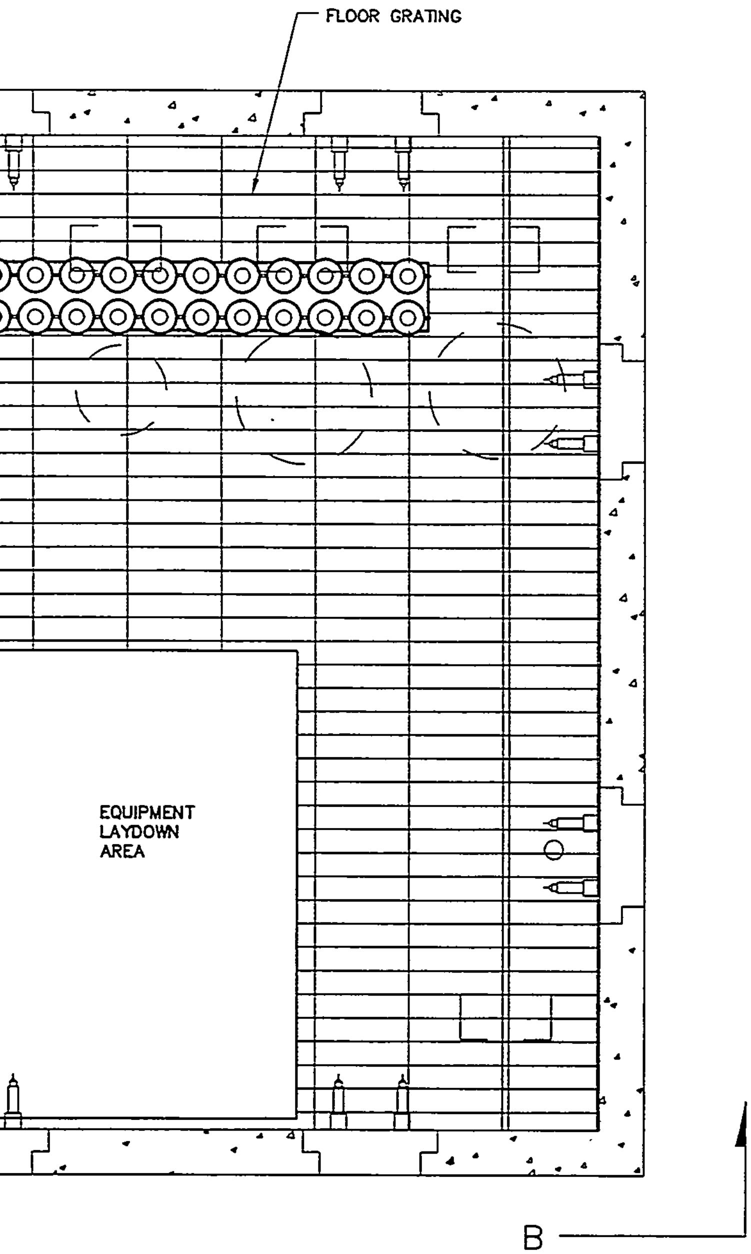
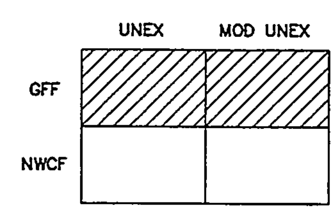
	REVISIONS	





FOR DRAWING INDEX SEE DRAWING NO.	SUBCONTRACT NO.	INEEL
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DESIGN PHASE:	FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D CAGE CODE 01MF3 INDEX CODE NUMBER AREA TYPE CL ORIG 090 DWG– REV
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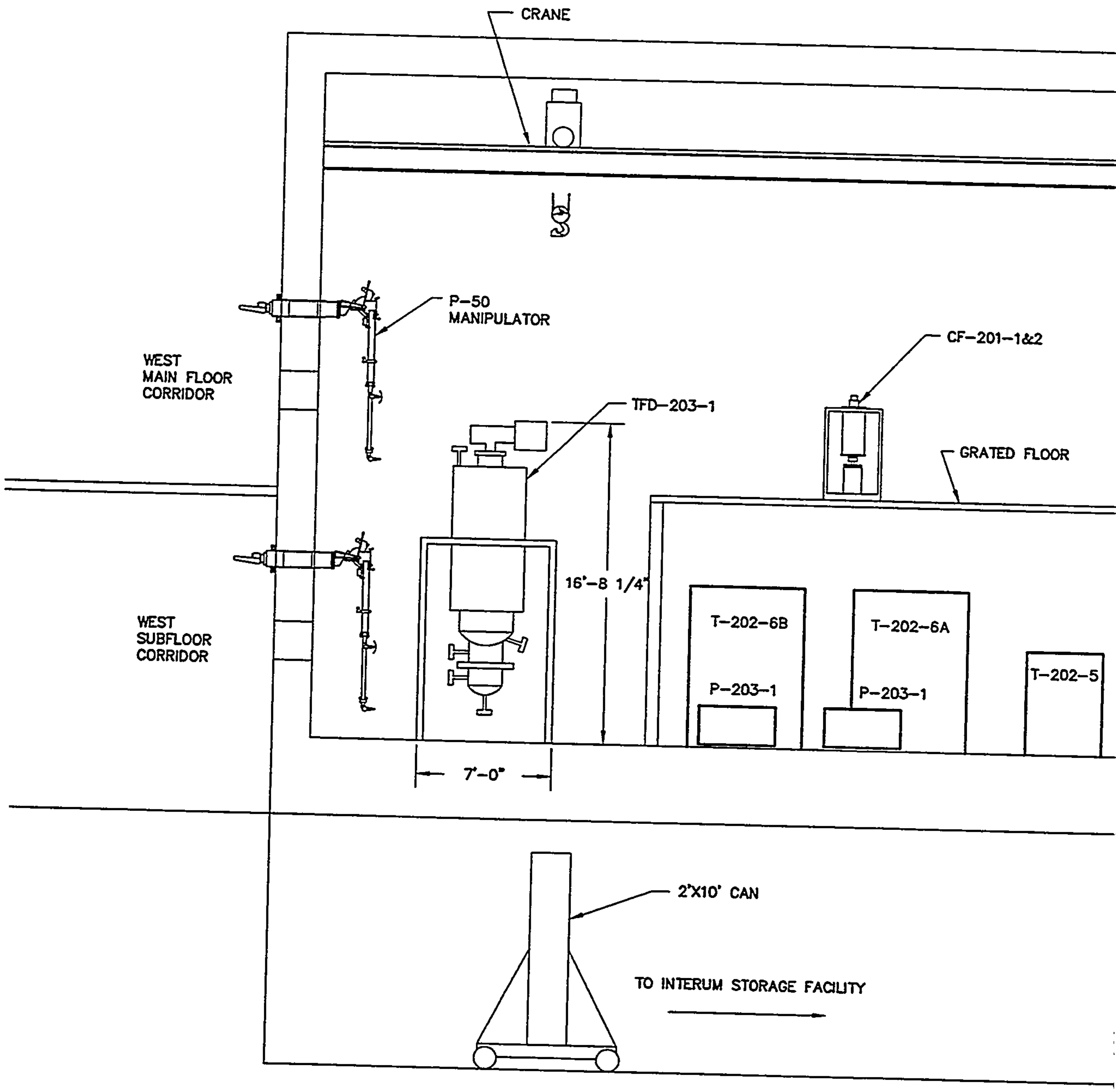

VIEW B

SCALE: 1/4"=1'-0"

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REVISIONS		
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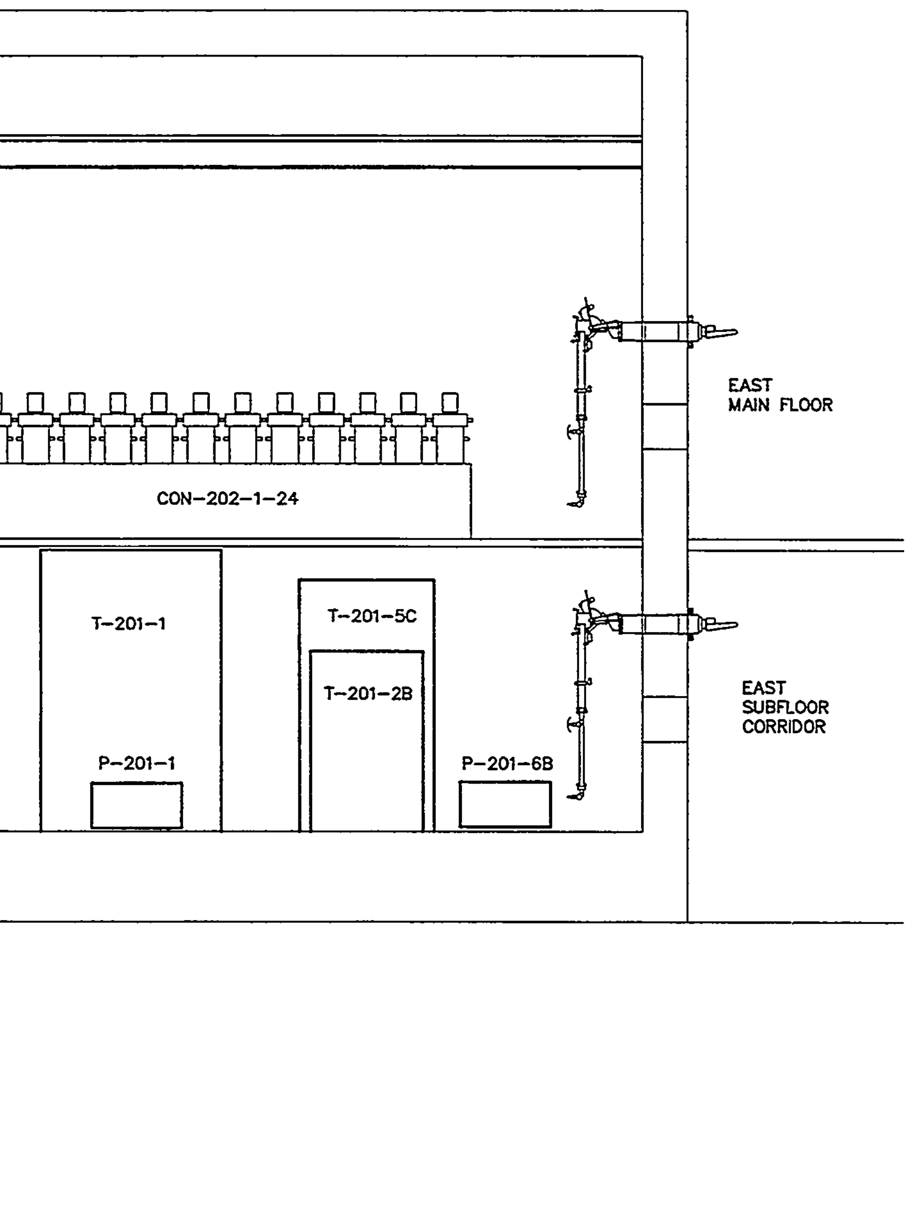

	UNEX	MOD UNEX
GFF		
NWCF		

FOR DRAWING INDEX SEE DRAWING NO.

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DESIGN PHASE:

QUALITY LEVEL:

SUBCONTRACT NO.

REQUESTER:

DESIGN:

DRAWN:

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.

EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
ELEVATION

SIZE	CAGE CODE	INDEX CODE NUMBER AREA	TYPE	CL	ORIG	DWG-	REV
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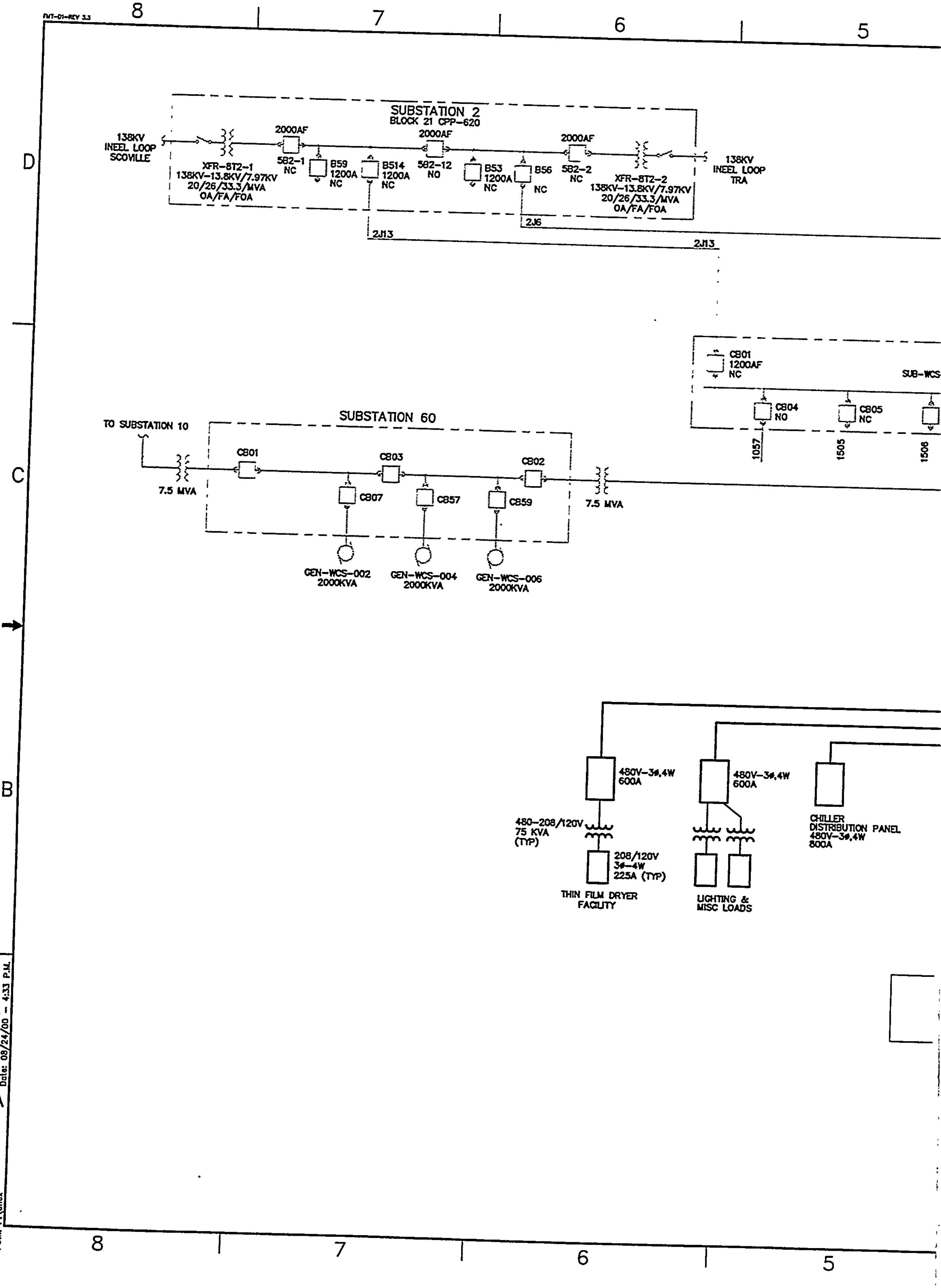
SHEET P-14



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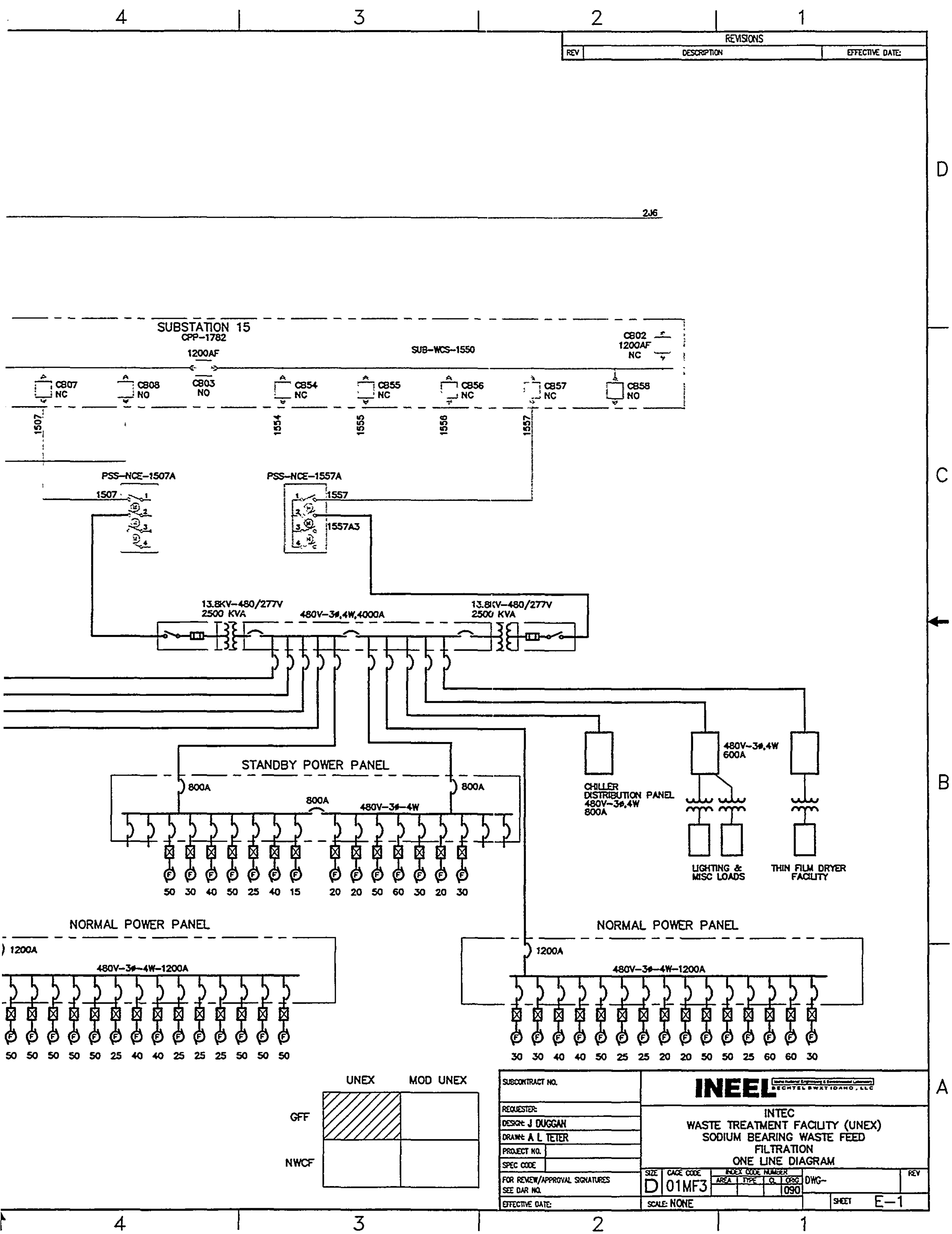


SUBCONTRACT NO.

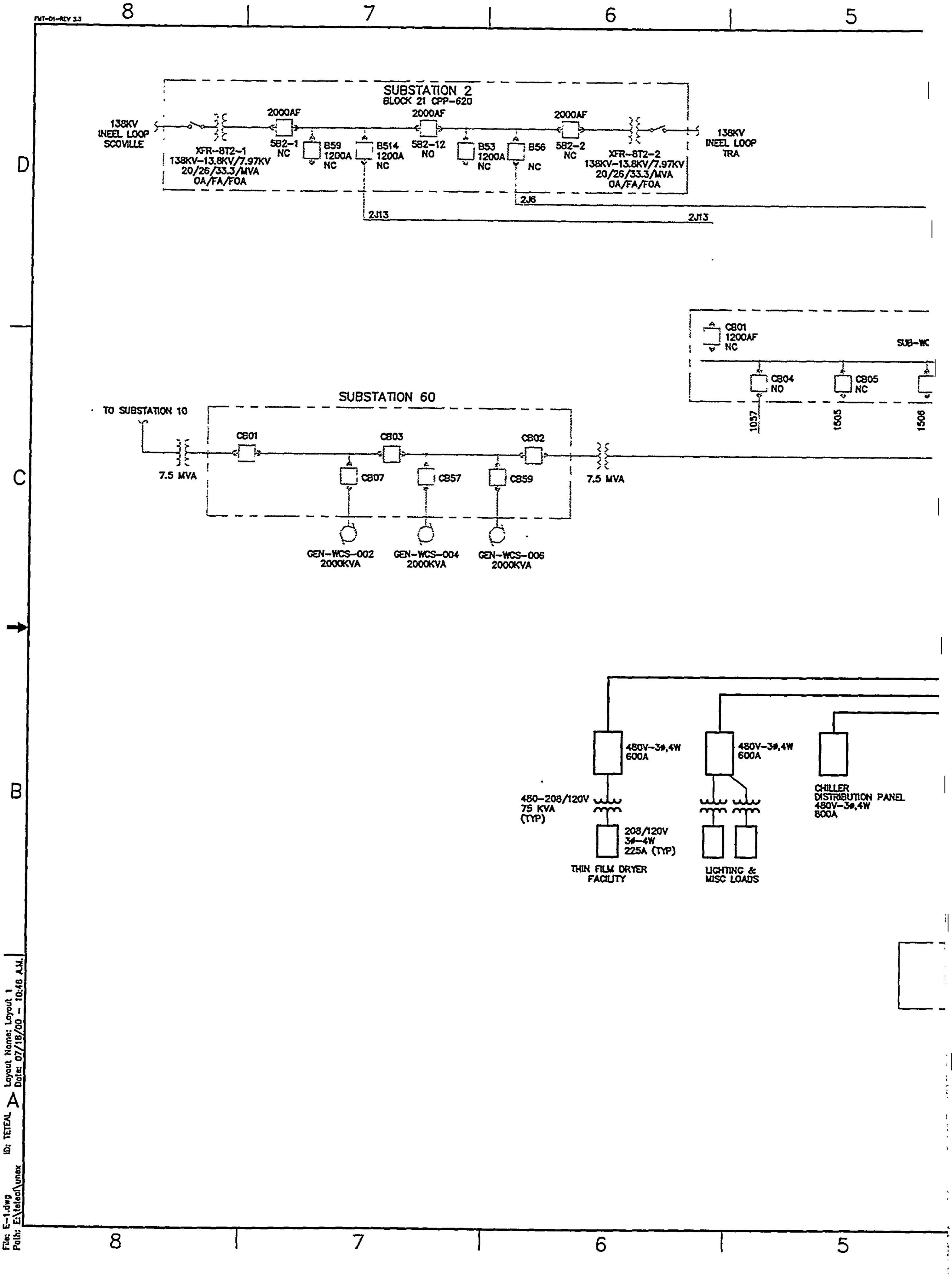
INEEL BECHTEL BWXT IDAHO, LLC

REQUESTER:
DESIGN: J DUGGAN
DRAWN: A L TETER
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
ONE LINE DIAGRAM

SIZE	CAGE CODE	AREA	TYPE	Q.	ORIG	DWG-	REV
D	01MF3				090		

SCALE: NONE SHEET E-1



SUBSTATION 2
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138KV
INEEL LOOP
SCOVILLE
XFR-8T2-1
138KV-13.8KV/7.97KV
20/26/33.3/MVA
OA/FA/FOA
2000AF
5B2-1
NC
B59
1200A
NC
B514
1200A
NC
2000AF
5B2-12
NO
B53
1200A
NC
B56
NC
2000AF
5B2-2
NC
XFR-8T2-2
138KV-13.8KV/7.97KV
20/26/33.3/MVA
OA/FA/FOA
138KV
INEEL LOOP
TRA
2J6
2J13
2J13
CB01
1200AF
NC
SUB-WC
CB04
NO
CB05
NC
1057
1505
1506
SUBSTATION 60
TO SUBSTATION 10
7.5 MVA
CB01
CB03
CB02
CB07
CB57
CB59
7.5 MVA
GEN-WCS-002
2000KVA
GEN-WCS-004
2000KVA
GEN-WCS-006
2000KVA
480V-3ø,4W
600A
480V-3ø,4W
600A
480-208/120V
75 KVA
(TYP)
208/120V
3ø-4W
225A (TYP)
THIN FILM DRYER
FACILITY
LIGHTING &
MISC LOADS
CHILLER
DISTRIBUTION PANEL
480V-3ø,4W
800A
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REVISIONS		
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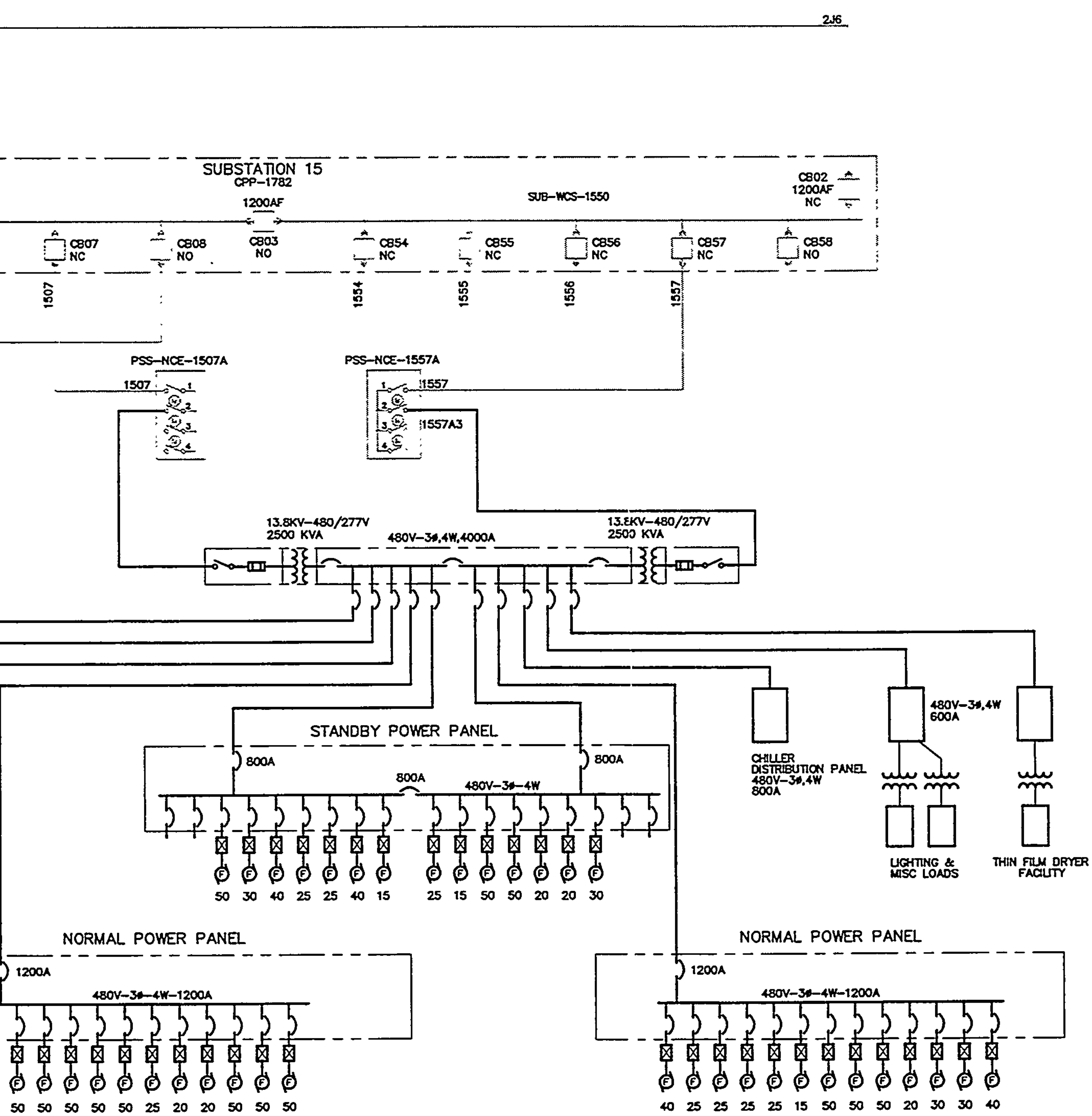
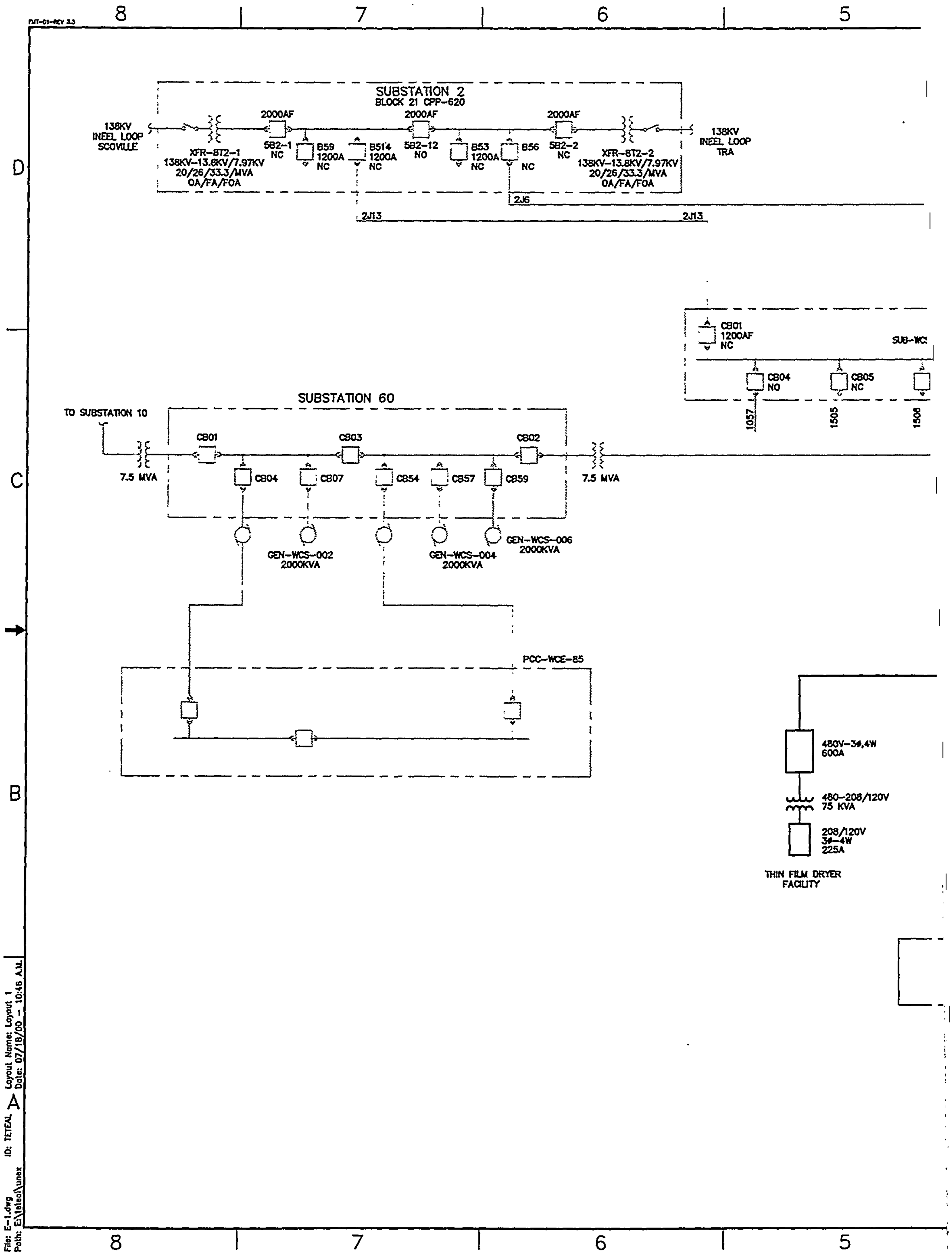


	UNEX	MOD UNEX
GFF		
NWCF		

SUBCONTRACT NO.	INEEL BECHTEL BWXT IDAHO, LLC
REQUESTER:	INTEC
DESIGN: J DUGGAN	WASTE TREATMENT FACILITY (UNEX)
DRAWN: A L TETER	SODIUM BEARING WASTE FEED
PROJECT NO.	FILTRATION
SPEC CODE	ONE LINE DIAGRAM
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D · CAGE CODE 01MF3 · INDEX CODE NUMBER: AREA, TYPE, QL, ORG 090 · DWG- · REV
EFFECTIVE DATE:	SCALE: NONE · SHEET E-2



FMT-01-REV 3.3
8
7
6
5
D
C
B
A
SUBSTATION 2
BLOCK 21 CPP-620
138KV INEEL LOOP SCOVILLE
XFR-8T2-1 138KV-13.8KV/7.97KV 20/26/33.3/MVA OA/FA/FOA
2000AF
582-1 NC
B59 1200A NC
B514 1200A NC
2000AF
582-12 NO
B53 1200A NC
B56 NC
2000AF
582-2 NC
XFR-8T2-2 138KV-13.8KV/7.97KV 20/26/33.3/MVA OA/FA/FOA
138KV INEEL LOOP TRA
2J6
2J13
2J13
CB01 1200AF NC
SUB-WC
CB04 NO
CB05 NC
1057
1505
1506
SUBSTATION 60
TO SUBSTATION 10
7.5 MVA
CB01
CB03
CB02
7.5 MVA
CB04
CB07
CB54
CB57
CB59
GEN-WCS-002 2000KVA
GEN-WCS-004 2000KVA
GEN-WCS-006 2000KVA
PCC-WCE-85
480V-3Ø,4W 600A
480-208/120V 75 KVA
208/120V 3Ø-4W 225A
THIN FILM DRYER FACILITY
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ID: TETEAL
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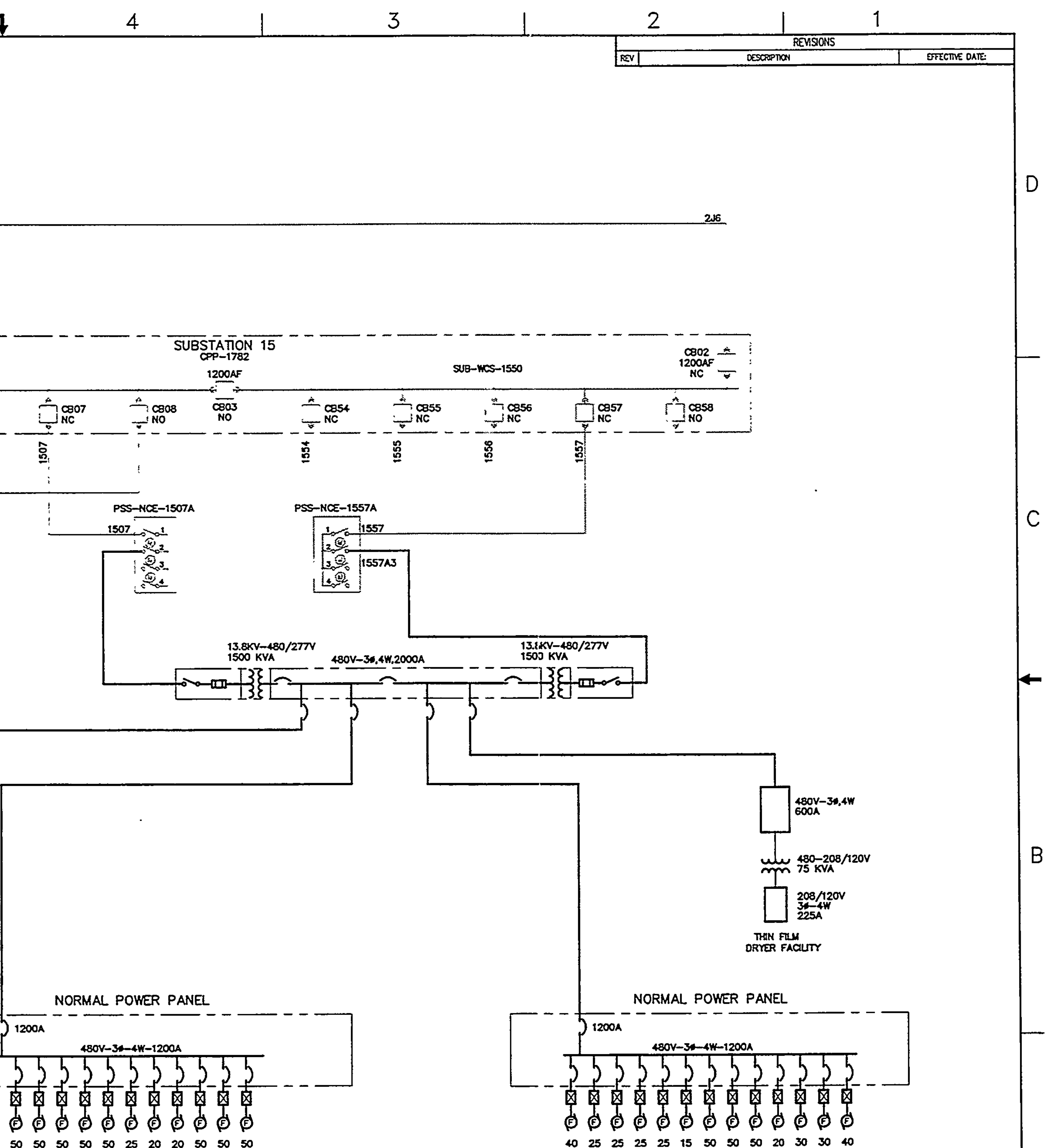

	UNEX	MOD UNEX
GFF		
NWCF		

SUBCONTRACT NO.

REQUESTER:

DESIGN: J DUGGAN

DRAWN: A L TETER

PROJECT NO.

SPEC CODE

FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.

EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
ONE LINE DIAGRAM

SIZE D | CAGE CODE 01MF3 | INDEX CODE NUMBER: AREA, TYPE, OL, ORIG 090 | DWG- | REV

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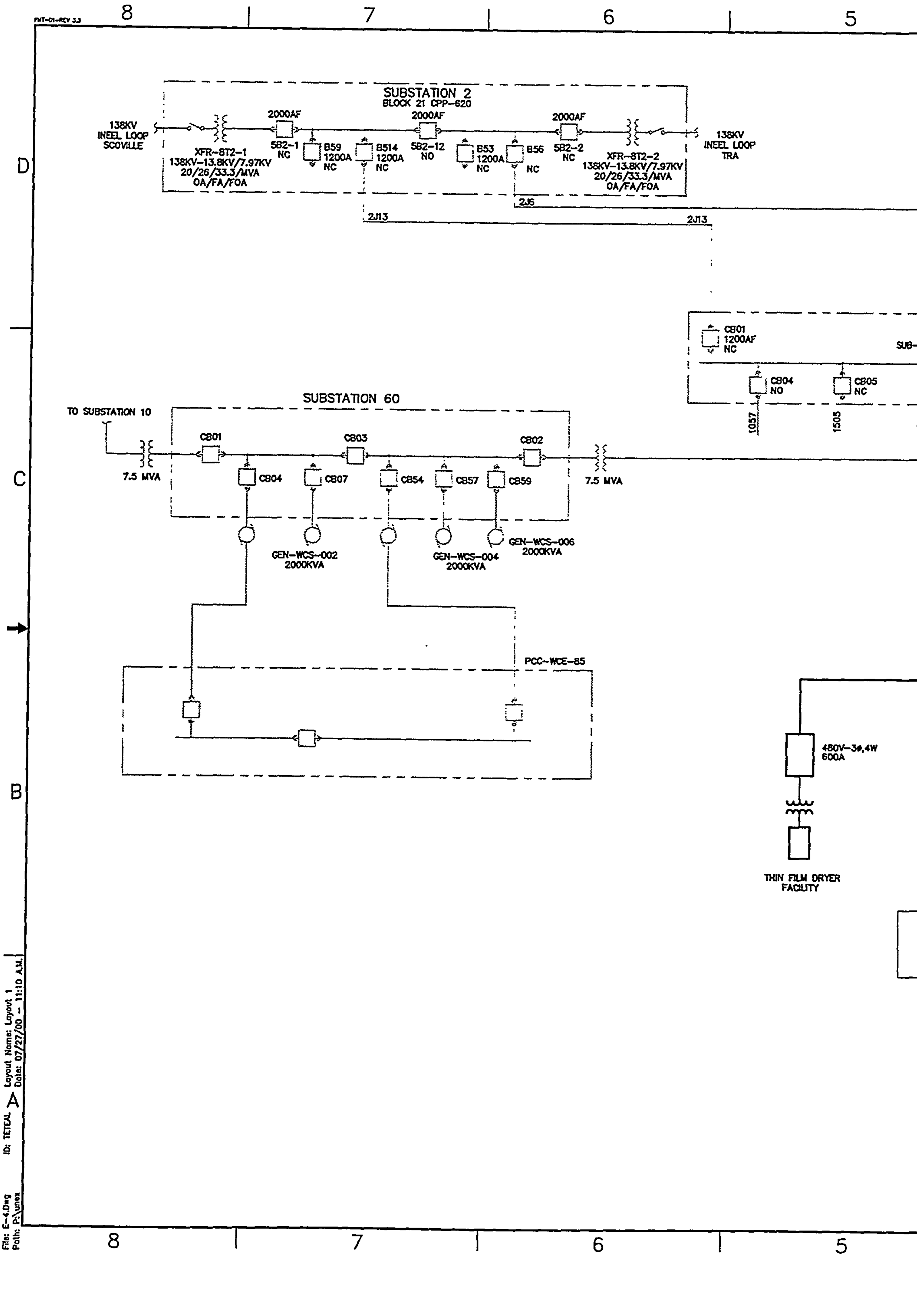

FMT-01-REV 3.3
8
7
6
5
D
C
B
A
SUBSTATION 2
BLOCK 21 CPP-620
138KV
INEEL LOOP
SCOVILLE
2000AF
5B2-1
NC
B59
1200A
NC
B514
1200A
NC
2000AF
5B2-12
NO
B53
1200A
NC
B56
NC
2000AF
5B2-2
NC
XFR-8T2-1
138KV-13.8KV/7.97KV
20/26/33.3/MVA
OA/FA/FOA
XFR-8T2-2
138KV-13.8KV/7.97KV
20/26/33.3/MVA
OA/FA/FOA
138KV
INEEL LOOP
TRA
2J6
2J13
2J13
CB01
1200AF
NC
SUB-
CB04
NO
CB05
NC
1057
1505
SUBSTATION 60
TO SUBSTATION 10
7.5 MVA
CB01
CB03
CB02
7.5 MVA
CB04
CB07
CB54
CB57
CB59
GEN-WCS-002
2000KVA
GEN-WCS-004
2000KVA
GEN-WCS-006
2000KVA
PCC-WCE-85
480V-3ø,4W
600A
THIN FILM DRYER
FACILITY
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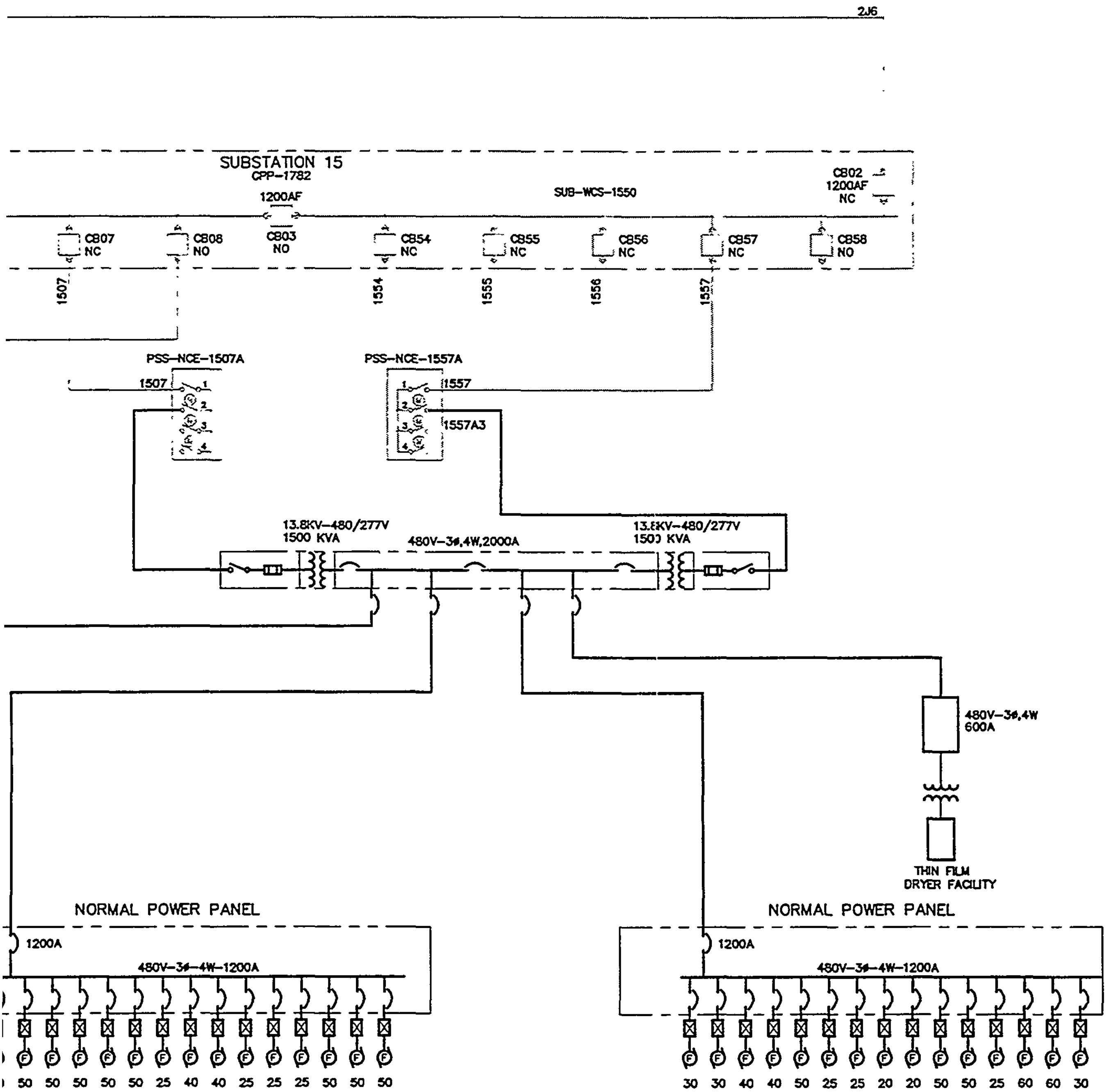

	UNEX	MOD UNEX
GFF		
NWCF		

SUBCONTRACT NO.

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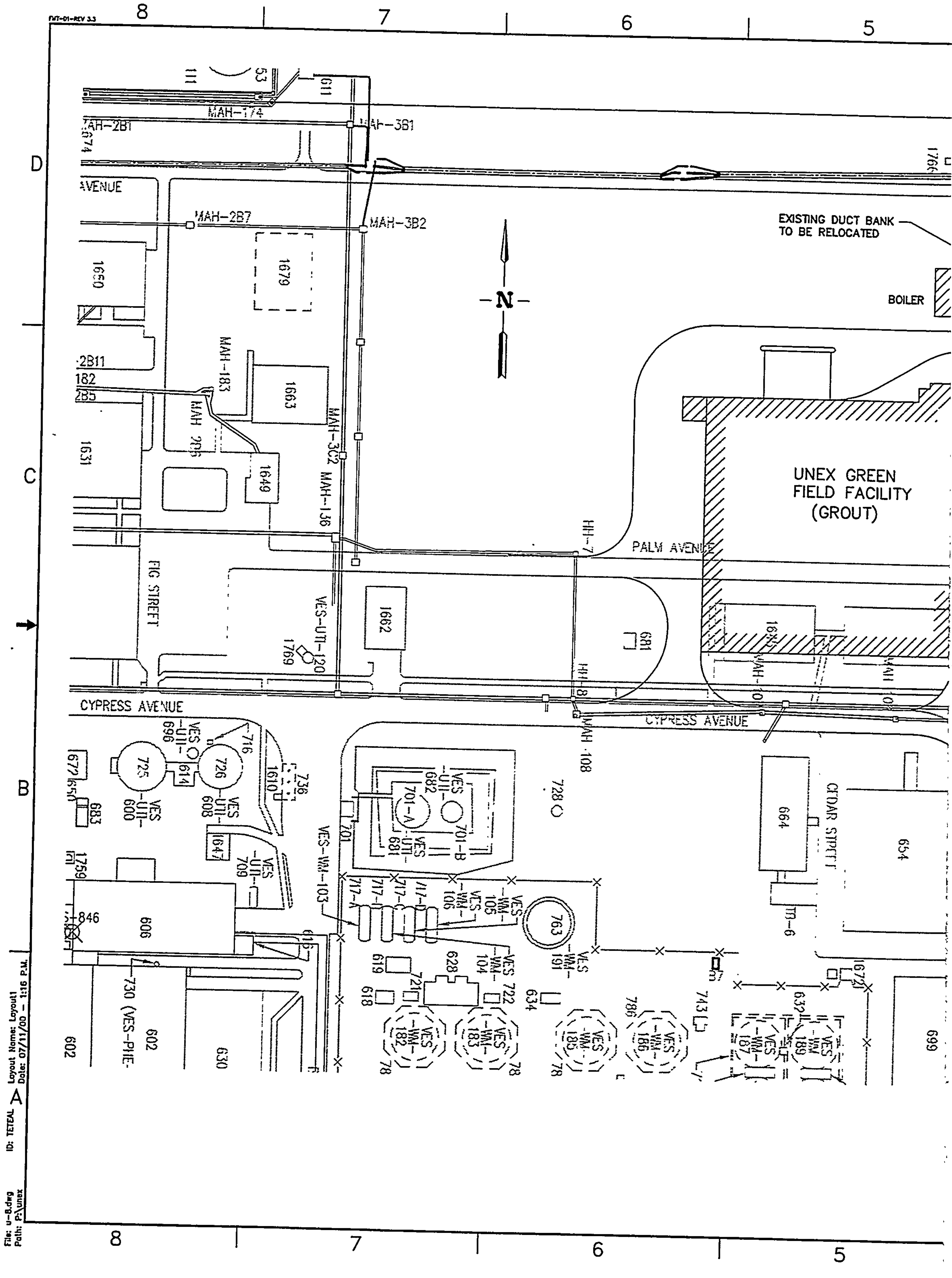
DRAWN: A L TETER
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

INEEL

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
ONE LINE DIAGRAM

SIZE D | CAGE CODE 01MF3 | INDEX CODE NUMBER: AREA | TYPE | CL | ORG 090 | DWG- | REV

SCALE: NONE | SHEET E-4


EXISTING DUCT BANK TO BE RELOCATED
BOILER
N
UNEX GREEN FIELD FACILITY (GROUT)
PALM AVENUE
CYPRESS AVENUE
FIG STREET
CEDAR STREET
AVENUE
MAH-174
MAH-2B1
MAH-3B1
MAH-2B7
MAH-3B2
MAH-183
MAH-3C2
MAH-136
MAH-108
HH-7
HH-8
VES-UTI-120
VES-WM-103
VES-WM-104
VES-WM-105
VES-WM-106
VES-WM-191
VES-UTI-600
VES-UTI-608
VES-UTI-681
VES-UTI-682
VES-UTI-696
VES-UTI-709
730 (VES-PHE-
1679
1650
1663
1631
1649
1662
1769
681
725
726
614
1610
736
716
683
1647
1759
846
606
602
630
664
654
699
728
763
701
701-A
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717-B
717-C
717-D
619
618
628
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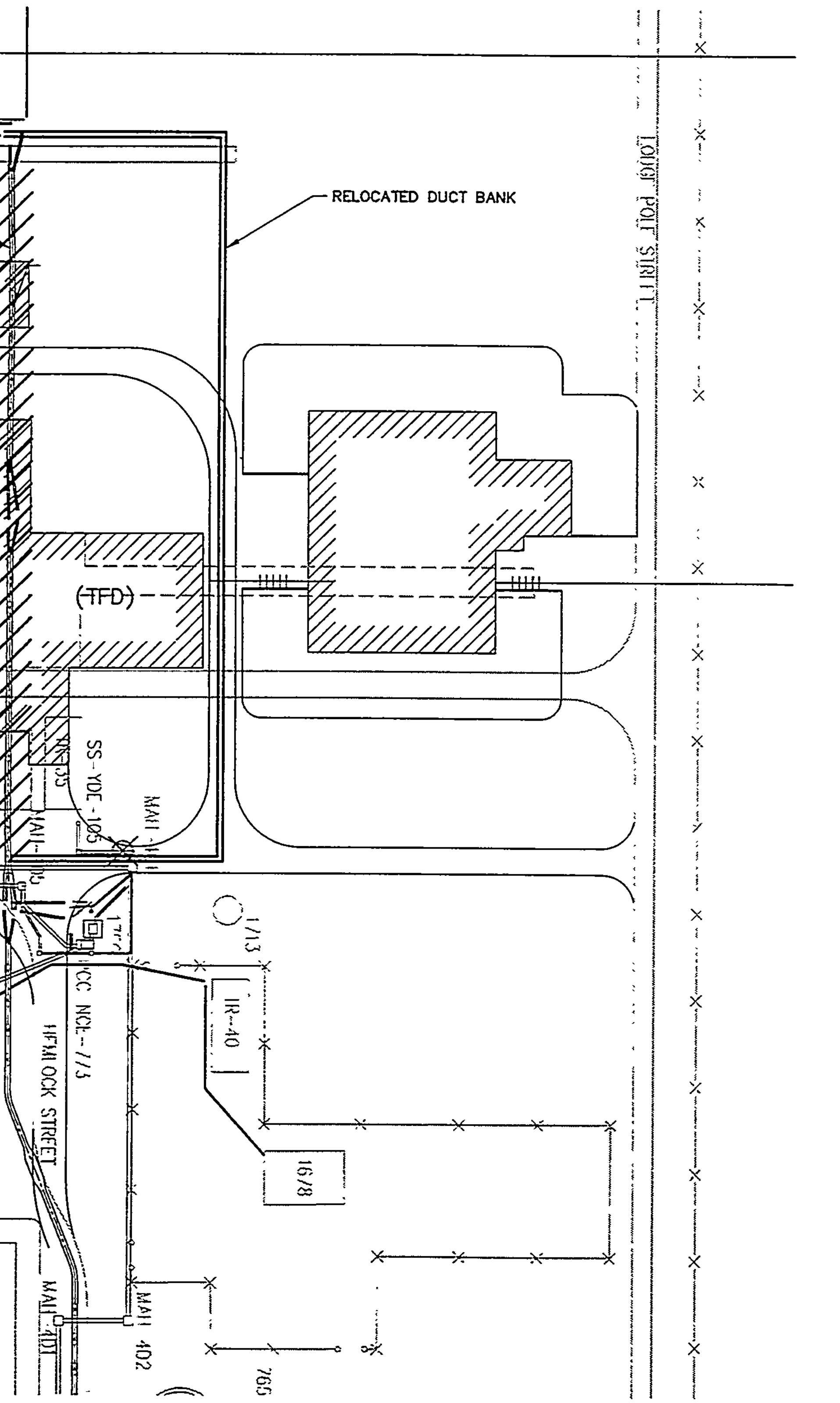

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

	UNEX	MOD UNEX
GFF		
NWCF		

SUBCONTRACT NO.
REQUESTER:
DESIGN: W LIU
DRAWN: A L TETER
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:

INEEL Idaho National Engineering & Environmental Laboratory BECHTEL BWXT IDAHO, LLC

INTEC
WASTE TREATMENT FACILITY (UNEX)
SODIUM BEARING WASTE FEED
FILTRATION
DUCT BANK RELOCATION PLAN

SIZE D | CAGE CODE 01MF3 | INDEX CODE NUMBER: AREA | TYPE | CL | ORG 090 | DWG– | REV
SCALE: 1" = 60' | SHEET E–5

Appendix E

Detailed Cost Estimate

INEEL
Idaho National Engineering & Environmental Laboratory

INTEROFFICE MEMORANDUM

Date:	4 September 2000		
To:	S. Losinski	MS-3625	6-5962
From:	M. M. Plum	MS-3878	6-1108
Subject:	DRAFT RESULTS of AN ECONOMIC EVALUATION for UNEX TREATMENT of SBW – MMP-12-2000		
Reference:	Economic evaluation on the treatment of SBW using the UNEX and Modified UNEX Treatment Process at either a Greenfield site or combination of the existing NWCF and a Greenfield site.		

I am sending a draft economic evaluation that should be included in the 90% draft study of the UNEX process. Current results suggests that the UNEX Process at a Greenfield site is the lowest cost (discounted life-cycle cost [LCC]). However, I would recommend a final decision on a path of future studies and design until the volumes and disposition path of the treated waste can be clearly defined.

A report and evaluation (both draft) of methodology, assumptions, and analysis is provided as an attachment. I am assuming at this time that we will update these results with comments rendered during the comment period in September. If I may be of further assistance, or if there are any questions, please feel free to contact me during reasonable business hours @ 526-1108 or PLUMMM@INEL.GOV.

ATTACHMENTS

cc: Vondell Balls MS-3650
Terry Battiste MS-6000
Norbert Valles MS-3625

mmp

Executive Summary insert

From an economics perspective, all four options are very capital intensive relative to the discounted LCC. This is largely the result of the SBW treatment facility size, its throughput requirements, and the duration of the treatment campaign. However, options that employ Greenfield construction have a lower discounted LCC. Additionally, the two options that employ the Modified UNEX Process is more resource intensive since a majority of the treated SBW is disposed at WIPP. As a result, the lowest cost alternative is Option A (a discounted LCC of $744.3M) which employs both the advantages of a Greenfield site construction and minimizes the volume of waste disposed at WIPP by employing the UNEX Process. The next lowest cost alternative is Option C (a discounted LCC of $848.5M) which continues to employ the UNEX process. This suggests that the marginal cost differences in the treatment process is more of a cost driver than the marginal cost differences in facility location.

Economic Summary insert
to be combined with the Capital Cost Estimate Summary

X. Life Cycle Cost Analysis

The purpose of a life-cycle cost (LCC) analysis is to determine the least cost alternative, from a resource perspective. For Federal Agencies like the U.S. Department of Energy (DOE), the preferred evaluation methodology is discounted LCA as prescribed by the Office of Management and Budgets (OMB) document A-94. Thus, all costs presented are actually discounted Life-cycle analyses.

In general, the purpose of life-cycle analysis is to determine the current value of the resources required to implement the option, assuming each alternative provides equal product and / or service output. In other words, we are interested only in evaluating the cash flows; we will not evaluate the value of the benefits because we have assumed all alternatives will meet the minimum technical performance standard (technical viability).

X.1. Economic Methodology

All costs are estimated in FY-2000 dollars and not inflated (one of two analysis methods accepted by OMB.) For purpose of this feasibility study, all production rates and resulting costs in production were flat-lined (assuming constant production.) As prescribed in OMB Circular A-94, all constant value cash flows are discounted 3.1% (compounded annually) to FY-2000 to calculate the present value (PV) of the projected cash flow. The total of all discounted cash flows over the life of the project is the discounted LCC (dLCC). This methodology, prescribed by OMB in Circular A-94 (discount rate update in January 2000), is used to determine the most cost-effective method in acquiring, operating, and maintaining Government programs and agencies. In general, this test for cost effectiveness mandates that the best alternative is one with lowest PV, assuming each alternative meets minimum performance requirements. Thus, system performance must be ensured in economic analysis. As prescribed by OMB A-94, any previously incurred capital costs for equipment and facilities are considered "sunk" and are not included in cost-effectiveness analysis.

X.2. Operations Cost Methodology

The design team generated most of the operation costs. A majority of these costs were either labor or direct materials consumed in the process of operation. Other incidental costs such as training and working capital were estimated using best engineering judgement equally applied to all options.

Costs were organized into a pre-operations, operations, and post-operations periods. These were decomposed into direct and support activities. These were then decomposed into a functional organization according to the design team's input. This included: 1) material receipt and rough filtration, 2) radionuclide extraction, 3) evaporative drying, 4) neutralizing and drying, 5) packaging, 6) interim storage, 7) transportation to disposition site, 8) and support functions of capital maintenance, facility maintenance, administration, QA /safety / Radcon, and process maintenance. Lastly, some economic evaluations include a cost category for intangible costs that are often mitigated through the administration of additional capital and / or operations investment. Such a methodology usually allows for the inclusion of an operations benefit that is not included when a cost / benefit analysis is not performed (i.e., an intangible cost may be the added cost of a system that fails more often because less costly selected over better performing equipment.) However, discussions with the design team suggested that the stand-alone independence of the facility would not impact other INTEC operations. Additionally, the failure rates of any of the options are probably equal, thus, if there are any intangible costs impacts, they impact the options equally.

Labor costs were estimated based on a general classification of the laborer. The design team provided the labor type and estimated number of laborers. The economic evaluation assumed annual burdened costs of $100K for operator / technicians, $125K for scientists / engineers, and $155K for management and supervisors. The design estimated a total of 110 personnel are required to operate the facility for any option; thus, there are no marginal labor cost advantages between a greenfield and existing facility, or the UNEX and Modified UNEX Process.

The design team provided all consumable materials and unit costs. These were calculated according to the volume throughput of SBW (and because the volume was equal over three years, these costs were equal for three years.) Interim storage and transporting / dispositioning costs for treated SBW was included in the evaluation. Including these costs completes the LCC evaluation and the effect the treatment process has on follow handling. For example, the evaluation assumed that UNEX treated waste could be handled a little more cost-effectively since they could be contact handled ($250 versus $500 per drum; $2500 versus $3500 for canisters). Similarly, the disposal could be performed on-site ($600 per drum) versus WIPP ($8.8K per drum). All contact handled canisters disposed at Hanford cost $26.4K. Lastly, an operations contingency equal to 35% was included to account for unknown operations / post-operations costs. This cost did not include a contingency on the capital cost estimate which has its own contingency included.

X.3. Schedule Methodology

For all options, the analysis assumed a 5-year construction schedule starting in FY-2003. Although meeting the financial obligations may be accelerated, this was the assumed schedule to meet treatment by the start of FY-2008. All options also assumed a three-year operating schedule, after which the facility would be maintained in standby operations until FY-2020. During standby, the analysis assumed the option would be maintained at 50% of direct capital maintenance, 33% of support labor and administration, 25% of process maintenance, 50% of facility maintenance, and incur zero costs for QA, radcon, safety and direct operations.

The analysis assumed that the NWCF and the Hg removal system would be decommissioned, decontaminated, and demolished (DD&D) in FY-2021. For purposes of simplicity, this activity of DD&D would occur over a one-year period, although a realistic time period could require 10 or 15 years. The evaluation estimated a DD&D cost to be 13% of the original capital investment because of the expected low levels of contamination and relative ease in dismantling a facility of these construction techniques.

X.4. Life-Cycle Results

From a LCC perspective, all four options are very capital intensive. This result is primarily a factor of the SBW facility size, its throughput requirements, and the duration of the treatment campaign. Option A (Greenfield / UNEX option) has the lowest dLCC because of the less costly capital infrastructure and the disposition path for the treated SBW. The next lowest alternative is Option C which employ the UNEX process. This suggests that the marginal cost differences in the treatment process is more of a cost driver than the marginal cost differences in facility location.

Table ***: Economic Evaluation Results
In discounted FY-2000 dollars

Option A: UNEX @ Greenfield	**$744.3M**
Option B: Modified UNEX @ Greenfield	**$890.1M**
Option C: UNEX @ NWCF / Greenfield	**$848.5M**
Option D: Modified UNEX @ NWCF / Greenfield	**$994.6M**

X.5. Economic Recommendation

Based on the economic evaluation, it appears that Option A has a significant cost advantage over all other options. This evaluation has estimated that the UNEX Process is at least 20% more cost-effective than the Modified UNEX Process (once the effects of dispositioning are accounted for.) Secondly, Option A includes Greenfield construction which is at least 20% more cost effective than the NWCF / Greenfield option. In both cases, a 20% margins are considered significant enough of a difference to select one alternative over another. However, because a large portion of the overall cost advantages is due to the variable of disposition path, this economic evaluation recommending that additional analysis be provided to validate the volume and the disposition path of treated SBW.

Option A - UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $744,347

Item				1 2001	2 2002	3 2003	4 2004	5 2005	6 2006	7 2007	8 2008	9 2009	10 2010
Discounted Annual Totals				$0	$0	$48,355	$70,352	$136,474	$110,395	$86,852	$60,443	$58,626	$56,863
discount factor (to 2001 dollars)				1.000	1.031	1.063	1.096	1.130	1.165	1.201	1.238	1.277	1.316
Annual Totals (contingency included; intangible costs not included)				$0	$0	$51,400	$77,100	$154,200	$128,600	$104,312	$74,844	$74,844	$74,844
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$19,404*	*$19,404*	*$19,404*
Pre-Operation				$0	$0	$51,400	$77,100	$154,200	$128,600	$104,312	$0	$0	$0
Capital Investment													
Facility / Equipment Investment													
TEC @	$424,100.0					$42,410.0	$63,615 0	$127,230.0	$106,025.0	$84,820.0			
OPC @	$89,900.0					$8,990.0	$13,485 0	$26,970 0	$22,475 0	$17,980.0			
Operations Training													
Develop training plan									$100.0	$500.0			
Operations training	4.0 wk(s)	for all FTE								$1,011.6			
Operation				$0	$0	$0	$0	$0	$0	$0	$55,440	$55,440	$55,440
volume of SBW to treat, in years	4.30 M-liters	in	3.0 yrs								1,433,333	1,433,333	1,433,333
treated volumes													
drums - UNEX	45,000 drums										15,000	15,000	15,000
RH-TRU cylinders - UNEX	300 canisters										100	100	100
Direct													
Material Receipt / Rough Filration (90% removal of UDS)											$1,080 0	$1,080 0	$1,080 0
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	1.0 FTE(dys) &	8.0 FTE(rotate)	$100.0 / yr								$900.0	$900.0	$900.0
supervisors / mgt	0.0 FTE(dys) &	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Direct operation consumables													
filters	$25.0 / yr										$25.0	$25.0	$25.0
power													
kw	0.5 MW @	$0.042 / MWhr									$0.0	$0.0	$0.0
Radionuclide Extraction using UNEX											$6,328 8	$6,328 8	$6,328 8
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	4.0 FTE(rotate)	$100.0 / yr								$400.0	$400.0	$400.0
supervisors / mgt	2.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$465.0	$465.0	$465.0
Direct operation consumables													
HF	430.0 m3 @	$1.875 / m3	$806.3 / yr								$806.3	$806.3	$806.3
FS-13 (Phenyltriflouromet	11.0 m3 @	$42.000 / m3	$462.0 / yr								$462.0	$462.0	$462.0
ChCoDiC	470.0 kg @	$3.000 / kg	$1,410.0 / yr								$1,410.0	$1,410.0	$1,410.0
CMPO	294.0 kg @	$1.000 / kg	$294.0 / yr								$294.0	$294.0	$294.0
PEG-400	294.0 kg @	$0.380 / kg	$111.7 / yr								$111.7	$111.7	$111.7
Al(NO3)3	94.0 m3 @	$17.000 / m3	$1,598.0 / yr								$1,598.0	$1,598.0	$1,598.0
Guanidine Carbonate	28.0 m3 @	$13.700 / m3	$383.6 / yr								$383.6	$383.6	$383.6
DTPA	18.0 m3 @	$22.000 / m3	$396.0 / yr								$396.0	$396.0	$396.0
HNO3	0.1 m3 @	$16.650 / m3	$1.7 / yr								$1.7	$1.7	$1.7
power													
kw	5.7 MW @	$0.042 / MWhr	$1,436.4 / yr								$0.2	$0.2	$0.2
steam in 1000 lbs/hr	22.6 1000 lbs @	$0.013 / 1000 lbs / hr	$1,762.8 / yr								$0.3	$0.3	$0.3
Process HAW with evaporative drying											$3,386.6	$3,386.6	$3,386 6
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	8.0 FTE(rotate)	$100.0 / yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables													
power													
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067.0	$1,067.0

Option A - UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $744,347

Item	Basis		Unit cost	1 2001	2 2002	3 2003	4 2004	5 2005	6 2006	7 2007	8 2008	9 2009	10 2010
Discounted Annual Totals				$0	$0	$48,355	$70,352	$136,474	$110,395	$86,852	$60,443	$58,626	$56,863
discount factor (to 2001 dollars)				1 000	1 031	1 063	1 096	1.130	1.165	1.201	1.238	1.277	1 316
Annual Totals (contingency included; intangible costs not included)				$0	$0	$51,400	$77,100	$154,200	$128,600	$104,312	$74,844	$74,844	$74,844
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$19,404*	*$19,404*	*$19,404*
Process LAW by neutralization & grouting											$25,571 6	$25,571 6	$25,571 6
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	24 0 FTE(rotate)	$100.0 / yr								$2,400 0	$2,400.0	$2,400.0
supervisors / mgt	1 0 FTE(dys) @	1 0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables													
NaOH	740 0 m3 @	$2.500 / m3	$1,850.0 / yr								$1,850 0	$1,850.0	$1,850.0
portland cement	360 0 m3 @	$3 250 / m3	$1,170 0 / yr								$1,170.0	$1,170.0	$1,170.0
slag	4,400.0 m3 @	$3 000 / m3	$13,200.0 / yr								$13,200.0	$13,200.0	$13,200.0
Ca(OH)2	970.0 m3 @	$4.500 / m3	$4,365.0 / yr								$4,365.0	$4,365.0	$4,365.0
power													
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067.0	$1,067.0
Secondary Waste Disposal	24-hr, 7-dys / wk operation												
HEPA filters	10.0 m3 @	$10.0 / m3	$100.0 / yr								$100.0	$100.0	$100.0
PPE	30.0 m3 @	$10.0 / m3	$300.0 / yr								$300.0	$300.0	$300.0
Spent solvent (3rd yr chai	40.0 drums	$25 0 each	$1,000.0 / yr								$0.0	$0.0	$1,000 0
Package treated waste											$3,830 0	$3,830 0	$3,830 0
Direct operations labor / drum	24-hr, 7-dys / wk operation												
operator / techs	8 0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr								$800 0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	0 0 FTE(rotate)	$155.0 / yr								$155.0	$155 0	$155 0
Direct operation consumables													
drums	$0.025 / drum										$375.0	$375.0	$375.0
canisters	$25.000 / canister										$2,500 0	$2,500.0	$2,500.0
Interim Store Treated Waste until Final Repository											$4,000 0	$4,000 0	$4,000.0
UNEX treated drums go to interim storage @ INEEL			$0 250 / drum								$3,750.0	$3,750.0	$3,750 0
UNEX treated canisters go to interim storage @ INEEL			$2,500 / canister								$250.0	$250.0	$250.0
Transportation and Final Implacement @ Repository											$0 0	$0 0	$0 0
UNEX drums are disposed on-site or @ Hanford			$0.600 / drum								$0 0	$0 0	$0 0
UNEX treated canisters go to WIPP			$26.400 / canister								$0 0	$0 0	$0 0
Support													
Direct capital maintenance											$6,168 0	$6,168 0	$6,168 0
capital building		1.00% of	capital invest								$5,140 00	$5,140 0	$5,140.0
general capital equipment		0 20% of	capital invest								$1,028 00	$1,028.0	$1,028.0
Administration, Support, Training, & Tech Support											$1,410 0	$1,410 0	$1,410 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr								$600.0	$600.0	$600.0
engineer / scientists	4.0 FTE(dys) @	0.0 FTE(rotate)	$125.0 / yr								$500 0	$500.0	$500 0
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
QA, Safety, Radcon											$1,555 0	$1,555 0	$1,555 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	2.0 FTE(dys) @	12 0 FTE(rotate)	$100.0 / yr								$1,400 0	$1,400.0	$1,400.0
supervisors / mgt	0 0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155 0	$155.0
Process Maintenance											$1,355 0	$1,355 0	$1,355 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	12 0 FTE(rotate)	$100 0 / yr								$1,200.0	$1,200.0	$1,200.0
supervisors / mgt	0 0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155 0	$155.0	$155.0
Facility Maintenance											$755 0	$755 0	$755 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$600.0	$600 0	$600 0
supervisors / mgt	1.0 FTE(dys) @	0 0 FTE(rotate)	$155.0 / yr								$155.0	$155 0	$155 0
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Direct													
DD&D		10 00% of	capital investment										
Support													
DD&D planning		3 00% of	capital investment										

Option A - UNEX @ Greenfield Facility

all cost in thousands

		11 2011 stand-by	12 2012 stand-by	13 2013 stand-by	14 2014 stand-by	15 2015 stand-by	16 2016 stand-by	17 2017 stand-by	18 2018 stand by	19 2019 stand-by	20 2020 stand-by	21 2022
dLCC (no intangible costs)	**$744,347**											
Discounted Annual Totals		$4,248	$4,120	$3,997	$3,876	$14,008	$13,587	$13,179	$3,431	$3,328	$3,228	$48,985
discount factor (to 2001 dollars)		1.357	1.399	1.442	1.487	1.533	1.581	1.630	1 680	1 732	1.786	1 642
Annual Totals (contingency included; intangible costs not included)		$5,765	$5,765	$5,765	$5,765	$21,479	$21,479	$21,479	$5,765	$5,765	$5,765	$90,207
contingency @	*35.0%* (not calculated on pre-operation / investment costs)	*$1,495*	*$1,495*	*$1,495*	*$1,495*	*$5,569*	*$5,569*	*$5,569*	*$1,495*	*$1,495*	*$1,495*	*$23,387*
Pre-Operation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Investment												
Facility / Equipment Investment												
TEC @	$424,100 0											
OPC @	$89,900 0											
Operations Training												
Develop training plan												
Operations training	4.0 wk(s) for all FTE											
Operation		$4,270	$4,270	$4,270	$4,270	$15,910	$15,910	$15,910	$4,270	$4,270	$4,270	$0
volume of SBW to treat, in years	4.30 M-liters in 3.0 yrs											
treated volumes												
drums - UNEX	45,000 drums											
RH-TRU cylinders - UNEX	300 canisters											
Direct												
Material Receipt / Rough Filtration	(90% removal of UDS)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	1.0 FTE(dys) & 8.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) & 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
filters	$25.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	0.5 MW @ $0.042 / MWhr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Radionuclide Extraction using UNEX		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 4.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	2.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
HF	430.0 m3 @ $1.875 / m3 $806.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
FS-13 (Phenyltriflouromol	11.0 m3 @ $42.000 / m3 $462.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
ChCoDiC	470.0 kg @ $3.000 / kg $1,410.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
CMPO	294.0 kg @ $1.000 / kg $294.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PEG-400	294.0 kg @ $0.380 / kg $111.7 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Al(NO3)3	94.0 m3 @ $17.000 / m3 $1,598.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Guanidine Carbonate	28.0 m3 @ $13.700 / m3 $383.6 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
DTPA	18.0 m3 @ $22.000 / m3 $396.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
HNO3	0.1 m3 @ $16.650 / m3 $1.7 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	5.7 MW @ $0.042 / MWhr $1,436.4 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	22.6 1000 lbs @ $0.013 / 1000 lbs / hr $1,762.8 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process HAW with evaporative drying		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0 0 FTE(dys) @ 8.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
power												
kw	1.0 MW @ $0.042 / MWhr $252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.0 1000 lbs @ $0.013 / 1000 lbs / hr $222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

Option A - UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $744,347

				11 2011 stand-by	12 2012 stand-by	13 2013 stand-by	14 2014 stand by	15 2015 stand-by	16 2016 stand by	17 2017 stand-by	18 2018 stand-by	19 2019 stand-by	20 2020 stand-by	21 2022
Discounted Annual Totals				$4,248	$4,120	$3,997	$3,876	$14,008	$13,587	$13,179	$3,431	$3,328	$3,228	$48,985
discount factor (to 2001 dollars)				1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)				$5,765	$5,765	$5,765	$5,765	$21,479	$21,479	$21,479	$5,765	$5,765	$5,765	$90,207
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$1,495*	*$1,495*	*$1,495*	*$1,495*	*$5,569*	*$5,569*	*$5,569*	*$1,495*	*$1,495*	*$1,495*	*$23,387*
Process LAW by neutralization & grouting				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	24.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables														
NaOH	740.0 m3 @	$2.500 / m3	$1,850.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
portland cement	360.0 m3 @	$3.250 / m3	$1,170.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
slag	4,400.0 m3 @	$3.000 / m3	$13,200.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Ca(OH)2	970.0 m3 @	$4.500 / m3	$4,365.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power														
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Secondary Waste Disposal	24-hr, 7-dys / wk operation													
HEPA filters	10.0 m3 @	$10.0 / m3	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PPE	30.0 m3 @	$10.0 / m3	$300.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Spent solvent (3rd yr cha	40.0 drums	$25.0 each	$1,000.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Package treated waste				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor / drum	24-hr, 7-dys / wk operation													
operator / techs	8.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables														
drums	$0.025 / drum			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
canisters	$25.000 / canister			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Interim Store Treated Waste until Final Repository				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
UNEX treated drums go to interim storage @ INEEL			$0.250 / dr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
UNEX treated canisters go to interim storage @ INEEL			$2.500 / ca	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Transportation and Final Implacement @ Repository				$0.0	$0.0	$0.0	$0.0	$11,640.0	$11,640.0	$11,640.0	$0.0	$0.0	$0.0	
UNEX drums are disposed on-site or @ Hanford			$0.600 / dr	$0.0	$0.0	$0.0	$0.0	$9,000.0	$9,000.0	$9,000.0	$0.0	$0.0	$0.0	
UNEX treated canisters go to WIPP			$28.400 / ca	$0.0	$0.0	$0.0	$0.0	$2,640.00	$2,640.00	$2,640.00	$0.0	$0.0	$0.0	
Support														
Direct capital maintenance				$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	
capital building		1.00% of	capital invest	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	$2,570.0	
general capital equipment		0.20% of	capital invest	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	
Administration, Support, Training, & Tech Support				$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	
engineer / scientists	4.0 FTE(dys) @	0.0 FTE(rotate)	$125.0 / yr	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	
QA, Safety, Radcon				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	2.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process Maintenance				$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$38.75	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	
Facility Maintenance				$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$77.50	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$66,820
Direct														
DD&D		10.00% of	capital investment											$51,400.0
Support														
DD&D planning		3.00% of	capital investment											$15,420.0

Option B - MODIFIED UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $890,140

					1 2001	2 2001	3 2002	4 2002	5 2002	6 2005	7 2006	8 2007	9 2008	10 2009
Discounted Annual Totals					$0	$0	$48,355	$70,352	$136,474	$110,395	$86,383	$45,666	$44,293	$42,961
discount factor (to 2001 dollars)					1 000	1.031	1.063	1 096	1.130	1.165	1.201	1.238	1.277	1.316
Annual Totals (contingency included; intangible costs not included)					$0	$0	$51,400	$77,100	$154,200	$128,600	$103,748	$56,547	$56,547	$56,547
contingency @	*35.0%*		(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$14,660*	*$14,660*	*$14,660*
Pre-Operation					$0	$0	$51,400	$77,100	$154,200	$128,600	$103,748	$0	$0	$0
Capital Investment														
Facility / Equipment Investment														
TEC @			$424,700.0				$42,470.0	$63,705.0	$127,410.0	$106,175.0	$84,940.0			
OPC @			$89,300.0				$8,930.0	$13,395.0	$26,790.0	$22,325.0	$17,860.0			
Operations Training														
Develop training plan										$100.0	$500.0			
Operations training			4.0 wk(s)	for all FTE							$448.0			
Operation					$0	$0	$0	$0	$0	$0	$0	$41,886	$41,886	$41,886
volume of SBW to treat, in years			4.30 M-liters	in 3 0 yrs								1,433,333	1,433,333	1,433,333
treated volumes														
drums - UNEX			30,000 drums									10,000	10,000	10,000
RH-TRU cylinders - UNEX			250 canisters									83	83	83
Direct														
Material Receipt / Rough Filtration	(90% removal of UDS)											$1,080 0	$1,080 0	$1,080 0
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	1.0 FTE(dys)	&	8.0 FTE(rotate)	$100.0 /yr								$900.0	$900.0	$900.0
supervisors / mgt	0.0 FTE(dys)	&	1.0 FTE(rotate)	$155.0 /yr								$155.0	$155.0	$155.0
Direct operation consumables														
filters	$25.0 /yr											$25 0	$25.0	$25.0
power														
kw	0.5 MW	@	$0.042 /MWhr									$0.0	$0.0	$0.0
Radionuclide Extraction using UNEX												$4,765.1	$4,765.1	$4,765 1
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys)	@	4.0 FTE(rotate)	$100.0 /yr								$400.0	$400.0	$400.0
supervisors / mgt	2.0 FTE(dys)	@	1.0 FTE(rotate)	$155.0 /yr								$465.0	$465.0	$465.0
Direct operation consumables														
FS-13 (Phenyltriflouromet	9.0 m3	@	$42.000 / m3	$378.0 /yr								$378.0	$378.0	$378.0
ChCoDiC	500.0 kg	@	$3.000 / kg	$1,500.0 /yr								$1,500.0	$1,500.0	$1,500.0
PEG-400	36.0 kg	@	$0.380 / kg	$13.7 /yr								$13.7	$13.7	$13.7
Guanidine Carbonate	142.0 m3	@	$13.700 / m3	$1,945.4 /yr								$1,945.4	$1,945.4	$1,945.4
NaOH	25 0 m3	@	$2.500 / m3	$62.5 /yr								$62.5	$62.5	$62.5
power														
kw	5.7 MW	@	$0.042 / MWhr	$1,436.4 /yr								$0.2	$0.2	$0.2
steam in 1000 lbs/hr	22.6 1000 lbs	@	$0.013 / 1000 lbs / hr	$1,762.8 /yr								$0.3	$0.3	$0.3
Secondary Waste Disposal	24-hr, 7-dys / wk operation													
HEPA filters	10.0 m3	@	$10.0 / m3	$100.0 /yr								$100.0	$100.0	$100.0
PPE	30.0 m3	@	$10 0 / m3	$300.0 /yr								$300.0	$300.0	$300.0
Spent solvent (3rd yr cha	40.0 drums		$25.0 each	$1,000.0 /yr								$0.0	$0.0	$1,000.0
Process HAW with evaporative drying												$3,386 6	$3,386.6	$3,386 6
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys)	@	8.0 FTE(rotate)	$100.0 /yr								$800.0	$800 0	$800.0
supervisors / mgt	1.0 FTE(dys)	@	1.0 FTE(rotate)	$155.0 /yr								$310.0	$310.0	$310.0
Direct operation consumables														
power														
kw	1.0 MW	@	$0.042 / MWhr	$252.0 /yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs	@	$0.013 / 1000 lbs / hr	$222.3 /yr								$1,067.0	$1,067.0	$1,067.0

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Option B - MODIFIED UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $890,140

				1 2001	2 2001	3 2002	4 2002	5 2002	6 2005	7 2006	8 2007	9 2008	10 2009
Discounted Annual Totals				$0	$0	$48,355	$70,352	$136,474	$110,395	$86,383	$45,666	$44,293	$42,961
discount factor (to 2001 dollars)				1.000	1 031	1 063	1.096	1 130	1 165	1 201	1 238	1.277	1 316
Annual Totals (contingency included; intangible costs not included)				$0	$0	$51,400	$77,100	$154,200	$128,600	$103,748	$56,547	$56,547	$56,547
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$14,660*	*$14,660*	*$14,660*
Process LAW by neutralization & grouting											$12,831 6	$12,831 6	$12 831 6
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	24.0 FTE(rotate)	$100.0 / yr								$2,400.0	$2,400.0	$2,400.0
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables													
portland cement	180 0 m3 @	$3 250 / m3	$585.0 / yr								$585.0	$585.0	$585.0
slag	620 0 m3 @	$3.000 / m3	$1,860.0 / yr								$1,860.0	$1,860.0	$1,860.0
Ca(OH)2	1,200.0 m3 @	$4.500 / m3	$5,400.0 / yr								$5,400.0	$5,400.0	$5,400.0
power													
kw	1 0 MW @	$0 042 / MWhr	$252.0 / yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2 9 1000 lbs @	$0 013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067.0	$1,067.0
Package treated waste											$3,288 3	$3,288 3	$3,288 3
Direct operations labor / drum	24-hr, 7-dys / wk operation												
operator / techs	8 0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Direct operation consumables													
drums	$0.025 / drum										$250 0	$250.0	$250 0
canisters	$25.000 / canister										$2,083.3	$2,083.3	$2,083 3
Interim Store Treated Waste until Final Repository											$5,291 7	$5 291 7	$5,291 7
MODIFIED UNEX drums go to interim storage @ INEEL			$0.500 / drum								$5,000 0	$5,000.0	$5,000.0
MODIFIED UNEX canisters go to interim storage @ INEEL			$3.500 / canister								$291.7	$291.7	$291.7
Transportation and Final Implacement @ Repository											$0 0	$0 0	$0 0
MODIFIED UNEX drums go to WIPP			$8.800 / drum								$0.0	$0 0	$0 0
MODIFIED UNEX canisters go to Hanford			$29.400 / canister								$0 0	$0 0	$0 0
Support													
Direct capital maintenance											$6,168 0	$6,168.0	$6 168 0
capital building		1.00% of	capital invest								$5,140 00	$5,140.0	$5,140 0
general capital equipment		0 20% of	capital invest								$1,028 00	$1,028 0	$1,028 0
Administration, Support, Training, & Tech Support											$1,410 0	$1,410 0	$1,410 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr								$600.0	$600.0	$600 0
engineer / scientists	4.0 FTE(dys) @	0 0 FTE(rotate)	$125.0 / yr								$500.0	$500.0	$500.0
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$310 0	$310.0	$310.0
QA, Safety, Radcon											$1,555 0	$1,555 0	$1,555 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	2 0 FTE(dys) @	12 0 FTE(rotate)	$100.0 / yr								$1,400.0	$1,400.0	$1,400.0
supervisors / mgt	0 0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Process Maintenance											$1,355 0	$1,355 0	$1,355 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	0 0 FTE(dys) @	12 0 FTE(rotate)	$100 0 / yr								$1,200.0	$1,200.0	$1,200.0
supervisors / mgt	0 0 FTE(dys) @	1.0 FTE(rotate)	$155 0 / yr								$155.0	$155 0	$155.0
Facility Maintenance											$755 0	$755 0	$755 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$600 0	$600 0	$600 0
supervisors / mgt	1.0 FTE(dys) @	0 0 FTE(rotate)	$155.0 / yr								$155 0	$155 0	$155 0
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Direct													
DD&D		10 00% of	capital investment										
Support													
DD&D planning		3 00% of	capital investment										

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Option B - MODIFIED UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $890,140

Item	Parameters	11 2010	12 2011	13 2012	14 2013 * stand-by	15 2014 stand-by	16 2015 stand-by	17 2016 stand-by	18 2017 stand-by	19 2018 stand-by	20 2019 stand-by	21 2021
Discounted Annual Totals		$4,248	$4,120	$3,997	$3,876	$83,398	$80,890	$78,458	$3,431	$3,328	$3,228	$36,286
discount factor (to 2001 dollars)		1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.600	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)		$5,765	$5,765	$5,765	$5,765	$127,872	$127,872	$127,872	$5,765	$5,765	$5,765	$66,820
contingency	*35.0%* (not calculated on pre-operation / investment costs)	*$1,495*	*$1,495*	*$1,495*	*$1,495*	*$33,152*	*$33,152*	*$33,152*	*$1,495*	*$1,495*	*$1,495*	*$0*
Pre-Operation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Investment												
Facility / Equipment Investment												
TEC	$424,700.0											
OPC	$89,300.0											
Operations Training												
Develop training plan												
Operations training	4.0 wk(s) for all FTE											
Operation		$4,270	$4,270	$4,270	$4,270	$94,720	$94,720	$94,720	$4,270	$4,270	$4,270	$0
volume of SBW to treat, in years	4.30 M-liters in 3.0 yrs											
treated volumes												
drums - UNEX	30,000 drums											
RH-TRU cylinders - UNEX	250 canisters											
Direct												
Material Receipt / Rough Filtration	(90% removal of UDS)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	1.0 FTE(dys) & 8.0 FTE(rotate) $100.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) & 1.0 FTE(rotate) $155.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
filters	$25.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	0.5 MW @ $0.042 /MWhr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Radionuclide Extraction using UNEX		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 4.0 FTE(rotate) $100.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	2.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
FS-13 (Phenyltriflouromel	9.0 m3 @ $42.000 /m3 $378.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
ChCoDIC	500.0 kg @ $3.000 /kg $1,500.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PEG-400	36.0 kg @ $0.380 /kg $13.7 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Guanidine Carbonate	142.0 m3 @ $13.700 /m3 $1,945.4 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
NaOH	25.0 m3 @ $2.500 /m3 $62.5 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	5.7 MW @ $0.042 /MWhr $1,436.4 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	22.6 1000 lbs @ $0.013 /1000 lbs / hr $1,762.8 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Secondary Waste Disposal	24-hr, 7-dys / wk operation											
HEPA filters	10.0 m3 @ $10.0 /m3 $100.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PPE	30.0 m3 @ $10.0 /m3 $300.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Spent solvent (3rd yr cha	40.0 drums $25.0 each $1,000.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process HAW with evaporative drying		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 8.0 FTE(rotate) $100.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
power												
kw	1.0 MW @ $0.042 /MWhr $252.0 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs @ $0.013 /1000 lbs / hr $222.3 /yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

Option B - MODIFIED UNEX @ Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $890,140

				11	12	13	14	15	16	17	18	19	20	21
				2010	2011	2012	2013 *	2014	2015	2016	2017	2018	2019	2021
							stand-by	stand-by	stand-by	stand-by	stand-by	stand-by	stand-by	
Discounted Annual Totals				$4,248	$4,120	$3,997	$3,876	$83,398	$80,890	$78,458	$3,431	$3,328	$3,228	$36,286
discount factor (to 2001 dollars)				1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)				$5,765	$5,765	$5,765	$5,765	$127,872	$127,872	$127,872	$5,765	$5,765	$5,765	$66,820
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$1,495*	*$1,495*	*$1,495*	*$1,495*	*$33,152*	*$33,152*	*$33,152*	*$1,495*	*$1,495*	*$1,495*	*$0*
Process LAW by neutralization & grouting				$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	24.0 FTE(rotate)	$100.0 / yr	$0.0	$0 0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	$0 0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0 0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0 0	$0.0	$0 0	
Direct operation consumables														
portland cement	180 0 m3 @	$3 250 / m3	$585.0 / yr	$0 0	$0.0	$0.0	$0 0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	
slag	620.0 m3 @	$3.000 / m3	$1,860.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	
Ca(OH)2	1,200.0 m3 @	$4.500 / m3	$5,400.0 / yr	$0.0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power														
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr	$0.0	$0 0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	
Package treated waste				$0 0	$0 0	$0.0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	
Direct operations labor / drum	24-hr, 7-dys / wk operation													
operator / techs	8.0 FTE(dys) @	0.0 FTE(rotate)	$100 0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0 0	$0.0	$0.0	$0.0	
Direct operation consumables														
drums	$0.025 / drum			$0 0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0.0	$0.0	$0.0	
canisters	$25.000 / canister			$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0 0	$0.0	$0 0	$0.0	
Interim Store Treated Waste until Final Repository				$0.0	$0.0	$0 0	$0 0	$0.0	$0 0	$0.0	$0 0	$0 0	$0 0	
MODIFIED UNEX drums go to interim storage @ INEEL			$0.500 / dr	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0 0	$0.0	$0 0	$0.0	
MODIFIED UNEX canisters go to interim storage @ INEEL			$3 500 / cr	$0.0	$0.0	$0.0	$0.0	$0.0	$0 0	$0.0	$0 0	$0.0	$0 0	
Transportation and Final Implacement @ Repository				$0.0	$0 0	$0.0	$0 0	$90,450 0	$90,450 0	$90,450 0	$0 0	$0 0	$0 0	
MODIFIED UNEX drums go to WIPP			$8.800 / dr	$0 0	$0 0	$0.0	$0.0	$88,000.0	$88,000.0	$88,000.0	$0.0	$0.0	$0.0	
MODIFIED UNEX canisters go to Hanford			$29.400 / cr	$0.0	$0.0	$0 0	$0 0	$2,450.00	$2,450.00	$2,450.00	$0.0	$0.0	$0.0	
Support														
Direct capital maintenance				$3,084 0	$3,084.0	$3,084 0	$3,084 0	$3,084 0	$3,084 0	$3,084 0	$3,084 0	$3,084 0	$3,084 0	
capital building	1 00%	of	capital invest	$2,570.0	$2,570 0	$2,570.0	$2,570.0	$2,570.0	$2,570 0	$2,570.0	$2,570 0	$2,570.0	$2,570 0	
general capital equipment	0 20%	of	capital invest	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	
Administration, Support, Training, & Tech Support				$470 0	$470.0	$470.0	$470.0	$470.0	$470 0	$470 0	$470 0	$470 0	$470 0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6.0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200 0	$200.0	
engineer / scientists	4.0 FTE(dys) @	0 0 FTE(rotate)	$125.0 / yr	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166 7	$166.7	$166.7	
supervisors / mgt	2.0 FTE(dys) @	0 0 FTE(rotate)	$155.0 / yr	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	
QA, Safety, Radcon				$0 0	$0 0	$0 0	$0.0	$0 0	$0 0	$0 0	$0 0	$0 0	$0 0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	2 0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr	$0 0	$0.0	$0.0	$0.0	$0.0	$0 0	$0 0	$0.0	$0.0	$0.0	
supervisors / mgt	0 0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0 0	$0 0	$0 0	$0.0	$0.0	$0.0	$0.0	$0 0	
Process Maintenance				$338 8	$338 8	$338 8	$338 8	$338 8	$338 8	$338 8	$338 8	$338 8	$338 8	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	12.0 FTE(rotate)	$100 0 / yr	$300 0	$300 0	$300.0	$300.0	$300.0	$300 0	$300 0	$300.0	$300.0	$300.0	
supervisors / mgt	0.0 FTE(dys) @	1 0 FTE(rotate)	$155.0 / yr	$38.75	$38.8	$38 8	$38 8	$38 8	$38 8	$38 8	$38.8	$38.8	$38 8	
Facility Maintenance				$377.5	$377.5	$377 5	$377 5	$377.5	$377 5	$377 5	$377 5	$377 5	$377 5	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6 0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr	$300.0	$300.0	$300 0	$300.0	$300 0	$300.0	$300.0	$300.0	$300.0	$300 0	
supervisors / mgt	1 0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$77.50	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$66,820
Direct														
DD&D	10 00%	of	capital investment											$51,400.0
Support														
DD&D planning	3 00%	of	capital investment											$15,420 0

Option C - UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $848,500

Item	Basis		Rate	Annual	1 2001	2 2002	3 2003	4 2004	5 2005	6 2006	7 2007	8 2008	9 2009	10 2010
Discounted Annual Totals					$0	$0	$56,822	$82,671	$160,370	$129,709	$101,839	$61,564	$59,713	$57,917
discount factor (to 2001 dollars)					1.000	1.031	1.063	1.096	1.130	1.165	1.201	1.238	1.277	1.316
Annual Totals (contingency included; intangible costs not included)					$0	$0	$60,400	$90,600	$181,200	$151,100	$122,312	$76,232	$76,232	$76,232
contingency	*35.0%*	(not calculated on pre-operation / investment costs)			*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$19,764*	*$19,764*	*$19,764*
Pre-Operation					$0	$0	$60,400	$90,600	$181,200	$151,100	$122,312	$0	$0	$0
Capital Investment														
Facility / Equipment Investment														
TEC		$458,100.0					$45,810.0	$68,715.0	$137,430.0	$114,525.0	$91,620.0			
OPC		$145,900.0					$14,590.0	$21,885.0	$43,770.0	$36,475.0	$29,180.0			
Operations Training														
Develop training plan										$100.0	$500.0			
Operations training		4.0 wk(s)	for all FTE								$1,011.6			
Operation					$0	$0	$0	$0	$0	$0	$0	$56,468	$56,468	$56,468
volume of SBW to treat, in years		4.30 M-liters	in 3.0 yrs									1,433,333	1,433,333	1,433,333
treated volumes														
drums - UNEX		45,000 drums										15,000	15,000	15,000
RH-TRU cylinders - UNEX		300 canisters										100	100	100
Direct														
Material Receipt / Rough Filtration	(90% removal of UDS)											$1,080.0	$1,080.0	$1,080.0
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	1.0 FTE(dys) &	8.0 FTE(rotate)		$100.0 /yr								$900.0	$900.0	$900.0
supervisors / mgt	0.0 FTE(dys) &	1.0 FTE(rotate)		$155.0 /yr								$155.0	$155.0	$155.0
Direct operation consumables														
filters	$25.0 /yr											$25.0	$25.0	$25.0
power														
kw	0.5 MW @	$0.042 /MWhr										$0.0	$0.0	$0.0
Radionuclide Extraction using UNEX												$6,328.8	$6,328.8	$6,328.8
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	4.0 FTE(rotate)		$100.0 /yr								$400.0	$400.0	$400.0
supervisors / mgt	2.0 FTE(dys) @	1.0 FTE(rotate)		$155.0 /yr								$465.0	$465.0	$465.0
Direct operation consumables														
HF	430.0 m3 @	$1.875 /m3		$806.3 /yr								$806.3	$806.3	$806.3
FS-13 (Phenyltriflouromet	11.0 m3 @	$42.000 /m3		$462.0 /yr								$462.0	$462.0	$462.0
ChCoDiC	470.0 kg @	$3.000 /kg		$1,410.0 /yr								$1,410.0	$1,410.0	$1,410.0
CMPO	294.0 kg @	$1.000 /kg		$294.0 /yr								$294.0	$294.0	$294.0
PEG-400	294.0 kg @	$0.380 /kg		$111.7 /yr								$111.7	$111.7	$111.7
Al(NO3)3	94.0 m3 @	$17.000 /m3		$1,598.0 /yr								$1,598.0	$1,598.0	$1,598.0
Guanidine Carbonate	28.0 m3 @	$13.700 /m3		$383.6 /yr								$383.6	$383.6	$383.6
DTPA	18.0 m3 @	$22.000 /m3		$396.0 /yr								$396.0	$396.0	$396.0
HNO3	0.1 m3 @	$16.650 /m3		$1.7 /yr								$1.7	$1.7	$1.7
power														
kw	5.7 MW @	$0.042 /MWhr		$1,436.4 /yr								$0.2	$0.2	$0.2
steam in 1000 lbs/hr	22.6 1000 lbs @	$0.013 /1000 lbs / hr		$1,762.8 /yr								$0.3	$0.3	$0.3
Secondary Waste Disposal	24-hr, 7-dys / wk operation													
HEPA filters	10.0 m3 @	$10.0 /m3		$100.0 /yr								$100.0	$100.0	$100.0
PPE	30.0 m3 @	$10.0 /m3		$300.0 /yr								$300.0	$300.0	$300.0
Spent solvent (3rd yr cha	40.0 drums	$25.0 each		$1,000.0 /yr								$0.0	$0.0	$1,000.0
Process HAW with evaporative drying												$3,386.6	$3,386.6	$3,386.6
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	8.0 FTE(rotate)		$100.0 /yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)		$155.0 /yr								$310.0	$310.0	$310.0
Direct operation consumables														
power														
kw	1.0 MW @	$0.042 /MWhr		$252.0 /yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 /1000 lbs / hr		$222.3 /yr								$1,067.0	$1,067.0	$1,067.0

Option C - UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $848,500

Item	Quantity	Rate / Factor	Cost	1 2001	2 2002	3 2003	4 2004	5 2005	6 2006	7 2007	8 2008	9 2009	10 2010
Discounted Annual Totals				$0	$0	$56,822	$82,671	$160,370	$129,709	$101,839	$61,564	$59,713	$57,917
discount factor (to 2001 dollars)				1.000	1.031	1.063	1.096	1.130	1.165	1.201	1.238	1.277	1.316
Annual Totals (contingency included; intangible costs not included)				$0	$0	$60,400	$90,600	$181,200	$151,100	$122,312	$76,232	$76,232	$76,232
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$19,764*	*$19,764*	*$19,764*
Process LAW by neutralization & grouting											$25,571.6	$25,571.6	$25,571.6
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	24.0 FTE(rotate)	$100.0 / yr								$2,400.0	$2,400.0	$2,400.0
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables													
NaOH	740.0 m3 @	$2.500 / m3	$1,850.0 / yr								$1,850.0	$1,850.0	$1,850.0
portland cement	360.0 m3 @	$3.250 / m3	$1,170.0 / yr								$1,170.0	$1,170.0	$1,170.0
slag	4,400.0 m3 @	$3.000 / m3	$13,200.0 / yr								$13,200.0	$13,200.0	$13,200.0
Ca(OH)2	970.0 m3 @	$4.500 / m3	$4,365.0 / yr								$4,365.0	$4,365.0	$4,365.0
power													
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr								$1,209.6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067.0	$1,067.0
Package treated waste											$3,830.0	$3,830.0	$3,830.0
Direct operations labor / drum	24-hr, 7-dys / wk operation												
operator / techs	8.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Direct operation consumables													
drums	$0.025 / drum										$375.0	$375.0	$375.0
canisters	$25.000 / canister										$2,500.0	$2,500.0	$2,500.0
Interim Store Treated Waste until Final Repository											$4,000.0	$4,000.0	$4,000.0
UNEX treated drums go to interim storage @ INEEL			$0.250 / drum								$3,750.0	$3,750.0	$3,750.0
UNEX treated canisters go to interim storage @ INEEL			$2.500 / canister								$250.0	$250.0	$250.0
Transportation and Final Implacement @ Repository											$0.0	$0.0	$0.0
UNEX drums are disposed on-site or @ Hanford			$0.600 / drum								$0.0	$0.0	$0.0
UNEX treated canisters go to WIPP			$26.400 / canister								$0.0	$0.0	$0.0
Support													
Direct capital maintenance											$7,196.0	$7,196.0	$7,196.0
capital building		1.20% of	capital invest								$6,168.00	$6,168.0	$6,168.0
general capital equipment		0.20% of	capital invest								$1,028.00	$1,028.0	$1,028.0
Administration, Support, Training, & Tech Support											$1,410.0	$1,410.0	$1,410.0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$600.0	$600.0	$600.0
engineer / scientists	4.0 FTE(dys) @	0.0 FTE(rotate)	$125.0 / yr								$500.0	$500.0	$500.0
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
QA, Safety, Radcon											$1,555.0	$1,555.0	$1,555.0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	2.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr								$1,400.0	$1,400.0	$1,400.0
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Process Maintenance											$1,355.0	$1,355.0	$1,355.0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr								$1,200.0	$1,200.0	$1,200.0
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Facility Maintenance											$755.0	$755.0	$755.0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$600.0	$600.0	$600.0
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Direct													
DD&D		12.00% of	capital investment										
Support													
DD&D planning		3.00% of	capital investment										

Option C - UNEX @ NWCF & Greenfield Facility

all cost in thousands

					11 2011 stand-by	12 2012 stand-by	13 2013 stand-by	14 2014 stand-by	15 2015 stand-by	16 2016 stand-by	17 2017 stand-by	18 2018 stand-by	19 2019 stand-by	20 2020 stand-by	21 2022
dLCC (no intangible costs)	**$848,500**														
Discounted Annual Totals					$4,759	$4,616	$4,478	$4,343	$14,461	$14,026	$13,604	$3,844	$3,728	$3,616	$66,418
discount factor (to 2001 dollars)					1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)					$6,459	$6,459	$6,459	$6,459	$22,173	$22,173	$22,173	$6,459	$6,459	$6,459	$122,310
contingency	*35.0%*	(not calculated on pre-operation / investment costs)			*$1,674*	*$1,674*	*$1,674*	*$1,674*	*$5,748*	*$5,748*	*$5,748*	*$1,674*	*$1,674*	*$1,674*	*$31,710*
Pre-Operation					$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Investment															
Facility / Equipment Investment															
TEC		$458,100.0													
OPC		$145,900.0													
Operations Training															
Develop training plan															
Operations training		4.0 wk(s)	for all FTE												
Operation					$4,784	$4,784	$4,784	$4,784	$16,424	$16,424	$16,424	$4,784	$4,784	$4,784	$0
volume of SBW to treat, in years		4.30 M-liters	in 3.0 yrs												
treated volumes															
drums - UNEX		45,000 drums													
RH-TRU cylinders - UNEX		300 canisters													
Direct															
Material Receipt / Rough Filtration	(00% removal of UDS)				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation														
operator / techs	1.0 FTE(dys) &	8.0 FTE(rotate)		$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) &	1.0 FTE(rotate)		$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables															
filters	$25.0 / yr				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power															
kw	0.5 MW	$0.042 / MWhr			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Radionuclide Extraction using UNEX					$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation														
operator / techs	0.0 FTE(dys)	4.0 FTE(rotate)		$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	2.0 FTE(dys)	1.0 FTE(rotate)		$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables															
HF	430.0 m3	$1.875 / m3		$806.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
FS-13 (Phenyltriflouromet	11.0 m3	$42.000 / m3		$462.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
ChCoDiC	470.0 kg	$3.000 / kg		$1,410.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
CMPO	294.0 kg	$1.000 / kg		$294.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PEG-400	294.0 kg	$0.380 / kg		$111.7 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Al(NO3)3	94.0 m3	$17.000 / m3		$1,598.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Guanidine Carbonate	28.0 m3	$13.700 / m3		$383.6 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
DTPA	18.0 m3	$22.000 / m3		$396.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
HNO3	0.1 m3	$16.650 / m3		$1.7 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power															
kw	5.7 MW	$0.042 / MWhr		$1,436.4 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	22.6 1000 lbs	$0.013 / 1000 lbs / hr		$1,762.8 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Secondary Waste Disposal	24-hr, 7-dys / wk operation														
HEPA filters	10.0 m3	$10.0 / m3		$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PPE	30.0 m3	$10.0 / m3		$300.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Spent solvent (3rd yr char	40.0 drums	$25.0 each		$1,000.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process HAW with evaporative drying					$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation														
operator / techs	0.0 FTE(dys)	8.0 FTE(rotate)		$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys)	1.0 FTE(rotate)		$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables															
power															
kw	1.0 MW	$0.042 / MWhr		$252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs	$0.013 / 1000 lbs / hr		$222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

Option C - UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $848,500

		11 2011 stand-by	12 2012 stand-by	13 2013 stand-by	14 2014 stand-by	15 2015 stand-by	16 2016 stand-by	17 2017 stand-by	18 2018 stand-by	19 2019 stand-by	20 2020 stand-by	21 2022
Discounted Annual Totals		**$4,759**	**$4,616**	**$4,478**	**$4,343**	**$14,461**	**$14,026**	**$13,604**	**$3,844**	**$3,728**	**$3,616**	**$66,418**
discount factor (to 2001 dollars)		1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)		**$6,459**	**$6,459**	**$6,459**	**$6,459**	**$22,173**	**$22,173**	**$22,173**	**$6,459**	**$6,459**	**$6,459**	**$122,310**
contingency @	*35.0%* (not calculated on pre-operation / investment costs)	*$1,674*	*$1,674*	*$1,674*	*$1,674*	*$5,748*	*$5,748*	*$5,748*	*$1,674*	*$1,674*	*$1,674*	*$31,710*
Process LAW by neutralization & grouting		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 24.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
NaOH	740.0 m3 @ $2.500 / m3 $1,850.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
portland cement	360.0 m3 @ $3.250 / m3 $1,170.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
slag	4,400.0 m3 @ $3.000 / m3 $13,200.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Ca(OH)2	970.0 m3 @ $4.500 / m3 $4,365.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	1.0 MW @ $0.042 / MWhr $252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs @ $0.013 / 1000 lbs / hr $222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Package treated waste		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor / drum	24-hr, 7-dys / wk operation											
operator / techs	8.0 FTE(dys) @ 0.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @ 0.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
drums	$0.025 / drum	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
canisters	$25.000 / canister	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Interim Store Treated Waste until Final Repository		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
UNEX treated drums go to interim storage @ INEEL	$0.250 / dr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
UNEX treated canisters go to interim storage @ INEEL	$2.500 / ca	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Transportation and Final Implacement @ Repository		$0.0	$0.0	$0.0	$0.0	$11,640.0	$11,640.0	$11,640.0	$0.0	$0.0	$0.0	
UNEX drums are disposed on-site or @ Hanford	$0.600 / dr	$0.0	$0.0	$0.0	$0.0	$9,000.0	$9,000.0	$9,000.0	$0.0	$0.0	$0.0	
UNEX treated canisters go to WIPP	$26.400 / ca	$0.0	$0.0	$0.0	$0.0	$2,640.00	$2,640.00	$2,640.00	$0.0	$0.0	$0.0	
Support												
Direct capital maintenance		$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	
capital building	1.20% of capital invest	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	
general capital equipment	0.20% of capital invest	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	
Administration, Support, Training, & Tech Support		$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	
Support labor	24-hr, 7-dys / wk operation											
operator / techs	6.0 FTE(dys) @ 0.0 FTE(rotate) $100.0 / yr	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	
engineer / scientists	4.0 FTE(dys) @ 0.0 FTE(rotate) $125.0 / yr	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	
supervisors / mgt	2.0 FTE(dys) @ 0.0 FTE(rotate) $155.0 / yr	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	
QA, Safety, Radcon		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Support labor	24-hr, 7-dys / wk operation											
operator / techs	2.0 FTE(dys) @ 12.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process Maintenance		$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	
Support labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 12.0 FTE(rotate) $100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	0.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$38.75	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	
Facility Maintenance		$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	
Support labor	24-hr, 7-dys / wk operation											
operator / techs	6.0 FTE(dys) @ 0.0 FTE(rotate) $100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	1.0 FTE(dys) @ 0.0 FTE(rotate) $155.0 / yr	$77.50	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	
Post-Operation		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$90,600**
Direct												
DD&D	12.00% of capital investment											$72,480.0
Support												
DD&D planning	3.00% of capital investment											$18,120.0

Option D - MODIFIED UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $994,568

					1 2001	2 2001	3 2002	4 2002	5 2002	6 2005	7 2006	8 2007	9 2008	10 2009
Discounted Annual Totals					$0	$0	$57,293	$83,355	$161,698	$130,782	$102,203	$46,787	$45,380	$44,016
discount factor (to 2001 dollars)					1.000	1 031	1.063	1 096	1.130	1.165	1.201	1.238	1.277	1.316
Annual Totals (contingency included; intangible costs not included)					$0	$0	$60,900	$91,350	$182,700	$152,350	$122,748	$57,934	$57,934	$57,934
contingency @	*35.0%*		(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$15,020*	*$15,020*	*$15,020*
Pre-Operation					$0	$0	$60,900	$91,350	$182,700	$152,350	$122,748	$0	$0	$0
Capital Investment														
Facility / Equipment Investment														
TEC @			$459,500.0				$45,950.0	$68,925 0	$137,850.0	$114,875.0	$91,900.0			
OPC @			$149,500.0				$14,950.0	$22,425.0	$44,850.0	$37,375.0	$29,900.0			
Operations Training														
Develop training plan										$100 0	$500.0			
Operations training			4.0 wk(s)	for all FTE							$448.0			
Operation					$0	$0	$0	$0	$0	$0	$0	$42,914	$42,914	$42,914
volume of SBW to treat, in years			4.30 M-liters	in 3 0 yrs								1,433,333	1,433,333	1,433,333
treated volumes														
drums - UNEX			30,000 drums									10,000	10,000	10,000
RH-TRU cylinders - UNEX			250 canisters									83	83	83
Direct														
Material Receipt / Rough Filtration (90% removal of UDS)												$1,080.0	$1,080 0	$1,080 0
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	1.0 FTE(dys)	&	8.0 FTE(rotate)	$100.0 / yr								$900.0	$900.0	$900.0
supervisors / mgt	0.0 FTE(dys)	&	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Direct operation consumables														
filters	$25.0 / yr											$25.0	$25.0	$25.0
power														
kw	0.5 MW	@	$0.042 / MWhr									$0.0	$0.0	$0.0
Radionuclide Extraction using UNEX												$4,765.1	$4,765.1	$4,765.1
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys)	@	4.0 FTE(rotate)	$100.0 / yr								$400.0	$400.0	$400.0
supervisors / mgt	2.0 FTE(dys)	@	1.0 FTE(rotate)	$155.0 / yr								$465.0	$465.0	$465.0
Direct operation consumables														
FS-13 (Phenyltriflouromel	9.0 m3	@	$42.000 / m3	$378.0 / yr								$378.0	$378.0	$378.0
ChCoDIC	500.0 kg	@	$3.000 / kg	$1,500.0 / yr								$1,500.0	$1,500.0	$1,500.0
PEG-400	36.0 kg	@	$0.380 / kg	$13.7 / yr								$13.7	$13.7	$13.7
Guanidine Carbonate	142.0 m3	@	$13.700 / m3	$1,945.4 / yr								$1,945.4	$1,945.4	$1,945.4
NaOH	25.0 m3	@	$2.500 / m3	$62.5 / yr								$62.5	$62.5	$62.5
power														
kw	5.7 MW	@	$0.042 / MWhr	$1,436.4 / yr								$0 2	$0.2	$0.2
steam in 1000 lbs/hr	22.6 1000 lbs	@	$0.013 / 1000 lbs / hr	$1,762.8 / yr								$0.3	$0.3	$0.3
Secondary Waste Disposal	24-hr, 7-dys / wk operation													
HEPA filters	10.0 m3	@	$10.0 / m3	$100.0 / yr								$100.0	$100.0	$100.0
PPE	30.0 m3	@	$10.0 / m3	$300.0 / yr								$300.0	$300.0	$300.0
Spent solvent (3rd yr chai	40.0 drums		$25.0 each	$1,000.0 / yr								$0.0	$0.0	$1,000.0
Process HAW with evaporative drying												$3,386 6	$3,386 6	$3,386.6
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys)	@	8.0 FTE(rotate)	$100.0 / yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys)	@	1.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables														
power														
kw	1.0 MW	@	$0.042 / MWhr	$252.0 / yr								$1,209.6	$1,209.6	$1,209 6
steam in 1000 lbs/hr	2.9 1000 lbs	@	$0.013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067.0	$1,067.0

Option D - MODIFIED UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $994,568

				1 2001	2 2001	3 2002	4 2002	5 2002	6 2005	7 2006	8 2007	9 2008	10 2009
Discounted Annual Totals				$0	$0	$57,293	$83,355	$161,698	$130,782	$102,203	$46,787	$45,380	$44,016
discount factor (to 2001 dollars)				1 000	1 031	1 063	1 096	1.130	1.165	1 201	1 238	1 277	1 316
Annual Totals (contingency included; intangible costs not included)				$0	$0	$60,900	$91,350	$182,700	$152,350	$122,748	$57,934	$57,934	$57,934
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$15,020*	*$15,020*	*$15,020*
Process LAW by neutralization & grouting											$12,831 6	$12,831 6	$12,831 6
Direct operations labor	24-hr, 7-dys / wk operation												
operator / techs	0 0 FTE(dys) @	24 0 FTE(rotate)	$100.0 / yr								$2,400.0	$2,400.0	$2,400.0
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$310.0	$310.0	$310.0
Direct operation consumables													
portland cement	180.0 m3 @	$3 250 / m3	$585.0 / yr								$585.0	$585 0	$585.0
slag	620 0 m3 @	$3 000 / m3	$1,860.0 / yr								$1,860.0	$1,860 0	$1,860.0
Ca(OH)2	1,200.0 m3 @	$4.500 / m3	$5,400.0 / yr								$5,400.0	$5,400.0	$5,400.0
power													
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr								$1,209 6	$1,209.6	$1,209.6
steam in 1000 lbs/hr	2.9 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr								$1,067.0	$1,067 0	$1,067.0
Package treated waste											$3,288 3	$3,288 3	$3,288 3
Direct operations labor / drum	24-hr, 7-dys / wk operation												
operator / techs	8.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr								$800.0	$800.0	$800.0
supervisors / mgt	1.0 FTE(dys) @	0 0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Direct operation consumables													
drums	$0.025 / drum										$250.0	$250.0	$250.0
canisters	$25.000 / canister										$2,083.3	$2,083.3	$2,083.3
Interim Store Treated Waste until Final Repository											$5,291.7	$5,291 7	$5,291 7
MODIFIED UNEX drums go to interim storage @ INEEL			$0.500 / drum								$5,000.0	$5,000.0	$5,000 0
MODIFIED UNEX canisters go to interim storage @ INEEL			$3.500 / canister								$291.7	$291.7	$291.7
Transportation and Final Implacement @ Repository											$0 0	$0 0	$0 0
MODIFIED UNEX drums go to WIPP			$8.800 / drum								$0 0	$0 0	$0 0
MODIFIED UNEX canisters go to Hanford			$29.400 / canister								$0 0	$0 0	$0 0
Support													
Direct capital maintenance											$7,196 0	$7,196 0	$7,196 0
capital building	1.20%	of	capital invest								$6,168.00	$6,168.0	$6,168.0
general capital equipment	0.20%	of	capital invest								$1,028.00	$1,028.0	$1,028.0
Administration, Support, Training, & Tech Support											$1,410 0	$1,410 0	$1,410 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100 0 / yr								$600 0	$600.0	$600.0
engineer / scientists	4.0 FTE(dys) @	0.0 FTE(rotate)	$125.0 / yr								$500 0	$500 0	$500.0
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$310 0	$310.0	$310.0
QA, Safety, Radcon											$1,555 0	$1 555 0	$1,555 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	2 0 FTE(dys) @	12 0 FTE(rotate)	$100.0 / yr								$1,400.0	$1,400.0	$1,400 0
supervisors / mgt	0 0 FTE(dys) @	1 0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155 0
Process Maintenance											$1,355 0	$1,355 0	$1,355 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	0.0 FTE(dys) @	12 0 FTE(rotate)	$100.0 / yr								$1,200.0	$1,200 0	$1,200.0
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr								$155.0	$155.0	$155.0
Facility Maintenance											$755 0	$755 0	$755 0
Support labor	24-hr, 7-dys / wk operation												
operator / techs	6 0 FTE(dys) @	0 0 FTE(rotate)	$100.0 / yr								$600 0	$600.0	$600.0
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr								$155 0	$155 0	$155.0
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Direct													
OD&D	12.00%	of	capital investment										
Support													
OD&D planning	3 00%	of	capital investment										

Option D - MODIFIED UNEX @ NWCF & Greenfield Facility

all cost in thousands

Item	Parameters	11 2010	12 2011	13 2012	14 2013 * stand-by	15 2014 stand-by	16 2015 stand-by	17 2016 stand-by	18 2017 stand-by	19 2018 stand-by	20 2019 stand-by	21 2021
dLCC (no intangible costs)	**$994,568**											
Discounted Annual Totals		$4,759	$4,616	$4,478	$4,343	$83,850	$81,329	$78,884	$3,844	$3,728	$3,616	$49,606
discount factor (to 2001 dollars)		1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)		$6,459	$6,459	$6,459	$6,459	$128,566	$128,566	$128,566	$6,459	$6,459	$6,459	$91,350
contingency	*35.0%* (not calculated on pre-operation / investment costs)	*$1,674*	*$1,674*	*$1,674*	*$1,674*	*$33,332*	*$33,332*	*$33,332*	*$1,674*	*$1,674*	*$1,674*	*$0*
Pre-Operation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Investment												
Facility / Equipment Investment												
TEC	$459,500.0											
OPC	$149,500.0											
Operations Training												
Develop training plan												
Operations training	4.0 wk(s) for all FTE											
Operation		$4,784	$4,784	$4,784	$4,784	$95,234	$95,234	$95,234	$4,784	$4,784	$4,784	$0
volume of SBW to treat, in years	4.30 M-liters in 3.0 yrs											
treated volumes												
drums - UNEX	30,000 drums											
RH-TRU cylinders - UNEX	250 canisters											
Direct												
Material Receipt / Rough Filtration (90% removal of UDS)		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	1.0 FTE(dys) & 8.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) & 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
filters	$25.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	0.5 MW @ $0.042 / MWhr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Radionuclide Extraction using UNEX		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 4.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	2.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
FS-13 (Phenyltriflouromel	9.0 m3 @ $42.000 / m3 $378.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
ChCoDIC	500.0 kg @ $3.000 / kg $1,500.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PEG-400	36.0 kg @ $0.380 / kg $13.7 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Guanidine Carbonate	142.0 m3 @ $13.700 / m3 $1,945.4 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
NaOH	25.0 m3 @ $2.500 / m3 $62.5 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power												
kw	5.7 MW @ $0.042 / MWhr $1,436.4 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	22.6 1000 lbs @ $0.013 / 1000 lbs / hr $1,762.8 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Secondary Waste Disposal	24-hr, 7-dys / wk operation											
HEPA filters	10.0 m3 @ $10.0 / m3 $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
PPE	30.0 m3 @ $10.0 / m3 $300.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Spent solvent (3rd yr chai	40.0 drums $25.0 each $1,000.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process HAW with evaporative drying		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation											
operator / techs	0.0 FTE(dys) @ 8.0 FTE(rotate) $100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @ 1.0 FTE(rotate) $155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables												
power												
kw	1.0 MW @ $0.042 / MWhr $252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.9 1000 lbs @ $0.013 / 1000 lbs / hr $222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

Option D - MODIFIED UNEX @ NWCF & Greenfield Facility

all cost in thousands

dLCC (no intangible costs) $994,568

Item	Basis	Unit cost	Annual	11 2010	12 2011	13 2012	14 2013 * stand-by	15 2014 stand-by	16 2015 stand-by	17 2016 stand-by	18 2017 stand-by	19 2018 stand-by	20 2019 stand-by	21 2021
Discounted Annual Totals				$4,759	$4,616	$4,478	$4,343	$83,850	$81,329	$78,884	$3,844	$3,728	$3,616	$49,606
discount factor (to 2001 dollars)				1.357	1.399	1.442	1.487	1.533	1.581	1.630	1.680	1.732	1.786	1.842
Annual Totals (contingency included; intangible costs not included)				$6,459	$6,459	$6,459	$6,459	$128,566	$128,566	$128,566	$6,459	$6,459	$6,459	$91,350
contingency @	*35.0%*	(not calculated on pre-operation / investment costs)		*$1,674*	*$1,674*	*$1,674*	*$1,674*	*$33,332*	*$33,332*	*$33,332*	*$1,674*	*$1,674*	*$1,674*	*$0*
Process LAW by neutralization & grouting				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	24.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables														
portland cement	180.0 m3 @	$3.250 / m3	$585.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
slag	620.0 m3 @	$3.000 / m3	$1,860.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Ca(OH)2	1,200.0 m3 @	$4.500 / m3	$5,400.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
power														
kw	1.0 MW @	$0.042 / MWhr	$252.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
steam in 1000 lbs/hr	2.0 1000 lbs @	$0.013 / 1000 lbs / hr	$222.3 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Package treated waste				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operations labor / drum	24-hr, 7-dys / wk operation													
operator / techs	8.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Direct operation consumables														
drums	$0.025 / drum			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
canisters	$25.000 / canister			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Interim Store Treated Waste until Final Repository				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
MODIFIED UNEX drums go to interim storage @ INEEL			$0.500 / dr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
MODIFIED UNEX canisters go to interim storage @ INEEL			$3.500 / ca	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Transportation and Final Implacement @ Repository				$0.0	$0.0	$0.0	$0.0	$90,450.0	$90,450.0	$90,450.0	$0.0	$0.0	$0.0	
MODIFIED UNEX drums go to WIPP			$8.800 / dr	$0.0	$0.0	$0.0	$0.0	$88,000.0	$88,000.0	$88,000.0	$0.0	$0.0	$0.0	
MODIFIED UNEX canisters go to Hanford			$29.400 / ca	$0.0	$0.0	$0.0	$0.0	$2,450.00	$2,450.00	$2,450.00	$0.0	$0.0	$0.0	
Support														
Direct capital maintenance				$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	$3,598.0	
capital building	1.20%	of	capital invest	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	$3,084.0	
general capital equipment	0.20%	of	capital invest	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	$514.0	
Administration, Support, Training, & Tech Support				$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	$470.0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	$200.0	
engineer / scientists	4.0 FTE(dys) @	0.0 FTE(rotate)	$125.0 / yr	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	$166.7	
supervisors / mgt	2.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	$103.3	
QA, Safety, Radcon				$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	2.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Process Maintenance				$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	$338.8	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	0.0 FTE(dys) @	12.0 FTE(rotate)	$100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	0.0 FTE(dys) @	1.0 FTE(rotate)	$155.0 / yr	$38.75	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	$38.8	
Facility Maintenance				$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	$377.5	
Support labor	24-hr, 7-dys / wk operation													
operator / techs	6.0 FTE(dys) @	0.0 FTE(rotate)	$100.0 / yr	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	$300.0	
supervisors / mgt	1.0 FTE(dys) @	0.0 FTE(rotate)	$155.0 / yr	$77.50	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	$77.5	
Post-Operation				$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$91,350
Direct														
DD&D	12.00%	of	capital investment											$73,080.0
Support														
DD&D planning	3.00%	of	capital investment											$18,270.0

INEEL

Idaho National Engineering & Environmental Laboratory

INTEROFFICE MEMORANDUM

Date:	August 31, 2000		
To:	V. J. Balls	MS 3650	6-2703
From:	D. A. Rowley DR	MS 3655	6-2978
Subject:	COST ESTIMATE – UNIVERSAL SOLVENT EXTRACTION (UNEX) FEASIBILITY STUDY – FOUR OPTIONS		

Transmitted herewith are the four Planning Cost Estimate options for the above referenced project. The estimate options are as follows:

Option A – UNEX Process in a new Greenfield Facility.
Option B – Modified UNEX in a new Greenfield Facility.
Option C – UNEX in the existing New Waste Calcining Facility (NWCF).
Option D – Modified UNEX in the existing NWCF.

Included in each estimate are Other Project Cost (OPC) allowances for Project Development, Technical Development, Project Execution, and Project Acceptance / Closeout.

Also included in each estimate are Total Estimated Cost (TEC) allowances for Engineering and Design (Title I and II), Quality Assurance, Project Management, Construction Management, Construction A/E Support, Construction (direct and indirect costs), Procurement, Escalation, G&A allowance, and Contingency.

These estimates combine TEC and OPC to arrive at the Total Project Cost (TPC).

TPC for Option A is ....$514,000,000.
TPC for Option B is ....$514,000,000.
TPC for Option C is ....$604,000,000.
TPC for Option D is ....$609,000,000.

Due to minimal detail and scoping definition, this estimate is considered a Planning estimate and is not intended to be used to establish a cost baseline.

Please refer to the attached detail, Recapitulation and Summary sheets for cost breakdowns, descriptions, and cost estimating basis.

If you have any questions or comments please contact me at 526-2978 or e-mail "drowley".

DAR

Attachments

cc: S. J. Losinski MS 3625
Estimate File 2570
D. A. Rowley File (DAR-20-00)

Bechtel BWXT Idaho, LLC

COST ESTIMATE SUPPORT DATA RECAPITULATION

Project Title: Universal Solvent Extraction (UNEX) Feasibility Study – Four Options
Estimator: D. A. Rowley / T. R. Mitchell / L. L. Marler
Date: August 31, 2000
Estimate Type: Planning
File: 2570
Approved By:

I. **SCOPE OF WORK:** *Brief description of the proposed project.*

Included in this package are four estimate options relative to the Universal Solvent Extraction (UNEX) study.

A. Option A – UNEX Process In A New Green Field Facility:
   1. Construction of a new Green Field Facility (GFF) – approximately 89,100 s.f. The new GFF shall include areas for Drum Shipping (9,030 s.f.), Drum Storage (51,993 s.f.), Drum Processing (14,790 s.f.), and Office / Restroom area (13,261 s.f.). The facility shall be slab-on-grade partly of precast concrete construction and partly of pre-engineered metal building construction.
   2. Construction of a new Thin Film Dryer (TFD) Facility – 13,700 s.f. The TDF shall be of precast concrete construction and shall include two basement levels and a roof height of 82 feet.
   3. Construction of a Truck Airlock Area – 2,089 s.f. The Truck Airlock shall be slab-on-grade and of precast concrete construction.
   4. Construction of a new Boiler House – 3,120 s.f. The Boiler House shall be slab-on-grade and of pre-engineered metal construction.
   5. Construction of a new Interim Storage Facility (ISF) – 20,440 s.f. The Interim Storage Facility shall be a concrete and steel structure.
   6. Construction of a concrete tunnel between the TFD and ISF.
   7. Installation of all utilities to support the new buildings.
   8. Procurement and installation of all equipment to support the new process.

B. Option B – Modified UNEX Process In A New GFF: Facility and structure requirements are the same as Option A. The Modified UNEX process is somewhat different than the UNEX process.

C. Option C – UNEX Process In The New Waste Calciner Facility (NWCF):
   1. Perform demolition in the Calciner Cell, Offgas Cell, Blend and Hold Cell, Valve Cubicle, and Storage Area of NWCF in preparation for installation of the UNEX process in those areas. Decontamination will have to be performed in contaminated areas.
   2. Install the UNEX process in designated areas.

I. **SCOPE OF WORK:** *(Continued)*

3. Construction of a new TFD – 13,700 s.f. The TDF shall be concrete slab-on-grade and precast concrete construction. Roof height of 82 feet. A portion of the tunnel shall run under the TFD to the Main Cell Area.
4. Construction of a Truck Airlock Area – 2,089 s.f. The Truck Airlock shall be slab-on-grade and of precast concrete construction.
5. Construction of a new Boiler House – 3,120 s.f. The Boiler House shall be slab-on-grade and of pre-engineered metal construction.
6. Construction of a new ISF – 20,440 s.f. The ISF shall be a concrete and steel structure.
7. Construction of a concrete tunnel between the TFD and ISF.
8. Installation of all utilities to support the new buildings.
9. Procurement and installation of all equipment to support the new process.

D. Option D – Modified UNEX Process In NWCF: Facility and structure requirements are the same as Option C. The Modified UNEX process is somewhat different than the UNEX process.

II. **BASIS OF THE ESTIMATE:** *Drawings, Design Report, Engineers Notes and/or other documentation upon which the estimate is originated.*

The estimate is based on the 60% review package and discussions held with S. J. Losinski (Project Technical Lead), J. L. Benson (Mechanical Engineer), J. E. Duggan (Electrical Engineer), K. D. Weaver (Nuclear Engineer), R. E. Johnson (Architectural Engineer), and S. D. McBride (ANLW, Mechanical Engineer).

III. **ASSUMPTIONS:** *Conditions statements accepted or supposed true without proof of demonstration. An assumption has a direct impact on total estimated cost.*

A. Assume the Conceptual Design schedule shall be FY2001 through FY2003. The Title Design schedule shall be FY2004 through FY2006. The Construction schedule shall be FY2006 through FY2010. The Facility Acceptance schedule shall be FY2010 through FY2012. (Per schedule provided by D. J. Harrell).
B. Assume the construction activities will be awarded through the competitive bidding process and performed by subcontractors familiar with doing work at the INEEL.
C. Assume the only construction related activity to be performed by INEEL labor personnel is the decontamination of the necessary NWCF locations.
D. Assume all equipment and service subcontracts shall be bid competitively and that "sole source" equipment or service subcontracts shall be minimal.

III. ASSUMPTIONS: *(Continued)*

E. Cost allowances for non-construction activities are per historical estimating allowances provided by R. D. Adams.

F. Assume a new TFD facility will be required for the NWCF options.

G. Assume the new ISF shall be approximately 140' x 146'. The facility shall be constructed for remote container handling only.

H. Assume a new boiler house shall be approximately 40' x 78'.

I. Assume the new concrete tunnel from the TFD to the ISF shall be 100' long and buried at a depth of 23' to the bottom of the tunnel. The tunnel size shall be 10' wide x 15' high. Thickness of all walls, floors and ceilings shall be 12".

J. Assume all excavation areas shall be sloped 1½ to 1.

K. Assume no radiological contamination will be encountered during excavation.

L. Assume no excavated soils will have to be "hot boxed" as contaminated.

M. Assume no excavated soil piles will have to be covered, monitored, or maintained.

N. Assume an additional 10% will be added to the cost of all materials and subcontracts to adhere to DOE/RW/0333P Quality Standards.

O. Assume all existing NWCF piping and equipment to be demolished shall be decontaminated to a point where it can be contact handled without exposing workers to radiation levels where "stay time" is limited.

P. Assume no existing contaminated piping and equipment will be demolished by use of remote equipment.

Q. Assume the Truck Air Lock and Tru-Pak areas are to be pre-engineered metal buildings. Each shall be insulated on the inside but shall include no gypsum board or painting.

R. Assume roofs for the TFD, ISF, and portions of the roof for the GFF shall be prestressed concrete double tees.

S. Assume the restroom/locker areas within the Offices/Restrooms building will have a tile floor covering along with a tile covering 4' up each wall.

T. Assume pavement will need to be repaired 15' wide for the entire length of the building.

U. Assume there will be an asphalt parking area on the east end of the GFF (100' long x 165').

V. Assume sidewalks that lead to double-doors are 8' wide, with all others being 4' wide.

W. Assume no interconnecting roadways will be required between facilities.

X. Assume no RCRA floors will be required except in the Grouting Facility.

Y. Assume the GFF and NWCF shall require a Tru-Pak loading area for the Modified UNEX options. (Options B and D)

Z. Assume all estimate options will require certifications from WIPP and Hanford.

IV. **CONTINGENCY GUIDELINE IMPLEMENTATION:** *The percentage used for contingency as determined by the contingency allowance guidelines can be altered to reflect the type of construction and conditions that may impact the total estimated cost.*

A meeting was held with Cost Estimators (R. D. Adams, T. R. Mitchell, and D. A. Rowley), the Project Technical Lead Engineer (S. J. Losinski), and the Project Manager (D. J. Harrell). The meeting was to establish high and low confidence percentages for each level of the estimate. The agreed upon percentages were used to perform a contingency analysis using the "@Risk" computer software.

"@Risk" is a risk application tool which links with the estimating software ("Success"). In "@Risk" the likely estimate key levels were assigned high and low values, equal to the low and high estimates received. These bounding values were then run through a Monte Carlo sampling simulation two thousand times to arrive at the additional money required to address risk at various levels of confidence. A confidence level of eighty per cent (or an accepted level of risk of twenty per cent) was chosen for this report. The risk output is shown both tabularly and graphically. The appropriate risk amount, represented as a percentage of the key level referred to above, was added to the estimate to result in a Total Project Cost (TPC) including risk for each option.

Contingency for each option of this project has been calculated as follows:

Option A – UNEX In A Greenfield Facility .... 41.24%.
Option B – Modified UNEX In A Greenfield Facility .... 40.88%.
Option C – UNEX In NWCF .... 44.13%.
Option D – Modified UNEX In NWCF .... 43.69%.

The complete contingency analysis has been included with the estimate as an attachment.

Major considerations used in establishing confidence levels were:

A. Historical performance for past INEEL major projects.
B. Potential that the project schedule will be delayed.
C. Potential that shipments to WIPP and Hanford cannot be made as planned.
D. Potential that safety requirements will impact the construction process.
E. Potential that the new technology will not work as planned.
F. Potential that radioactive waste will be encountered during excavation and higher than anticipated radioactive contamination levels will be encountered while working in NWCF.
G. Potential that the decontamination of NWCF will be much more labor intensive than is presently believed.

IV. CONTINGENCY GUIDELINE IMPLEMENTATION: *(Continued)*

H. Potential that the projected 1,000,000 gallons of decontamination solution required to decontaminate the NWCF equipment will either not be allowed to be sent to the Tank Farm or that the cost to store / process the solution will be in excess of the estimated cost.

I. Potential that more equipment will be required than is presently included in the design.

V. OTHER COMMENTS/CONCERNS SPECIFIC TO THE ESTIMATE:

A. Due to minimal detail and scope definition, this estimate is considered a "Planning" estimate and is not intended to be used to establish a cost baseline.

B. Costs for each activity represent present day costs escalated to the appropriate activity midpoint.

C. Subcontractor labor costs reflect present day INEEL Site Jurisdictional Agreement craft labor rates.

D. Costs for General and Administrative allowance (G&A) and procurement fee have been applied to construction activities and GFE at the rate of .8%. (Per R. D. Adams)

E. Costs and impacts related to "Conduct of Operations / Conduct of Maintenance" requirements are included in the estimate.

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Project Number: *2570 - Option A*

TPC Summary Report 2

ESTIMATE ELEMENT	Estimate Subtotal	Escalation	Contingency	TOTAL
		24.19%	*35.02%*	
Total Estimated Cost (TEC)	$252,890,982	$61,173,957	$109,998,479	$424,063,418
		21.94%	*80.31%*	
Other Project Cost (OPC)	$40,971,600	$8,990,412	$40,126,748	$90,088,760
		23.88%	*41.24%*	
Total Project Cost (TPC)	$293,862,582	$70,164,368	$150,125,227	$514,152,178
Rounded TPC (Rounded to the nearest $ 1000000)				$514,000,000

	Remarks
Type of Estimate: Planning	
Estimator: Rowley / Mitchell / Marler	
Checked By: RDA	
Approved By:	

INEEL

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC1000	**PROJECT DEVELOPMENT**	**$16,326,700**	**$973,071**	**$13,691,174**	**79.14%**	**$30,990,946**
OPC1001	--PROJECT DEVELOPMENT	$5,326,700	$317,471	$1,919,018	34.00%	$7,563,190
OPC1001.1	----CONCEPTUAL DESIGN	$3,403,500	$202,849	$1,226,159	34.00%	$4,832,507
OPC1001.2	----PROJECT EXECUTION PLAN	$170,200	$10,144	$61,317	34.00%	$241,661
OPC1001.3	----WORK PACKAGE DEVELOPMENT	$391,400	$23,327	$141,007	34.00%	$555,735
OPC1001.4	----TASK BASELINE AGREEMENT	$561,600	$33,471	$202,324	34.00%	$797,396
OPC1001.5	----PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)	$800,000	$47,680	$288,211	34.00%	$1,135,891
OPC1600	--TECHNICAL DEVELOPMENT	$11,000,000	$655,600	$11,772,156	101.00%	$23,427,756
OPC2000	**PROJECT EXECUTION**	**$9,605,300**	**$2,464,720**	**$5,431,509**	**45.00%**	**$17,501,529**
OPC2100	--PROJECT SUPPORT	$5,105,300	$1,310,020	$2,886,894	45.00%	$9,302,214
OPC2200	--PERMITTING	$4,500,000	$1,154,700	$2,544,615	45.00%	$8,199,315
1000	**CONSTRUCTION MANAGEMENT**	**$18,379,100**	**$4,716,077**	**$8,314,264**	**36.00%**	**$31,409,441**
1100	--CONSTRUCTION SUPERVISION & ENGINEERING	$15,315,800	$3,930,034	$6,928,500	36.00%	$26,174,335
1110	--CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$340,400	$87,347	$153,989	36.00%	$581,735
1200	--CM PROJECT CONTROLS	$1,191,200	$305,662	$538,870	36.00%	$2,035,732
1300	--CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)	$850,900	$218,341	$384,927	36.00%	$1,454,168
1400	--CM TRAINING	$340,400	$87,347	$153,989	36.00%	$581,735
1500	--CM - OTHER DIRECT COSTS	$340,400	$87,347	$153,989	36.00%	$581,735
2000	**TITLE I DESIGN**	**$10,210,500**	**$1,234,449**	**$4,120,182**	**36.00%**	**$15,565,131**
2400	--DESIGN ACTIVITIES	$10,210,500	$1,234,449	$4,120,182	36.00%	$15,565,131

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
3000	**TITLE II DESIGN**	**$19,229,800**	**$2,949,851**	**$6,432,099**	**29.00%**	**$28,611,750**
3400	--DESIGN ACTIVITIES	$19,229,800	$2,949,851	$6,432,099	29.00%	$28,611,750
4000	**QUALITY ASSURANCE**	**$8,508,800**	**$2,183,358**	**$3,314,569**	**31.00%**	**$14,006,727**
4100	--QUALITY ASSURANCE	$8,508,800	$2,183,358	$3,314,569	31.00%	$14,006,727
5000	**PROJECT MANAGEMENT**	**$22,489,100**	**$5,770,703**	**$10,738,725**	**38.00%**	**$38,998,528**
5100	--PM ADMINISTRATION	$13,614,000	$3,493,352	$6,500,794	38.00%	$23,608,146
5110	--PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$68,100	$17,474	$32,518	38.00%	$118,093
5200	--PM PROJECT CONTROLS	$3,403,500	$873,338	$1,625,198	38.00%	$5,902,037
5300	--PM RECORDS MANAGEMENT	$3,403,500	$873,338	$1,625,198	38.00%	$5,902,037
5400	--SAFETY ANALYSIS	$2,000,000	$513,200	$955,016	38.00%	$3,468,216
6000	**CONSTRUCTION AE SUPPORT**	**$2,552,600**	**$654,997**	**$898,127**	**28.00%**	**$4,105,724**
9000	**CONSTRUCTION**	**$170,165,707**	**$43,664,521**	**$75,218,197**	**35.18%**	**$289,048,425**
9100	--CONSTRUCTION SUBCONTRACTS	$168,621,873	$43,268,373	$74,519,804	35.17%	$286,410,049
9101	----GENERAL CONDITIONS	$15,622,490	$4,008,731	$8,048,801	41.00%	$27,680,022
9101.1	------GENERAL CONDITIONS	$14,633,812	$3,755,036	$7,539,428	41.00%	$25,928,276
9101.2	------GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$988,678	$253,695	$509,373	41.00%	$1,751,746
9102	----SITEWORK	$1,342,619	$344,516	$1,147,252	68.00%	$2,834,388
9102.1	------SITEWORK - UTILITIES	$68,438	$17,561	$58,479	68.00%	$144,478
9102.2	------SITEWORK - GFF	$361,242	$92,695	$308,677	68.00%	$762,614
9102.3	------SITEWORK - TFD FACILITY	$336,396	$86,319	$287,446	68.00%	$710,162
9102.4	------SITEWORK - BOILER HOUSE	$71,579	$18,367	$61,163	68.00%	$151,109

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9102.5	------SITEWORK - STORAGE FACILITY	$150,574	$38,637	$128,663	68.00%	$317,874
9102.5	------SITEWORK - TUNNEL	$187,700	$48,164	$160,387	68.00%	$396,251
9102.6	------SITEWORK - PAVING	$166,691	$42,773	$142,435	68.00%	$351,899
9103	**----CONCRETE**	**$8,539,012**	**$2,191,111**	**$2,789,832**	**26.00%**	**$13,519,955**
9103.1	------CONCRETE - GFF	$4,602,876	$1,181,098	$1,503,833	26.00%	$7,287,807
9103.2	------CONCRETE - TFD FACILITY	$2,570,437	$659,574	$839,803	26.00%	$4,069,813
9103.3	------CONCRETE - BOILER HOUSE	$46,061	$11,819	$15,049	26.00%	$72,929
9103.4	------CONCRETE - STORAGE FACILITY	$1,230,990	$315,872	$402,184	26.00%	$1,949,047
9103.5	------CONCRETE - TUNNEL	$88,649	$22,747	$28,963	26.00%	$140,359
9105	**----METALS**	**$6,099,156**	**$1,565,043**	**$1,992,692**	**26.00%**	**$9,656,891**
9105.2	------METALS - GFF	$1,300,866	$333,802	$425,014	26.00%	$2,059,681
9105.3	------METALS - TFD FACILITY	$546,606	$140,259	$178,585	26.00%	$865,451
9105.4	------METALS - BOILER HOUSE	$147,342	$37,808	$48,139	26.00%	$233,290
9105.5	------METALS - STORAGE FACILITY	$4,104,341	$1,053,174	$1,340,954	26.00%	$6,498,469
9107	**----THERMAL & MOISTURE PROTECTION**	**$2,677,943**	**$687,160**	**$874,927**	**26.00%**	**$4,240,030**
9107.1	------THERMAL & MOISTURE PROTECTION - GFF	$1,439,697	$369,426	$470,372	26.00%	$2,279,496
9107.2	------THERMAL & MOISTURE PROTECTION - TFD FACILITY	$692,200	$177,618	$226,153	26.00%	$1,095,971
9107.3	------THERMAL & MOISTURE PROTECTION - BOILER HOUSE	$82,533	$21,178	$26,965	26.00%	$130,676
9107.4	------THERMAL & MOISTURE PROTECTION - STORAGE FACILITY	$463,513	$118,937	$151,437	26.00%	$733,887
9108	**----DOORS & WINDOWS**	**$411,474**	**$105,584**	**$134,435**	**26.00%**	**$651,493**
9108.1	------DOORS & WINDOWS - GFF	$142,969	$36,686	$46,710	26.00%	$226,364
9108.2	------DOORS & WINDOWS - TFD FACILITY	$175,925	$45,142	$57,478	26.00%	$278,545

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9108.3	------DOORS & WINDOWS - BOILER HOUSE	$33,544	$8,607	$10,959	26.00%	$53,110
9108.4	------DOORS & WINDOWS - STORAGE FACILITY	$59,036	$15,149	$19,288	26.00%	$93,473
9109	**----FINISHES**	**$1,257,389**	**$322,646**	**$410,809**	**26.00%**	**$1,990,844**
9109.1	------FINISHES - GFF	$454,273	$116,566	$148,418	26.00%	$719,257
9109.2	------FINISHES - TFD FACILITY	$500,276	$128,371	$163,448	26.00%	$792,095
9109.3	------FINISHES - BOILER HOUSE	$1,902	$488	$621	26.00%	$3,011
9109.4	------FINISHES - STORAGE FACILITY	$300,938	$77,221	$98,321	26.00%	$476,481
9110	**----SPECIALTIES**	**$73,623,461**	**$18,891,780**	**$28,679,725**	**31.00%**	**$121,194,965**
9110.1	------SPECIALTIES - GFF	$2,364,886	$606,830	$921,232	31.00%	$3,892,947
9110.2	------SPECIALTIES - TFD FACILITY	$17,521,957	$4,496,134	$6,825,608	31.00%	$28,843,699
9110.3	------SPECIALTIES - BOILER HOUSE	$59,374	$15,235	$23,129	31.00%	$97,739
9110.4	------SPECIALTIES - STORAGE FACILITY	$53,677,244	$13,773,581	$20,909,756	31.00%	$88,360,580
9111	**----EQUIPMENT**	**$37,275,088**	**$9,564,788**	**$25,293,533**	**54.00%**	**$72,133,409**
9111.1	------EQUIPMENT - IN GFF	$7,765,897	$1,992,729	$5,269,658	54.00%	$15,028,284
9111.1.1	--------EQUIPMENT - GFF	$2,251,358	$577,698	$1,527,691	54.00%	$4,356,747
9111.1.2	--------EQUIPMENT - GROUT FACILITY	$5,514,538	$1,415,031	$3,741,967	54.00%	$10,671,536
9111.2	------EQUIPMENT - THIN FILM DRYER FACILITY	$1,621,050	$415,962	$1,099,986	54.00%	$3,136,999
9111.3	------EQUIPMENT - BOILER HOUSE	$1,343,561	$344,758	$911,692	54.00%	$2,600,012
9111.4	------EQUIPMENT - GROUTING FACILITY	$5,514,538	$1,415,031	$3,741,967	54.00%	$10,671,536
9111.5	------EQUIPMENT - STORAGE FACILITY	$21,030,041	$5,396,309	$14,270,229	54.00%	$40,696,579
9114	**----CONVEYING SYSTEMS**	**$9,395,361**	**$2,410,850**	**$1,062,559**	**9.00%**	**$12,868,769**
9114.4	------CONVEYING SYSTEMS - STORAGE FACILITY	$9,395,361	$2,410,850	$1,062,559	9.00%	$12,868,769

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option A***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9115	**----MECHANICAL**	**$9,768,612**	**$2,506,626**	**$3,068,809**	**25.00%**	**$15,344,047**
9115.2	------MECHANICAL - NEW - GFF - UNEX	$6,270,168	$1,608,925	$1,969,773	25.00%	$9,848,866
9115.2.1	--------HVAC EQUIPMENT - NEW - GFF - UNEX	$6,270,168	$1,608,925	$1,969,773	25.00%	$9,848,866
9115.3	------MECHANICAL - NEW - TFD FACILITY	$2,415,785	$619,890	$758,919	25.00%	$3,794,594
9115.2.1	--------HVAC - TFD FACILITY - HOT CELL	$607,407	$155,861	$190,817	25.00%	$954,084
9115.2.2	--------HVAC - TFD FACILITY - OPERATING CORRIDORS	$1,523,564	$390,947	$478,628	25.00%	$2,393,138
9115.2.3	--------PLUMBING / PIPING - TFD FACILITY	$284,814	$73,083	$89,474	25.00%	$447,372
9115.4	------MECHANICAL - NEW - BOILER HOUSE	$381,698	$97,944	$119,911	25.00%	$599,553
9115.4.2	--------HVAC - NEW - BOILER HOUSE	$68,261	$17,516	$21,444	25.00%	$107,221
9115.4.3	--------PLUMBING - BOILER HOUSE	$4,739	$1,216	$1,489	25.00%	$7,444
9115.4.4	--------PIPING - NEW - BOILER HOUSE	$293,199	$75,235	$92,109	25.00%	$460,543
9115.4.5	--------FIRE PROTECTION - NEW - BOILER HOUSE	$15,499	$3,977	$4,869	25.00%	$24,345
9115.4	------MECHANICAL - NEW - STORAGE FACILITY	$700,961	$179,867	$220,207	25.00%	$1,101,034
9116	**----ELECTRICAL**	**$2,609,269**	**$669,538**	**$1,016,430**	**31.00%**	**$4,295,237**
9116.2	------ELECTRICAL - NEW - GFF	$1,915,729	$491,576	$746,265	31.00%	$3,153,570
9116.2.1	--------SWITCHGEAR AND TRANSFORMERS - GFF	$717,408	$184,087	$279,464	31.00%	$1,180,959
9116.2.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - GFF	$175,000	$44,905	$68,171	31.00%	$288,076
9116.2.3	--------MISC. COSTS - GFF	$517,472	$132,783	$201,579	31.00%	$851,834
9116.2.4	--------LIGHTING - GFF	$505,849	$129,801	$197,052	31.00%	$832,702
9116.3	------ELECTRICAL - NEW - TFD FACILITY	$188,994	$48,496	$73,622	31.00%	$311,112
9116.3.1	--------SWITCHGEAR AND TRANSFORMERS - TFD	$14,068	$3,610	$5,480	31.00%	$23,158
9116.3.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - TFD	$35,000	$8,981	$13,634	31.00%	$57,615

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9116.3.3	--------MISC. COSTS - TFD	$86,496	$22,195	$33,694	31.00%	$142,385
9116.3.4	--------LIGHTING - TFD	$53,430	$13,710	$20,813	31.00%	$87,954
9116.4	------ELECTRICAL - BOILER HOUSE	$56,186	$14,417	$21,887	31.00%	$92,490
9116.4.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE	$12,000	$3,079	$4,675	31.00%	$19,754
9116.4.3	--------MISC. COSTS - BOILER HOUSE	$30,901	$7,929	$12,037	31.00%	$50,868
9116.4.4	--------LIGHTING - BOILER HOUSE	$13,285	$3,409	$5,175	31.00%	$21,869
9116.5	------ELECTRICAL - STORAGE FACILITY	$435,854	$111,840	$169,785	31.00%	$717,479
9116.5.1	--------SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE	$172,275	$44,206	$67,109	31.00%	$283,590
9116.5.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE	$21,000	$5,389	$8,180	31.00%	$34,569
9116.5.3	--------MISC. COSTS - INTERIM STORAGE	$141,040	$36,191	$54,942	31.00%	$232,173
9116.5.4	--------LIGHTING - INTERIM STORAGE	$101,539	$26,055	$39,554	31.00%	$167,148
9116.6	------ELECTRICAL - TRANSFER TUNNEL	$12,505	$3,209	$4,871	31.00%	$20,585
9301	**--CONSTRUCTION MISCELLANEOUS**	**$1,543,834**	**$396,148**	**$698,394**	**36.00%**	**$2,638,376**
9301.1	**----CONSTRUCTION SUPPORT**	**$522,734**	**$134,134**	**$236,472**	**36.00%**	**$893,340**
9301.2	**----CONSTRUCTION QUALITY CONTROL**	**$170,200**	**$43,673**	**$76,994**	**36.00%**	**$290,868**
9301.3	**----CONSTRUCTION DOCUMENTATION**	**$850,900**	**$218,341**	**$384,927**	**36.00%**	**$1,454,168**
OPC3000	**PROJECT ACCEPTANCE/CLOSEOUT**	**$15,039,600**	**$5,552,620**	**$21,004,065**	**102.00%**	**$41,596,285**
OPC3100	**--TESTING AND TURNOVER PLANNING**	**$340,400**	**$125,676**	**$475,397**	**102.00%**	**$941,473**
OPC3200	**--S. O. TESTING**	**$8,508,800**	**$3,141,449**	**$11,883,254**	**102.00%**	**$23,533,503**
OPC3300	**--ORR SUPPORT**	**$374,400**	**$138,228**	**$522,881**	**102.00%**	**$1,035,510**
OPC3400	**--FACILITY ACCEPTANCE REVIEW**	**$255,300**	**$94,257**	**$356,548**	**102.00%**	**$706,105**

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC3500	--RADIOLOGICAL CONTROL SUPPORT	$187,200	$69,114	$261,441	102.00%	$517,755
OPC3600	--OPERATOR TRAINING	$3,403,500	$1,256,572	$4,753,274	102.00%	$9,413,346
OPC3700	--OPERATING PROCEDURES	$748,800	$276,457	$1,045,762	102.00%	$2,071,019
OPC3800	--START-UP COORDINATION	$221,200	$81,667	$308,924	102.00%	$611,791
OPC3900	--SPARES	$1,000,000	$369,200	$1,396,584	102.00%	$2,765,784
GAPIF	Non-Org G&A and PROCUREMENT	$1,355,375	$0	$962,316	71.00%	$2,317,691
Total	UNEX IN GFF - OPTION A	$293,862,582	$70,164,368	$150,125,227	41.24%	$514,152,178

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.1 CONCEPTUAL DESIGN										
	BWI	U.C. per LOT			3403500	0	0	0	0	3403500
CONCEPTUAL DESIGN (2% OF TCC)		1.00	0		$3,403,500	$0	$0	$0	$0	$3,403,500
Subtotal					$3,403,500	$0	$0	$0	$0	$3,403,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,403,500
Escalation					$202,849	$0	$0	$0	$0	$202,849
Contingency					$1,226,159	$0	$0	$0	$0	$1,226,159
---Total OPC1001.1 CONCEPTUAL DESIGN			0		$4,832,507	$0	$0	$0	$0	$4,832,507
--- OPC1001.2 PROJECT EXECUTION PLAN										
	BWI	U.C. per LOT			170200	0	0	0	0	170200
ACDC/SOW,CPDS,PEP,DC,/SOW REVIEWS @ .1% OF TCC		1.00	0		$170,200	$0	$0	$0	$0	$170,200
Subtotal					$170,200	$0	$0	$0	$0	$170,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$170,200
Escalation					$10,144	$0	$0	$0	$0	$10,144
Contingency					$61,317	$0	$0	$0	$0	$61,317
---Total OPC1001.2 PROJECT EXECUTION PLAN			0		$241,661	$0	$0	$0	$0	$241,661
--- OPC1001.3 WORK PACKAGE DEVELOPMENT										
	BWI	U.C. per Lot			391400	0	0	0	0	391400
Work Package Development - .23% Of TCC		1.00	0		$391,400	$0	$0	$0	$0	$391,400
Subtotal					$391,400	$0	$0	$0	$0	$391,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$391,400
Escalation					$23,327	$0	$0	$0	$0	$23,327
Contingency					$141,007	$0	$0	$0	$0	$141,007
---Total OPC1001.3 WORK PACKAGE DEVELOPMENT			0		$555,735	$0	$0	$0	$0	$555,735
--- OPC1001.4 TASK BASELINE AGREEMENT										
	BWI	U.C. per Lot			561600	0	0	0	0	561600
Task Baseline Agreement - .33% Of TCC		1.00	0		$561,600	$0	$0	$0	$0	$561,600

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.4 TASK BASELINE AGREEMENT										
Subtotal					$561,600	$0	$0	$0	$0	$561,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$561,600
Escalation					$33,471	$0	$0	$0	$0	$33,471
Contingency					$202,324	$0	$0	$0	$0	$202,324
---Total OPC1001.4 TASK BASELINE AGREEMENT			0		$797,396	$0	$0	$0	$0	$797,396
--- OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)										
	BWI	U.C. per Lot			800000	0	0	0	0	800000
Preliminary Safety Analysis Report (PSAR)		1.00	0		$800,000	$0	$0	$0	$0	$800,000
Subtotal					$800,000	$0	$0	$0	$0	$800,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$800,000
Escalation					$47,680	$0	$0	$0	$0	$47,680
Contingency					$288,211	$0	$0	$0	$0	$288,211
---Total OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)			0		$1,135,891	$0	$0	$0	$0	$1,135,891
--- OPC1600 TECHNICAL DEVELOPMENT										
	BWI	U.C. per Lot			11000000	0	0	0	0	11000000
(*)UNEX Process Development		1.00	0		$11,000,000	$0	$0	$0	$0	$11,000,000
Memo: Cost for process development is per the HLW SBW Process Development Costs (Arlin L. Olson).										
Subtotal					$11,000,000	$0	$0	$0	$0	$11,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$11,000,000
Escalation					$655,600	$0	$0	$0	$0	$655,600
Contingency					$11,772,156	$0	$0	$0	$0	$11,772,156
---Total OPC1600 TECHNICAL DEVELOPMENT			0		$23,427,756	$0	$0	$0	$0	$23,427,756
--- OPC2100 PROJECT SUPPORT										
	BWI	U.C. per Lot			5105300	0	0	0	0	5105300
Project Support - 3% OF TCC		1.00	0		$5,105,300	$0	$0	$0	$0	$5,105,300

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC2100 PROJECT SUPPORT										
Subtotal					$5,105,300	$0	$0	$0	$0	$5,105,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$5,105,300
Escalation					$1,310,020	$0	$0	$0	$0	$1,310,020
Contingency					$2,886,894	$0	$0	$0	$0	$2,886,894
---Total OPC2100 PROJECT SUPPORT			0		$9,302,214	$0	$0	$0	$0	$9,302,214
--- OPC2200 PERMITTING										
	BWI	U.C. per Lot			1500000	0	0	0	0	1500000
Permitting		1.00	0		$1,500,000	$0	$0	$0	$0	$1,500,000
	BWI	U.C. per Lot			2500000	0	0	0	0	2500000
WIPP Certification		1.00	0		$2,500,000	$0	$0	$0	$0	$2,500,000
	BWI	U.C. per Lot			500000	0	0	0	0	500000
Hanford Certification		1.00	0		$500,000	$0	$0	$0	$0	$500,000
Subtotal					$4,500,000	$0	$0	$0	$0	$4,500,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$4,500,000
Escalation					$1,154,700	$0	$0	$0	$0	$1,154,700
Contingency					$2,544,615	$0	$0	$0	$0	$2,544,615
---Total OPC2200 PERMITTING			0		$8,199,315	$0	$0	$0	$0	$8,199,315
--- 1100 CONSTRUCTION SUPERVISION & ENGINEERING										
00401400	BWI	U.C. per Lot	1		15315800	0	0	0	0	15315800
Construction Management - 9% Of TCC		1.00	1	$***.**	$15,315,800	$0	$0	$0	$0	$15,315,800
Subtotal					$15,315,800	$0	$0	$0	$0	$15,315,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$15,315,800
Escalation					$3,930,034	$0	$0	$0	$0	$3,930,034
Contingency					$6,928,500	$0	$0	$0	$0	$6,928,500
---Total 1100 CONSTRUCTION SUPERVISION & ENGINEERING			1		$26,174,335	$0	$0	$0	$0	$26,174,335
--- 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
00401400	BWI	U.C. per Lot	1		340400	0	0	0	0	340400
CM - Conduct Of Operations / Conduct Of Maintenance - .2% Of TCC		1.00	1	$***.**	$340,400	$0	$0	$0	$0	$340,400

Project Name: CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
Subtotal					$340,400	$0	$0	$0	$0	$340,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$340,400
Escalation					$87,347	$0	$0	$0	$0	$87,347
Contingency					$153,989	$0	$0	$0	$0	$153,989
---Total 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE				1	**$581,735**	**$0**	**$0**	**$0**	**$0**	**$581,735**
--- 1200 CM PROJECT CONTROLS										
	BWI	U.C. per Lot			1191200	0	0	0	0	1191200
CM Project Controls - .7% Of TCC			1.00	0	$1,191,200	$0	$0	$0	$0	$1,191,200
Subtotal					$1,191,200	$0	$0	$0	$0	$1,191,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,191,200
Escalation					$305,662	$0	$0	$0	$0	$305,662
Contingency					$538,870	$0	$0	$0	$0	$538,870
---Total 1200 CM PROJECT CONTROLS				0	**$2,035,732**	**$0**	**$0**	**$0**	**$0**	**$2,035,732**
--- 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)										
	BWI	U.C. per Lot			850900	0	0	0	0	850900
CM - ES&H - .5% Of TCC			1.00	0	$850,900	$0	$0	$0	$0	$850,900
Subtotal					$850,900	$0	$0	$0	$0	$850,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$850,900
Escalation					$218,341	$0	$0	$0	$0	$218,341
Contingency					$384,927	$0	$0	$0	$0	$384,927
---Total 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)				0	**$1,454,168**	**$0**	**$0**	**$0**	**$0**	**$1,454,168**
--- 1400 CM TRAINING										
	BWI	U.C. per Lot			340400	0	0	0	0	340400
CM - Training - .2% Of TCC			1.00	0	$340,400	$0	$0	$0	$0	$340,400

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1400 CM TRAINING										
Subtotal					$340,400	$0	$0	$0	$0	$340,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$340,400
Escalation					$87,347	$0	$0	$0	$0	$87,347
Contingency					$153,989	$0	$0	$0	$0	$153,989
---Total 1400 CM TRAINING			0		$581,735	$0	$0	$0	$0	$581,735
--- 1500 CM - OTHER DIRECT COSTS										
	BWI	U.C. per Lot			340400	0	0	0	0	340400
CM - Other Direct Costs - .2% Of TCC		1.00	0		$340,400	$0	$0	$0	$0	$340,400
Subtotal					$340,400	$0	$0	$0	$0	$340,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$340,400
Escalation					$87,347	$0	$0	$0	$0	$87,347
Contingency					$153,989	$0	$0	$0	$0	$153,989
---Total 1500 CM - OTHER DIRECT COSTS			0		$581,735	$0	$0	$0	$0	$581,735
--- 2400 DESIGN ACTIVITIES										
	BWI	U.C. per Lot			10210500	0	0	0	0	10210500
Title I Design - 6% Of TCC		1.00	0		$10,210,500	$0	$0	$0	$0	$10,210,500
Subtotal					$10,210,500	$0	$0	$0	$0	$10,210,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$10,210,500
Escalation					$1,234,449	$0	$0	$0	$0	$1,234,449
Contingency					$4,120,182	$0	$0	$0	$0	$4,120,182
---Total 2400 DESIGN ACTIVITIES			0		$15,565,131	$0	$0	$0	$0	$15,565,131
--- 3400 DESIGN ACTIVITIES										
	BWI	U.C. per Lot			19229800	0	0	0	0	19229800
Title II Design - 11.3% Of TCC		1.00	0		$19,229,800	$0	$0	$0	$0	$19,229,800

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 3400 DESIGN ACTIVITIES										
Subtotal					$19,229,800	$0	$0	$0	$0	$19,229,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$19,229,800
Escalation					$2,949,851	$0	$0	$0	$0	$2,949,851
Contingency					$6,432,099	$0	$0	$0	$0	$6,432,099
---Total 3400 DESIGN ACTIVITIES			0		$28,611,750	$0	$0	$0	$0	$28,611,750
--- 4100 QUALITY ASSURANCE										
	BWI	U.C. per Lot	0.1		8508800	0	0	0	0	8508800
Quality Assurance - 5% Of TCC		1.00	0	$***.**	$8,508,800	$0	$0	$0	$0	$8,508,800
Subtotal					$8,508,800	$0	$0	$0	$0	$8,508,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,508,800
Escalation					$2,183,358	$0	$0	$0	$0	$2,183,358
Contingency					$3,314,569	$0	$0	$0	$0	$3,314,569
---Total 4100 QUALITY ASSURANCE			0		$14,006,727	$0	$0	$0	$0	$14,006,727
--- 5100 PM ADMINISTRATION										
	BWI	U.C. per Lot			13614000	0	0	0	0	13614000
Project Management - 8% Of TCC		1.00	0		$13,614,000	$0	$0	$0	$0	$13,614,000
Subtotal					$13,614,000	$0	$0	$0	$0	$13,614,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$13,614,000
Escalation					$3,493,352	$0	$0	$0	$0	$3,493,352
Contingency					$6,500,794	$0	$0	$0	$0	$6,500,794
---Total 5100 PM ADMINISTRATION			0		$23,608,146	$0	$0	$0	$0	$23,608,146
--- 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	BWI	U.C. per Lot	0.1		68100	0	0	0	0	68100
PM Conduct Of Operations / Conduct Of Maintenance - .04% Of TCC		1.00	0	$***.**	$68,100	$0	$0	$0	$0	$68,100

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
Subtotal					$68,100	$0	$0	$0	$0	$68,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$68,100
Escalation					$17,474	$0	$0	$0	$0	$17,474
Contingency					$32,518	$0	$0	$0	$0	$32,518
—Total 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			0		$118,093	$0	$0	$0	$0	$118,093
— 5200 PM PROJECT CONTROLS										
	BWI	U.C. per Lot			3403500	0	0	0	0	3403500
PM Project Controls - 2% Of TCC		1.00	0		$3,403,500	$0	$0	$0	$0	$3,403,500
Subtotal					$3,403,500	$0	$0	$0	$0	$3,403,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,403,500
Escalation					$873,338	$0	$0	$0	$0	$873,338
Contingency					$1,625,198	$0	$0	$0	$0	$1,625,198
—Total 5200 PM PROJECT CONTROLS			0		$5,902,037	$0	$0	$0	$0	$5,902,037
— 5300 PM RECORDS MANAGEMENT										
	BWI	U.C. per Lot			3403500	0	0	0	0	3403500
PM Records Management - 2% Of TCC		1.00	0		$3,403,500	$0	$0	$0	$0	$3,403,500
Subtotal					$3,403,500	$0	$0	$0	$0	$3,403,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,403,500
Escalation					$873,338	$0	$0	$0	$0	$873,338
Contingency					$1,625,198	$0	$0	$0	$0	$1,625,198
—Total 5300 PM RECORDS MANAGEMENT			0		$5,902,037	$0	$0	$0	$0	$5,902,037
— 5400 SAFETY ANALYSIS										
	BWI	U.C. per Lot			2000000	0	0	0	0	2000000
Safety Analysis Report (SAR)		1.00	0		$2,000,000	$0	$0	$0	$0	$2,000,000

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5400 SAFETY ANALYSIS										
Subtotal					$2,000,000	$0	$0	$0	$0	$2,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$2,000,000
Escalation					$513,200	$0	$0	$0	$0	$513,200
Contingency					$955,016	$0	$0	$0	$0	$955,016
---Total 5400 SAFETY ANALYSIS			**0**		**$3,468,216**	**$0**	**$0**	**$0**	**$0**	**$3,468,216**
--- 6000 CONSTRUCTION AE SUPPORT										
BWI	U.C. per Lot				2552600	0	0	0	0	2552600
Construction AE Support - 1.5% Of TCC		1.00	0		$2,552,600	$0	$0	$0	$0	$2,552,600
Subtotal					$2,552,600	$0	$0	$0	$0	$2,552,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$2,552,600
Escalation					$654,997	$0	$0	$0	$0	$654,997
Contingency					$898,127	$0	$0	$0	$0	$898,127
---Total 6000 CONSTRUCTION AE SUPPORT			**0**		**$4,105,724**	**$0**	**$0**	**$0**	**$0**	**$4,105,724**
--- 9101.1 GENERAL CONDITIONS										
GEN	U.C. per Lot		41619	CN-SUPR	1664760	0	0	0	0	1664760
Supervision - 15% Of Labor Hours		1.00	41,619	$40.00	$1,664,760	$0	$0	$0	$0	$1,664,760
GEN	U.C. per Lot		19422	CN-LABR	584407.98	0	0	0	0	584407.98
Training - 7% Of Labor Hours		1.00	19,422	$30.09	$584,408	$0	$0	$0	$0	$584,408
GEN	U.C. per Lot		1387	CN-LABR	41734.83	10000	0	0	0	51734.83
Mobilization & Demobilization - .5% Of Labor Hours		1.00	1,387	$30.09	$41,735	$10,000	$0	$0	$0	$51,735
GEN	U.C. per Lot				0	0	8610000	0	0	8610000
(*)Material Adjustment - Additional 10% On Material & Subcontracts		1.00	0		$0	$0	$8,610,000	$0	$0	$8,610,000
Memo: Adjustment for DOE/RW/0333P Quality Standards.										
Subtotal					$2,290,903	$10,000	$8,610,000	$0	$0	$10,910,903
Sales Tax					$0	$0	$430,500	$0	$0	$430,500
INEEL ORG Labor/Subcontractor Overheads					$665,049	$2,903	$2,624,457	$0	$0	$3,292,409
Subtotal Estimate										$14,633,812
Escalation					$758,497	$3,311	$2,993,228	$0	$0	$3,755,036
Contingency					$1,522,924	$6,648	$6,009,856	$0	$0	$7,539,428
---Total 9101.1 GENERAL CONDITIONS			**62,428**		**$5,237,373**	**$22,862**	**$20,668,041**	**$0**	**$0**	**$25,928,276**

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	GEN U.C. per Hr		0.08	CN-SKWK	2.762	0	0	0	0	2.762
(*)Labor Adjustment		277,462.00	22,197	$34.52	$766,239	$0	$0	$0	$0	$766,239
Memo: Conduct of Operations / Conduct of Maintenance - Add 8% to construction labor hours.										
Subtotal					$766,239	$0	$0	$0	$0	$766,239
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$222,439	$0	$0	$0	$0	$222,439
Subtotal Estimate										$988,678
Escalation					$253,695	$0	$0	$0	$0	$253,695
Contingency					$509,373	$0	$0	$0	$0	$509,373
---Total 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			22,197		$1,751,746	$0	$0	$0	$0	$1,751,746
--- 9102.1 SITEWORK - UTILITIES										
	GEN U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Firewater		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN U.C. per Lf		0.5	CN-LABR	15.045	2	12	0	0	29.045
Piping - Firewater		300.00	150	$30.09	$4,514	$600	$3,600	$0	$0	$8,714
	GEN U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Sewer		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN U.C. per Lf		0.03	CN-LABR	0.903	2	5	0	0	7.903
Piping - Sewer		300.00	9	$30.09	$271	$600	$1,500	$0	$0	$2,371
Subtotal					$38,485	$9,200	$5,100	$0	$0	$52,785
Sales Tax					$0	$0	$255	$0	$0	$255
INEEL ORG Labor/Subcontractor Overheads					$11,172	$2,671	$1,555	$0	$0	$15,398
Subtotal Estimate										$68,438
Escalation					$12,742	$3,046	$1,773	$0	$0	$17,561
Contingency					$42,432	$10,143	$5,904	$0	$0	$58,479
---Total 9102.1 SITEWORK - UTILITIES			1,279		$104,831	$25,060	$14,587	$0	$0	$144,478
--- 9102.2 SITEWORK - GFF										
	GEN U.C. per Sf		0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		100,000.00	3,000	$30.09	$90,270	$50,000	$0	$0	$0	$140,270

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.2 SITEWORK - GFF										
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill - Footings		5,360.00	3,752	$30.09	$112,898	$26,800	$0	$0	$0	$139,698
Subtotal					$203,168	$76,800	$0	$0	$0	$279,968
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$58,980	$22,295	$0	$0	$0	$81,275
Subtotal Estimate										$361,242
Escalation					$67,267	$25,428	$0	$0	$0	$92,695
Contingency					$224,002	$84,676	$0	$0	$0	$308,677
---Total 9102.2 SITEWORK - GFF			**6,752**		**$553,416**	**$209,198**	**$0**	**$0**	**$0**	**$762,614**
--- 9102.3 SITEWORK - TFD FACILITY										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		27,000.00	810	$30.09	$24,373	$13,500	$0	$0	$0	$37,873
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		8,550.00	5,985	$30.09	$180,089	$42,750	$0	$0	$0	$222,839
Subtotal					$204,462	$56,250	$0	$0	$0	$260,712
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$59,355	$16,329	$0	$0	$0	$75,685
Subtotal Estimate										$336,396
Escalation					$67,695	$18,624	$0	$0	$0	$86,319
Contingency					$225,428	$62,018	$0	$0	$0	$287,446
---Total 9102.3 SITEWORK - TFD FACILITY			**6,795**		**$556,940**	**$153,221**	**$0**	**$0**	**$0**	**$710,162**
--- 9102.4 SITEWORK - BOILER HOUSE										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		4,000.00	120	$30.09	$3,611	$2,000	$0	$0	$0	$5,611
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		500.00	350	$30.09	$10,532	$2,500	$0	$0	$0	$13,032
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Steam & Condensate		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.05	CN-LABR	1.505	2	5	0	0	8.505
Piping - Steam & Condensate		600.00	30	$30.09	$903	$1,200	$3,000	$0	$0	$5,103

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.4 SITEWORK - BOILER HOUSE										
	GEN	U.C. per Cf	0.17	CN-LABR	5.115	0	16.55	0	0	21.665
Gilsulate Insulation		477.00	81	$30.09	$2,440	$0	$7,894	$0	$0	$10,334
Subtotal					$34,335	$9,700	$10,894	$0	$0	$54,930
Sales Tax					$0	$0	$545	$0	$0	$545
INEEL ORG Labor/Subcontractor Overheads					$9,968	$2,816	$3,321	$0	$0	$16,104
Subtotal Estimate										$71,579
Escalation					$11,368	$3,212	$3,787	$0	$0	$18,367
Contingency					$37,856	$10,695	$12,612	$0	$0	$61,163
---Total 9102.4 SITEWORK - BOILER HOUSE			1,141		$93,527	$26,422	$31,159	$0	$0	$151,109
--- 9102.5 SITEWORK - STORAGE FACILITY										
	GEN	U.C. per CY	0.012	CN-ENGR	0.391	2	0	0	0	2.391
BUILDING EXCAVATION		17,160.00	206	$32.56	$6,705	$34,320	$0	$0	$0	$41,025
	GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BACKFILL		12,240.00	734	$32.56	$23,912	$24,480	$0	$0	$0	$48,392
	GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BERM FILL		6,900.00	414	$32.56	$13,480	$13,800	$0	$0	$0	$27,280
Subtotal					$44,097	$72,600	$0	$0	$0	$116,697
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$12,801	$21,076	$0	$0	$0	$33,877
Subtotal Estimate										$150,574
Escalation					$14,600	$24,037	$0	$0	$0	$38,637
Contingency					$48,619	$80,045	$0	$0	$0	$128,663
---Total 9102.5 SITEWORK - STORAGE FACILITY			1,354		$120,117	$197,758	$0	$0	$0	$317,874
--- 9102.5 SITEWORK - TUNNEL										
	GEN	U.C. per Cy	0.6	CN-LABR	18.054	12	0	0	0	30.054
(*)Excavate & Backfill For Tunnel		4,500.00	2,700	$30.09	$81,243	$54,000	$0	$0	$0	$135,243

Memo: Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.5 SITEWORK - TUNNEL										
GEN	U.C. per Cy		3	CN-LABR	90.27	12	0	0	0	102.27
Allowance For Hand Excavation		100.00	300	$30.09	$9,027	$1,200	$0	$0	$0	$10,227
Subtotal					$90,270	$55,200	$0	$0	$0	$145,470
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$26,205	$16,025	$0	$0	$0	$42,230
Subtotal Estimate										$187,700
Escalation					$29,888	$18,276	$0	$0	$0	$48,164
Contingency					$99,527	$60,861	$0	$0	$0	$160,387
---Total 9102.5 SITEWORK - TUNNEL			**3,000**		**$245,890**	**$150,361**	**$0**	**$0**	**$0**	**$396,251**
--- 9102.6 SITEWORK - PAVING										
GEN	U.C. per Sf		0.05	CN-SKWK	1.726	1.2	0	0	0	2.926
Pavement Removal		7,050.00	353	$34.52	$12,168	$8,460	$0	$0	$0	$20,628
GEN	U.C. per Sf		0.03	CN-SKWK	1.036	1	2	0	0	4.036
New Pavement		26,250.00	788	$34.52	$27,185	$26,250	$52,500	$0	$0	$105,935
Subtotal					$39,353	$34,710	$52,500	$0	$0	$126,563
Sales Tax					$0	$0	$2,625	$0	$0	$2,625
INEEL ORG Labor/Subcontractor Overheads					$11,424	$10,076	$16,003	$0	$0	$37,503
Subtotal Estimate										$166,691
Escalation					$13,029	$11,492	$18,251	$0	$0	$42,773
Contingency					$43,388	$38,269	$60,778	$0	$0	$142,435
---Total 9102.6 SITEWORK - PAVING			**1,140**		**$107,195**	**$94,548**	**$150,157**	**$0**	**$0**	**$351,899**
--- 9103.1 CONCRETE - GFF										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings		953.00	4,765	$34.52	$164,488	$0	$171,540	$0	$0	$336,028
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick		1,690.00	8,450	$34.52	$291,694	$0	$304,200	$0	$0	$595,894
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick		755.00	3,775	$34.52	$130,313	$0	$135,900	$0	$0	$266,213
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping - 4" Thick		824.00	4,120	$34.52	$142,222	$0	$148,320	$0	$0	$290,542
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.		250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.										

Project Name:

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9103.1 CONCRETE - GFF										
	GEN	U.C. per Lot	120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads		1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
	GEN	U.C. per Sf		CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 6" Thick		56,560.00	0		$0	$0	$0	$692,860	$0	$692,860
	GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels		66,800.00	0		$0	$0	$601,200	$0	$0	$601,200
	GEN	U.C. per Lf			0	0	0	170	0	170
Pre-Cast Concrete Inverted Tees		600.00	0		$0	$0	$0	$102,000	$0	$102,000
	GEN	U.C. per Lf			0	0	0	150	0	150
Pre-Cast Concrete Columns - 24" x 24"		672.00	0		$0	$0	$0	$100,800	$0	$100,800
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed Wall Panels - 56' Long		118.00	944	$34.52	$32,587	$0	$0	$0	$0	$32,587
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed Roof Panels		114.00	912	$34.52	$31,482	$0	$0	$0	$0	$31,482
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Cast Columns		12.00	96	$34.52	$3,314	$0	$0	$0	$0	$3,314
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Cast Inverted Tees		10.00	80	$34.52	$2,762	$0	$0	$0	$0	$2,762
	GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Columns		36.00	720	$34.52	$24,854	$0	$0	$0	$0	$24,854
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels		254.00	2,032	$34.52	$70,145	$0	$5,080	$0	$0	$75,225
	GEN	U.C. per Ea	250	CN-SKWK	8630	0	45000	0	0	53630
Stairwell - 56' High		2.00	500	$34.52	$17,260	$0	$90,000	$0	$0	$107,260
	GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		1,200.00	240	$34.52	$8,285	$0	$6,000	$0	$0	$14,285
	GEN	U.C. per Ea	150	CN-SKWK	5178	1000	3500	0	0	9678
Concrete Ramp		2.00	300	$34.52	$10,356	$2,000	$7,000	$0	$0	$19,356

Project Name:

CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location *INTEC*
Estimate Number *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.1 CONCRETE - GFF										
	GEN	U.C. per Ea			0	0	0	50000	0	50000
Loading Dock		2.00	0		$0	$0	$0	$100,000	$0	$100,000
Subtotal					$977,054	$2,000	$1,516,740	$995,660	$0	$3,491,454
Sales Tax					$0	$0	$75,837	$0	$0	$75,837
INEEL ORG Labor/Subcontractor Overheads					$283,639	$581	$462,325	$289,040	$0	$1,035,585
Subtotal Estimate										$4,602,876
Escalation					$323,494	$662	$527,288	$329,654	$0	$1,181,098
Contingency					$411,889	$843	$671,369	$419,732	$0	$1,503,833
---Total 9103.1 CONCRETE - GFF			28,304		$1,996,075	$4,086	$3,253,559	$2,034,086	$0	$7,287,807
--- 9103.2 CONCRETE - TFD FACILITY										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings		430.00	2,150	$34.52	$74,218	$0	$77,400	$0	$0	$151,618
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 12" Thick		725.00	3,625	$34.52	$125,135	$0	$130,500	$0	$0	$255,635
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick		200.00	1,000	$34.52	$34,520	$0	$36,000	$0	$0	$70,520
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping		170.00	850	$34.52	$29,342	$0	$30,600	$0	$0	$59,942
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.		250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Lot	120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads		1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
	GEN	U.C. per Sf		CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 12" Thick		36,345.00	0		$0	$0	$0	$445,226	$0	$445,226
	GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels		13,700.00	0		$0	$0	$123,300	$0	$0	$123,300
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels		170.00	1,360	$34.52	$46,947	$0	$0	$0	$0	$46,947
	GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams		24.00	480	$34.52	$16,570	$0	$0	$0	$0	$16,570
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels		170.00	1,360	$34.52	$46,947	$0	$3,400	$0	$0	$50,347

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.2 CONCRETE - TFD FACILITY										
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	60000	0	0	73808
Stairwell - 100' High		1.00	400	$34.52	$13,808	$0	$60,000	$0	$0	$73,808
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 24" Thick		585.00	2,925	$34.52	$100,971	$0	$105,300	$0	$0	$206,271
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Shielding Walls - 24" Thick		1,005.00	5,025	$34.52	$173,463	$0	$180,900	$0	$0	$354,363
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		250.00	50	$34.52	$1,726	$0	$1,250	$0	$0	$2,976
Subtotal					$710,939	$0	$796,150	$445,226	$0	$1,952,316
Sales Tax					$0	$0	$39,808	$0	$0	$39,808
INEEL ORG Labor/Subcontractor Overheads					$206,386	$0	$242,678	$129,249	$0	$578,313
Subtotal Estimate										$2,570,437
Escalation					$235,386	$0	$276,778	$147,410	$0	$659,574
Contingency					$299,705	$0	$352,408	$187,690	$0	$839,803
---Total 9103.2 CONCRETE - TFD FACILITY			**20,595**		**$1,452,416**	**$0**	**$1,707,822**	**$909,576**	**$0**	**$4,069,813**
--- 9103.3 CONCRETE - BOILER HOUSE										
	GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings & Floors		92.00	460	$34.52	$15,879	$0	$16,560	$0	$0	$32,439
Memo: Includes formwork, concrete, and rebar.										
	GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		100.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
	GEN	U.C. per Lot	20	CN-SKWK	690.4	0	500	0	0	1190.4
Misc. Concrete Pads		1.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
Subtotal					$17,260	$0	$17,560	$0	$0	$34,820
Sales Tax					$0	$0	$878	$0	$0	$878
INEEL ORG Labor/Subcontractor Overheads					$5,011	$0	$5,353	$0	$0	$10,363
Subtotal Estimate										$46,061
Escalation					$5,715	$0	$6,105	$0	$0	$11,819
Contingency					$7,276	$0	$7,773	$0	$0	$15,049
---Total 9103.3 CONCRETE - BOILER HOUSE			**500**		**$35,261**	**$0**	**$37,668**	**$0**	**$0**	**$72,929**
--- 9103.4 CONCRETE - STORAGE FACILITY										
	GEN	U.C. per EA			0	0	0	75000	0	75000
Hatch Plugs		3.00	0		$0	$0	$0	$225,000	$0	$225,000

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.4 CONCRETE - STORAGE FACILITY									
GEN	U.C. per Sf		CN-SKWK	0	0	0	8.5	0	8.5
Precast Concrete Walls - 6" Thick	17,160.00	0		$0	$0	$0	$145,860	$0	$145,860
GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels	20,440.00	0		$0	$0	$183,960	$0	$0	$183,960
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels	126.00	1,008	$34.52	$34,796	$0	$0	$0	$0	$34,796
GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams	22.00	440	$34.52	$15,189	$0	$0	$0	$0	$15,189
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels	126.00	1,008	$34.52	$34,796	$0	$2,520	$0	$0	$37,316
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings	260.00	1,300	$34.52	$44,876	$0	$46,800	$0	$0	$91,676
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick	380.00	1,900	$34.52	$65,588	$0	$68,400	$0	$0	$133,988
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Partition Wall - 12" Thick	180.00	900	$34.52	$31,068	$0	$32,400	$0	$0	$63,468
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide	500.00	100	$34.52	$3,452	$0	$2,500	$0	$0	$5,952
Subtotal				$229,765	$0	$336,580	$370,860	$0	$937,205
Sales Tax				$0	$0	$16,829	$0	$0	$16,829
INEEL ORG Labor/Subcontractor Overheads				$66,701	$0	$102,595	$107,661	$0	$276,956
Subtotal Estimate									$1,230,990
Escalation				$76,073	$0	$117,011	$122,788	$0	$315,872
Contingency				$96,860	$0	$148,984	$156,340	$0	$402,184
---Total 9103.4 CONCRETE - STORAGE FACILITY		6,656		$469,399	$0	$721,998	$757,649	$0	$1,949,047
--- 9103.5 CONCRETE - TUNNEL									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete For Tunnel - 12" Thick All Surfaces	190.00	950	$34.52	$32,794	$0	$34,200	$0	$0	$66,994

Memo: Includes formwork, concrete, and rebar. Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.5 CONCRETE - TUNNEL										
Subtotal					$32,794	$0	$34,200	$0	$0	$66,994
Sales Tax					$0	$0	$1,710	$0	$0	$1,710
INEEL ORG Labor/Subcontractor Overheads					$9,520	$0	$10,425	$0	$0	$19,945
Subtotal Estimate										$88,649
Escalation					$10,858	$0	$11,889	$0	$0	$22,747
Contingency					$13,825	$0	$15,138	$0	$0	$28,963
---Total 9103.5 CONCRETE - TUNNEL			950		$66,997	$0	$73,362	$0	$0	$140,359
--- 9105.2 METALS - GFF										
STEEL	U.C. per Sf		0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure		66,790.00	2,672	$40.16	$107,291	$0	$160,296	$0	$0	$267,587
STEEL	U.C. per Lot		1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals		1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
GEN	U.C. per Sf				0	0	0	20	0	20
(*)Pre-Engineered Metal Building		24,380.00	0		$0	$0	$0	$487,600	$0	$487,600
Memo: Office / restroom, Tru-Pak, and truck airlock areas.										
Subtotal					$147,451	$0	$310,296	$487,600	$0	$945,347
Sales Tax					$0	$0	$15,515	$0	$0	$15,515
INEEL ORG Labor/Subcontractor Overheads					$61,831	$0	$136,622	$141,550	$0	$340,003
Subtotal Estimate										$1,300,866
Escalation					$53,702	$0	$118,660	$161,440	$0	$333,802
Contingency					$68,376	$0	$151,084	$205,553	$0	$425,014
---Total 9105.2 METALS - GFF			3,672		$331,360	$0	$732,178	$996,144	$0	$2,059,681
--- 9105.3 METALS - TFD FACILITY										
STEEL	U.C. per Sf		2	CN-IRON	80.32	0	10	0	0	90.32
Liner Plate - 4' Up From Floor		1,025.00	2,050	$40.16	$82,328	$0	$10,250	$0	$0	$92,578
STEEL	U.C. per Lot		200	CN-IRON	8032	0	25000	0	0	33032
Misc. Embeds		1.00	200	$40.16	$8,032	$0	$25,000	$0	$0	$33,032
STEEL	U.C. per Lot		1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals		1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
STEEL	U.C. per Sf		0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure		13,700.00	548	$40.16	$22,008	$0	$32,880	$0	$0	$54,888

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.3 METALS - TFD FACILITY										
	STEEL	U.C. per Ea	10	CN-IRON	401.6	0	3000	0	0	3401.6
Stairway		1.00	10	$40.16	$402	$0	$3,000	$0	$0	$3,402
Subtotal					$152,929	$0	$221,130	$0	$0	$374,059
Sales Tax					$0	$0	$11,057	$0	$0	$11,057
INEEL ORG Labor/Subcontractor Overheads					$64,128	$0	$97,363	$0	$0	$161,491
Subtotal Estimate										$546,606
Escalation					$55,697	$0	$84,562	$0	$0	$140,259
Contingency					$70,916	$0	$107,669	$0	$0	$178,585
---Total 9105.3 METALS - TFD FACILITY			3,808		$343,670	$0	$521,781	$0	$0	$865,451
--- 9105.4 METALS - BOILER HOUSE										
	GEN	U.C. per Sf			0	0	0	18	0	18
Pre-Engineered Metal Building		3,120.00	0		$0	$0	$0	$56,160	$0	$56,160
	GEN	U.C. per Lot	40	CN-IRON	1606.4	0	1200	0	0	2806.4
Misc. Metals		1.00	40	$40.16	$1,606	$0	$1,200	$0	$0	$2,806
	STEEL	U.C. per EA	40	CN-IRON	1606.4	0	275	0	0	1881.4
BOILER STACK SUPPORTS		2.00	80	$40.16	$3,213	$0	$550	$0	$0	$3,763
	STEEL	U.C. per LBS	0.018	CN-IRON	0.723	0	1.62	0	0	2.343
BOILER BUILDING PLATFORMS		11,000.00	198	$40.16	$7,952	$0	$17,820	$0	$0	$25,772
	STEEL	U.C. per LBS	0.012	CN-IRON	0.482	0	0.4	0	0	0.882
BOILER BUILDING ROOF FRAMING		21,840.00	262	$40.16	$10,525	$0	$8,736	$0	$0	$19,261
Subtotal					$23,296	$0	$28,306	$56,160	$0	$107,762
Sales Tax					$0	$0	$1,415	$0	$0	$1,415
INEEL ORG Labor/Subcontractor Overheads					$9,561	$0	$12,300	$16,303	$0	$38,165
Subtotal Estimate										$147,342
Escalation					$8,431	$0	$10,783	$18,594	$0	$37,808
Contingency					$10,735	$0	$13,729	$23,675	$0	$48,139
---Total 9105.4 METALS - BOILER HOUSE			580		$52,024	$0	$66,534	$114,732	$0	$233,290
--- 9105.5 METALS - STORAGE FACILITY										
	STEEL	U.C. per TON	6	CN-IRON	240.96	0	1100	0	0	1340.96
CHARGE FACE SLAB FRAME		780.00	4,680	$40.16	$187,949	$0	$858,000	$0	$0	$1,045,949
	STEEL	U.C. per TON	10	CN-IRON	401.6	0	1200	0	0	1601.6
BUILDING STRUCTURAL STEEL		756.00	7,560	$40.16	$303,610	$0	$907,200	$0	$0	$1,210,810
	STEEL	U.C. per LF	3.85	CN-IRON	154.616	0	161	0	0	315.616
GANTRY CRANE RAILS, EMBEDS, ETC.		400.00	1,540	$40.16	$61,846	$0	$64,400	$0	$0	$126,246

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
-- 9105.5 METALS - STORAGE FACILITY										
STEEL	U.C. per LF		2	CN-IRON	80.32	0	92.	0	0	172.32
RAILROAD TRACKS - WITHIN BUILDING		180.00	360	$40.16	$14,458	$0	$16,560	$0	$0	$31,018
STEEL	U.C. per LF		2	CN-IRON	80.32	0	92	0	0	172.32
TRANSFER CART RAILS		210.00	420	$40.16	$16,867	$0	$19,320	$0	$0	$36,187
STEEL	U.C. per SF		0.25	CN-IRON	10.04	0	40	0	0	50.04
BIRD SCREEN AND VENT LOUVERS		2,300.00	575	$40.16	$23,092	$0	$92,000	$0	$0	$115,092
STEEL	U.C. per SF			CN-IRON	0	0	0	12	0	12
AIR OUTLET WALL (INSIDE)		12,600.00	0		$0	$0	$0	$151,200	$0	$151,200
STEEL	U.C. per Lot		750	CN-IRON	30120	0	45000	0	0	75120
(*)Misc. Steel		1.00	750	$40.16	$30,120	$0	$45,000	$0	$0	$75,120
Memo: Handrails, stairways, grating, and etc.										
Subtotal					$637,942	$0	$2,002,480	$151,200	$0	$2,791,622
Sales Tax					$0	$0	$100,124	$0	$0	$100,124
INEEL ORG Labor/Subcontractor Overheads					$267,508	$0	$881,685	$63,403	$0	$1,212,596
Subtotal Estimate										$4,104,341
Escalation					$232,338	$0	$765,769	$55,067	$0	$1,053,174
Contingency					$295,825	$0	$975,015	$70,114	$0	$1,340,954
--Total 9105.5 METALS - STORAGE FACILITY			15,885		$1,433,613	$0	$4,725,072	$339,784	$0	$6,498,469
-- 9107.1 THERMAL & MOISTURE PROTECTION - GFF										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		6,700.00	221	$34.64	$7,659	$0	$4,020	$0	$0	$11,679
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		46,000.00	2,760	$34.64	$95,606	$0	$96,600	$0	$0	$192,206
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		46,000.00	3,680	$30.09	$110,731	$0	$207,000	$0	$0	$317,731
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		66,790.00	1,336	$30.09	$40,194	$0	$63,451	$0	$0	$103,645
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		66,790.00	935	$29.95	$28,005	$0	$146,938	$0	$0	$174,943
ROOF	U.C. per Lot		300	CN-ROFC	8985	0	7500	0	0	16485
Redwood, Flashing, & Etc.		1.00	300	$29.95	$8,985	$0	$7,500	$0	$0	$16,485
GEN	U.C. per Sf		0.016	CN-CARP	0.554	0	0.35	0	0	0.904
3-1/2" Thick Batt Insulation - Metal Building Walls		35,360.00	566	$34.64	$19,598	$0	$12,376	$0	$0	$31,974
GEN	U.C. per Sf		0.018	CN-CARP	0.624	0	0.4	0	0	1.024
6" Vinyl Faced Batt Insulation - Metal Building Walls		35,360.00	636	$34.64	$22,048	$0	$14,144	$0	$0	$36,192

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.1 THERMAL & MOISTURE PROTECTION - GFF										
GEN	U.C. per Sf		0.045	CN-CARP	1.559	0	1.1	0	0	2.659
Insul-Basket - Metal Building Roof		24,380.00	1,097	$34.64	$38,004	$0	$26,818	$0	$0	$64,822
GEN	U.C. per SF		0.007	CN-CARP	0.242	0	0.2	0	0	0.442
3" Unfaced Batt Insulation - Metal Building Roof		24,380.00	171	$34.64	$5,912	$0	$4,876	$0	$0	$10,788
GEN	U.C. per Sf		0.007	CN-CARP	0.242	0	0.33	0	0	0.572
6" Vinyl Faced Batt Insulation - Metal Building Roof		24,380.00	171	$34.64	$5,912	$0	$8,045	$0	$0	$13,957
Subtotal					$382,653	$0	$591,768	$0	$0	$974,421
Sales Tax					$0	$0	$29,588	$0	$0	$29,588
INEEL ORG Labor/Subcontractor Overheads					$137,872	$0	$297,816	$0	$0	$435,688
Subtotal Estimate										$1,439,697
Escalation					$133,567	$0	$235,859	$0	$0	$369,426
Contingency					$170,064	$0	$300,308	$0	$0	$470,372
---Total 9107.1 THERMAL & MOISTURE PROTECTION - GFF			11,873		$824,156	$0	$1,455,339	$0	$0	$2,279,496
--- 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,000.00	66	$34.64	$2,286	$0	$1,200	$0	$0	$3,486
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		37,000.00	2,220	$34.64	$76,901	$0	$77,700	$0	$0	$154,601
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		37,000.00	2,960	$30.09	$89,066	$0	$166,500	$0	$0	$255,566
GEN	U.C. per Hr		0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		1,290.00	323	$30.09	$9,704	$0	$0	$0	$0	$9,704
GEN	U.C. per Lot				0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		13,700.00	274	$30.09	$8,245	$0	$13,015	$0	$0	$21,260
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		13,700.00	192	$29.95	$5,744	$0	$30,140	$0	$0	$35,884

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX in GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
ROOF	U.C. per Lot		200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$197,937	$3,000	$293,555	$0	$0	$494,492
Sales Tax					$0	$0	$14,678	$0	$0	$14,678
INEEL ORG Labor/Subcontractor Overheads					$65,959	$871	$116,201	$0	$0	$183,031
Subtotal Estimate										$692,200
Escalation					$67,716	$993	$108,910	$0	$0	$177,618
Contingency					$86,219	$1,265	$138,669	$0	$0	$226,153
---Total 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY			6,234		$417,830	$6,129	$672,012	$0	$0	$1,095,971
--- 9107.3 THERMAL & MOISTURE PROTECTION - BOILER HOUSE										
INSUL	U.C. per SF				0	0	0	1.9	0	1.9
EXTERIOR WALL INSULATION W/ Z-GIRTS		6,720.00	0		$0	$0	$0	$12,768	$0	$12,768
INSUL	U.C. per SF				0	0	0	1	0	1
ROOF INSULATION		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
GEN	U.C. per SF		0.023	CN-SHEE	0.816	0	3	0	0	3.816
EXTERIOR WALL METAL SIDING		6,720.00	155	$35.48	$5,484	$0	$20,160	$0	$0	$25,644
GEN	U.C. per SF		0.016	CN-SHEE	0.568	0	5	0	0	5.568
STANDING SEAM METAL ROOF		3,120.00	50	$35.48	$1,771	$0	$15,600	$0	$0	$17,371
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		950.00	31	$34.64	$1,086	$0	$570	$0	$0	$1,656
Subtotal					$8,341	$0	$36,330	$15,888	$0	$60,559
Sales Tax					$0	$0	$1,817	$0	$0	$1,817
INEEL ORG Labor/Subcontractor Overheads					$2,421	$0	$11,074	$6,662	$0	$20,158
Subtotal Estimate										$82,533
Escalation					$2,762	$0	$12,630	$5,786	$0	$21,178
Contingency					$3,516	$0	$16,081	$7,368	$0	$26,965
---Total 9107.3 THERMAL & MOISTURE PROTECTION - BOILER HOUSE			236		$17,040	$0	$77,931	$35,704	$0	$130,676
--- 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,300.00	76	$34.64	$2,629	$0	$1,380	$0	$0	$4,009
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		17,200.00	1,032	$34.64	$35,748	$0	$36,120	$0	$0	$71,868
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		17,200.00	1,376	$30.09	$41,404	$0	$77,400	$0	$0	$118,804

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
GEN	U.C. per Hr		0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		2,408.00	602	$30.09	$18,114	$0	$0	$0	$0	$18,114
GEN	U.C. per Lot				0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		20,500.00	410	$30.09	$12,337	$0	$19,475	$0	$0	$31,812
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		20,500.00	287	$29.95	$8,596	$0	$45,100	$0	$0	$53,696
ROOF	U.C. per Lot		200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$124,818	$3,000	$184,475	$0	$0	$312,293
Sales Tax					$0	$0	$9,224	$0	$0	$9,224
INEEL ORG Labor/Subcontractor Overheads					$46,798	$871	$94,327	$0	$0	$141,996
Subtotal Estimate										$463,513
Escalation					$44,037	$993	$73,907	$0	$0	$118,937
Contingency					$56,070	$1,265	$94,103	$0	$0	$151,437
---Total 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY			3,983		$271,722	$6,129	$456,036	$0	$0	$733,887
--- 9108.1 DOORS & WINDOWS - GFF										
GEN	U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		30.00	300	$34.64	$10,392	$0	$30,000	$0	$0	$40,392
GEN	U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		2.00	30	$34.64	$1,039	$0	$3,600	$0	$0	$4,639
GEN	U.C. per Ea		12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors - Single		7.00	84	$34.64	$2,910	$0	$14,000	$0	$0	$16,910
GEN	U.C. per Ea		20	CN-CARP	692.8	0	3000	0	0	3692.8
Exterior Doors - Double		2.00	40	$34.64	$1,386	$0	$6,000	$0	$0	$7,386

Project Name:

CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.1 DOORS & WINDOWS - GFF										
	GEN	U.C. per Ea	75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal					$20,923	$0	$85,600	$0	$0	$106,523
Sales Tax					$0	$0	$4,280	$0	$0	$4,280
INEEL ORG Labor/Subcontractor Overheads					$6,074	$0	$26,092	$0	$0	$32,166
Subtotal Estimate										$142,969
Escalation					$6,927	$0	$29,758	$0	$0	$36,686
Contingency					$8,820	$0	$37,890	$0	$0	$46,710
---Total 9108.1 DOORS & WINDOWS - GFF			604		$42,744	$0	$183,621	$0	$0	$226,364
--- 9108.2 DOORS & WINDOWS - TFD FACILITY										
	GEN	U.C. per Ea	10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		12.00	120	$34.64	$4,157	$0	$12,000	$0	$0	$16,157
	GEN	U.C. per Ea	15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		6.00	90	$34.64	$3,118	$0	$10,800	$0	$0	$13,918
	GEN	U.C. per Ea	12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors		4.00	48	$34.64	$1,663	$0	$8,000	$0	$0	$9,663
	GEN	U.C. per Ea	40	CN-CARP	1385.6	500	25000	0	0	26885.6
3' x 7' Shielding Doors		2.00	80	$34.64	$2,771	$1,000	$50,000	$0	$0	$53,771
	GEN	U.C. per Ea	75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal					$16,904	$1,000	$112,800	$0	$0	$130,704
Sales Tax					$0	$0	$5,640	$0	$0	$5,640
INEEL ORG Labor/Subcontractor Overheads					$4,907	$290	$34,383	$0	$0	$39,581
Subtotal Estimate										$175,925
Escalation					$5,597	$331	$39,214	$0	$0	$45,142
Contingency					$7,126	$422	$49,930	$0	$0	$57,478
---Total 9108.2 DOORS & WINDOWS - TFD FACILITY			488		$34,535	$2,043	$241,967	$0	$0	$278,545
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
	GEN	U.C. per Ea	10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		3.00	30	$34.64	$1,039	$0	$3,000	$0	$0	$4,039
	GEN	U.C. per Ea	15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		1.00	15	$34.64	$520	$0	$1,800	$0	$0	$2,320

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
	GEN	U.C. per Ea	75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		1.00	75	$34.64	$2,598	$0	$16,000	$0	$0	$18,598
Subtotal					$4,157	$0	$20,800	$0	$0	$24,957
Sales Tax					$0	$0	$1,040	$0	$0	$1,040
INEEL ORG Labor/Subcontractor Overheads					$1,207	$0	$6,340	$0	$0	$7,547
Subtotal Estimate										$33,544
Escalation					$1,376	$0	$7,231	$0	$0	$8,607
Contingency					$1,752	$0	$9,207	$0	$0	$10,959
---Total 9108.3 DOORS & WINDOWS - BOILER HOUSE			120		$8,492	$0	$44,618	$0	$0	$53,110
--- 9108.4 DOORS & WINDOWS - STORAGE FACILITY										
	GEN	U.C. per EA	75	CN-SKWK	2589	0	16000	0	0	18589
OVERHEAD DOORS		2.00	150	$34.52	$5,178	$0	$32,000	$0	$0	$37,178
	GEN	U.C. per EA	10	CN-SKWK	345.2	0	1000	0	0	1345.2
PERSONNEL DOORS		5.00	50	$34.52	$1,726	$0	$5,000	$0	$0	$6,726
Subtotal					$6,904	$0	$37,000	$0	$0	$43,904
Sales Tax					$0	$0	$1,850	$0	$0	$1,850
INEEL ORG Labor/Subcontractor Overheads					$2,004	$0	$11,278	$0	$0	$13,282
Subtotal Estimate										$59,036
Escalation					$2,286	$0	$12,863	$0	$0	$15,149
Contingency					$2,910	$0	$16,378	$0	$0	$19,288
---Total 9108.4 DOORS & WINDOWS - STORAGE FACILITY			200		$14,105	$0	$79,369	$0	$0	$93,473
--- 9109.1 FINISHES - GFF										
	PAINT	U.C. per Sf	0.012	CN-PAIN	0.365	0	0.12	0	0	0.485
Painting Gypsum Board Wall		23,500.00	282	$30.39	$8,570	$0	$2,820	$0	$0	$11,390
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting - Drum Storage		52,000.00	572	$30.39	$17,383	$0	$26,000	$0	$0	$43,383
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting - Drum Processing		14,800.00	163	$30.39	$4,947	$0	$7,400	$0	$0	$12,347
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		65.00	260	$30.39	$7,901	$0	$3,250	$0	$0	$11,151

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.1 FINISHES - GFF											
	PAINT	U.C. per Lot		80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint			1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
	GEN	U.C. per Sf		0.03	CN-LABR	0.903	0	1.5	0	0	2.403
Carpet Tile			10,550.00	317	$30.09	$9,523	$0	$15,825	$0	$0	$25,348
	TILE	U.C. per Sf		0.04	CN-TILF	1.386	0	2.5	0	0	3.886
Ceramic Tile			4,100.00	164	$34.64	$5,681	$0	$10,250	$0	$0	$15,931
	GEN	U.C. per Ea		1	CN-LABR	30.09	0	200	0	0	230.09
Entry Mat - Large			4.00	4	$30.09	$120	$0	$800	$0	$0	$920
	GEN	U.C. per Lf		0.06	CN-LABR	1.805	0	0.75	0	0	2.555
4" Vinyl Cove Base			2,000.00	120	$30.09	$3,611	$0	$1,500	$0	$0	$5,111
	GEN	U.C. per Sf		0.04	CN-LABR	1.204	0	1	0	0	2.204
Acoustical Suspended Ceiling			10,550.00	422	$30.09	$12,698	$0	$10,550	$0	$0	$23,248
	GEN	U.C. per Lot		6	CN-CARP	207.84	0	750	0	0	957.84
Building Lettering			1.00	6	$34.64	$208	$0	$750	$0	$0	$958
	GEN	U.C. per Sf		0.019	CN-CARP	0.658	0	0.24	0	0	0.898
3-1/2" Metal Stud Wall			12,000.00	228	$34.64	$7,898	$0	$2,880	$0	$0	$10,778
	GEN	U.C. per Sf		0.017	CN-CARP	0.589	0	0.33	0	0	0.919
5/8" Gypsum Board - Taped & Textured			23,500.00	400	$34.64	$13,839	$0	$7,755	$0	$0	$21,594
	GEN	U.C. per Sf				0	0	0	7	0	7
RCRA Floor - Grouting Facility			14,800.00	0		$0	$0	$0	$103,600	$0	$103,600
Subtotal						$135,716	$0	$95,300	$103,600	$0	$334,616
Sales Tax						$0	$0	$4,765	$0	$0	$4,765
INEEL ORG Labor/Subcontractor Overheads						$49,885	$0	$34,932	$30,075	$0	$114,891
Subtotal Estimate											$454,273
Escalation						$47,625	$0	$34,640	$34,301	$0	$116,566
Contingency						$60,639	$0	$44,106	$43,674	$0	$148,418
---Total 9109.1 FINISHES - GFF				4,363		$293,864	$0	$213,743	$211,650	$0	$719,257
--- 9109.2 FINISHES - TFD FACILITY											
	PAINT	U.C. per Sf		0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting			100,000.00	3,000	$30.39	$91,170	$0	$75,000	$0	$0	$166,170
	PAINT	U.C. per SF		0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel			13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf		0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Hot Cell			26,000.00	2,080	$30.39	$63,211	$0	$39,000	$0	$0	$102,211

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9109.2 FINISHES - TFD FACILITY										
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting		30,000.00	330	$30.39	$10,029	$0	$15,000	$0	$0	$25,029
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		20.00	80	$30.39	$2,431	$0	$1,000	$0	$0	$3,431
	PAINT	U.C. per Lot	80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint		1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
Subtotal					$210,177	$0	$135,520	$0	$0	$345,697
Sales Tax					$0	$0	$6,776	$0	$0	$6,776
INEEL ORG Labor/Subcontractor Overheads					$88,134	$0	$59,669	$0	$0	$147,803
Subtotal Estimate										$500,276
Escalation					$76,547	$0	$51,824	$0	$0	$128,371
Contingency					$97,463	$0	$65,985	$0	$0	$163,448
---Total 9109.2 FINISHES - TFD FACILITY			**6,916**		**$472,320**	**$0**	**$319,774**	**$0**	**$0**	**$792,095**
— 9109.3 FINISHES - BOILER HOUSE										
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		4.00	16	$30.39	$486	$0	$200	$0	$0	$686
	PAINT	U.C. per Lot	16	CN-PAIN	486.24	0	150	0	0	636.24
Touch-Up Paint		1.00	16	$30.39	$486	$0	$150	$0	$0	$636
Subtotal					$972	$0	$350	$0	$0	$1,322
Sales Tax					$0	$0	$18	$0	$0	$18
INEEL ORG Labor/Subcontractor Overheads					$408	$0	$154	$0	$0	$562
Subtotal Estimate										$1,902
Escalation					$354	$0	$134	$0	$0	$488
Contingency					$451	$0	$170	$0	$0	$621
---Total 9109.3 FINISHES - BOILER HOUSE			**32**		**$2,185**	**$0**	**$826**	**$0**	**$0**	**$3,011**
— 9109.4 FINISHES - STORAGE FACILITY										
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		2,500.00	75	$30.39	$2,279	$0	$1,875	$0	$0	$4,154
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Remote Handling Area		22,000.00	1,760	$30.39	$53,486	$0	$33,000	$0	$0	$86,486

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.4 FINISHES - STORAGE FACILITY										
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Floor Painting - Decontaminable - Remote Handling Area		17,600.00	1,408	$30.39	$42,789	$0	$26,400	$0	$0	$69,189
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		7.00	28	$30.39	$851	$0	$350	$0	$0	$1,201
	PAINT	U.C. per Lot	40	CN-PAIN	1215.6	0	150	0	0	1365.6
Touch-Up Paint		1.00	40	$30.39	$1,216	$0	$150	$0	$0	$1,366
Subtotal					$141,526	$0	$67,145	$0	$0	$208,671
Sales Tax					$0	$0	$3,357	$0	$0	$3,357
INEEL ORG Labor/Subcontractor Overheads					$59,346	$0	$29,564	$0	$0	$88,910
Subtotal Estimate										$300,938
Escalation					$51,544	$0	$25,677	$0	$0	$77,221
Contingency					$65,628	$0	$32,693	$0	$0	$98,321
---Total 9109.4 FINISHES - STORAGE FACILITY			4,657		$318,045	$0	$158,436	$0	$0	$476,481
--- 9110.1 SPECIALTIES - GFF										
	GEN	U.C. per Lf	0.25	CN-LABR	7.523	0	80	0	0	87.523
Storage Racks		6,250.00	1,563	$30.09	$47,016	$0	$500,000	$0	$0	$547,016
	GEN	U.C. per Ea			0	0	0	45000	0	45000
Truck Loading Platform		2.00	0		$0	$0	$0	$90,000	$0	$90,000
	GEN	U.C. per Ea	5	CN-CARP	173.2	0	1800	0	0	1973.2
Modular Offices		20.00	100	$34.64	$3,464	$0	$36,000	$0	$0	$39,464
	GEN	U.C. per Plc	5	CN-CARP	173.2	0	2500	0	0	2673.2
Office Furnishings		20.00	100	$34.64	$3,464	$0	$50,000	$0	$0	$53,464
	GEN	U.C. per Ea	1	CN-CARP	34.64	0	155	0	0	189.64
Mirror With Shelf - 20" x 30"		7.00	7	$34.64	$242	$0	$1,085	$0	$0	$1,327
	GEN	U.C. per Ea	3	CN-CARP	103.92	0	170	0	0	273.92
Urinal Screen		3.00	9	$34.64	$312	$0	$510	$0	$0	$822
	GEN	U.C. per Ea	4	CN-CARP	138.56	0	380	0	0	518.56
Toilet Partition		7.00	28	$34.64	$970	$0	$2,660	$0	$0	$3,630
	GEN	U.C. per Ea	0.4	CN-CARP	13.856	0	10	0	0	23.856
T.P. Dispenser		3.00	1	$34.64	$42	$0	$30	$0	$0	$72
	GEN	U.C. per Ea	0.5	CN-CARP	17.32	0	15	0	0	32.32
T.P. Dispenser With Purse Shelf		4.00	2	$34.64	$69	$0	$60	$0	$0	$129

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.1 SPECIALTIES - GFF											
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	20	0	0	37.32
San. Napkin Disposal			4.00	2	$34.64	$69	$0	$80	$0	$0	$149
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	65	0	0	85.784
H.C. Grab Bar - 52"			2.00	1	$34.64	$42	$0	$130	$0	$0	$172
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	75	0	0	95.784
Concealed Grab Bar - 42"			4.00	2	$34.64	$83	$0	$300	$0	$0	$383
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	65	0	0	85.784
Concealed Grab Bar - 36"			2.00	1	$34.64	$42	$0	$130	$0	$0	$172
	GEN	U.C. per Ea		1	CN-CARP	34.64	0	250	0	0	284.64
Towel Dispenser & Waste Receptacle			4.00	4	$34.64	$139	$0	$1,000	$0	$0	$1,139
	GEN	U.C. per Ea		0.75	CN-CARP	25.98	0	75	0	0	100.98
Folding Shower Seat			2.00	2	$34.64	$52	$0	$150	$0	$0	$202
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	45	0	0	62.32
Shower Curtain - 40' x 78"			2.00	1	$34.64	$35	$0	$90	$0	$0	$125
	GEN	U.C. per Ea		1	CN-CARP	34.64	0	155	0	0	189.64
Tilting Mirror - 24" x 30"			2.00	2	$34.64	$69	$0	$310	$0	$0	$379
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	25	0	0	42.32
Shower Curtain Rod - 36" Long			2.00	1	$34.64	$35	$0	$50	$0	$0	$85
	GEN	U.C. per Ea		0.15	CN-CARP	5.196	0	5	0	0	10.196
Double Prong Hooks - SST			20.00	3	$34.64	$104	$0	$100	$0	$0	$204
	GEN	U.C. per Ea		3	CN-CARP	103.92	0	250	0	0	353.92
Pedestal Bench - 36" Long			6.00	18	$34.64	$624	$0	$1,500	$0	$0	$2,124
	GEN	U.C. per Ea		1.25	CN-CARP	43.3	0	125	0	0	168.3
Single Tier Locker - 12" x 15" x 72"			60.00	75	$34.64	$2,598	$0	$7,500	$0	$0	$10,098
	GEN	U.C. per Ea		0.3	CN-CARP	10.392	0	55	0	0	65.392
Waste Receptacle			4.00	1	$34.64	$42	$0	$220	$0	$0	$262
	GEN	U.C. per Ea				0	0	0	250000	0	250000
Freight Elevator			1.00	0		$0	$0	$0	$250,000	$0	$250,000

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.1 SPECIALTIES - GFF										
GEN	U.C. per Ea		400	CN-SKWK	13808	0	750000	0	0	763808
Auto Retrieval System With Three Fork Lifts		1.00	400	$34.52	$13,808	$0	$750,000	$0	$0	$763,808
Subtotal					$73,318	$0	$1,351,905	$340,000	$0	$1,765,223
Sales Tax					$0	$0	$67,595	$0	$0	$67,595
INEEL ORG Labor/Subcontractor Overheads					$21,284	$0	$412,081	$98,702	$0	$532,067
Subtotal Estimate										$2,364,886
Escalation					$24,275	$0	$469,984	$112,571	$0	$606,830
Contingency					$36,852	$0	$713,485	$170,895	$0	$921,232
---Total 9110.1 SPECIALTIES - GFF			2,323		$155,730	$0	$3,015,050	$722,168	$0	$3,892,947
--- 9110.2 SPECIALTIES - TFD FACILITY										
GEN	U.C. per Ea		120	CN-IRON	4819.2	0	75000	0	0	79819.2
20 Ton O.H. Crane		1.00	120	$40.16	$4,819	$0	$75,000	$0	$0	$79,819
GEN	U.C. per Ea		80	CN-IRON	3212.8	0	50000	0	0	53212.8
Hot Cell O.H. Crane		1.00	80	$40.16	$3,213	$0	$50,000	$0	$0	$53,213
GEN	U.C. per Ea		100	CN-MILL	3292	0	170000	0	0	173292
Shielding Windows - 2' Thick		8.00	800	$32.92	$26,336	$0	$1,360,000	$0	$0	$1,386,336
GEN	U.C. per Ea		200	CN-MILL	6584	0	1419000	0	0	1425584
PaR Manipulators - Model 4350 - Wall Mounted		4.00	800	$32.92	$26,336	$0	$5,676,000	$0	$0	$5,702,336
GEN	U.C. per Lot				0	0	0	6000000	0	6000000
Robotic / Remote Handling Allowance		1.00	0		$0	$0	$0	$6,000,000	$0	$6,000,000
Subtotal					$60,704	$0	$7,161,000	$6,000,000	$0	$13,221,704
Sales Tax					$0	$0	$358,050	$0	$0	$358,050
INEEL ORG Labor/Subcontractor Overheads					$17,622	$0	$2,182,780	$1,741,800	$0	$3,942,203
Subtotal Estimate										$17,521,957
Escalation					$20,099	$0	$2,489,490	$1,986,546	$0	$4,496,134
Contingency					$30,512	$0	$3,779,309	$3,015,787	$0	$6,825,608
---Total 9110.2 SPECIALTIES - TFD FACILITY			1,800		$128,937	$0	$15,970,629	$12,744,133	$0	$28,843,699
--- 9110.3 SPECIALTIES - BOILER HOUSE										
GEN	U.C. per Ea		100	CN-IRON	4016	0	40000	0	0	44016
10 Ton O.H. Crane		1.00	100	$40.16	$4,016	$0	$40,000	$0	$0	$44,016

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.3 SPECIALTIES - BOILER HOUSE										
Subtotal					$4,016	$0	$40,000	$0	$0	$44,016
Sales Tax					$0	$0	$2,000	$0	$0	$2,000
INEEL ORG Labor/Subcontractor Overheads					$1,166	$0	$12,193	$0	$0	$13,358
Subtotal Estimate										$59,374
Escalation					$1,330	$0	$13,906	$0	$0	$15,235
Contingency					$2,019	$0	$21,111	$0	$0	$23,129
---Total 9110.3 SPECIALTIES - BOILER HOUSE			**100**		**$8,530**	**$0**	**$89,209**	**$0**	**$0**	**$97,739**
--- 9110.4 SPECIALTIES - STORAGE FACILITY										
	GEN	U.C. per EA	50	CN-IRON	2008	0	23100	0	0	25108
VAULT TUBE ASSEMBLIES		1,584.00	79,200	$40.16	$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Subtotal					$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Sales Tax					$0	$0	$1,829,520	$0	$0	$1,829,520
INEEL ORG Labor/Subcontractor Overheads					$923,349	$0	$11,153,303	$0	$0	$12,076,652
Subtotal Estimate										$53,677,244
Escalation					$1,053,092	$0	$12,720,489	$0	$0	$13,773,581
Contingency					$1,598,705	$0	$19,311,051	$0	$0	$20,909,756
---Total 9110.4 SPECIALTIES - STORAGE FACILITY			**79,200**		**$6,755,818**	**$0**	**$81,604,762**	**$0**	**$0**	**$88,360,580**
--- 9111.1.1 EQUIPMENT - GFF										
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	7500	0	0	7875.8
Filter Feed Pump - P-201-2a & 2b (Skid Mounted)		2.00	20	$37.58	$752	$0	$15,000	$0	$0	$15,752
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	500	5500	0	0	6225.48
SBW Slurry XFR Pump - P-201-6a, b - 30 hp		2.00	12	$37.58	$451	$1,000	$11,000	$0	$0	$12,451
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	15000	0	0	15300.64
SBW Day Tank - T-201-2a, b - 1179 Gal. - SST		2.00	16	$37.58	$601	$0	$30,000	$0	$0	$30,601
	PIPE	U.C. per Ea	40	CN-PIPE	1503.2	0	100000	0	0	101503.2
Cross Flow Filter - CF-201-1, 2 (36"x60"x65")		2.00	80	$37.58	$3,006	$0	$200,000	$0	$0	$203,006
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	1200	0	0	1275.16
Extraction Feed Pump - P-201-5 - .375 hp		1.00	2	$37.58	$75	$0	$1,200	$0	$0	$1,275
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	500	0	0	575.16
Solvent Feed Pump - P-202-5 - .25 hp		1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	8500	0	0	8725.48
UNEX Solvent Tank - T-202-5 - 500 Gal. - SST		1.00	6	$37.58	$225	$0	$8,500	$0	$0	$8,725
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Extraction Contactor - CON-202-1-14 (3'x13'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.1 EQUIPMENT - GFF											
	PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Scrubbing Contactor - SB-202-1-2 (3'x2'x5')			1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Stripping Contactor - SP-202-1-8 (3'x7'x5')			1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	31000	0	0	31950.96
SBW Feed Tank - T-201-1 - 4718 Gal. SST			1.00	12	$37.58	$451	$500	$31,000	$0	$0	$31,951
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	21000	0	0	21875.8
Extraction Feed Tank - T-201-5a, b, c - 2359 Gal. SST			3.00	30	$37.58	$1,127	$1,500	$63,000	$0	$0	$65,627
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	250	18600	0	0	19150.64
UNEX Raffinate Tank - T-202-6a, b - 1761 Gal. SST			2.00	16	$37.58	$601	$500	$37,200	$0	$0	$38,301
	PIPE	U.C. per Ea		6	CN-PIPE	225.48	250	14900	0	0	15375.48
UNEX Strip Effluent Tank - T-202-14 - 1124 Gal. SST			1.00	6	$37.58	$225	$250	$14,900	$0	$0	$15,375
	PIPE	U.C. per Ea		16	CN-PIPE	601.28	0	4500	0	0	5101.28
SBW XFR Pump - P201-1 - 30 hp			1.00	16	$37.58	$601	$0	$4,500	$0	$0	$5,101
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Raffinate XFR Pump - P-202-6a - .25 hp			1.00	3	$37.58	$113	$0	$600	$0	$0	$713
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	2800	0	0	2950.32
Raffinate Off Spec. XFR Pump - P-202-6b - 2 hp			1.00	4	$37.58	$150	$0	$2,800	$0	$0	$2,950
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Strip Effluent XFR Pump - P-202-14 - .25 hp			1.00	3	$37.58	$113	$0	$600	$0	$0	$713
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
HF Pump - P-201-4 - .125 hp			1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Dicarbolide Feed Pump - P-202-1 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
PEG Feed Pump - P-202-2 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
CMPO Feed Pump - P-202-3 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
FS-13 Feed Pump - P-202-4 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Acid Feed Pump - P-202-7 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Aluminum Nitrate Feed Pump - P-202-8 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.1.1 EQUIPMENT - GFF										
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Makeup XFR Pump - P-202-9 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Solution Feed Pump - P-202-10 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Makeup XFR Pump - P-202-12 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Solution Feed Pump - P-202-13 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		16	CN-PIPE	601.28	500	20500	0	0	21601.28
HF Storage Tank - T-201-3 - 4000 Gal. - C-276		1.00	16	$37.58	$601	$500	$20,500	$0	$0	$21,601
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	4000	0	0	4112.74
HF Makeup Tank - T-201-4 - 237 Gal. - C-276		1.00	3	$37.58	$113	$0	$4,000	$0	$0	$4,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Dicarbolide Feed Tank - T-202-1 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
PEG 400 Feed Tank - T-202-2 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Ph2Bu2CMPO Feed Tank - T-202-3a, b - 55 Gal. SST		2.00	6	$37.58	$225	$0	$4,000	$0	$0	$4,225
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
FS-13 Tank - T-202-4 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Recycle Acid Tank - T-202-7 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Aluminum Nitrate Tank - T-202-8 -55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	11900	0	0	12775.8
UNEX Scrub Makeup Tank - T-202-9 - 807 Gal. SST		1.00	10	$37.58	$376	$500	$11,900	$0	$0	$12,776
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	12500	0	0	13375.8
UNEX Scrub Solution Tank - T-202-10 - 888 Gal. SST		1.00	10	$37.58	$376	$500	$12,500	$0	$0	$13,376
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
DPTA Storage Tank - T-202-11 - 55 Gal. SST (UNEX Only)		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	15000	0	0	15950.96
UNEX Strip Makeup Tank - T-202-12 - 1132 Gal. SST		1.00	12	$37.58	$451	$500	$15,000	$0	$0	$15,951

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.1 EQUIPMENT - GFF											
	PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	16000	0	0	16950.96
UNEX Strip Solution Feed Tank - T-202-13 - 1245 Gal. SST			1.00	12	$37.58	$451	$500	$16,000	$0	$0	$16,951
Subtotal						$15,145	$9,250	$1,424,500	$0	$0	$1,448,895
Sales Tax						$0	$0	$71,225	$0	$0	$71,225
INEEL ORG Labor/Subcontractor Overheads						$7,285	$4,450	$719,504	$0	$0	$731,238
Subtotal Estimate											$2,251,358
Escalation						$5,756	$3,515	$568,428	$0	$0	$577,698
Contingency						$15,220	$9,296	$1,503,174	$0	$0	$1,527,691
---Total 9111.1.1 EQUIPMENT - GFF				403		$43,406	$26,511	$4,286,831	$0	$0	$4,356,747
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)			1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp			1.00	2	$37.58	$75	$0	$800	$0	$0	$875
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp			1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp			3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
	PIPE	U.C. per Ea		24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST			1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST			1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST			1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST			3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602
B-105	PIPE	U.C. per EA		80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF			1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF		1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3700	0	0	3812.74
CaOH Day Storage Tank - T-205-6b - 46 CF (UNEX Only)		1.00	3	$37.58	$113	$0	$3,700	$0	$0	$3,813
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF		1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')		1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea	40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")		1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503
	PIPE	U.C. per Ea	60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")		1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255
B-104	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3		1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr		4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3		1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA	80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3		2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER		2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN		2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3		3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN		3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627
M-101A,B&C	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3		3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764
B-106A	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3		1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK		2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
P-106	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
P-115	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA		50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3			1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY			1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR		2.00	80	$37 58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH		1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516

Project Name:

CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT			3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA			14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION			1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per LOT		500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE			1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE			1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE			1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR			1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT			2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS			9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,113	$10,750	$3,267,200	$0	$0	$3,560,063
Sales Tax						$0	$0	$163,360	$0	$0	$163,360
INEEL ORG Labor/Subcontractor Overheads						$135,708	$5,171	$1,650,237	$0	$0	$1,791,115
Subtotal Estimate											$5,514,538
Escalation						$107,213	$4,085	$1,303,732	$0	$0	$1,415,031
Contingency						$283,518	$10,804	$3,447,646	$0	$0	$3,741,967
---Total 9111.1.2 EQUIPMENT - GROUT FACILITY				7,507		$808,552	$30,810	$9,832,175	$0	$0	$10,671,536
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY											
	PIPE	U.C. per Ea		100	CN-PIPE	3758	3000	1000000	0	0	1006758
Thin Film Dryer -TFD203-1 (12'x12'x25')			1.00	100	$37.58	$3,758	$3,000	$1,000,000	$0	$0	$1,006,758
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	500	0	0	575 16
TFD Feed Pump - P-203-2 - .25 hp			1.00	2	$37.58	$75	$0	$500	$0	$0	$575

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY										
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Strip Cystallizer Condensate Pump - P-203-1 - Skid Mounted		1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	10000	0	0	10225.48
TFD Vacuum Pump - VP-203-1		1.00	6	$37.58	$225	$0	$10,000	$0	$0	$10,225
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	1500	0	0	1575.16
Chrystallizer Condensate Tank - T-203-1 - 10 Gal - SST		1.00	2	$37.58	$75	$0	$1,500	$0	$0	$1,575
PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15000	0	0	15800.64
Strip Feed Tank - T-203-2 - 1124 Gal. - SST (NWCF Only)		1.00	8	$37.58	$301	$500	$15,000	$0	$0	$15,801
Subtotal					$4,810	$3,500	$1,034,500	$0	$0	$1,042,810
Sales Tax					$0	$0	$51,725	$0	$0	$51,725
INEEL ORG Labor/Subcontractor Overheads					$2,314	$1,684	$522,518	$0	$0	$526,515
Subtotal Estimate										$1,621,050
Escalation					$1,828	$1,330	$412,803	$0	$0	$415,962
Contingency					$4,834	$3,517	$1,091,635	$0	$0	$1,099,986
---Total 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY			128		$13,786	$10,031	$3,113,181	$0	$0	$3,136,999
--- 9111.3 EQUIPMENT - BOILER HOUSE										
GEN	U.C. per EA		60	CN-BOILMK	1384.8	0	200000	0	0	201384.8
BOILERS		2.00	120	$23.08	$2,770	$0	$400,000	$0	$0	$402,770
GEN	U.C. per EA		40	CN-BOILMK	923.2	0	20000	0	0	20923.2
FEED WATER HEATER		2.00	80	$23.08	$1,846	$0	$40,000	$0	$0	$41,846
PIPE	U.C. per LOT		500	CN-PIPE	18790	0	100000	0	0	118790
CHEMICAL FEED SYSTEM		1.00	500	$37.58	$18,790	$0	$100,000	$0	$0	$118,790
PIPE	U.C. per LOT		1800	CN-PIPE	67644	0	250000	0	0	317644
WATER TREATMENT SYSTEM		1.00	1,800	$37.58	$67,644	$0	$250,000	$0	$0	$317,644
TANK	U.C. per BBL				0	0	0	65	0	65
OIL STORAGE TANK, ~750 BBL		750.00	0		$0	$0	$0	$48,750	$0	$48,750
Subtotal					$91,050	$0	$790,000	$48,750	$0	$929,800
Sales Tax					$0	$0	$39,500	$0	$0	$39,500
INEEL ORG Labor/Subcontractor Overheads					$42,918	$0	$310,901	$20,442	$0	$374,261
Subtotal Estimate										$1,343,561
Escalation					$34,376	$0	$292,627	$17,755	$0	$344,758
Contingency					$90,906	$0	$773,835	$46,951	$0	$911,692
---Total 9111.3 EQUIPMENT - BOILER HOUSE			2,500		$259,251	$0	$2,206,863	$133,899	$0	$2,600,012

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)		1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp		1.00	2	$37.58	$75	$0	$800	$0	$0	$875
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp		3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
	PIPE	U.C. per Ea	24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST		1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST		1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST		1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST		3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602
B-105	PIPE	U.C. per EA	80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF		1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA	60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF		1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA	60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF		1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF		1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3700	0	0	3812.74
CaOH Day Storage Tank - T-205-6b - 46 CF (UNEX Only)		1.00	3	$37.58	$113	$0	$3,700	$0	$0	$3,813
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF		1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')		1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea	40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")		1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option A***

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per Ea	60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")		1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255
B-104	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3		1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr		4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3		1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA	80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3		2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER		2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN		2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3		3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN		3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627
M-101A,B&C	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3		3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764
B-106A	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3		1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK		2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127
P-106	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
P-115	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA	50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3		1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376

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CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK		1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR		1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT		2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY		1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH		1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR		1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK		1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY										
PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA		14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
PIPE	U.C. per LOT		500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE		1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT		2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
PIPE	U.C. per EA		400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE		1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE		1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127
PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR		1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT		2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY											
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS			9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,113	$10,750	$3,267,200	$0	$0	$3,560,063
Sales Tax						$0	$0	$163,360	$0	$0	$163,360
INEEL ORG Labor/Subcontractor Overheads						$135,708	$5,171	$1,650,237	$0	$0	$1,791,115
Subtotal Estimate											$5,514,538
Escalation						$107,213	$4,085	$1,303,732	$0	$0	$1,415,031
Contingency						$283,518	$10,804	$3,447,646	$0	$0	$3,741,967
---Total 9111.4 EQUIPMENT - GROUTING FACILITY				7,507		$808,552	$30,810	$9,832,175	$0	$0	$10,671,536
--- 9111.5 EQUIPMENT - STORAGE FACILITY											
	GEN	U.C. per Lot		750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment			1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
	GEN	U.C. per Ea		400	CN-SKWK	13808	0	2500000	0	0	2513808
Smeared Canister Loadout Crane			1.00	400	$34.52	$13,808	$0	$2,500,000	$0	$0	$2,513,808
	GEN	U.C. per Ea		400	CN-SKWK	13808	0	250000	0	0	263808
Canister Storage Crane - Clean Environment			1.00	400	$34.52	$13,808	$0	$250,000	$0	$0	$263,808
	GEN	U.C. per Ea		200	CN-SKWK	6904	0	103000	0	0	109904
Canister Heater			2.00	400	$34.52	$13,808	$0	$206,000	$0	$0	$219,808
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	175000	0	0	178452
CO2 System			1.00	100	$34.52	$3,452	$0	$175,000	$0	$0	$178,452
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	25000	0	0	28452
Canister Transportation Cart			1.00	100	$34.52	$3,452	$0	$25,000	$0	$0	$28,452
	GEN	U.C. per Ea		120	CN-SKWK	4142.4	0	257500	0	0	261642.4
Canister Lifting Mechanism			2.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.5 EQUIPMENT - STORAGE FACILITY										
	GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	120000	0	0	122761.6
Canister Sealing Manipulator		1.00	80	$34.52	$2,762	$0	$120,000	$0	$0	$122,762
	GEN	U.C. per Ea	120	CN-SKWK	4142.4	0	50000	0	0	54142.4
Decon Solution Pumping Station		1.00	120	$34.52	$4,142	$0	$50,000	$0	$0	$54,142
	GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	515000	0	0	523284.8
Decon Cell Equipment		1.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
	GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	500000	0	0	508284.8
Decon / Disassembly Equipment - Turntable, Manipulator Tools, W/ Rack & Etc.		1.00	240	$34.52	$8,285	$0	$500,000	$0	$0	$508,285
	GEN	U.C. per Ea	100	CN-SKWK	3452	0	515000	0	0	518452
Smear Monitor		1.00	100	$34.52	$3,452	$0	$515,000	$0	$0	$518,452
	GEN	U.C. per Ea		CN-SKWK	0	0	0	42000	0	42000
Smear Station Module		1.00	0		$0	$0	$0	$42,000	$0	$42,000
	GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	150000	0	0	152761.6
Shuttle Cart		1.00	80	$34.52	$2,762	$0	$150,000	$0	$0	$152,762
	GEN	U.C. per Ea	40	CN-SKWK	1380.8	0	41200	0	0	42580.8
Glove Box		1.00	40	$34.52	$1,381	$0	$41,200	$0	$0	$42,581
	GEN	U.C. per Ea	24	CN-SKWK	828.48	0	3000	0	0	3828.48
Cameras		30.00	720	$34.52	$24,854	$0	$90,000	$0	$0	$114,854
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	103000	0	0	109904
Weld Station Module		1.00	200	$34.52	$6,904	$0	$103,000	$0	$0	$109,904
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	2575000	0	0	2588808
HLW Canister Transfer Cart		1.00	400	$34.52	$13,808	$0	$2,575,000	$0	$0	$2,588,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	7000	0	0	13904
Empty Canister Receiving Crane		2.00	400	$34.52	$13,808	$0	$14,000	$0	$0	$27,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	250000	0	0	256904
PaR Manipulator		1.00	200	$34.52	$6,904	$0	$250,000	$0	$0	$256,904
	GEN	U.C. per Ea		CN-SKWK	0	0	0	2060000	0	2060000
Canister Fill Monitoring Instruments		2.00	0		$0	$0	$0	$4,120,000	$0	$4,120,000
	GEN	U.C. per Ea	100	CN-SKWK	3452	0	1030000	0	0	1033452
Canister Welder Leak Check Module		1.00	100	$34.52	$3,452	$0	$1,030,000	$0	$0	$1,033,452

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.5 EQUIPMENT - STORAGE FACILITY											
	GEN	U.C. per Lot		300	CN-SKWK	10356	0	1000000	0	0	1010356
Misc. Equipment			1.00	300	$34.52	$10,356	$0	$1,000,000	$0	$0	$1,010,356
Subtotal						$193,657	$0	$11,374,200	$4,162,000	$0	$15,729,857
Sales Tax						$0	$0	$568,710	$0	$0	$568,710
INEEL ORG Labor/Subcontractor Overheads						$56,219	$0	$3,467,027	$1,208,229	$0	$4,731,474
Subtotal Estimate											$21,030,041
Escalation						$64,118	$0	$3,954,190	$1,378,001	$0	$5,396,309
Contingency						$169,557	$0	$10,456,628	$3,644,044	$0	$14,270,229
---Total 9111.5 EQUIPMENT - STORAGE FACILITY				5,610		$483,551	$0	$29,820,755	$10,392,273	$0	$40,696,579
--- 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY											
	GEN	U.C. per EA		1000	CN-SKWK	34520	0	2500000	0	0	2534520
GANTRY CRANE			2.00	2,000	$34.52	$69,040	$0	$5,000,000	$0	$0	$5,069,040
	GEN	U.C. per EA		500	CN-SKWK	17260	0	300000	0	0	317260
TRANSFER CART IN TUNNEL			1.00	500	$34.52	$17,260	$0	$300,000	$0	$0	$317,260
	GEN	U.C. per EA		300	CN-SKWK	10356	0	250000	0	0	260356
5 TON DECONTAMINATABLE BRIDGE CRANE			2.00	600	$34.52	$20,712	$0	$500,000	$0	$0	$520,712
	GEN	U.C. per EA		1000	CN-SKWK	34520	0	1000000	0	0	1034520
CASK MANUVERING HYDRAULIC PLATFORM			1.00	1,000	$34.52	$34,520	$0	$1,000,000	$0	$0	$1,034,520
Subtotal						$141,532	$0	$6,800,000	$0	$0	$6,941,532
Sales Tax						$0	$0	$340,000	$0	$0	$340,000
INEEL ORG Labor/Subcontractor Overheads						$41,087	$0	$2,072,742	$0	$0	$2,113,829
Subtotal Estimate											$9,395,361
Escalation						$46,860	$0	$2,363,990	$0	$0	$2,410,850
Contingency						$20,653	$0	$1,041,906	$0	$0	$1,062,559
---Total 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY				4,100		$250,132	$0	$12,618,637	$0	$0	$12,868,769
--- 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX											
	HVAC	U.C. per Ea		10	CN-SHEE	354.8	500	5700	0	0	6554.8
Vent. Centrifugal Fans - 20 hp			5.00	50	$35.48	$1,774	$2,500	$28,500	$0	$0	$32,774
	HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 25 hp			7.00	84	$35.48	$2,980	$3,500	$63,000	$0	$0	$69,480
	HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 30 hp			5.00	60	$35.48	$2,129	$2,500	$45,000	$0	$0	$49,629
	HVAC	U.C. per Ea		18	CN-SHEE	638.64	500	13000	0	0	14138.64
Vent. Centrifugal Fans - 40 hp			5.00	90	$35.48	$3,193	$2,500	$65,000	$0	$0	$70,693

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX										
	HVAC	U.C. per Ea	14	CN-SHEE	496.72	500	15000	0	0	15996.72
Vent. Centrifugal Fans - 50 hp		14.00	196	$35.48	$6,954	$7,000	$210,000	$0	$0	$223,954
	HVAC	U.C. per Ea	40	CN-SHEE	1419.2	500	27000	0	0	28919.2
Vent. Centrifugal Fans - 60 hp		3.00	120	$35.48	$4,258	$1,500	$81,000	$0	$0	$86,758
	HVAC	U.C. per Ea	30	CN-SHEE	1064.4	500	72000	0	0	73564.4
*HEPA Filter Bank - Single Stage - 4X4 - 12 Filters Per Bank Memo: Each Filter is 24" x 24".		2.00	60	$35.48	$2,129	$1,000	$144,000	$0	$0	$147,129
	HVAC	U.C. per Ea	40	CN-SHEE	1419.2	500	96000	0	0	97919.2
*HEPA Filter Bank - Single Stage - 4X4 - 16 Filters Per Bank Memo: Each Filter is 24" x 24".		23.00	920	$35.48	$32,642	$11,500	$2,208,000	$0	$0	$2,252,142
	HVAC	U.C. per Ea	40	CN-SHEE	1419.2	500	144000	0	0	145919.2
*HEPA Filter Bank - Dual Stage - 4X4 - 12 Filters Per Bank Memo: Each Filter is 24" x 24".		2.00	80	$35.48	$2,838	$1,000	$288,000	$0	$0	$291,838
	HVAC	U.C. per Ea	50	CN-SHEE	1774	500	192000	0	0	194274
*HEPA Filter Bank - Dual Stage - 4X4 - 16 Filters Per Bank Memo: Each Filter is 24" x 24".		4.00	200	$35.48	$7,096	$2,000	$768,000	$0	$0	$777,096
	HVAC	U.C. per Ea	60	CN-SHEE	2128.8	0	35000	0	0	37128.8
Chiller (Complete With Compressor & Fans) - 80 Ton		1.00	60	$35.48	$2,129	$0	$35,000	$0	$0	$37,129
	HVAC	U.C. per Ea	48	CN-SHEE	1703.04	0	21000	0	0	22703.04
Chiller (Complete With Compressor & Fans) - 40 Ton		1.00	48	$35.48	$1,703	$0	$21,000	$0	$0	$22,703
	HVAC	U.C. per Ea	0.9	CN-SHEE	31.932	0	150	0	0	181.932
Actuated Air Dampers		100.00	90	$35.48	$3,193	$0	$15,000	$0	$0	$18,193
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	2500	0	0	6048
Pre-Filters		1.00	100	$35.48	$3,548	$0	$2,500	$0	$0	$6,048
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	5000	0	0	8548
Heating Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	5000	0	0	8548
Cooling Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX											
	HVAC	U.C. per Lot		40	CN-SHEE	1419.2	0	2000	0	0	3419.2
Heat Recovery Coil			1.00	40	$35.48	$1,419	$0	$2,000	$0	$0	$3,419
Subtotal						$85,081	$35,000	$3,986,000	$0	$0	$4,106,081
Sales Tax						$0	$0	$199,300	$0	$0	$199,300
INEEL ORG Labor/Subcontractor Overheads						$38,827	$15,972	$1,909,987	$0	$0	$1,964,786
Subtotal Estimate											$6,270,168
Escalation						$31,795	$13,080	$1,564,051	$0	$0	$1,608,925
Contingency						$38,926	$16,013	$1,914,834	$0	$0	$1,969,773
---Total 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX				2,398		$194,629	$80,065	$9,574,172	$0	$0	$9,848,866
— 9115.2.1 HVAC - TFD FACILITY - HOT CELL											
	HVAC	U.C. per Lot		1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork			1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The hot cell is approximately 77' x 51' x 77' high.											
	HVAC	U.C. per Lot		700	CN-SHEE	24836	3000	125000	0	0	152836
HVAC Equipment			1.00	700	$35.48	$24,836	$3,000	$125,000	$0	$0	$152,836
	HVAC	U.C. per Lot		300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters			1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers			1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal			1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance			1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal						$92,248	$3,000	$306,500	$0	$0	$401,748
Sales Tax						$0	$0	$15,325	$0	$0	$15,325
INEEL ORG Labor/Subcontractor Overheads						$42,098	$1,369	$146,867	$0	$0	$190,334
Subtotal Estimate											$607,407
Escalation						$34,473	$1,121	$120,266	$0	$0	$155,861
Contingency						$42,205	$1,373	$147,240	$0	$0	$190,817
---Total 9115.2.1 HVAC - TFD FACILITY - HOT CELL				2,600		$211,024	$6,863	$736,198	$0	$0	$954,084
— 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS											
Memo: The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.											
	HVAC	U.C. per Lot		4000	CN-SHEE	141920	0	140000	0	0	281920
(*)Sheet Metal Ductwork			1.00	4,000	$35.48	$141,920	$0	$140,000	$0	$0	$281,920
Memo: Includes all corridors and equipment areas - approximately 72,500 square feet of floor space.											

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS											
Memo:	*The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.*										
	HVAC	U.C. per Lot		4000	CN-SHEE	141920	15000	525000	0	0	681920
HVAC Equipment			1.00	4,000	$35.48	$141,920	$15,000	$525,000	$0	$0	$681,920
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	13000	0	0	20096
Diffusers, Grilles, Dampers, Registers			1.00	200	$35.48	$7,096	$0	$13,000	$0	$0	$20,096
	HVAC	U.C. per Lot		350	CN-SHEE	12418	0	5000	0	0	17418
Misc. Sheet Metal			1.00	350	$35.48	$12,418	$0	$5,000	$0	$0	$17,418
	HVAC	U.C. per Lot		300	CN-SHEE	10644	0	0	0	0	10644
Test & Balance			1.00	300	$35.48	$10,644	$0	$0	$0	$0	$10,644
Subtotal						$313,998	$15,000	$683,000	$0	$0	$1,011,998
Sales Tax						$0	$0	$34,150	$0	$0	$34,150
INEEL ORG Labor/Subcontractor Overheads						$143,295	$6,845	$327,276	$0	$0	$477,416
Subtotal Estimate											**$1,523,564**
Escalation						$117,341	$5,606	$268,000	$0	$0	$390,947
Contingency						$143,659	$6,863	$328,106	$0	$0	$478,628
---Total 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS				**8,850**		**$718,293**	**$34,314**	**$1,640,532**	**$0**	**$0**	**$2,393,138**
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY											
	PIPE	U.C. per Sf		0.1	CN-PIPE	3.758	0	5	0	0	8.758
Process Piping			13,700.00	1,370	$37.58	$51,485	$0	$68,500	$0	$0	$119,985
	PIPE	U.C. per Sf		0.05	CN-PIPE	1.879	0	3	0	0	4.879
Building Plumbing			13,700.00	685	$37.58	$25,742	$0	$41,100	$0	$0	$66,842
Subtotal						$77,227	$0	$109,600	$0	$0	$186,827
Sales Tax						$0	$0	$5,480	$0	$0	$5,480
INEEL ORG Labor/Subcontractor Overheads						$37,149	$0	$55,358	$0	$0	$92,507
Subtotal Estimate											**$284,814**
Escalation						$29,349	$0	$43,734	$0	$0	$73,083
Contingency						$35,931	$0	$53,543	$0	$0	$89,474
---Total 9115.2.3 PLUMBING / PIPING - TFD FACILITY				**2,055**		**$179,656**	**$0**	**$267,716**	**$0**	**$0**	**$447,372**
--- 9115.4.2 HVAC - NEW - BOILER HOUSE											
	HVAC	U.C. per LOT		200	CN-SHEE	7096	240	36700	1000	0	45036
HVAC			1.00	200	$35.48	$7,096	$240	$36,700	$1,000	$0	$45,036

Memo: Based on AFC estimate #2547-A. This will be a two boiler system vs. a four in estimate 2547-A; all quantities are halved.

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.2 HVAC - NEW - BOILER HOUSE										
Subtotal					$7,096	$240	$36,700	$1,000	$0	$45,036
Sales Tax					$0	$0	$1,835	$0	$0	$1,835
INEEL ORG Labor/Subcontractor Overheads					$3,238	$110	$17,586	$456	$0	$21,390
Subtotal Estimate										$68,261
Escalation					$2,652	$90	$14,401	$374	$0	$17,516
Contingency					$3,247	$110	$17,630	$458	$0	$21,444
---Total 9115.4.2 HVAC - NEW - BOILER HOUSE			200		$16,233	$549	$88,152	$2,288	$0	$107,221
--- 9115.4.3 PLUMBING - BOILER HOUSE										
	PIPE	U.C. per Lot	40	CN-PIPE	1503.2	0	600	0	0	2103.2
Building Drain		1.00	40	$37.58	$1,503	$0	$600	$0	$0	$2,103
	PIPE	U.C. per Lot	20	CN-PIPE	751.6	0	300	0	0	1051.6
Building Water		1.00	20	$37.58	$752	$0	$300	$0	$0	$1,052
Subtotal					$2,255	$0	$900	$0	$0	$3,155
Sales Tax					$0	$0	$45	$0	$0	$45
INEEL ORG Labor/Subcontractor Overheads					$1,085	$0	$455	$0	$0	$1,539
Subtotal Estimate										$4,739
Escalation					$857	$0	$359	$0	$0	$1,216
Contingency					$1,049	$0	$440	$0	$0	$1,489
---Total 9115.4.3 PLUMBING - BOILER HOUSE			60		$5,245	$0	$2,198	$0	$0	$7,444
--- 9115.4.4 PIPING - NEW - BOILER HOUSE										
	PIPE	U.C. per LOT	2325	CN-PIPE	87373.5	1820	89150	0	0	178343.5
STEAM & SUPPORT PIPING		1.00	2,325	$37.58	$87,374	$1,820	$89,150	$0	$0	$178,344
	INSUL	U.C. per LOT	175	CN-ASBE	6461	0	8920	0	0	15381
PIPE INSULATION		1.00	175	$36.92	$6,461	$0	$8,920	$0	$0	$15,381
Subtotal					$93,835	$1,820	$98,070	$0	$0	$193,725
Sales Tax					$0	$0	$4,904	$0	$0	$4,904
INEEL ORG Labor/Subcontractor Overheads					$44,739	$875	$48,956	$0	$0	$94,571
Subtotal Estimate										$293,199
Escalation					$35,558	$692	$38,985	$0	$0	$75,235
Contingency					$43,533	$847	$47,729	$0	$0	$92,109
---Total 9115.4.4 PIPING - NEW - BOILER HOUSE			2,500		$217,665	$4,234	$238,644	$0	$0	$460,543
--- 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE										
	FP	U.C. per SF			0	0	0	3.5	0	3.5
FIRE SPRINKLER SYSTEM - BOILER BUILDING		3,120.00	0		$0	$0	$0	$10,920	$0	$10,920

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE										
Subtotal					$0	$0	$0	$10,920	$0	$10,920
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$4,579	$0	$4,579
Subtotal Estimate										$15,499
Escalation					$0	$0	$0	$3,977	$0	$3,977
Contingency					$0	$0	$0	$4,869	$0	$4,869
---Total 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE			0		$0	$0	$0	$24,345	$0	$24,345
--- 9115.4 MECHANICAL - NEW - STORAGE FACILITY										
	PIPE	U.C. per LOT			0	0	0	40000	0	40000
MISC. PIPING - ALLOW		1.00	0		$0	$0	$0	$40,000	$0	$40,000
	FP	U.C. per SF			0	0	0	3.5	0	3.5
FIRE PROTECTION		20,440.00	0		$0	$0	$0	$71,540	$0	$71,540
	HVAC	U.C. per SF	0.18	CN-SHEE	6.386	0	11.2	0	0	17.586
HVAC		20,440.00	3,679	$35.48	$130,538	$0	$228,928	$0	$0	$359,466
Subtotal					$130,538	$0	$228,928	$111,540	$0	$471,006
Sales Tax					$0	$0	$11,446	$0	$0	$11,446
INEEL ORG Labor/Subcontractor Overheads					$59,572	$0	$109,696	$49,240	$0	$218,509
Subtotal Estimate										$700,961
Escalation					$48,782	$0	$89,828	$41,256	$0	$179,867
Contingency					$59,723	$0	$109,975	$50,509	$0	$220,207
---Total 9115.4 MECHANICAL - NEW - STORAGE FACILITY			3,679		$298,615	$0	$549,874	$252,546	$0	$1,101,034
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF										
	ELEC	U.C. per Ea	96	CN-ELEC	3275.52	2500	200000	0	0	205775.52
4000 amp, 480/277 double ended 3R walk-in switchgear		1.00	96	$34.12	$3,276	$2,500	$200,000	$0	$0	$205,776
	ELEC	U.C. per Ea	24	CN-ELEC	818.88	2500	75000	0	0	78318.88
2500 kVA 13.8-480/277 transformers		2 00	48	$34.12	$1,638	$5,000	$150,000	$0	$0	$156,638
	ELEC	U.C. per Ls	32	CN-ELEC	1091.84	0	10000	0	0	11091.84
4000 amp armor clad busway		1.00	32	$34.12	$1,092	$0	$10,000	$0	$0	$11,092
	ELEC	U.C. per Ea	24	CN-ELEC	818.88	0	12000	0	0	12818.88
800 amp 480 volt standby power panels		1.00	24	$34.12	$819	$0	$12,000	$0	$0	$12,819
	ELEC	U.C. per Ea	16	CN-ELEC	545.92	0	10000	0	0	10545.92
1200 amp 480 volt normal power panels		2.00	32	$34.12	$1,092	$0	$20,000	$0	$0	$21,092
	ELEC	U.C. per Ls			0	0	0	0	35000	35000
Vault and equipment pads for main gear and transformers		1.00	0		$0	$0	$0	$0	$35,000	$35,000

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL / Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF										
ELEC	U.C. per Ea		12	CN-ELEC	409.44	0	5000	0	0	5409.44
480 volt power panels		6.00	72	$34.12	$2,457	$0	$30,000	$0	$0	$32,457
ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers		4.00	32	$34.12	$1,092	$0	$6,800	$0	$0	$7,892
ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads		4.00	32	$34.12	$1,092	$0	$10,000	$0	$0	$11,092
Subtotal					$12,556	$7,500	$438,800	$0	$35,000	$493,856
Sales Tax					$0	$0	$21,940	$0	$0	$21,940
INEEL ORG Labor/Subcontractor Overheads					$5,265	$3,145	$193,202	$0	$0	$201,612
Subtotal Estimate										$717,408
Escalation					$4,573	$2,732	$167,802	$0	$8,981	$184,087
Contingency					$6,942	$4,147	$254,741	$0	$13,634	$279,464
---Total 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF			**368**		**$29,337**	**$17,523**	**$1,076,484**	**$0**	**$57,615**	**$1,180,959**
--- 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - GFF										
ELEC	U.C. per Lf				0	0	0	0	125	125
15kV electrical duct bank, 2 runs of 200 lf.		400.00	0		$0	$0	$0	$0	$50,000	$50,000
ELEC	U.C. per Ls				0	0	0	0	25000	25000
600 volt feeders		1.00	0		$0	$0	$0	$0	$25,000	$25,000
ELEC	U.C. per Ls				0	0	0	0	100000	100000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$100,000	$100,000
Subtotal					$0	$0	$0	$0	$175,000	$175,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$175,000
Escalation					$0	$0	$0	$0	$44,905	$44,905
Contingency					$0	$0	$0	$0	$68,171	$68,171
---Total 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - GFF			**0**		**$0**	**$0**	**$0**	**$0**	**$288,076**	**$288,076**
--- 9116.2.3 MISC. COSTS - GFF										
ELEC	U.C. per Ls		120	CN-ELEC	4094.4	0	0	0	0	4094.4
Testing of systems and equipment		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
ELEC	U.C. per Ls		120	CN-ELEC	4094.4	0	0	0	0	4094.4
Material handling		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
ELEC	U.C. per Sf				0	0	0	2	0	2
Lightning Protection		89,100.00	0		$0	$0	$0	$178,200	$0	$178,200

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.3 MISC. COSTS - GFF										
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		89,100.00	0		$0	$0	$0	$89,100	$0	$89,100
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		89,100.00	0		$0	$0	$0	$89,100	$0	$89,100
Subtotal					$8,189	$0	$0	$356,400	$0	$364,589
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$3,434	$0	$0	$149,449	$0	$152,883
Subtotal Estimate										$517,472
Escalation					$2,982	$0	$0	$129,801	$0	$132,783
Contingency					$4,528	$0	$0	$197,052	$0	$201,579
---Total 9116.2.3 MISC. COSTS - GFF			**240**		**$19,133**	**$0**	**$0**	**$832,702**	**$0**	**$851,834**
--- 9116.2.4 LIGHTING - GFF										
	ELEC	U.C. per Sf			0	0	0	4	0	4
Lighting		89,100.00	0		$0	$0	$0	$356,400	$0	$356,400
Subtotal					$0	$0	$0	$356,400	$0	$356,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$149,449	$0	$149,449
Subtotal Estimate										$505,849
Escalation					$0	$0	$0	$129,801	$0	$129,801
Contingency					$0	$0	$0	$197,052	$0	$197,052
---Total 9116.2.4 LIGHTING - GFF			**0**		**$0**	**$0**	**$0**	**$832,702**	**$0**	**$832,702**
--- 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD										
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers		2.00	16	$34.12	$546	$0	$3,400	$0	$0	$3,946
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads		2.00	16	$34.12	$546	$0	$5,000	$0	$0	$5,546
Subtotal					$1,092	$0	$8,400	$0	$0	$9,492
Sales Tax					$0	$0	$420	$0	$0	$420
INEEL ORG Labor/Subcontractor Overheads					$458	$0	$3,698	$0	$0	$4,156
Subtotal Estimate										$14,068
Escalation					$398	$0	$3,212	$0	$0	$3,610
Contingency					$604	$0	$4,877	$0	$0	$5,480
---Total 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD			**32**		**$2,551**	**$0**	**$20,607**	**$0**	**$0**	**$23,158**

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD											
	ELEC	U.C. per Ls				0	0	0	0	35000	35000
Branch power and lighting circuits			1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal						$0	$0	$0	$0	$35,000	$35,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$35,000
Escalation						$0	$0	$0	$0	$8,981	$8,981
Contingency						$0	$0	$0	$0	$13,634	$13,634
—Total 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD				0		$0	$0	$0	$0	$57,615	$57,615
— 9116.3.3 MISC. COSTS - TFD											
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Testing of systems and equipment			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Material handling			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Sf				0	0	0	2	0	2
Lightning Protection			13,700.00	0		$0	$0	$0	$27,400	$0	$27,400
	ELEC	U.C. per Sf				0	0	0	1	0	1
Grounding Grid			13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
	ELEC	U.C. per Sf				0	0	0	1	0	1
Wiring Devices & Enclosures			13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
Subtotal						$6,142	$0	$0	$54,800	$0	$60,942
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$2,575	$0	$0	$22,979	$0	$25,555
Subtotal Estimate											$86,496
Escalation						$2,237	$0	$0	$19,958	$0	$22,195
Contingency						$3,396	$0	$0	$30,299	$0	$33,694
—Total 9116.3.3 MISC. COSTS - TFD				180		$14,349	$0	$0	$128,036	$0	$142,385
— 9116.3.4 LIGHTING - TFD											
	ELEC	U.C. per Sf				0	0	0	0	3.9	3.9
Lighting			13,700.00	0		$0	$0	$0	$0	$53,430	$53,430

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.3.4 LIGHTING - TFD										
Subtotal					$0	$0	$0	$0	$53,430	$53,430
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$53,430
Escalation					$0	$0	$0	$0	$13,710	$13,710
Contingency					$0	$0	$0	$0	$20,813	$20,813
---Total 9116.3.4 LIGHTING - TFD			0		$0	$0	$0	$0	$87,954	$87,954
--- 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
	ELEC	U.C. per Ls			0	0	0	0	12000	12000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$12,000	$12,000
Subtotal					$0	$0	$0	$0	$12,000	$12,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$12,000
Escalation					$0	$0	$0	$0	$3,079	$3,079
Contingency					$0	$0	$0	$0	$4,675	$4,675
---Total 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE			0		$0	$0	$0	$0	$19,754	$19,754
--- 9116.4.3 MISC. COSTS - BOILER HOUSE										
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Testing of systems and equipment		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Material handling		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		3,120.00	0		$0	$0	$0	$6,240	$0	$6,240
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.4.3 MISC. COSTS - BOILER HOUSE										
	ELEC	U.C. per Lot	100	CN-ELEC	3412	0	3000	0	0	6412
Boiler Controls		1.00	100	$34.12	$3,412	$0	$3,000	$0	$0	$6,412
Subtotal					$6,142	$0	$3,000	$12,480	$0	$21,622
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$2,575	$0	$1,321	$5,233	$0	$9,129
Subtotal Estimate										$30,901
Escalation					$2,237	$0	$1,147	$4,545	$0	$7,929
Contingency					$3,396	$0	$1,742	$6,900	$0	$12,037
---Total 9116.4.3 MISC. COSTS - BOILER HOUSE			180		$14,349	$0	$7,360	$29,159	$0	$50,868
— 9116.4.4 LIGHTING - BOILER HOUSE										
	ELEC	U.C. per Sf			0	0	0	3	0	3
Lighting		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360
Subtotal					$0	$0	$0	$9,360	$0	$9,360
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$3,925	$0	$3,925
Subtotal Estimate										$13,285
Escalation					$0	$0	$0	$3,409	$0	$3,409
Contingency					$0	$0	$0	$5,175	$0	$5,175
---Total 9116.4.4 LIGHTING - BOILER HOUSE			0		$0	$0	$0	$21,869	$0	$21,869
— 9116.5.1 SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE										
	ELEC	U.C. per LOT	480	CN-ELEC	16377.6	0	100000	0	0	116377.6
SWITCHGEAR AND TRANSFORMERS		1.00	480	$34.12	$16,378	$0	$100,000	$0	$0	$116,378
Subtotal					$16,378	$0	$100,000	$0	$0	$116,378
Sales Tax					$0	$0	$5,000	$0	$0	$5,000
INEEL ORG Labor/Subcontractor Overheads					$6,868	$0	$44,030	$0	$0	$50,897
Subtotal Estimate										$172,275
Escalation					$5,965	$0	$38,241	$0	$0	$44,206
Contingency					$9,055	$0	$58,054	$0	$0	$67,109
---Total 9116.5.1 SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE			480		$38,265	$0	$245,325	$0	$0	$283,590
— 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE										
	ELEC	U.C. per Ls			0	0	0	0	21000	21000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$21,000	$21,000

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE											
Subtotal						$0	$0	$0	$0	$21,000	$21,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$21,000
Escalation						$0	$0	$0	$0	$5,389	$5,389
Contingency						$0	$0	$0	$0	$8,180	$8,180
---Total 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE				0		$0	$0	$0	$0	$34,569	$34,569
--- 9116.5.3 MISC. COSTS - INTERIM STORAGE											
	ELEC	U.C. per Ls		100	CN-ELEC	3412	0	0	0	0	3412
Testing of systems and equipment			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Ls		100	CN-ELEC	3412	0	0	0	0	3412
Material handling			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Sf				0	0	0	2	0	2
Lightning Protection			20,440.00	0		$0	$0	$0	$40,880	$0	$40,880
	ELEC	U.C. per Sf				0	0	0	1	0	1
Grounding Grid			20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per Sf				0	0	0	1	0	1
Wiring Devices & Enclosures			20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per LOT		100	CN-ELEC	3412	0	2500	4750	0	10662
INSTRUMENTATION & CONTROLS			1.00	100	$34.12	$3,412	$0	$2,500	$4,750	$0	$10,662
Subtotal						$10,236	$0	$2,500	$86,510	$0	$99,246
Sales Tax						$0	$0	$125	$0	$0	$125
INEEL ORG Labor/Subcontractor Overheads						$4,292	$0	$1,101	$36,276	$0	$41,669
Subtotal Estimate											$141,040
Escalation						$3,728	$0	$956	$31,507	$0	$36,191
Contingency						$5,659	$0	$1,451	$47,831	$0	$54,942
---Total 9116.5.3 MISC. COSTS - INTERIM STORAGE				300		$23,916	$0	$6,133	$202,124	$0	$232,173
--- 9116.5.4 LIGHTING - INTERIM STORAGE											
	ELEC	U.C. per Sf				0	0	0	3.5	0	3.5
Lighting			20,440.00	0		$0	$0	$0	$71,540	$0	$71,540

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.5.4 LIGHTING - INTERIM STORAGE										
Subtotal					$0	$0	$0	$71,540	$0	$71,540
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$29,999	$0	$29,999
Subtotal Estimate										$101,539
Escalation					$0	$0	$0	$26,055	$0	$26,055
Contingency					$0	$0	$0	$39,554	$0	$39,554
—Total 9116.5.4 LIGHTING - INTERIM STORAGE			0		$0	$0	$0	$167,148	$0	$167,148
— 9116.6 ELECTRICAL - TRANSFER TUNNEL										
	ELEC	U.C. per SF		CN-ELEC	0	0	0	2.75	0	2.75
LIGHTING		1,500.00	0		$0	$0	$0	$4,125	$0	$4,125
	ELEC	U.C. per SF	0.03	CN-ELEC	1.024	0	2	0	0	3.024
VOICE PAGING / EVAC.		1,500.00	45	$34.12	$1,535	$0	$3,000	$0	$0	$4,535
Subtotal					$1,535	$0	$3,000	$4,125	$0	$8,660
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$644	$0	$1,321	$1,730	$0	$3,694
Subtotal Estimate										$12,505
Escalation					$559	$0	$1,147	$1,502	$0	$3,209
Contingency					$849	$0	$1,742	$2,281	$0	$4,871
—Total 9116.6 ELECTRICAL - TRANSFER TUNNEL			45		$3,587	$0	$7,360	$9,638	$0	$20,585
— 9301.1 CONSTRUCTION SUPPORT										
	BWI	U.C. per Lot			170200	0	0	0	0	170200
Construction Support - .1% Of TCC		1.00	0		$170,200	$0	$0	$0	$0	$170,200
	7620	U.C. per Wk	60	U60	1479.6	0	0	0	0	1479.6
Radiological Control Technicians - 1.5 FTE		104.00	6,240	$24.66	$153,878	$0	$0	$0	$0	$153,878
	7610	U.C. per Hr	0.1	Z03	5.232	0	0	0	0	5.232
Radiation Control - Management Support - 10% OF RCT Total		6,240.00	624	$52.32	$32,648	$0	$0	$0	$0	$32,648
Subtotal					$356,726	$0	$0	$0	$0	$356,726
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$166,008	$0	$0	$0	$0	$166,008
Subtotal Estimate										$522,734
Escalation					$134,134	$0	$0	$0	$0	$134,134
Contingency					$236,472	$0	$0	$0	$0	$236,472
—Total 9301.1 CONSTRUCTION SUPPORT			6,864		$893,340	$0	$0	$0	$0	$893,340

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF

Project Location: *INTEC*

Estimate Number: *2570 - Option A*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9301.2 CONSTRUCTION QUALITY CONTROL										
	BWI	U.C. per Lot			170200	0	0	0	0	170200
Construction Quality Control - .1% Of TCC		1.00	0		$170,200	$0	$0	$0	$0	$170,200
Subtotal					$170,200	$0	$0	$0	$0	$170,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$170,200
Escalation					$43,673	$0	$0	$0	$0	$43,673
Contingency					$76,994	$0	$0	$0	$0	$76,994
---Total 9301.2 CONSTRUCTION QUALITY CONTROL			0		$290,868	$0	$0	$0	$0	$290,868
--- 9301.3 CONSTRUCTION DOCUMENTATION										
	BWI	U.C. per Lot			850900	0	0	0	0	850900
PM Construction Document Control - .5% Of TCC		1.00	0		$850,900	$0	$0	$0	$0	$850,900
Subtotal					$850,900	$0	$0	$0	$0	$850,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$850,900
Escalation					$218,341	$0	$0	$0	$0	$218,341
Contingency					$384,927	$0	$0	$0	$0	$384,927
---Total 9301.3 CONSTRUCTION DOCUMENTATION			0		$1,454,168	$0	$0	$0	$0	$1,454,168
--- OPC3100 TESTING AND TURNOVER PLANNING										
	BWI	U.C. per Lot			340400	0	0	0	0	340400
Testing & Turnover Planning - .2% Of TCC		1.00	0		$340,400	$0	$0	$0	$0	$340,400
Subtotal					$340,400	$0	$0	$0	$0	$340,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$340,400
Escalation					$125,676	$0	$0	$0	$0	$125,676
Contingency					$475,397	$0	$0	$0	$0	$475,397
---Total OPC3100 TESTING AND TURNOVER PLANNING			0		$941,473	$0	$0	$0	$0	$941,473
--- OPC3200 S. O. TESTING										
	BWI	U.C. per Lot			8508800	0	0	0	0	8508800
SO Testing - 5% Of TCC		1.00	0		$8,508,800	$0	$0	$0	$0	$8,508,800

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3200 S. O. TESTING										
Subtotal					$8,508,800	$0	$0	$0	$0	$8,508,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,508,800
Escalation					$3,141,449	$0	$0	$0	$0	$3,141,449
Contingency					$11,883,254	$0	$0	$0	$0	$11,883,254
---Total OPC3200 S. O. TESTING			0		$23,533,503	$0	$0	$0	$0	$23,533,503
--- OPC3300 ORR SUPPORT										
BWI	U.C. per Lot				374400	0	0	0	0	374400
ORR Support - .22% Of TCC		1.00	0		$374,400	$0	$0	$0	$0	$374,400
Subtotal					$374,400	$0	$0	$0	$0	$374,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$374,400
Escalation					$138,228	$0	$0	$0	$0	$138,228
Contingency					$522,881	$0	$0	$0	$0	$522,881
---Total OPC3300 ORR SUPPORT			0		$1,035,510	$0	$0	$0	$0	$1,035,510
--- OPC3400 FACILITY ACCEPTANCE REVIEW										
BWI	U.C. per Lot				255300	0	0	0	0	255300
Facility Acceptance Review - .15% Of TCC		1.00	0		$255,300	$0	$0	$0	$0	$255,300
Subtotal					$255,300	$0	$0	$0	$0	$255,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$255,300
Escalation					$94,257	$0	$0	$0	$0	$94,257
Contingency					$356,548	$0	$0	$0	$0	$356,548
---Total OPC3400 FACILITY ACCEPTANCE REVIEW			0		$706,105	$0	$0	$0	$0	$706,105
--- OPC3500 RADIOLOGICAL CONTROL SUPPORT										
BWI	U.C. per Lot				187200	0	0	0	0	187200
Radiological Control Support - .11% Of TCC		1.00	0		$187,200	$0	$0	$0	$0	$187,200

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3500 RADIOLOGICAL CONTROL SUPPORT										
Subtotal					$187,200	$0	$0	$0	$0	$187,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$187,200
Escalation					$69,114	$0	$0	$0	$0	$69,114
Contingency					$261,441	$0	$0	$0	$0	$261,441
---Total OPC3500 RADIOLOGICAL CONTROL SUPPORT			**0**		**$517,755**	**$0**	**$0**	**$0**	**$0**	**$517,755**
--- OPC3600 OPERATOR TRAINING										
	BWI	U.C. per Lot			3403500	0	0	0	0	3403500
Operator Training - 2% Of TCC		1.00	0		$3,403,500	$0	$0	$0	$0	$3,403,500
Subtotal					$3,403,500	$0	$0	$0	$0	$3,403,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,403,500
Escalation					$1,256,572	$0	$0	$0	$0	$1,256,572
Contingency					$4,753,274	$0	$0	$0	$0	$4,753,274
---Total OPC3600 OPERATOR TRAINING			**0**		**$9,413,346**	**$0**	**$0**	**$0**	**$0**	**$9,413,346**
--- OPC3700 OPERATING PROCEDURES										
	BWI	U.C. per Lot			748800	0	0	0	0	748800
Operating Procedures - .44% Of TCC		1.00	0		$748,800	$0	$0	$0	$0	$748,800
Subtotal					$748,800	$0	$0	$0	$0	$748,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$748,800
Escalation					$276,457	$0	$0	$0	$0	$276,457
Contingency					$1,045,762	$0	$0	$0	$0	$1,045,762
---Total OPC3700 OPERATING PROCEDURES			**0**		**$2,071,019**	**$0**	**$0**	**$0**	**$0**	**$2,071,019**
--- OPC3800 START-UP COORDINATION										
	BWI	U.C. per Lot			221200	0	0	0	0	221200
Startup Coordination - .13% Of TCC		1.00	0		$221,200	$0	$0	$0	$0	$221,200

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option A - UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option A*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3800 START-UP COORDINATION										
Subtotal					$221,200	$0	$0	$0	$0	$221,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$221,200
Escalation					$81,667	$0	$0	$0	$0	$81,667
Contingency					$308,924	$0	$0	$0	$0	$308,924
---Total OPC3800 START-UP COORDINATION			0		$611,791	$0	$0	$0	$0	$611,791
--- OPC3900 SPARES										
	BWI	U.C. per Lot			1000000	0	0	0	0	1000000
Spares		1.00	0		$1,000,000	$0	$0	$0	$0	$1,000,000
Subtotal					$1,000,000	$0	$0	$0	$0	$1,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,000,000
Escalation					$369,200	$0	$0	$0	$0	$369,200
Contingency					$1,396,584	$0	$0	$0	$0	$1,396,584
---Total OPC3900 SPARES			0		$2,765,784	$0	$0	$0	$0	$2,765,784
--- GAPIF Non-Org G&A and PROCUREMENT										
PF	NOGAPIF	U.C. per $			0	0	0	0	1	1
Procurement Fee %		1,355,375.00	0		$0	$0	$0	$0	$1,355,375	$1,355,375
Subtotal					$0	$0	$0	$0	$1,355,375	$1,355,375
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,355,375
Escalation					$0	$0	$0	$0	$0	$0
Contingency					$0	$0	$0	$0	$962,316	$962,316
---Total GAPIF Non-Org G&A and PROCUREMENT			0		$0	$0	$0	$0	$2,317,691	$2,317,691

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
Subtotal UNEX IN GFF - OPTION A					$**,***,***	$430,270	$94,708,882	$14,252,019	$1,686,805	$**,***,***
Sales Tax					$0	$0	$4,735,444	$0	$0	$4,735,444
INEEL ORG Labor/Subcontractor Overheads					$4,463,475	$141,596	$32,332,884	$4,306,433	$0	$41,244,388
Subtotal Estimate										$**,***,***
Escalation					$31,356,451	$146,741	$33,814,032	$4,762,099	$85,045	$70,164,368
Contingency					$82,171,715	$420,920	$57,867,366	$8,573,802	$1,091,423	$**,***,***
Total UNEX IN GFF - OPTION A			368,953		$254,796,415	$1,139,527	$223,458,609	$31,894,353	$2,863,273	$514,152,178

UNEX PROCESS IN A GREEN FIELD FACILITY

@RISK Sensitivity Report

OPTION A

Sensitivity Ranking
Step-Wise Regression

Rank	Name	Cell	Regression	Weight	Amount	Level Markup
- PROJECT DEVELOPMENT / Contingency at F3, for Simulation 1						
1	SPECIALTIES	B20	0.5956	0.1949	$29,517,049	31%
2	EQUIPMENT	B21	0.5137	0.1681	$25,457,390	54%
3	PROJECT ACCEPTANCE/CLOSEOUT	B27	0.4273	0.1398	$21,175,352	102%
4	TECHNICAL DEVELOPMENT	B4	0.2365	0.0774	$11,721,740	101%
5	PROJECT MANAGEMENT	B10	0.2178	0.0713	$10,791,143	38%
6	GENERAL CONDITIONS	B13	0.1844	0.0603	$9,136,752	41%
7	CONSTRUCTION MANAGEMENT	B6	0.1709	0.0559	$8,467,325	36%
8	TITLE II DESIGN	B8	0.1302	0.0426	$6,454,059	29%
9	PROJECT EXECUTION	B5	0.1098	0.0359	$5,441,815	45%
10	TITLE I DESIGN	B7	0.0835	0.0273	$4,138,322	36%
11	QUALITY ASSURANCE	B9	0.0672	0.0220	$3,328,808	31%
12	CONCRETE	B15	0.0563	0.0184	$2,789,096	26%
13	METALS	B16	0.0397	0.0130	$1,968,939	26%
14	PROJECT DEVELOPMENT	B3	0.0385	0.0126	$1,906,757	34%
15	MECHANICAL	B24	0.0371	0.0121	$1,839,609	25%
16	SITEWORK	B14	0.0231	0.0075	$1,142,635	68%
17	ELECTRICAL	B25	0.0222	0.0073	$1,099,417	31%
18	CONVEYING SYSTEMS	B23	0.0207	0.0068	$1,024,039	9%
19	Non-Org G&A and PROCUREMENT	B28	0.0195	0.0064	$967,014	71%
20	CONSTRUCTION AE SUPPORT	B11	0.0182	0.0060	$903,252	28%
21	THERMAL & MOISTURE PROTECTION	B17	0.0178	0.0058	$883,054	26%
22	CONSTRUCTION MISCELLANEOUS	B26	0.0144	0.0047	$711,878	36%
23	FINISHES	B19	0.0084	0.0028	$417,861	26%
24	DOORS & WINDOWS	B18	0.0027	0.0009	$135,434	26%
25	GOVERNMENT FURNISHED EQUIPMENT	B12	0.0000	0.0000	$0	

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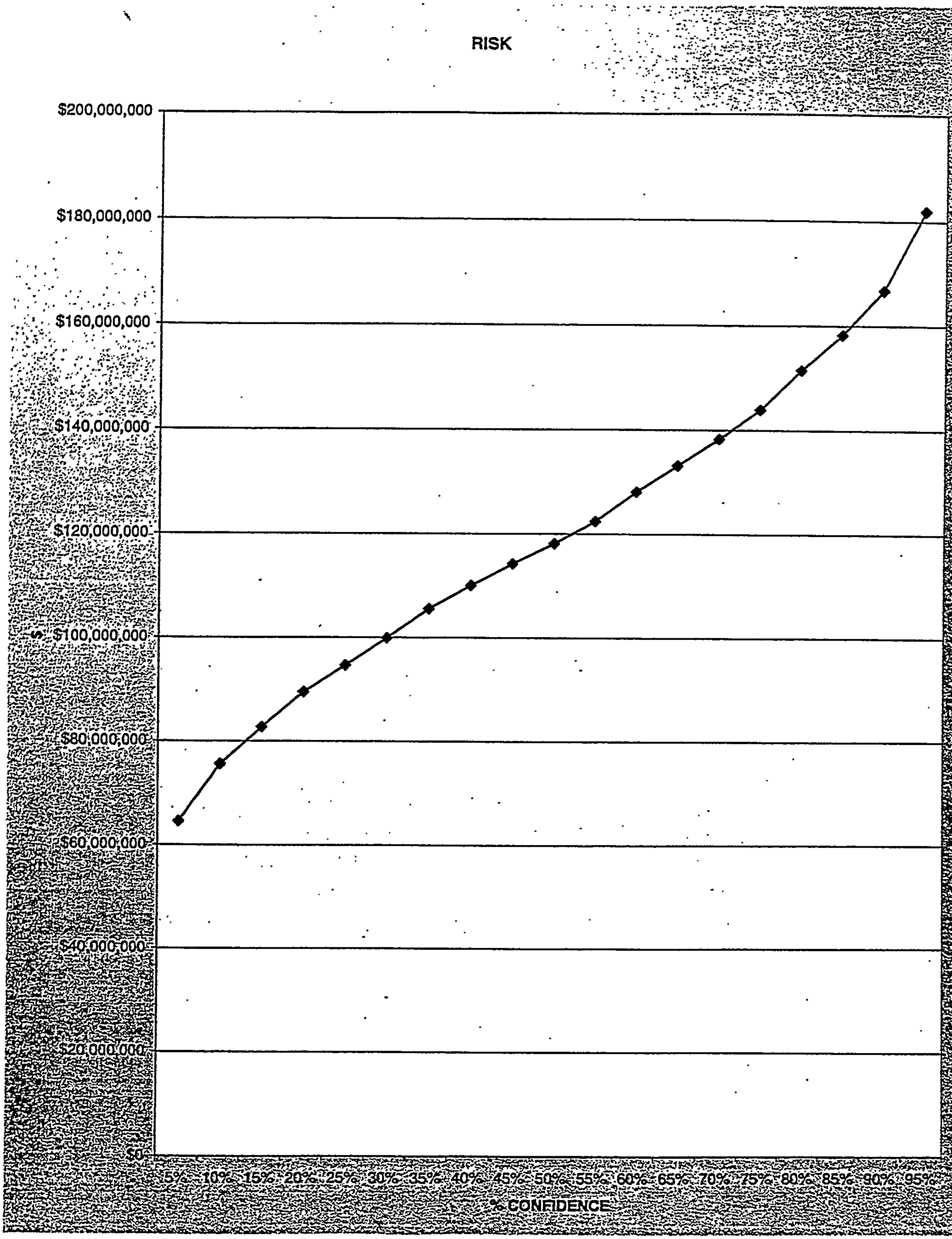
UNEX PROCESS IN A GREEN FIELD FACILITY

@RISK Output Details Report

Output Statistics

Outputs	Contingency
Simulation#	1
Statistics / Cell	F3
Minimum	20518454
Maximum	247844256
Mean	120292909.8
Standard Deviation	35362421.45
Variance	1.2505E+15
Skewness	0.227932905
Kurtosis	2.786055424
NumErrs	0
Mode	117812001.2
5%	$64,558,753
10%	$75,576,528
15%	$82,712,657
20%	$89,462,256
25%	$94,654,152
30%	$99,891,672
35%	$105,520,791
40%	$109,991,496
45%	$114,193,032
50%	$118,105,016
55%	$122,446,864
60%	$128,131,921
65%	$133,154,382
70%	$138,281,999
75%	$143,848,128
80%	$151,419,089
85%	$158,267,091
90%	$166,753,621
95%	181944541.6

UNEX PROCESS IN A GREEN FIELD FACILITY



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Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Project Number: *2570 - Option B*

TPC Summary Report 2

ESTIMATE ELEMENT	Estimate Subtotal	Escalation	Contingency	TOTAL
Total Estimated Cost (TEC)	$253,767,080	*24.20%* $61,405,744	*34.75%* $109,529,961	$424,702,785
Other Project Cost (OPC)	$40,906,600	*21.93%* $8,971,860	*79.62%* $39,710,892	$89,589,352
Total Project Cost (TPC)	$294,673,680	*23.88%* $70,377,604	*40.88%* $149,240,852	$514,292,137
Rounded TPC (Rounded to the nearest $ 1000000)				$514,000,000

	Remarks
Type of Estimate: Planning	
Estimator: Rowley / Mitchell / Marler	
Checked By: RDH	
Approved By: bd	

INEEL

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC1000	**PROJECT DEVELOPMENT**	**$16,314,200**	**$972,326**	**$13,337,003**	**77.15%**	**$30,623,529**
OPC1001	--PROJECT DEVELOPMENT	$5,314,200	$316,726	$1,914,515	34.00%	$7,545,441
OPC1001.1	----CONCEPTUAL DESIGN	$3,394,200	$202,294	$1,222,808	34.00%	$4,819,302
OPC1001.2	----PROJECT EXECUTION PLAN	$169,700	$10,114	$61,137	34.00%	$240,951
OPC1001.3	----WORK PACKAGE DEVELOPMENT	$390,300	$23,262	$140,611	34.00%	$554,173
OPC1001.4	----TASK BASELINE AGREEMENT	$560,000	$33,376	$201,748	34.00%	$795,124
OPC1001.5	----PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)	$800,000	$47,680	$288,211	34.00%	$1,135,891
OPC1600	--TECHNICAL DEVELOPMENT	$11,000,000	$655,600	$11,422,488	98.00%	$23,078,088
OPC2000	**PROJECT EXECUTION**	**$9,591,300**	**$2,461,128**	**$5,423,592**	**45.00%**	**$17,476,020**
OPC2001	--PROJECT EXECUTION	$9,591,300	$2,461,128	$5,423,592	45.00%	$17,476,020
OPC2001.1	----PROJECT SUPPORT	$5,091,300	$1,306,428	$2,878,977	45.00%	$9,276,705
OPC2001.2	----PERMITTING	$4,500,000	$1,154,700	$2,544,615	45.00%	$8,199,315
1000	**CONSTRUCTION MANAGEMENT**	**$18,328,600**	**$4,703,119**	**$8,521,736**	**37.00%**	**$31,553,455**
1100	--CONSTRUCTION SUPERVISION & ENGINEERING	$15,273,900	$3,919,283	$7,101,478	37.00%	$26,294,660
1110	--CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$339,400	$87,090	$157,801	37.00%	$584,291
1200	--CM PROJECT CONTROLS	$1,188,000	$304,841	$552,351	37.00%	$2,045,192
1300	--CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)	$848,500	$217,725	$394,503	37.00%	$1,460,728
1400	--CM TRAINING	$339,400	$87,090	$157,801	37.00%	$584,291
1500	--CM - OTHER DIRECT COSTS	$339,400	$87,090	$157,801	37.00%	$584,291
2000	**TITLE I DESIGN**	**$10,182,600**	**$1,231,076**	**$4,108,923**	**36.00%**	**$15,522,600**
2400	--DESIGN ACTIVITIES	$10,182,600	$1,231,076	$4,108,923	36.00%	$15,522,600

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: ***INTEC***
Estimate Number:***2570 - Option B***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
3000	**TITLE II DESIGN**	**$19,177,200**	**$2,941,782**	**$6,193,315**	**28.00%**	**$28,312,298**
3400	--DESIGN ACTIVITIES	$19,177,200	$2,941,782	$6,193,315	28.00%	$28,312,298
4000	**QUALITY ASSURANCE**	**$8,485,500**	**$2,177,379**	**$3,305,493**	**31.00%**	**$13,968,372**
4100	--QUALITY ASSURANCE	$8,485,500	$2,177,379	$3,305,493	31.00%	$13,968,372
5000	**PROJECT MANAGEMENT**	**$22,433,100**	**$5,756,333**	**$10,711,985**	**38.00%**	**$38,901,418**
5100	--PM ADMINISTRATION	$13,576,800	$3,483,807	$6,483,031	38.00%	$23,543,637
5110	--PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$67,900	$17,423	$32,423	38.00%	$117,746
5200	--PM PROJECT CONTROLS	$3,394,200	$870,952	$1,620,758	38.00%	$5,885,909
5300	--PM RECORDS MANAGEMENT	$3,394,200	$870,952	$1,620,758	38.00%	$5,885,909
5400	--SAFETY ANALYSIS	$2,000,000	$513,200	$955,016	38.00%	$3,468,216
6000	**CONSTRUCTION AE SUPPORT**	**$2,545,600**	**$653,201**	**$895,664**	**28.00%**	**$4,094,465**
9000	**CONSTRUCTION**	**$171,250,400**	**$43,942,853**	**$74,851,630**	**34.78%**	**$290,044,882**
9100	--CONSTRUCTION SUBCONTRACTS	$169,709,966	$43,547,577	$74,154,774	34.77%	$287,412,317
9101	----GENERAL CONDITIONS	$15,621,615	$4,008,506	$8,244,651	42.00%	$27,874,773
9101.1	------GENERAL CONDITIONS	$14,632,948	$3,754,814	$7,722,860	42.00%	$26,110,622
9101.2	------GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$988,668	$253,692	$521,791	42.00%	$1,764,151
9102	----SITEWORK	$1,342,619	$344,516	$1,147,252	68.00%	$2,834,388
9102.1	------SITEWORK - UTILITIES	$68,438	$17,561	$58,479	68.00%	$144,478
9102.2	------SITEWORK - GFF	$361,242	$92,695	$308,677	68.00%	$762,614
9102.3	------SITEWORK - TFD FACILITY	$336,396	$86,319	$287,446	68.00%	$710,162
9102.4	------SITEWORK - BOILER HOUSE	$71,579	$18,367	$61,163	68.00%	$151,109

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option B***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9102.5	------SITEWORK - STORAGE FACILITY	$150,574	$38,637	$128,663	68.00%	$317,874
9102.5	------SITEWORK - TUNNEL	$187,700	$48,164	$160,387	68.00%	$396,251
9102.6	------SITEWORK - PAVING	$166,691	$42,773	$142,435	68.00%	$351,899
9103	**----CONCRETE**	**$8,539,012**	**$2,191,111**	**$2,789,832**	**26.00%**	**$13,519,955**
9103.1	------CONCRETE - GFF	$4,602,876	$1,181,098	$1,503,833	26.00%	$7,287,807
9103.2	------CONCRETE - TFD FACILITY	$2,570,437	$659,574	$839,803	26.00%	$4,069,813
9103.3	------CONCRETE - BOILER HOUSE	$46,061	$11,819	$15,049	26.00%	$72,929
9103.4	------CONCRETE - STORAGE FACILITY	$1,230,990	$315,872	$402,184	26.00%	$1,949,047
9103.5	------CONCRETE - TUNNEL	$88,649	$22,747	$28,963	26.00%	$140,359
9105	**----METALS**	**$6,099,156**	**$1,565,043**	**$1,992,692**	**26.00%**	**$9,656,891**
9105.2	------METALS - GFF	$1,300,866	$333,802	$425,014	26.00%	$2,059,681
9105.3	------METALS - TFD FACILITY	$546,606	$140,259	$178,585	26.00%	$865,451
9105.4	------METALS - BOILER HOUSE	$147,342	$37,808	$48,139	26.00%	$233,290
9105.5	------METALS - STORAGE FACILITY	$4,104,341	$1,053,174	$1,340,954	26.00%	$6,498,469
9107	**----THERMAL & MOISTURE PROTECTION**	**$2,677,943**	**$687,160**	**$874,927**	**26.00%**	**$4,240,030**
9107.1	------THERMAL & MOISTURE PROTECTION - GFF	$1,439,697	$369,426	$470,372	26.00%	$2,279,496
9107.2	------THERMAL & MOISTURE PROTECTION - TFD FACILITY	$692,200	$177,618	$226,153	26.00%	$1,095,971
9107.3	------THERMAL & MOISTURE PROTECTION - BOILER HOUSE	$82,533	$21,178	$26,965	26.00%	$130,676
9107.4	------THERMAL & MOISTURE PROTECTION - STORAGE FACILITY	$463,513	$118,937	$151,437	26.00%	$733,887
9108	**----DOORS & WINDOWS**	**$411,474**	**$105,584**	**$134,435**	**26.00%**	**$651,493**
9108.1	------DOORS & WINDOWS - GFF	$142,969	$36,686	$46,710	26.00%	$226,364
9108.2	------DOORS & WINDOWS - TFD FACILITY	$175,925	$45,142	$57,478	26.00%	$278,545

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option B***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9108.3	------DOORS & WINDOWS - BOILER HOUSE	$33,544	$8,607	$10,959	26.00%	$53,110
9108.4	------DOORS & WINDOWS - STORAGE FACILITY	$59,036	$15,149	$19,288	26.00%	$93,473
9109	**----FINISHES**	**$1,257,389**	**$322,646**	**$395,009**	**25.00%**	**$1,975,043**
9109.1	------FINISHES - GFF	$454,273	$116,566	$142,710	25.00%	$713,549
9109.2	------FINISHES - TFD FACILITY	$500,276	$128,371	$157,162	25.00%	$785,808
9109.3	------FINISHES - BOILER HOUSE	$1,902	$488	$597	25.00%	$2,987
9109.4	------FINISHES - STORAGE FACILITY	$300,938	$77,221	$94,540	25.00%	$472,699
9110	**----SPECIALTIES**	**$74,720,216**	**$19,173,207**	**$28,168,027**	**30.00%**	**$122,061,450**
9110.1	------SPECIALTIES - GFF	$3,461,641	$888,257	$1,304,969	30.00%	$5,654,867
9110.2	------SPECIALTIES - TFD FACILITY	$17,521,957	$4,496,134	$6,605,427	30.00%	$28,623,518
9110.3	------SPECIALTIES - BOILER HOUSE	$59,374	$15,235	$22,383	30.00%	$96,993
9110.4	------SPECIALTIES - STORAGE FACILITY	$53,677,244	$13,773,581	$20,235,247	30.00%	$87,686,072
9111	**----EQUIPMENT**	**$37,267,301**	**$9,562,790**	**$25,288,249**	**54.00%**	**$72,118,340**
9111.1	------EQUIPMENT - IN GFF	$7,758,110	$1,990,731	$5,264,374	54.00%	$15,013,215
9111.1.1	--------EQUIPMENT - GFF	$2,249,492	$577,220	$1,526,424	54.00%	$4,353,136
9111.1.2	--------EQUIPMENT - GROUT FACILITY	$5,508,618	$1,413,511	$3,737,950	54.00%	$10,660,079
9111.2	------EQUIPMENT - THIN FILM DRYER FACILITY	$1,621,050	$415,962	$1,099,986	54.00%	$3,136,999
9111.3	------EQUIPMENT - BOILER HOUSE	$1,343,561	$344,758	$911,692	54.00%	$2,600,012
9111.4	------EQUIPMENT - GROUTING FACILITY	$5,514,538	$1,415,031	$3,741,967	54.00%	$10,671,536
9111.5	------EQUIPMENT - STORAGE FACILITY	$21,030,041	$5,396,309	$14,270,229	54.00%	$40,696,579
9114	**----CONVEYING SYSTEMS**	**$9,395,361**	**$2,410,850**	**$944,497**	**8.00%**	**$12,750,707**
9114.4	------CONVEYING SYSTEMS - STORAGE FACILITY	$9,395,361	$2,410,850	$944,497	8.00%	$12,750,707

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9115	**----MECHANICAL**	**$9,768,612**	**$2,506,626**	**$3,191,562**	**26.00%**	**$15,466,799**
9115.2	------MECHANICAL - NEW - GFF - UNEX	$6,270,168	$1,608,925	$2,048,564	26.00%	$9,927,657
9115.2.1	--------HVAC EQUIPMENT - NEW - GFF - UNEX	$6,270,168	$1,608,925	$2,048,564	26.00%	$9,927,657
9115.3	------MECHANICAL - NEW - TFD FACILITY	$2,415,785	$619,890	$789,276	26.00%	$3,824,951
9115.2.1	--------HVAC - TFD FACILITY - HOT CELL	$607,407	$155,861	$198,450	26.00%	$961,717
9115.2.2	--------HVAC - TFD FACILITY - OPERATING CORRIDORS	$1,523,564	$390,947	$497,773	26.00%	$2,412,283
9115.2.3	--------PLUMBING / PIPING - TFD FACILITY	$284,814	$73,083	$93,053	26.00%	$450,951
9115.4	------MECHANICAL - NEW - BOILER HOUSE	$381,698	$97,944	$124,707	26.00%	$604,349
9115.4.2	--------HVAC - NEW - BOILER HOUSE	$68,261	$17,516	$22,302	26.00%	$108,079
9115.4.3	--------PLUMBING - BOILER HOUSE	$4,739	$1,216	$1,548	26.00%	$7,503
9115.4.4	--------PIPING - NEW - BOILER HOUSE	$293,199	$75,235	$95,793	26.00%	$464,227
9115.4.5	--------FIRE PROTECTION - NEW - BOILER HOUSE	$15,499	$3,977	$5,064	26.00%	$24,540
9115.4	------MECHANICAL - NEW - STORAGE FACILITY	$700,961	$179,867	$229,015	26.00%	$1,109,843
9116	**----ELECTRICAL**	**$2,609,269**	**$669,538**	**$983,642**	**30.00%**	**$4,262,449**
9116.2	------ELECTRICAL - NEW - GFF	$1,915,729	$491,576	$722,192	30.00%	$3,129,497
9116.2.1	--------SWITCHGEAR AND TRANSFORMERS - GFF	$717,408	$184,087	$270,449	30.00%	$1,171,944
9116.2.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - GFF	$175,000	$44,905	$65,972	30.00%	$285,877
9116.2.3	--------MISC. COSTS - GFF	$517,472	$132,783	$195,077	30.00%	$845,332
9116.2.4	--------LIGHTING - GFF	$505,849	$129,801	$190,695	30.00%	$826,345
9116.3	------ELECTRICAL - NEW - TFD FACILITY	$188,994	$48,496	$71,247	30.00%	$308,737
9116.3.1	--------SWITCHGEAR AND TRANSFORMERS - TFD	$14,068	$3,610	$5,303	30.00%	$22,981
9116.3.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - TFD	$35,000	$8,981	$13,194	30.00%	$57,175

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option B***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9116.3.3	--------MISC. COSTS - TFD	$86,496	$22,195	$32,607	30.00%	$141,299
9116.3.4	--------LIGHTING - TFD	$53,430	$13,710	$20,142	30.00%	$87,282
9116.4	------ELECTRICAL - BOILER HOUSE	$56,186	$14,417	$21,181	30.00%	$91,784
9116.4.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE	$12,000	$3,079	$4,524	30.00%	$19,603
9116.4.3	--------MISC. COSTS - BOILER HOUSE	$30,901	$7,929	$11,649	30.00%	$50,479
9116.4.4	--------LIGHTING - BOILER HOUSE	$13,285	$3,409	$5,008	30.00%	$21,702
9116.5	------ELECTRICAL - STORAGE FACILITY	$435,854	$111,840	$164,308	30.00%	$712,002
9116.5.1	--------SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE	$172,275	$44,206	$64,944	30.00%	$281,425
9116.5.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE	$21,000	$5,389	$7,917	30.00%	$34,305
9116.5.3	--------MISC. COSTS - INTERIM STORAGE	$141,040	$36,191	$53,169	30.00%	$230,401
9116.5.4	--------LIGHTING - INTERIM STORAGE	$101,539	$26,055	$38,278	30.00%	$165,872
9116.6	------ELECTRICAL - TRANSFER TUNNEL	$12,505	$3,209	$4,714	30.00%	$20,428
9301	**--CONSTRUCTION MISCELLANEOUS**	**$1,540,434**	**$395,275**	**$696,856**	**36.00%**	**$2,632,565**
9301.1	----CONSTRUCTION SUPPORT	$522,234	$134,005	$236,246	36.00%	$892,486
9301.2	----CONSTRUCTION QUALITY CONTROL	$169,700	$43,545	$76,768	36.00%	$290,013
9301.3	----CONSTRUCTION DOCUMENTATION	$848,500	$217,725	$383,841	36.00%	$1,450,066
OPC3000	**PROJECT ACCEPTANCE/CLOSEOUT**	**$15,001,100**	**$5,538,406**	**$20,950,296**	**102.00%**	**$41,489,802**
OPC3100	**--TESTING AND TURNOVER PLANNING**	**$339,400**	**$125,306**	**$474,001**	**102.00%**	**$938,707**
OPC3200	**--S. O. TESTING**	**$8,485,500**	**$3,132,847**	**$11,850,714**	**102.00%**	**$23,469,060**
OPC3300	**--ORR SUPPORT**	**$373,400**	**$137,859**	**$521,484**	**102.00%**	**$1,032,744**
OPC3400	**--FACILITY ACCEPTANCE REVIEW**	**$254,600**	**$93,998**	**$355,570**	**102.00%**	**$704,169**

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC3500	--RADIOLOGICAL CONTROL SUPPORT	$186,700	$68,930	$260,742	102.00%	$516,372
OPC3600	--OPERATOR TRAINING	$3,394,200	$1,253,139	$4,740,285	102.00%	$9,387,624
OPC3700	--OPERATING PROCEDURES	$746,700	$275,682	$1,042,829	102.00%	$2,065,211
OPC3800	--START-UP COORDINATION	$220,600	$81,446	$308,086	102.00%	$610,132
OPC3900	--SPARES	$1,000,000	$369,200	$1,396,584	102.00%	$2,765,784
GAPIF	Non-Org G&A and PIF	$1,364,080	$0	$941,215	69.00%	$2,305,295
Total	MODIFIED UNEX IN GFF - OPTION B	$294,673,680	$70,377,604	$149,240,852	40.88%	$514,292,137

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL / Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— OPC1001.1 CONCEPTUAL DESIGN										
BWI	U.C. per LOT				3394200	0	0	0	0	3394200
CONCEPTUAL DESIGN (2% OF TCC)		1.00	0		$3,394,200	$0	$0	$0	$0	$3,394,200
Subtotal					$3,394,200	$0	$0	$0	$0	$3,394,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,394,200
Escalation					$202,294	$0	$0	$0	$0	$202,294
Contingency					$1,222,808	$0	$0	$0	$0	$1,222,808
—Total OPC1001.1 CONCEPTUAL DESIGN			0		$4,819,302	$0	$0	$0	$0	$4,819,302
— OPC1001.2 PROJECT EXECUTION PLAN										
BWI	U.C. per LOT				169700	0	0	0	0	169700
ACDC/SOW,CPDS,PEP,DC,/SOW REVIEWS @ .1% OF TCC		1.00	0		$169,700	$0	$0	$0	$0	$169,700
Subtotal					$169,700	$0	$0	$0	$0	$169,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$169,700
Escalation					$10,114	$0	$0	$0	$0	$10,114
Contingency					$61,137	$0	$0	$0	$0	$61,137
—Total OPC1001.2 PROJECT EXECUTION PLAN			0		$240,951	$0	$0	$0	$0	$240,951
— OPC1001.3 WORK PACKAGE DEVELOPMENT										
BWI	U.C. per Lot				390300	0	0	0	0	390300
Work Package Development - .23% Of TCC		1.00	0		$390,300	$0	$0	$0	$0	$390,300
Subtotal					$390,300	$0	$0	$0	$0	$390,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$390,300
Escalation					$23,262	$0	$0	$0	$0	$23,262
Contingency					$140,611	$0	$0	$0	$0	$140,611
—Total OPC1001.3 WORK PACKAGE DEVELOPMENT			0		$554,173	$0	$0	$0	$0	$554,173
— OPC1001.4 TASK BASELINE AGREEMENT										
BWI	U.C. per Lot				560000	0	0	0	0	560000
Task Baseline Agreement - .33% Of TCC		1.00	0		$560,000	$0	$0	$0	$0	$560,000

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.4 TASK BASELINE AGREEMENT										
Subtotal					$560,000	$0	$0	$0	$0	$560,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$560,000
Escalation					$33,376	$0	$0	$0	$0	$33,376
Contingency					$201,748	$0	$0	$0	$0	$201,748
---Total OPC1001.4 TASK BASELINE AGREEMENT			**0**		**$795,124**	**$0**	**$0**	**$0**	**$0**	**$795,124**
--- OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)										
	BWI	U.C. per Lot			800000	0	0	0	0	800000
Preliminary Safety Analysis Report (PSAR)		1.00	0		$800,000	$0	$0	$0	$0	$800,000
Subtotal					$800,000	$0	$0	$0	$0	$800,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$800,000
Escalation					$47,680	$0	$0	$0	$0	$47,680
Contingency					$288,211	$0	$0	$0	$0	$288,211
---Total OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)			**0**		**$1,135,891**	**$0**	**$0**	**$0**	**$0**	**$1,135,891**
--- OPC1600 TECHNICAL DEVELOPMENT										
	BWI	U.C. per Lot			11000000	0	0	0	0	11000000
(*)UNEX Process Development		1.00	0		$11,000,000	$0	$0	$0	$0	$11,000,000
Memo: Cost for process development is per the HLW SBW Process Development Costs (Arlin L. Olson).										
Subtotal					$11,000,000	$0	$0	$0	$0	$11,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$11,000,000
Escalation					$655,600	$0	$0	$0	$0	$655,600
Contingency					$11,422,488	$0	$0	$0	$0	$11,422,488
---Total OPC1600 TECHNICAL DEVELOPMENT			**0**		**$23,078,088**	**$0**	**$0**	**$0**	**$0**	**$23,078,088**
--- OPC2001.1 PROJECT SUPPORT										
	BWI	U.C. per Lot			5091300	0	0	0	0	5091300
Project Support - 3% OF TCC		1.00	0		$5,091,300	$0	$0	$0	$0	$5,091,300

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC2001.1 PROJECT SUPPORT										
Subtotal					$5,091,300	$0	$0	$0	$0	$5,091,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$5,091,300
Escalation					$1,306,428	$0	$0	$0	$0	$1,306,428
Contingency					$2,878,977	$0	$0	$0	$0	$2,878,977
---Total OPC2001.1 PROJECT SUPPORT			0		$9,276,705	$0	$0	$0	$0	$9,276,705
--- OPC2001.2 PERMITTING										
	BWI	U.C. per Lot			1500000	0	0	0	0	1500000
Permitting		1.00	0		$1,500,000	$0	$0	$0	$0	$1,500,000
	BWI	U.C. per Lot			2500000	0	0	0	0	2500000
WIPP Certification		1.00	0		$2,500,000	$0	$0	$0	$0	$2,500,000
	BWI	U.C. per Lot			500000	0	0	0	0	500000
Hanford Certification		1.00	0		$500,000	$0	$0	$0	$0	$500,000
Subtotal					$4,500,000	$0	$0	$0	$0	$4,500,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$4,500,000
Escalation					$1,154,700	$0	$0	$0	$0	$1,154,700
Contingency					$2,544,615	$0	$0	$0	$0	$2,544,615
---Total OPC2001.2 PERMITTING			0		$8,199,315	$0	$0	$0	$0	$8,199,315
--- 1100 CONSTRUCTION SUPERVISION & ENGINEERING										
00401400	BWI	U.C. per Lot	1		15273900	0	0	0	0	15273900
Construction Management - 9% Of TCC		1.00	1	$***.**	$15,273,900	$0	$0	$0	$0	$15,273,900
Subtotal					$15,273,900	$0	$0	$0	$0	$15,273,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$15,273,900
Escalation					$3,919,283	$0	$0	$0	$0	$3,919,283
Contingency					$7,101,478	$0	$0	$0	$0	$7,101,478
---Total 1100 CONSTRUCTION SUPERVISION & ENGINEERING			1		$26,294,660	$0	$0	$0	$0	$26,294,660
--- 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
00401400	BWI	U.C. per Lot	1		339400	0	0	0	0	339400
CM - Conduct Of Operations / Conduct Of Maintenance - .2% Of TCC		1.00	1	$***.**	$339,400	$0	$0	$0	$0	$339,400

EX In GFF

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
				$19,177,200	$0	$0	$0	$0	$19,177,200
				$0	$0	$0	$0	$0	$0
				$0	$0	$0	$0	$0	$0
									$19,177,200
				$2,941,782	$0	$0	$0	$0	$2,941,782
				$6,193,315	$0	$0	$0	$0	$6,193,315
		0		$28,312,298	$0	$0	$0	$0	$28,312,298
U.C. per Lot		0.1		8485500	0	0	0	0	8485500
	1.00	0	$***.**	$8,485,500	$0	$0	$0	$0	$8,485,500
				$8,485,500	$0	$0	$0	$0	$8,485,500
				$0	$0	$0	$0	$0	$0
				$0	$0	$0	$0	$0	$0
									$8,485,500
				$2,177,379	$0	$0	$0	$0	$2,177,379
				$3,305,493	$0	$0	$0	$0	$3,305,493
		0		$13,968,372	$0	$0	$0	$0	$13,968,372
U.C. per Lot		8		13576800	0	0	0	0	13576800
	1.00	8	$***.**	$13,576,800	$0	$0	$0	$0	$13,576,800
				$13,576,800	$0	$0	$0	$0	$13,576,800
				$0	$0	$0	$0	$0	$0
				$0	$0	$0	$0	$0	$0
									$13,576,800
				$3,483,807	$0	$0	$0	$0	$3,483,807
				$6,483,031	$0	$0	$0	$0	$6,483,031
		8		$23,543,637	$0	$0	$0	$0	$23,543,637
F MAINTENANCE									
U.C. per Lot		0.1		67900	0	0	0	0	67900
	1.00	0	$***.**	$67,900	$0	$0	$0	$0	$67,900

: *V. J. Balls*
ired By: *Rowley / Mitchell / Marler*
ate Type: *Planning*

S/C	Other	TOTAL
$0	$0	$339,400
$0	$0	$0
$0	$0	$0
		$339,400
$0	$0	$87,090
$0	$0	$157,801
$0	$0	$584,291
0	0	1188000
$0	$0	$1,188,000
$0	$0	$1,188,000
$0	$0	$0
$0	$0	$0
		$1,188,000
$0	$0	$304,841
$0	$0	$552,351
$0	$0	$2,045,192
0	0	848500
$0	$0	$848,500
$0	$0	$848,500
$0	$0	$0
$0	$0	$0
		$848,500
$0	$0	$217,725
$0	$0	$394,503
$0	$0	$1,460,728
0	0	339400
$0	$0	$339,400

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- **1400 CM TRAINING**										
Subtotal					$339,400	$0	$0	$0	$0	$339,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$339,400
Escalation					$87,090	$0	$0	$0	$0	$87,090
Contingency					$157,801	$0	$0	$0	$0	$157,801
---Total 1400 CM TRAINING			0		**$584,291**	**$0**	**$0**	**$0**	**$0**	**$584,291**
--- **1500 CM - OTHER DIRECT COSTS**										
	BWI	U.C. per Lot			339400	0	0	0	0	339400
CM - Other Direct Costs - .2% Of TCC		1.00	0		$339,400	$0	$0	$0	$0	$339,400
Subtotal					$339,400	$0	$0	$0	$0	$339,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$339,400
Escalation					$87,090	$0	$0	$0	$0	$87,090
Contingency					$157,801	$0	$0	$0	$0	$157,801
---Total 1500 CM - OTHER DIRECT COSTS			0		**$584,291**	**$0**	**$0**	**$0**	**$0**	**$584,291**
--- **2400 DESIGN ACTIVITIES**										
	BWI	U.C. per Lot			10182600	0	0	0	0	10182600
Title I Design - 6% Of TCC		1.00	0		$10,182,600	$0	$0	$0	$0	$10,182,600
Subtotal					$10,182,600	$0	$0	$0	$0	$10,182,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$10,182,600
Escalation					$1,231,076	$0	$0	$0	$0	$1,231,076
Contingency					$4,108,923	$0	$0	$0	$0	$4,108,923
---Total 2400 DESIGN ACTIVITIES			0		**$15,522,600**	**$0**	**$0**	**$0**	**$0**	**$15,522,600**
--- **3400 DESIGN ACTIVITIES**										
	BWI	U.C. per Lot			19177200	0	0	0	0	19177200
Title II Design - 11.3% Of TCC		1.00	0		$19,177,200	$0	$0	$0	$0	$19,177,200

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 3400 DESIGN ACTIVITIES										
Subtotal					$19,177,200	$0	$0	$0	$0	$19,177,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$19,177,200
Escalation					$2,941,782	$0	$0	$0	$0	$2,941,782
Contingency					$6,193,315	$0	$0	$0	$0	$6,193,315
---Total 3400 DESIGN ACTIVITIES			**0**		**$28,312,298**	**$0**	**$0**	**$0**	**$0**	**$28,312,298**
--- 4100 QUALITY ASSURANCE										
	BWI	U.C. per Lot	0.1		8485500	0	0	0	0	8485500
Quality Assurance - 5% Of TCC		1.00	0	$***.**	$8,485,500	$0	$0	$0	$0	$8,485,500
Subtotal					$8,485,500	$0	$0	$0	$0	$8,485,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,485,500
Escalation					$2,177,379	$0	$0	$0	$0	$2,177,379
Contingency					$3,305,493	$0	$0	$0	$0	$3,305,493
---Total 4100 QUALITY ASSURANCE			**0**		**$13,968,372**	**$0**	**$0**	**$0**	**$0**	**$13,968,372**
--- 5100 PM ADMINISTRATION										
	BWI	U.C. per Lot	8		13576800	0	0	0	0	13576800
Project Management - 8% Of TCC		1.00	8	$***.**	$13,576,800	$0	$0	$0	$0	$13,576,800
Subtotal					$13,576,800	$0	$0	$0	$0	$13,576,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$13,576,800
Escalation					$3,483,807	$0	$0	$0	$0	$3,483,807
Contingency					$6,483,031	$0	$0	$0	$0	$6,483,031
---Total 5100 PM ADMINISTRATION			**8**		**$23,543,637**	**$0**	**$0**	**$0**	**$0**	**$23,543,637**
--- 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	BWI	U.C. per Lot	0.1		67900	0	0	0	0	67900
PM Conduct Of Operations / Conduct Of Maintenance - .04% Of TCC		1.00	0	$***.**	$67,900	$0	$0	$0	$0	$67,900

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
Subtotal					$67,900	$0	$0	$0	$0	$67,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$67,900
Escalation					$17,423	$0	$0	$0	$0	$17,423
Contingency					$32,423	$0	$0	$0	$0	$32,423
---Total 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			0		$117,746	$0	$0	$0	$0	$117,746
--- 5200 PM PROJECT CONTROLS										
	BWI	U.C. per Lot			3394200	0	0	0	0	3394200
PM Project Controls - 2% Of TCC		1.00	0		$3,394,200	$0	$0	$0	$0	$3,394,200
Subtotal					$3,394,200	$0	$0	$0	$0	$3,394,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,394,200
Escalation					$870,952	$0	$0	$0	$0	$870,952
Contingency					$1,620,758	$0	$0	$0	$0	$1,620,758
---Total 5200 PM PROJECT CONTROLS			0		$5,885,909	$0	$0	$0	$0	$5,885,909
--- 5300 PM RECORDS MANAGEMENT										
	BWI	U.C. per Lot			3394200	0	0	0	0	3394200
PM Records Management - 2% Of TCC		1.00	0		$3,394,200	$0	$0	$0	$0	$3,394,200
Subtotal					$3,394,200	$0	$0	$0	$0	$3,394,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,394,200
Escalation					$870,952	$0	$0	$0	$0	$870,952
Contingency					$1,620,758	$0	$0	$0	$0	$1,620,758
---Total 5300 PM RECORDS MANAGEMENT			0		$5,885,909	$0	$0	$0	$0	$5,885,909
--- 5400 SAFETY ANALYSIS										
	BWI	U.C. per Lot			2000000	0	0	0	0	2000000
Safety Analysis Report (SAR) - 2% Of TCC		1.00	0		$2,000,000	$0	$0	$0	$0	$2,000,000

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5400 SAFETY ANALYSIS									
Subtotal				$2,000,000	$0	$0	$0	$0	$2,000,000
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$2,000,000
Escalation				$513,200	$0	$0	$0	$0	$513,200
Contingency				$955,016	$0	$0	$0	$0	$955,016
---Total 5400 SAFETY ANALYSIS		**0**		**$3,468,216**	**$0**	**$0**	**$0**	**$0**	**$3,468,216**
--- 6000 CONSTRUCTION AE SUPPORT									
BWI	U.C. per Lot			2545600	0	0	0	0	2545600
Construction AE Support - 1.5% Of TCC	1.00	0		$2,545,600	$0	$0	$0	$0	$2,545,600
Subtotal				$2,545,600	$0	$0	$0	$0	$2,545,600
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$2,545,600
Escalation				$653,201	$0	$0	$0	$0	$653,201
Contingency				$895,664	$0	$0	$0	$0	$895,664
---Total 6000 CONSTRUCTION AE SUPPORT		**0**		**$4,094,465**	**$0**	**$0**	**$0**	**$0**	**$4,094,465**
--- 9101.1 GENERAL CONDITIONS									
GEN	U.C. per Lot	41618	CN-SUPR	1664720	0	0	0	0	1664720
Supervision - 15% Of Labor Hours	1.00	41,618	$40.00	$1,664,720	$0	$0	$0	$0	$1,664,720
GEN	U.C. per Lot	19422	CN-LABR	584407.98	0	0	0	0	584407.98
Training - 7% Of Labor Hours	1.00	19,422	$30.09	$584,408	$0	$0	$0	$0	$584,408
GEN	U.C. per Lot	1387	CN-LABR	41734.83	10000	0	0	0	51734.83
Mobilization & Demobilization - .5% Of Labor Hours	1.00	1,387	$30.09	$41,735	$10,000	$0	$0	$0	$51,735
GEN	U.C. per Lot			0	0	8609400	0	0	8609400
(*)Material Adjustment - Additional 10% On Material & Subcontracts	1.00	0		$0	$0	$8,609,400	$0	$0	$8,609,400
Memo: Adjustment for DOE/RW/0333P Quality Standards.									
Subtotal				$2,290,863	$10,000	$8,609,400	$0	$0	$10,910,263
Sales Tax				$0	$0	$430,470	$0	$0	$430,470
INEEL ORG Labor/Subcontractor Overheads				$665,037	$2,903	$2,624,274	$0	$0	$3,292,215
Subtotal Estimate									$14,632,948
Escalation				$758,484	$3,311	$2,993,019	$0	$0	$3,754,814
Contingency				$1,560,041	$6,810	$6,156,009	$0	$0	$7,722,860
---Total 9101.1 GENERAL CONDITIONS		**62,427**		**$5,274,426**	**$23,024**	**$20,813,172**	**$0**	**$0**	**$26,110,622**

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE											
	GEN	U.C. per Hr		0.08	CN-SKWK	2.762	0	0	0	0	2.762
(*)Labor Adjustment			277,459.00	22,197	$34.52	$766,231	$0	$0	$0	$0	$766,231
Memo: Conduct of Operations / Conduct of Maintenance - Add 8% to construction labor hours.											
Subtotal						$766,231	$0	$0	$0	$0	$766,231
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$222,437	$0	$0	$0	$0	$222,437
Subtotal Estimate											$988,668
Escalation						$253,692	$0	$0	$0	$0	$253,692
Contingency						$521,791	$0	$0	$0	$0	$521,791
---Total 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE				22,197		$1,764,151	$0	$0	$0	$0	$1,764,151
--- 9102.1 SITEWORK - UTILITIES											
	GEN	U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Firewater			800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.											
	GEN	U.C. per Lf		0.5	CN-LABR	15.045	2	12	0	0	29.045
Piping - Firewater			300.00	150	$30.09	$4,514	$600	$3,600	$0	$0	$8,714
	GEN	U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Sewer			800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.											
	GEN	U.C. per Lf		0.03	CN-LABR	0.903	2	5	0	0	7.903
Piping - Sewer			300.00	9	$30.09	$271	$600	$1,500	$0	$0	$2,371
Subtotal						$38,485	$9,200	$5,100	$0	$0	$52,785
Sales Tax						$0	$0	$255	$0	$0	$255
INEEL ORG Labor/Subcontractor Overheads						$11,172	$2,671	$1,555	$0	$0	$15,398
Subtotal Estimate											$68,438
Escalation						$12,742	$3,046	$1,773	$0	$0	$17,561
Contingency						$42,432	$10,143	$5,904	$0	$0	$58,479
---Total 9102.1 SITEWORK - UTILITIES				1,279		$104,831	$25,060	$14,587	$0	$0	$144,478
--- 9102.2 SITEWORK - GFF											
	GEN	U.C. per Sf		0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading			100,000.00	3,000	$30.09	$90,270	$50,000	$0	$0	$0	$140,270

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *257*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.2 SITEWORK - GFF										
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill - Footings		5,360.00	3,752	$30.09	$112,898	$26,800	$0	$0	$0	$139,698
Subtotal					$203,168	$76,800	$0	$0	$0	$279,968
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$58,980	$22,295	$0	$0	$0	$81,275
Subtotal Estimate										$361,242
Escalation					$67,267	$25,428	$0	$0	$0	$92,695
Contingency					$224,002	$84,676	$0	$0	$0	$308,677
---Total 9102.2 SITEWORK - GFF			**6,752**		**$553,416**	**$209,198**	**$0**	**$0**	**$0**	**$762,614**
--- 9102.3 SITEWORK - TFD FACILITY										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		27,000.00	810	$30.09	$24,373	$13,500	$0	$0	$0	$37,873
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		8,550.00	5,985	$30.09	$180,089	$42,750	$0	$0	$0	$222,839
Subtotal					$204,462	$56,250	$0	$0	$0	$260,712
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$59,355	$16,329	$0	$0	$0	$75,685
Subtotal Estimate										$336,396
Escalation					$67,695	$18,624	$0	$0	$0	$86,319
Contingency					$225,428	$62,018	$0	$0	$0	$287,446
---Total 9102.3 SITEWORK - TFD FACILITY			**6,795**		**$556,940**	**$153,221**	**$0**	**$0**	**$0**	**$710,162**
--- 9102.4 SITEWORK - BOILER HOUSE										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		4,000.00	120	$30.09	$3,611	$2,000	$0	$0	$0	$5,611
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		500.00	350	$30.09	$10,532	$2,500	$0	$0	$0	$13,032
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Steam & Condensate		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.05	CN-LABR	1.505	2	5	0	0	8.505
Piping - Steam & Condensate		600.00	30	$30.09	$903	$1,200	$3,000	$0	$0	$5,103

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.4 SITEWORK - BOILER HOUSE									
GEN	U.C. per Cf	0.17	CN-LABR	5.115	0	16.55	0	0	21.665
Gilsulate Insulation	477.00	81	$30.09	$2,440	$0	$7,894	$0	$0	$10,334
Subtotal				$34,335	$9,700	$10,894	$0	$0	$54,930
Sales Tax				$0	$0	$545	$0	$0	$545
INEEL ORG Labor/Subcontractor Overheads				$9,968	$2,816	$3,321	$0	$0	$16,104
Subtotal Estimate									$71,579
Escalation				$11,368	$3,212	$3,787	$0	$0	$18,367
Contingency				$37,856	$10,695	$12,612	$0	$0	$61,163
---Total 9102.4 SITEWORK - BOILER HOUSE		1,141		$93,527	$26,422	$31,159	$0	$0	$151,109
--- 9102.5 SITEWORK - STORAGE FACILITY									
GEN	U.C. per CY	0.012	CN-ENGR	0.391	2	0	0	0	2.391
BUILDING EXCAVATION	17,160.00	206	$32.56	$6,705	$34,320	$0	$0	$0	$41,025
GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BACKFILL	12,240.00	734	$32.56	$23,912	$24,480	$0	$0	$0	$48,392
GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BERM FILL	6,900.00	414	$32.56	$13,480	$13,800	$0	$0	$0	$27,280
Subtotal				$44,097	$72,600	$0	$0	$0	$116,697
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$12,801	$21,076	$0	$0	$0	$33,877
Subtotal Estimate									$150,574
Escalation				$14,600	$24,037	$0	$0	$0	$38,637
Contingency				$48,619	$80,045	$0	$0	$0	$128,663
---Total 9102.5 SITEWORK - STORAGE FACILITY		1,354		$120,117	$197,758	$0	$0	$0	$317,874
--- 9102.5 SITEWORK - TUNNEL									
GEN	U.C. per Cy	0.6	CN-LABR	18.054	12	0	0	0	30.054
(*)Excavate & Backfill For Tunnel	4,500.00	2,700	$30.09	$81,243	$54,000	$0	$0	$0	$135,243

Memo: Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- **9102.5 SITEWORK - TUNNEL**									
GEN	U.C. per Cy	3	CN-LABR	90.27	12	0	0	0	102.27
Allowance For Hand Excavation	100.00	300	$30.09	$9,027	$1,200	$0	$0	$0	$10,227
Subtotal				$90,270	$55,200	$0	$0	$0	$145,470
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$26,205	$16,025	$0	$0	$0	$42,230
Subtotal Estimate									$187,700
Escalation				$29,888	$18,276	$0	$0	$0	$48,164
Contingency				$99,527	$60,861	$0	$0	$0	$160,387
---Total 9102.5 SITEWORK - TUNNEL		3,000		$245,890	$150,361	$0	$0	$0	$396,251
--- **9102.6 SITEWORK - PAVING**									
GEN	U.C. per Sf	0.05	CN-SKWK	1.726	1.2	0	0	0	2.926
Pavement Removal	7,050.00	353	$34.52	$12,168	$8,460	$0	$0	$0	$20,628
GEN	U.C. per Sf	0.03	CN-SKWK	1.036	1	2	0	0	4.036
New Pavement	26,250.00	788	$34.52	$27,185	$26,250	$52,500	$0	$0	$105,935
Subtotal				$39,353	$34,710	$52,500	$0	$0	$126,563
Sales Tax				$0	$0	$2,625	$0	$0	$2,625
INEEL ORG Labor/Subcontractor Overheads				$11,424	$10,076	$16,003	$0	$0	$37,503
Subtotal Estimate									$166,691
Escalation				$13,029	$11,492	$18,251	$0	$0	$42,773
Contingency				$43,388	$38,269	$60,778	$0	$0	$142,435
---Total 9102.6 SITEWORK - PAVING		1,140		$107,195	$94,548	$150,157	$0	$0	$351,899
--- **9103.1 CONCRETE - GFF**									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings	953.00	4,765	$34.52	$164,488	$0	$171,540	$0	$0	$336,028
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick	1,690.00	8,450	$34.52	$291,694	$0	$304,200	$0	$0	$595,894
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick	755.00	3,775	$34.52	$130,313	$0	$135,900	$0	$0	$266,213
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping - 4" Thick	824.00	4,120	$34.52	$142,222	$0	$148,320	$0	$0	$290,542
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.	250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.									

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
-- 9103.1 CONCRETE - GFF										
	GEN	U.C. per Lot	120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads		1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
	GEN	U.C. per Sf		CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 6" Thick		56,560.00	0		$0	$0	$0	$692,860	$0	$692,860
	GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels		66,800.00	0		$0	$0	$601,200	$0	$0	$601,200
	GEN	U.C. per Lf			0	0	0	170	0	170
Pre-Cast Concrete Inverted Tees		600.00	0		$0	$0	$0	$102,000	$0	$102,000
	GEN	U.C. per Lf			0	0	0	150	0	150
Pre-Cast Concrete Columns - 24" x 24"		672.00	0		$0	$0	$0	$100,800	$0	$100,800
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed Wall Panels - 56' Long		118.00	944	$34.52	$32,587	$0	$0	$0	$0	$32,587
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed Roof Panels		114.00	912	$34.52	$31,482	$0	$0	$0	$0	$31,482
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Cast Columns		12.00	96	$34.52	$3,314	$0	$0	$0	$0	$3,314
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Cast Inverted Tees		10.00	80	$34.52	$2,762	$0	$0	$0	$0	$2,762
	GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Columns		36.00	720	$34.52	$24,854	$0	$0	$0	$0	$24,854
	GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels		254.00	2,032	$34.52	$70,145	$0	$5,080	$0	$0	$75,225
	GEN	U.C. per Ea	250	CN-SKWK	8630	0	45000	0	0	53630
Stairwell - 56' High		2.00	500	$34.52	$17,260	$0	$90,000	$0	$0	$107,260
	GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		1,200.00	240	$34.52	$8,285	$0	$6,000	$0	$0	$14,285
	GEN	U.C. per Ea	150	CN-SKWK	5178	1000	3500	0	0	9678
Concrete Ramp		2.00	300	$34.52	$10,356	$2,000	$7,000	$0	$0	$19,356

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.1 CONCRETE - GFF									
GEN	U.C. per Ea			0	0	0	50000	0	50000
Loading Dock	2.00	0		$0	$0	$0	$100,000	$0	$100,000
Subtotal				$977,054	$2,000	$1,516,740	$995,660	$0	$3,491,454
Sales Tax				$0	$0	$75,837	$0	$0	$75,837
INEEL ORG Labor/Subcontractor Overheads				$283,639	$581	$462,325	$289,040	$0	$1,035,585
Subtotal Estimate									$4,602,876
Escalation				$323,494	$662	$527,288	$329,654	$0	$1,181,098
Contingency				$411,889	$843	$671,369	$419,732	$0	$1,503,833
---Total 9103.1 CONCRETE - GFF		28,304		$1,996,075	$4,086	$3,253,559	$2,034,086	$0	$7,287,807
--- 9103.2 CONCRETE - TFD FACILITY									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings	430.00	2,150	$34.52	$74,218	$0	$77,400	$0	$0	$151,618
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 12" Thick	725.00	3,625	$34.52	$125,135	$0	$130,500	$0	$0	$255,635
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick	200.00	1,000	$34.52	$34,520	$0	$36,000	$0	$0	$70,520
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping	170.00	850	$34.52	$29,342	$0	$30,600	$0	$0	$59,942
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.	250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Lot	120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads	1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
GEN	U.C. per Sf		CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 12" Thick	36,345.00	0		$0	$0	$0	$445,226	$0	$445,226
GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels	13,700.00	0		$0	$0	$123,300	$0	$0	$123,300
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels	170.00	1,360	$34.52	$46,947	$0	$0	$0	$0	$46,947
GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams	24.00	480	$34.52	$16,570	$0	$0	$0	$0	$16,570
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels	170.00	1,360	$34.52	$46,947	$0	$3,400	$0	$0	$50,347

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.2 CONCRETE - TFD FACILITY										
GEN	U.C. per Ea		400	CN-SKWK	13808	0	60000	0	0	73808
Stairwell - 100' High		1.00	400	$34.52	$13,808	$0	$60,000	$0	$0	$73,808
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 24" Thick		585.00	2,925	$34.52	$100,971	$0	$105,300	$0	$0	$206,271
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Shielding Walls - 24" Thick		1,005.00	5,025	$34.52	$173,463	$0	$180,900	$0	$0	$354,363
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		250.00	50	$34.52	$1,726	$0	$1,250	$0	$0	$2,976
Subtotal					$710,939	$0	$796,150	$445,226	$0	$1,952,316
Sales Tax					$0	$0	$39,808	$0	$0	$39,808
INEEL ORG Labor/Subcontractor Overheads					$208,386	$0	$242,678	$129,249	$0	$578,313
Subtotal Estimate										$2,570,437
Escalation					$235,386	$0	$276,778	$147,410	$0	$659,574
Contingency					$299,705	$0	$352,408	$187,690	$0	$839,803
---Total 9103.2 CONCRETE - TFD FACILITY			20,595		$1,452,416	$0	$1,707,822	$909,576	$0	$4,069,813
--- 9103.3 CONCRETE - BOILER HOUSE										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings & Floors		92.00	460	$34.52	$15,879	$0	$16,560	$0	$0	$32,439
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		100.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
GEN	U.C. per Lot		20	CN-SKWK	690.4	0	500	0	0	1190.4
Misc. Concrete Pads		1.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
Subtotal					$17,260	$0	$17,560	$0	$0	$34,820
Sales Tax					$0	$0	$878	$0	$0	$878
INEEL ORG Labor/Subcontractor Overheads					$5,011	$0	$5,353	$0	$0	$10,363
Subtotal Estimate										$46,061
Escalation					$5,715	$0	$6,105	$0	$0	$11,819
Contingency					$7,276	$0	$7,773	$0	$0	$15,049
---Total 9103.3 CONCRETE - BOILER HOUSE			500		$35,261	$0	$37,668	$0	$0	$72,929
--- 9103.4 CONCRETE - STORAGE FACILITY										
GEN	U.C. per EA				0	0	0	75000	0	75000
Hatch Plugs		3.00	0		$0	$0	$0	$225,000	$0	$225,000

CONSTRUCTION DETAIL ITEM REPORT

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.4 CONCRETE - STORAGE FACILITY									
GEN	U.C. per Sf		CN-SKWK	0	0	0	8.5	0	8.5
Precast Concrete Walls - 6" Thick	17,160.00	0		$0	$0	$0	$145,860	$0	$145,860
GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels	20,440.00	0		$0	$0	$183,960	$0	$0	$183,960
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels	126.00	1,008	$34.52	$34,796	$0	$0	$0	$0	$34,796
GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams	22.00	440	$34.52	$15,189	$0	$0	$0	$0	$15,189
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels	126.00	1,008	$34.52	$34,796	$0	$2,520	$0	$0	$37,316
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings	260.00	1,300	$34.52	$44,876	$0	$46,800	$0	$0	$91,676
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick	380.00	1,900	$34.52	$65,588	$0	$68,400	$0	$0	$133,988
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Partition Wall - 12" Thick	180.00	900	$34.52	$31,068	$0	$32,400	$0	$0	$63,468
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide	500.00	100	$34.52	$3,452	$0	$2,500	$0	$0	$5,952
Subtotal				$229,765	$0	$336,580	$370,860	$0	$937,205
Sales Tax				$0	$0	$16,829	$0	$0	$16,829
INEEL ORG Labor/Subcontractor Overheads				$66,701	$0	$102,595	$107,661	$0	$276,956
Subtotal Estimate									$1,230,990
Escalation				$76,073	$0	$117,011	$122,788	$0	$315,872
Contingency				$96,860	$0	$148,984	$156,340	$0	$402,184
--Total 9103.4 CONCRETE - STORAGE FACILITY		6,656		$469,399	$0	$721,998	$757,649	$0	$1,949,047
--- 9103.5 CONCRETE - TUNNEL									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete For Tunnel - 12" Thick All Surfaces	190.00	950	$34.52	$32,794	$0	$34,200	$0	$0	$66,994
Memo: Includes formwork, concrete, and rebar. Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.									

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.5 CONCRETE - TUNNEL									
Subtotal				$32,794	$0	$34,200	$0	$0	$66,994
Sales Tax				$0	$0	$1,710	$0	$0	$1,710
INEEL ORG Labor/Subcontractor Overheads				$9,520	$0	$10,425	$0	$0	$19,945
Subtotal Estimate									$88,649
Escalation				$10,858	$0	$11,889	$0	$0	$22,747
Contingency				$13,825	$0	$15,138	$0	$0	$28,963
---Total 9103.5 CONCRETE - TUNNEL		950		$66,997	$0	$73,362	$0	$0	$140,359
--- 9105.2 METALS - GFF									
STEEL	U.C. per Sf	0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure	66,790.00	2,672	$40.16	$107,291	$0	$160,296	$0	$0	$267,587
STEEL	U.C. per Lot	1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals	1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
GEN	U.C. per Sf			0	0	0	20	0	20
(*)Pre-Engineered Metal Building	24,380.00	0		$0	$0	$0	$487,600	$0	$487,600
Memo: Office / restroom, Tru-Pak, and truck airlock areas.									
Subtotal				$147,451	$0	$310,296	$487,600	$0	$945,347
Sales Tax				$0	$0	$15,515	$0	$0	$15,515
INEEL ORG Labor/Subcontractor Overheads				$61,831	$0	$136,622	$141,550	$0	$340,003
Subtotal Estimate									$1,300,866
Escalation				$53,702	$0	$118,660	$161,440	$0	$333,802
Contingency				$68,376	$0	$151,084	$205,553	$0	$425,014
---Total 9105.2 METALS - GFF		3,672		$331,360	$0	$732,178	$996,144	$0	$2,059,681
--- 9105.3 METALS - TFD FACILITY									
STEEL	U.C. per Sf	2	CN-IRON	80.32	0	10	0	0	90.32
Liner Plate - 4' Up From Floor	1,025.00	2,050	$40.16	$82,328	$0	$10,250	$0	$0	$92,578
STEEL	U.C. per Lot	200	CN-IRON	8032	0	25000	0	0	33032
Misc. Embeds	1.00	200	$40.16	$8,032	$0	$25,000	$0	$0	$33,032
STEEL	U.C. per Lot	1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals	1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
STEEL	U.C. per Sf	0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure	13,700.00	548	$40.16	$22,008	$0	$32,880	$0	$0	$54,888

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.3 METALS - TFD FACILITY										
	STEEL	U.C. per Ea	10	CN-IRON	401.6	0	3000	0	0	3401.6
Stairway		1.00	10	$40.16	$402	$0	$3,000	$0	$0	$3,402
Subtotal					$152,929	$0	$221,130	$0	$0	$374,059
Sales Tax					$0	$0	$11,057	$0	$0	$11,057
INEEL ORG Labor/Subcontractor Overheads					$64,128	$0	$97,363	$0	$0	$161,491
Subtotal Estimate										$546,606
Escalation					$55,697	$0	$84,562	$0	$0	$140,259
Contingency					$70,916	$0	$107,669	$0	$0	$178,585
---Total 9105.3 METALS - TFD FACILITY			**3,808**		**$343,670**	**$0**	**$521,781**	**$0**	**$0**	**$865,451**
--- 9105.4 METALS - BOILER HOUSE										
	GEN	U.C. per Sf			0	0	0	18	0	18
Pre-Engineered Metal Building		3,120.00	0		$0	$0	$0	$56,160	$0	$56,160
	GEN	U.C. per Lot	40	CN-IRON	1606.4	0	1200	0	0	2806.4
Misc. Metals		1.00	40	$40.16	$1,606	$0	$1,200	$0	$0	$2,806
	STEEL	U.C. per EA	40	CN-IRON	1606.4	0	275	0	0	1881.4
BOILER STACK SUPPORTS		2.00	80	$40.16	$3,213	$0	$550	$0	$0	$3,763
	STEEL	U.C. per LBS	0.018	CN-IRON	0.723	0	1.62	0	0	2.343
BOILER BUILDING PLATFORMS		11,000.00	198	$40.16	$7,952	$0	$17,820	$0	$0	$25,772
	STEEL	U.C. per LBS	0.012	CN-IRON	0.482	0	0.4	0	0	0.882
BOILER BUILDING ROOF FRAMING		21,840.00	262	$40.16	$10,525	$0	$8,736	$0	$0	$19,261
Subtotal					$23,296	$0	$28,306	$56,160	$0	$107,762
Sales Tax					$0	$0	$1,415	$0	$0	$1,415
INEEL ORG Labor/Subcontractor Overheads					$9,561	$0	$12,300	$16,303	$0	$38,165
Subtotal Estimate										$147,342
Escalation					$8,431	$0	$10,783	$18,594	$0	$37,808
Contingency					$10,735	$0	$13,729	$23,675	$0	$48,139
---Total 9105.4 METALS - BOILER HOUSE			**580**		**$52,024**	**$0**	**$66,534**	**$114,732**	**$0**	**$233,290**
--- 9105.5 METALS - STORAGE FACILITY										
	STEEL	U.C. per TON	6	CN-IRON	240.96	0	1100	0	0	1340.96
CHARGE FACE SLAB FRAME		780.00	4,680	$40.16	$187,949	$0	$858,000	$0	$0	$1,045,949
	STEEL	U.C. per TON	10	CN-IRON	401.6	0	1200	0	0	1601.6
BUILDING STRUCTURAL STEEL		756.00	7,560	$40.16	$303,610	$0	$907,200	$0	$0	$1,210,810
	STEEL	U.C. per LF	3.85	CN-IRON	154.616	0	161	0	0	315.616
GANTRY CRANE RAILS, EMBEDS, ETC.		400.00	1,540	$40.16	$61,846	$0	$64,400	$0	$0	$126,246

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.5 METALS - STORAGE FACILITY										
STEEL	U.C. per LF		2	CN-IRON	80.32	0	92	0	0	172.32
RAILROAD TRACKS - WITHIN BUILDING		180.00	360	$40.16	$14,458	$0	$16,560	$0	$0	$31,018
STEEL	U.C. per LF		2	CN-IRON	80.32	0	92	0	0	172.32
TRANSFER CART RAILS		210.00	420	$40.16	$16,867	$0	$19,320	$0	$0	$36,187
STEEL	U.C. per SF		0.25	CN-IRON	10.04	0	40	0	0	50.04
BIRD SCREEN AND VENT LOUVERS		2,300.00	575	$40.16	$23,092	$0	$92,000	$0	$0	$115,092
STEEL	U.C. per SF			CN-IRON	0	0	0	12	0	12
AIR OUTLET WALL (INSIDE)		12,600.00	0		$0	$0	$0	$151,200	$0	$151,200
STEEL	U.C. per Lot		750	CN-IRON	30120	0	45000	0	0	75120
(*)Misc. Steel		1.00	750	$40.16	$30,120	$0	$45,000	$0	$0	$75,120
Memo: Handrails, stairways, grating, and etc.										
Subtotal					$637,942	$0	$2,002,480	$151,200	$0	$2,791,622
Sales Tax					$0	$0	$100,124	$0	$0	$100,124
INEEL ORG Labor/Subcontractor Overheads					$267,508	$0	$881,685	$63,403	$0	$1,212,596
Subtotal Estimate										$4,104,341
Escalation					$232,338	$0	$765,769	$55,067	$0	$1,053,174
Contingency					$295,825	$0	$975,015	$70,114	$0	$1,340,954
---Total 9105.5 METALS - STORAGE FACILITY			15,885		$1,433,613	$0	$4,725,072	$339,784	$0	$6,498,469
--- 9107.1 THERMAL & MOISTURE PROTECTION - GFF										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		6,700.00	221	$34.64	$7,659	$0	$4,020	$0	$0	$11,679
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		46,000.00	2,760	$34.64	$95,606	$0	$96,600	$0	$0	$192,206
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		46,000.00	3,680	$30.09	$110,731	$0	$207,000	$0	$0	$317,731
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		66,790.00	1,336	$30.09	$40,194	$0	$63,451	$0	$0	$103,645
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		66,790.00	935	$29.95	$28,005	$0	$146,938	$0	$0	$174,943
ROOF	U.C. per Lot		300	CN-ROFC	8985	0	7500	0	0	16485
Redwood, Flashing, & Etc.		1.00	300	$29.95	$8,985	$0	$7,500	$0	$0	$16,485
GEN	U.C. per Sf		0.016	CN-CARP	0.554	0	0.35	0	0	0.904
3-1/2" Thick Batt Insulation - Metal Building Walls		35,360.00	566	$34.64	$19,598	$0	$12,376	$0	$0	$31,974
GEN	U.C. per Sf		0.018	CN-CARP	0.624	0	0.4	0	0	1.024
6" Vinyl Faced Batt Insulation - Metal Building Walls		35,360.00	636	$34.64	$22,048	$0	$14,144	$0	$0	$36,192

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9107.1 THERMAL & MOISTURE PROTECTION - GFF										
GEN	U.C. per Sf		0.045	CN-CARP	1.559	0	1.1	0	0	2.659
Insul-Basket - Metal Building Roof		24,380.00	1,097	$34.64	$38,004	$0	$26,818	$0	$0	$64,822
GEN	U.C. per SF		0.007	CN-CARP	0.242	0	0.2	0	0	0.442
3" Unfaced Batt Insulation - Metal Building Roof		24,380.00	171	$34.64	$5,912	$0	$4,876	$0	$0	$10,788
GEN	U.C. per Sf		0.007	CN-CARP	0.242	0	0.33	0	0	0.572
6" Vinyl Faced Batt Insulation - Metal Building Roof		24,380.00	171	$34.64	$5,912	$0	$8,045	$0	$0	$13,957
Subtotal					$382,653	$0	$591,768	$0	$0	$974,421
Sales Tax					$0	$0	$29,588	$0	$0	$29,588
INEEL ORG Labor/Subcontractor Overheads					$137,872	$0	$297,816	$0	$0	$435,688
Subtotal Estimate										$1,439,697
Escalation					$133,567	$0	$235,859	$0	$0	$369,426
Contingency					$170,064	$0	$300,308	$0	$0	$470,372
---Total 9107.1 THERMAL & MOISTURE PROTECTION - GFF			11,873		$824,156	$0	$1,455,339	$0	$0	$2,279,496
— 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,000.00	66	$34.64	$2,286	$0	$1,200	$0	$0	$3,486
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		37,000.00	2,220	$34.64	$76,901	$0	$77,700	$0	$0	$154,601
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		37,000.00	2,960	$30.09	$89,066	$0	$166,500	$0	$0	$255,566
GEN	U.C. per Hr		0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		1,290.00	323	$30.09	$9,704	$0	$0	$0	$0	$9,704
GEN	U.C. per Lot				0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		13,700.00	274	$30.09	$8,245	$0	$13,015	$0	$0	$21,260
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		13,700.00	192	$29.95	$5,744	$0	$30,140	$0	$0	$35,884

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
	ROOF	U.C. per Lot	200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$197,937	$3,000	$293,555	$0	$0	$494,492
Sales Tax					$0	$0	$14,678	$0	$0	$14,678
INEEL ORG Labor/Subcontractor Overheads					$65,959	$871	$116,201	$0	$0	$183,031
Subtotal Estimate										$692,200
Escalation					$67,716	$993	$108,910	$0	$0	$177,618
Contingency					$86,219	$1,265	$138,669	$0	$0	$226,153
---Total 9107.2 THERMAL & MOISTURE PROTECTION - TFD FACILITY			6,234		$417,830	$6,129	$672,012	$0	$0	$1,095,971
--- 9107.3 THERMAL & MOISTURE PROTECTION - BOILER HOUSE										
	INSUL	U.C. per SF			0	0	0	1.9	0	1.9
EXTERIOR WALL INSULATION W/ Z-GIRTS		6,720.00	0		$0	$0	$0	$12,768	$0	$12,768
	INSUL	U.C. per SF			0	0	0	1	0	1
ROOF INSULATION		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	GEN	U.C. per SF	0.023	CN-SHEE	0.816	0	3	0	0	3.816
EXTERIOR WALL METAL SIDING		6,720.00	155	$35.48	$5,484	$0	$20,160	$0	$0	$25,644
	GEN	U.C. per SF	0.016	CN-SHEE	0.568	0	5	0	0	5.568
STANDING SEAM METAL ROOF		3,120.00	50	$35.48	$1,771	$0	$15,600	$0	$0	$17,371
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		950.00	31	$34.64	$1,086	$0	$570	$0	$0	$1,656
Subtotal					$8,341	$0	$36,330	$15,888	$0	$60,559
Sales Tax					$0	$0	$1,817	$0	$0	$1,817
INEEL ORG Labor/Subcontractor Overheads					$2,421	$0	$11,074	$6,662	$0	$20,158
Subtotal Estimate										$82,533
Escalation					$2,762	$0	$12,630	$5,786	$0	$21,178
Contingency					$3,516	$0	$16,081	$7,368	$0	$26,965
---Total 9107.3 THERMAL & MOISTURE PROTECTION - BOILER HOUSE			236		$17,040	$0	$77,931	$35,704	$0	$130,676
--- 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,300.00	76	$34.64	$2,629	$0	$1,380	$0	$0	$4,009
	GEN	U.C. per Sf	0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		17,200.00	1,032	$34.64	$35,748	$0	$36,120	$0	$0	$71,868
	GEN	U.C. per Sf	0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		17,200.00	1,376	$30.09	$41,404	$0	$77,400	$0	$0	$118,804

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
	GEN	U.C. per Hr	0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		2,408.00	602	$30.09	$18,114	$0	$0	$0	$0	$18,114
	GEN	U.C. per Lot			0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
	GEN	U.C. per Sf	0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		20,500.00	410	$30.09	$12,337	$0	$19,475	$0	$0	$31,812
	ROOF	U.C. per Sf	0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		20,500.00	287	$29.95	$8,596	$0	$45,100	$0	$0	$53,696
	ROOF	U.C. per Lot	200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$124,818	$3,000	$184,475	$0	$0	$312,293
Sales Tax					$0	$0	$9,224	$0	$0	$9,224
INEEL ORG Labor/Subcontractor Overheads					$46,798	$871	$94,327	$0	$0	$141,996
Subtotal Estimate										$463,513
Escalation					$44,037	$993	$73,907	$0	$0	$118,937
Contingency					$56,070	$1,265	$94,103	$0	$0	$151,437
---Total 9107.4 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY			3,983		$271,722	$6,129	$456,036	$0	$0	$733,887
--- 9108.1 DOORS & WINDOWS - GFF										
	GEN	U.C. per Ea	10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		30.00	300	$34.64	$10,392	$0	$30,000	$0	$0	$40,392
	GEN	U.C. per Ea	15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		2.00	30	$34.64	$1,039	$0	$3,600	$0	$0	$4,639
	GEN	U.C. per Ea	12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors - Single		7.00	84	$34.64	$2,910	$0	$14,000	$0	$0	$16,910
	GEN	U.C. per Ea	20	CN-CARP	692.8	0	3000	0	0	3692.8
Exterior Doors - Double		2.00	40	$34.64	$1,386	$0	$6,000	$0	$0	$7,386

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.1 DOORS & WINDOWS - GFF										
	GEN U.C. per Ea		75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal					$20,923	$0	$85,600	$0	$0	$106,523
Sales Tax					$0	$0	$4,280	$0	$0	$4,280
INEEL ORG Labor/Subcontractor Overheads					$6,074	$0	$26,092	$0	$0	$32,166
Subtotal Estimate										$142,969
Escalation					$6,927	$0	$29,758	$0	$0	$36,686
Contingency					$8,820	$0	$37,890	$0	$0	$46,710
---Total 9108.1 DOORS & WINDOWS - GFF			604		$42,744	$0	$183,621	$0	$0	$226,364
--- 9108.2 DOORS & WINDOWS - TFD FACILITY										
	GEN U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		12.00	120	$34.64	$4,157	$0	$12,000	$0	$0	$16,157
	GEN U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		6.00	90	$34.64	$3,118	$0	$10,800	$0	$0	$13,918
	GEN U.C. per Ea		12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors		4.00	48	$34.64	$1,663	$0	$8,000	$0	$0	$9,663
	GEN U.C. per Ea		40	CN-CARP	1385.6	500	25000	0	0	26885.6
3' x 7' Shielding Doors		2.00	80	$34.64	$2,771	$1,000	$50,000	$0	$0	$53,771
	GEN U.C. per Ea		75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal					$16,904	$1,000	$112,800	$0	$0	$130,704
Sales Tax					$0	$0	$5,640	$0	$0	$5,640
INEEL ORG Labor/Subcontractor Overheads					$4,907	$290	$34,383	$0	$0	$39,581
Subtotal Estimate										$175,925
Escalation					$5,597	$331	$39,214	$0	$0	$45,142
Contingency					$7,126	$422	$49,930	$0	$0	$57,478
---Total 9108.2 DOORS & WINDOWS - TFD FACILITY			488		$34,535	$2,043	$241,967	$0	$0	$278,545
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
	GEN U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		3.00	30	$34.64	$1,039	$0	$3,000	$0	$0	$4,039
	GEN U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		1.00	15	$34.64	$520	$0	$1,800	$0	$0	$2,320

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
	GEN	U.C. per Ea	75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		1.00	75	$34.64	$2,598	$0	$16,000	$0	$0	$18,598
Subtotal					$4,157	$0	$20,800	$0	$0	$24,957
Sales Tax					$0	$0	$1,040	$0	$0	$1,040
INEEL ORG Labor/Subcontractor Overheads					$1,207	$0	$6,340	$0	$0	$7,547
Subtotal Estimate										$33,544
Escalation					$1,376	$0	$7,231	$0	$0	$8,607
Contingency					$1,752	$0	$9,207	$0	$0	$10,959
---Total 9108.3 DOORS & WINDOWS - BOILER HOUSE			**120**		**$8,492**	**$0**	**$44,618**	**$0**	**$0**	**$53,110**
--- 9108.4 DOORS & WINDOWS - STORAGE FACILITY										
	GEN	U.C. per EA	75	CN-SKWK	2589	0	16000	0	0	18589
OVERHEAD DOORS		2.00	150	$34.52	$5,178	$0	$32,000	$0	$0	$37,178
	GEN	U.C. per EA	10	CN-SKWK	345.2	0	1000	0	0	1345.2
PERSONNEL DOORS		5.00	50	$34.52	$1,726	$0	$5,000	$0	$0	$6,726
Subtotal					$6,904	$0	$37,000	$0	$0	$43,904
Sales Tax					$0	$0	$1,850	$0	$0	$1,850
INEEL ORG Labor/Subcontractor Overheads					$2,004	$0	$11,278	$0	$0	$13,282
Subtotal Estimate										$59,036
Escalation					$2,286	$0	$12,863	$0	$0	$15,149
Contingency					$2,910	$0	$16,378	$0	$0	$19,288
---Total 9108.4 DOORS & WINDOWS - STORAGE FACILITY			**200**		**$14,105**	**$0**	**$79,369**	**$0**	**$0**	**$93,473**
--- 9109.1 FINISHES - GFF										
	PAINT	U.C. per Sf	0.012	CN-PAIN	0.365	0	0.12	0	0	0.485
Painting Gypsum Board Wall		23,500.00	282	$30.39	$8,570	$0	$2,820	$0	$0	$11,390
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting - Drum Storage		52,000.00	572	$30.39	$17,383	$0	$26,000	$0	$0	$43,383
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting - Drum Processing		14,800.00	163	$30.39	$4,947	$0	$7,400	$0	$0	$12,347
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		65.00	260	$30.39	$7,901	$0	$3,250	$0	$0	$11,151

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.1 FINISHES - GFF										
	PAINT	U.C. per Lot	80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint		1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0	1.5	0	0	2.403
Carpet Tile		10,550.00	317	$30.09	$9,523	$0	$15,825	$0	$0	$25,348
	TILE	U.C. per Sf	0.04	CN-TILF	1.386	0	2.5	0	0	3.886
Ceramic Tile		4,100.00	164	$34.64	$5,681	$0	$10,250	$0	$0	$15,931
	GEN	U.C. per Ea	1	CN-LABR	30.09	0	200	0	0	230.09
Entry Mat - Large		4.00	4	$30.09	$120	$0	$800	$0	$0	$920
	GEN	U.C. per Lf	0.06	CN-LABR	1.805	0	0.75	0	0	2.555
4" Vinyl Cove Base		2,000.00	120	$30.09	$3,611	$0	$1,500	$0	$0	$5,111
	GEN	U.C. per Sf	0.04	CN-LABR	1.204	0	1	0	0	2.204
Acoustical Suspended Ceiling		10,550.00	422	$30.09	$12,698	$0	$10,550	$0	$0	$23,248
	GEN	U.C. per Lot	6	CN-CARP	207.84	0	750	0	0	957.84
Building Lettering		1.00	6	$34.64	$208	$0	$750	$0	$0	$958
	GEN	U.C. per Sf	0.019	CN-CARP	0.658	0	0.24	0	0	0.898
3-1/2" Metal Stud Wall		12,000.00	228	$34.64	$7,898	$0	$2,880	$0	$0	$10,778
	GEN	U.C. per Sf	0.017	CN-CARP	0.589	0	0.33	0	0	0.919
5/8" Gypsum Board - Taped & Textured		23,500.00	400	$34.64	$13,839	$0	$7,755	$0	$0	$21,594
	GEN	U.C. per Sf			0	0	0	7	0	7
RCRA Floor - Grouting Facility		14,800.00	0		$0	$0	$0	$103,600	$0	$103,600
Subtotal					$135,716	$0	$95,300	$103,600	$0	$334,616
Sales Tax					$0	$0	$4,765	$0	$0	$4,765
INEEL ORG Labor/Subcontractor Overheads					$49,885	$0	$34,932	$30,075	$0	$114,891
Subtotal Estimate										$454,273
Escalation					$47,625	$0	$34,640	$34,301	$0	$116,566
Contingency					$58,306	$0	$42,409	$41,994	$0	$142,710
---Total 9109.1 FINISHES - GFF			4,363		$291,532	$0	$212,046	$209,970	$0	$713,549
--- 9109.2 FINISHES - TFD FACILITY										
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		100,000.00	3,000	$30.39	$91,170	$0	$75,000	$0	$0	$166,170
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Hot Cell		26,000.00	2,080	$30.39	$63,211	$0	$39,000	$0	$0	$102,211

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- **9109.2 FINISHES - TFD FACILITY**										
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting		30,000.00	330	$30.39	$10,029	$0	$15,000	$0	$0	$25,029
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		20.00	80	$30.39	$2,431	$0	$1,000	$0	$0	$3,431
	PAINT	U.C. per Lot	80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint		1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
Subtotal					$210,177	$0	$135,520	$0	$0	$345,697
Sales Tax					$0	$0	$6,776	$0	$0	$6,776
INEEL ORG Labor/Subcontractor Overheads					$88,134	$0	$59,669	$0	$0	$147,803
Subtotal Estimate										$500,276
Escalation					$76,547	$0	$51,824	$0	$0	$128,371
Contingency					$93,714	$0	$63,447	$0	$0	$157,162
---Total 9109.2 FINISHES - TFD FACILITY			**6,916**		**$468,572**	**$0**	**$317,236**	**$0**	**$0**	**$785,808**
--- **9109.3 FINISHES - BOILER HOUSE**										
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		4.00	16	$30.39	$486	$0	$200	$0	$0	$686
	PAINT	U.C. per Lot	16	CN-PAIN	486.24	0	150	0	0	636.24
Touch-Up Paint		1.00	16	$30.39	$486	$0	$150	$0	$0	$636
Subtotal					$972	$0	$350	$0	$0	$1,322
Sales Tax					$0	$0	$18	$0	$0	$18
INEEL ORG Labor/Subcontractor Overheads					$408	$0	$154	$0	$0	$562
Subtotal Estimate										$1,902
Escalation					$354	$0	$134	$0	$0	$488
Contingency					$434	$0	$164	$0	$0	$597
---Total 9109.3 FINISHES - BOILER HOUSE			**32**		**$2,168**	**$0**	**$819**	**$0**	**$0**	**$2,987**
--- **9109.4 FINISHES - STORAGE FACILITY**										
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		2,500.00	75	$30.39	$2,279	$0	$1,875	$0	$0	$4,154
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Remote Handling Area		22,000.00	1,760	$30.39	$53,486	$0	$33,000	$0	$0	$86,486

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.4 FINISHES - STORAGE FACILITY										
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Floor Painting - Decontaminable - Remote Handling Area		17,600.00	1,408	$30.39	$42,789	$0	$26,400	$0	$0	$69,189
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		7.00	28	$30.39	$851	$0	$350	$0	$0	$1,201
	PAINT	U.C. per Lot	40	CN-PAIN	1215.6	0	150	0	0	1365.6
Touch-Up Paint		1.00	40	$30.39	$1,216	$0	$150	$0	$0	$1,366
Subtotal					$141,526	$0	$67,145	$0	$0	$208,671
Sales Tax					$0	$0	$3,357	$0	$0	$3,357
INEEL ORG Labor/Subcontractor Overheads					$59,346	$0	$29,564	$0	$0	$88,910
Subtotal Estimate										$300,938
Escalation					$51,544	$0	$25,677	$0	$0	$77,221
Contingency					$63,104	$0	$31,436	$0	$0	$94,540
---Total 9109.4 FINISHES - STORAGE FACILITY			4,657		$315,520	$0	$157,179	$0	$0	$472,699
--- 9110.1 SPECIALTIES - GFF										
	GEN	U.C. per Lf	0.25	CN-LABR	7.523	0	80	0	0	87.523
Storage Racks		6,250.00	1,563	$30.09	$47,016	$0	$500,000	$0	$0	$547,016
	GEN	U.C. per Ea			0	0	0	850000	0	850000
Tru-Pack Assembly		1.00	0		$0	$0	$0	$850,000	$0	$850,000
	GEN	U.C. per Ea			0	0	0	45000	0	45000
Truck Loading Platform		2.00	0		$0	$0	$0	$90,000	$0	$90,000
	GEN	U.C. per Ea	5	CN-CARP	173.2	0	1800	0	0	1973.2
Modular Offices		20.00	100	$34.64	$3,464	$0	$36,000	$0	$0	$39,464
	GEN	U.C. per Plc	5	CN-CARP	173.2	0	2500	0	0	2673.2
Office Furnishings		20.00	100	$34.64	$3,464	$0	$50,000	$0	$0	$53,464
	GEN	U.C. per Ea	1	CN-CARP	34.64	0	155	0	0	189.64
Mirror With Shelf - 20" x 30"		7.00	7	$34.64	$242	$0	$1,085	$0	$0	$1,327
	GEN	U.C. per Ea	3	CN-CARP	103.92	0	170	0	0	273.92
Urinal Screen		3.00	9	$34.64	$312	$0	$510	$0	$0	$822
	GEN	U.C. per Ea	4	CN-CARP	138.56	0	380	0	0	518.56
Toilet Partition		7.00	28	$34.64	$970	$0	$2,660	$0	$0	$3,630
	GEN	U.C. per Ea	0.4	CN-CARP	13.856	0	10	0	0	23.856
T.P. Dispenser		3.00	1	$34.64	$42	$0	$30	$0	$0	$72

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9110.1 SPECIALTIES - GFF											
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	15	0	0	32.32
T.P. Dispenser With Purse Shelf			4.00	2	$34.64	$69	$0	$60	$0	$0	$129
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	20	0	0	37.32
San. Napkin Disposal			4.00	2	$34.64	$69	$0	$80	$0	$0	$149
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	65	0	0	85.784
H.C. Grab Bar - 52"			2.00	1	$34.64	$42	$0	$130	$0	$0	$172
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	75	0	0	95.784
Concealed Grab Bar - 42"			4.00	2	$34.64	$83	$0	$300	$0	$0	$383
	GEN	U.C. per Ea		0.6	CN-CARP	20.784	0	65	0	0	85.784
Concealed Grab Bar - 36"			2.00	1	$34.64	$42	$0	$130	$0	$0	$172
	GEN	U.C. per Ea		1	CN-CARP	34.64	0	250	0	0	284.64
Towel Dispenser & Waste Receptacle			4.00	4	$34.64	$139	$0	$1,000	$0	$0	$1,139
	GEN	U.C. per Ea		0.75	CN-CARP	25.98	0	75	0	0	100.98
Folding Shower Seat			2.00	2	$34.64	$52	$0	$150	$0	$0	$202
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	45	0	0	62.32
Shower Curtain - 40' x 78"			2.00	1	$34.64	$35	$0	$90	$0	$0	$125
	GEN	U.C. per Ea		1	CN-CARP	34.64	0	155	0	0	189.64
Tilting Mirror - 24" x 30"			2.00	2	$34.64	$69	$0	$310	$0	$0	$379
	GEN	U.C. per Ea		0.5	CN-CARP	17.32	0	25	0	0	42.32
Shower Curtain Rod - 36" Long			2.00	1	$34.64	$35	$0	$50	$0	$0	$85
	GEN	U.C. per Ea		0.15	CN-CARP	5.196	0	5	0	0	10.196
Double Prong Hooks - SST			20.00	3	$34.64	$104	$0	$100	$0	$0	$204
	GEN	U.C. per Ea		3	CN-CARP	103.92	0	250	0	0	353.92
Pedestal Bench - 36" Long			6.00	18	$34.64	$624	$0	$1,500	$0	$0	$2,124
	GEN	U.C. per Ea		1.25	CN-CARP	43.3	0	125	0	0	168.3
Single Tier Locker - 12" x 15" x 72"			60.00	75	$34.64	$2,598	$0	$7,500	$0	$0	$10,098
	GEN	U.C. per Ea		0.3	CN-CARP	10.392	0	55	0	0	65.392
Waste Receptacle			4.00	1	$34.64	$42	$0	$220	$0	$0	$262
	GEN	U.C. per Ea				0	0	0	250000	0	250000
Freight Elevator			1.00	0		$0	$0	$0	$250,000	$0	$250,000

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9110.1 SPECIALTIES - GFF										
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	750000	0	0	763808
Auto Retrieval System With Three Fork Lifts		1.00	400	$34.52	$13,808	$0	$750,000	$0	$0	$763,808
Subtotal					$73,318	$0	$1,351,905	$1,190,000	$0	$2,615,223
Sales Tax					$0	$0	$67,595	$0	$0	$67,595
INEEL ORG Labor/Subcontractor Overheads					$21,284	$0	$412,081	$345,457	$0	$778,822
Subtotal Estimate										$3,461,641
Escalation					$24,275	$0	$469,984	$393,998	$0	$888,257
Contingency					$35,663	$0	$690,469	$578,837	$0	$1,304,969
—Total 9110.1 SPECIALTIES - GFF			2,323		$154,541	$0	$2,992,034	$2,508,292	$0	$5,654,867
— 9110.2 SPECIALTIES - TFD FACILITY										
	GEN	U.C. per Ea	120	CN-IRON	4819.2	0	75000	0	0	79819.2
20 Ton O.H. Crane		1.00	120	$40.16	$4,819	$0	$75,000	$0	$0	$79,819
	GEN	U.C. per Ea	80	CN-IRON	3212.8	0	50000	0	0	53212.8
Hot Cell O.H. Crane		1.00	80	$40.16	$3,213	$0	$50,000	$0	$0	$53,213
	GEN	U.C. per Ea	100	CN-MILL	3292	0	170000	0	0	173292
Shielding Windows - 2' Thick		8.00	800	$32.92	$26,336	$0	$1,360,000	$0	$0	$1,386,336
	GEN	U.C. per Ea	200	CN-MILL	6584	0	1419000	0	0	1425584
PaR Manipulators - Model 4350 - Wall Mounted		4.00	800	$32.92	$26,336	$0	$5,676,000	$0	$0	$5,702,336
	GEN	U.C. per Lot			0	0	0	6000000	0	6000000
Robotic / Remote Handling Allowance		1.00	0		$0	$0	$0	$6,000,000	$0	$6,000,000
Subtotal					$60,704	$0	$7,161,000	$6,000,000	$0	$13,221,704
Sales Tax					$0	$0	$358,050	$0	$0	$358,050
INEEL ORG Labor/Subcontractor Overheads					$17,622	$0	$2,182,780	$1,741,800	$0	$3,942,203
Subtotal Estimate										$17,521,957
Escalation					$20,099	$0	$2,489,490	$1,986,546	$0	$4,496,134
Contingency					$29,527	$0	$3,657,396	$2,918,504	$0	$6,605,427
—Total 9110.2 SPECIALTIES - TFD FACILITY			1,800		$127,952	$0	$15,848,716	$12,646,850	$0	$28,623,518
— 9110.3 SPECIALTIES - BOILER HOUSE										
	GEN	U.C. per Ea	100	CN-IRON	4016	0	40000	0	0	44016
10 Ton O.H. Crane		1.00	100	$40.16	$4,016	$0	$40,000	$0	$0	$44,016

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.3 SPECIALTIES - BOILER HOUSE										
Subtotal					$4,016	$0	$40,000	$0	$0	$44,016
Sales Tax					$0	$0	$2,000	$0	$0	$2,000
INEEL ORG Labor/Subcontractor Overheads					$1,166	$0	$12,193	$0	$0	$13,358
Subtotal Estimate										$59,374
Escalation					$1,330	$0	$13,906	$0	$0	$15,235
Contingency					$1,953	$0	$20,430	$0	$0	$22,383
---Total 9110.3 SPECIALTIES - BOILER HOUSE			100		$8,465	$0	$88,528	$0	$0	$96,993
--- 9110.4 SPECIALTIES - STORAGE FACILITY										
GEN	U.C. per EA		50	CN-IRON	2008	0	23100	0	0	25108
VAULT TUBE ASSEMBLIES		1,584.00	79,200	$40.16	$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Subtotal					$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Sales Tax					$0	$0	$1,829,520	$0	$0	$1,829,520
INEEL ORG Labor/Subcontractor Overheads					$923,349	$0	$11,153,303	$0	$0	$12,076,652
Subtotal Estimate										$53,677,244
Escalation					$1,053,092	$0	$12,720,489	$0	$0	$13,773,581
Contingency					$1,547,134	$0	$18,688,114	$0	$0	$20,235,247
---Total 9110.4 SPECIALTIES - STORAGE FACILITY			79,200		$6,704,247	$0	$80,981,825	$0	$0	$87,686,072
--- 9111.1.1 EQUIPMENT - GFF										
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Filter Feed Pump - P-201-2a & 2b (Skid Mounted)		2.00	20	$37.58	$752	$0	$15,000	$0	$0	$15,752
PIPE	U.C. per Ea		6	CN-PIPE	225.48	500	5500	0	0	6225.48
SBW Slurry XFR Pump - P-201-6a, b - 30 hp		2.00	12	$37.58	$451	$1,000	$11,000	$0	$0	$12,451
PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	15000	0	0	15300.64
SBW Day Tank - T-201-2a, b - 1179 Gal. - SST		2.00	16	$37.58	$601	$0	$30,000	$0	$0	$30,601
PIPE	U.C. per Ea		40	CN-PIPE	1503.2	0	100000	0	0	101503.2
Cross Flow Filter - CF-201-1, 2 (36"x60"x65")		2.00	80	$37.58	$3,006	$0	$200,000	$0	$0	$203,006
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	1200	0	0	1275.16
Extraction Feed Pump - P-201-5 - .375 hp		1.00	2	$37.58	$75	$0	$1,200	$0	$0	$1,275
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	500	0	0	575.16
Solvent Feed Pump - P-202-5 - .25 hp		1.00	2	$37.58	$75	$0	$500	$0	$0	$575
PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	8500	0	0	8725.48
UNEX Solvent Tank - T-202-5 - 500 Gal. - SST		1.00	6	$37.58	$225	$0	$8,500	$0	$0	$8,725
PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Extraction Contactor - CON-202-1-14 (3'x13'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
-- 9111.1.1 EQUIPMENT - GFF										
PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Scrubbing Contactor - SB-202-1-2 (3'x2'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Stripping Contactor - SP-202-1-8 (3'x7'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	31000	0	0	31950.96
SBW Feed Tank - T-201-1 - 4718 Gal. SST		1.00	12	$37.58	$451	$500	$31,000	$0	$0	$31,951
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	21000	0	0	21875.8
Extraction Feed Tank - T-201-5a, b, c - 2359 Gal. SST		3.00	30	$37.58	$1,127	$1,500	$63,000	$0	$0	$65,627
PIPE	U.C. per Ea		8	CN-PIPE	300.64	250	18600	0	0	19150.64
UNEX Raffinate Tank - T-202-6a, b - 1761 Gal. SST		2.00	16	$37.58	$601	$500	$37,200	$0	$0	$38,301
PIPE	U.C. per Ea		6	CN-PIPE	225.48	250	14900	0	0	15375.48
UNEX Strip Effluent Tank - T-202-14 - 1124 Gal. SST		1.00	6	$37.58	$225	$250	$14,900	$0	$0	$15,375
PIPE	U.C. per Ea		16	CN-PIPE	601.28	0	4500	0	0	5101.28
SBW XFR Pump - P201-1 - 30 hp		1.00	16	$37.58	$601	$0	$4,500	$0	$0	$5,101
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Raffinate XFR Pump - P-202-6a - .25 hp		1.00	3	$37.58	$113	$0	$600	$0	$0	$713
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	2800	0	0	2950.32
Raffinate Off Spec. XFR Pump - P-202-6b - 2 hp		1.00	4	$37.58	$150	$0	$2,800	$0	$0	$2,950
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Strip Effluent XFR Pump - P-202-14 - .25 hp		1.00	3	$37.58	$113	$0	$600	$0	$0	$713
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
HF Pump - P-201-4 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Dicarbolide Feed Pump - P-202-1 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
PEG Feed Pump - P-202-2 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
CMPO Feed Pump - P-202-3 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
FS-13 Feed Pump - P-202-4 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Acid Feed Pump - P-202-7 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Aluminum Nitrate Feed Pump - P-202-8 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.1.1 EQUIPMENT - GFF										
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Makeup XFR Pump - P-202-9 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Solution Feed Pump - P-202-10 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
DTPA Feed Pump - P-202-11 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Makeup XFR Pump - P-202-12 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Solution Feed Pump - P-202-13 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		16	CN-PIPE	601.28	500	20500	0	0	21601.28
HF Storage Tank - T-201-3 - 4000 Gal. - C-276		1.00	16	$37.58	$601	$500	$20,500	$0	$0	$21,601
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	4000	0	0	4112.74
HF Makeup Tank - T-201-4 - 237 Gal. - C-276		1.00	3	$37.58	$113	$0	$4,000	$0	$0	$4,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Dicarbolide Feed Tank - T-202-1 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
PEG 400 Feed Tank - T-202-2 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Ph2Bu2CMPO Feed Tank - T-202-3a, b - 55 Gal. SST		2.00	6	$37.58	$225	$0	$4,000	$0	$0	$4,225
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
FS-13 Tank - T-202-4 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Recycle Acid Tank - T-202-7 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Aluminum Nitrate Tank - T-202-8 -55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	11900	0	0	12775.8
UNEX Scrub Makeup Tank - T-202-9 - 807 Gal. SST		1.00	10	$37.58	$376	$500	$11,900	$0	$0	$12,776
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	12500	0	0	13375.8
UNEX Scrub Solution Tank - T-202-10 - 888 Gal. SST		1.00	10	$37.58	$376	$500	$12,500	$0	$0	$13,376
PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	15000	0	0	15950.96
UNEX Strip Makeup Tank - T-202-12 - 1132 Gal. SST		1.00	12	$37.58	$451	$500	$15,000	$0	$0	$15,951

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.1 EQUIPMENT - GFF											
	PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	16000	0	0	16950.96
UNEX Strip Solution Feed Tank - T-202-13 - 1245 Gal. SST			1.00	12	$37.58	$451	$500	$16,000	$0	$0	$16,951
Subtotal						$15,145	$9,250	$1,423,300	$0	$0	$1,447,695
Sales Tax						$0	$0	$71,165	$0	$0	$71,165
INEEL ORG Labor/Subcontractor Overheads						$7,285	$4,450	$718,897	$0	$0	$730,632
Subtotal Estimate											$2,249,492
Escalation						$5,756	$3,515	$567,949	$0	$0	$577,220
Contingency						$15,220	$9,296	$1,501,908	$0	$0	$1,526,424
---Total 9111.1.1 EQUIPMENT - GFF				403		$43,406	$26,511	$4,283,219	$0	$0	$4,353,136
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp			1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)			1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp			1.00	2	$37.58	$75	$0	$800	$0	$0	$875
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp			1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp			3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
	PIPE	U.C. per Ea		24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST			1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST			1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST			1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST			3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602
B-105	PIPE	U.C. per EA		80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF			1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF			1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF			1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')			1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea		40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")			1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503
	PIPE	U.C. per Ea		60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")			1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255
B-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3			1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr			4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3			1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA		80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3			2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER			2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN			2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3			3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN			3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627
M-101A,B&C	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3			3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764
B-106A	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3			1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK			2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127
P-106	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.1.2 EQUIPMENT - GROUT FACILITY											
P-115	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA		50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3			1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY			1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR			1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY			1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL			1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE			3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH			1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per LOT		100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT			1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per LOT		100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL			1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR		1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK		1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA		14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per LOT	500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE		1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT		2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE		1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE		1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
-- 9111.1.2 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR			1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT			2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS			9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,000	$10,750	$3,263,500	$0	$0	$3,556,250
Sales Tax						$0	$0	$163,175	$0	$0	$163,175
INEEL ORG Labor/Subcontractor Overheads						$135,653	$5,171	$1,648,368	$0	$0	$1,789,192
Subtotal Estimate											$5,508,618
Escalation						$107,170	$4,085	$1,302,256	$0	$0	$1,413,511
Contingency						$283,405	$10,804	$3,443,741	$0	$0	$3,737,950
---Total 9111.1.2 EQUIPMENT - GROUT FACILITY				7,504		$808,228	$30,810	$9,821,040	$0	$0	$10,660,079
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY											
	PIPE	U.C. per Ea		100	CN-PIPE	3758	3000	1000000	0	0	1006758
Thin Film Dryer -TFD203-1 (12'x12'x25')			1.00	100	$37.58	$3,758	$3,000	$1,000,000	$0	$0	$1,006,758
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	500	0	0	575.16
TFD Feed Pump - P-203-2 - .25 hp			1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Strip Cystallizer Condensate Pump - P-203-1 - Skid Mounted			1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY									
PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	10000	0	0	10225.48
TFD Vacuum Pump - VP-203-1	1.00	6	$37.58	$225	$0	$10,000	$0	$0	$10,225
PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	1500	0	0	1575.16
Chrystallizer Condensate Tank - T-203-1 - 10 Gal - SST	1.00	2	$37.58	$75	$0	$1,500	$0	$0	$1,575
PIPE	U.C. per Ea	8	CN-PIPE	300.64	500	15000	0	0	15800.64
Strip Feed Tank - T-203-2 - 1124 Gal. - SST (NWCF Only)	1.00	8	$37.58	$301	$500	$15,000	$0	$0	$15,801
Subtotal				$4,810	$3,500	$1,034,500	$0	$0	$1,042,810
Sales Tax				$0	$0	$51,725	$0	$0	$51,725
INEEL ORG Labor/Subcontractor Overheads				$2,314	$1,684	$522,518	$0	$0	$526,515
Subtotal Estimate									$1,621,050
Escalation				$1,828	$1,330	$412,803	$0	$0	$415,962
Contingency				$4,834	$3,517	$1,091,635	$0	$0	$1,099,986
---Total 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY		128		$13,786	$10,031	$3,113,181	$0	$0	$3,136,999
--- 9111.3 EQUIPMENT - BOILER HOUSE									
GEN	U.C. per EA	60	CN-BOILMK	1384.8	0	200000	0	0	201384.8
BOILERS	2.00	120	$23.08	$2,770	$0	$400,000	$0	$0	$402,770
GEN	U.C. per EA	40	CN-BOILMK	923.2	0	20000	0	0	20923.2
FEED WATER HEATER	2.00	80	$23.08	$1,846	$0	$40,000	$0	$0	$41,846
PIPE	U.C. per LOT	500	CN-PIPE	18790	0	100000	0	0	118790
CHEMICAL FEED SYSTEM	1.00	500	$37.58	$18,790	$0	$100,000	$0	$0	$118,790
PIPE	U.C. per LOT	1800	CN-PIPE	67644	0	250000	0	0	317644
WATER TREATMENT SYSTEM	1.00	1,800	$37.58	$67,644	$0	$250,000	$0	$0	$317,644
TANK	U.C. per BBL			0	0	0	65	0	65
OIL STORAGE TANK, ~750 BBL	750.00	0		$0	$0	$0	$48,750	$0	$48,750
Subtotal				$91,050	$0	$790,000	$48,750	$0	$929,800
Sales Tax				$0	$0	$39,500	$0	$0	$39,500
INEEL ORG Labor/Subcontractor Overheads				$42,918	$0	$310,901	$20,442	$0	$374,261
Subtotal Estimate									$1,343,561
Escalation				$34,376	$0	$292,627	$17,755	$0	$344,758
Contingency				$90,906	$0	$773,835	$46,951	$0	$911,692
---Total 9111.3 EQUIPMENT - BOILER HOUSE		2,500		$259,251	$0	$2,206,863	$133,899	$0	$2,600,012
--- 9111.4 EQUIPMENT - GROUTING FACILITY									
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp	1.00	3	$37.58	$113	$0	$800	$0	$0	$913

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)		1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp		1.00	2	$37.58	$75	$0	$800	$0	$0	$875
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp		3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
	PIPE	U.C. per Ea	24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST		1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST		1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST		1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST		3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602
B-105	PIPE	U.C. per EA	80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF		1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA	60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF		1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA	60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF		1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF		1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3700	0	0	3812.74
CaOH Day Storage Tank - T-205-6b - 46 CF (UNEX Only)		1.00	3	$37.58	$113	$0	$3,700	$0	$0	$3,813
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF		1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')		1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea	40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")		1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503
	PIPE	U.C. per Ea	60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")		1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
9111.4 EQUIPMENT - GROUTING FACILITY										
B-104	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3		1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr		4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3		1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA	80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3		2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER		2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN		2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3		3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN		3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627
M-101A,B&C	PIPE	U.C. per EA	60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3		3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764
B-106A	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3		1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK		2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127
P-106	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
P-115	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA	50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3		1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.4 EQUIPMENT - GROUTING FACILITY											
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY			1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR			1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY			1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL			1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.4 EQUIPMENT - GROUTING FACILITY										
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH		1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR		1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK		1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA		14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY										
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
PIPE	U.C. per LOT		500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE		1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT		2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'		8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
PIPE	U.C. per EA		400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE		1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE		1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127
PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR		1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT		2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS		9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.4 EQUIPMENT - GROUTING FACILITY											
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147.
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,113	$10,750	$3,267,200	$0	$0	$3,560,063
Sales Tax						$0	$0	$163,360	$0	$0	$163,360
INEEL ORG Labor/Subcontractor Overheads						$135,708	$5,171	$1,650,237	$0	$0	$1,791,115
Subtotal Estimate											$5,514,538
Escalation						$107,213	$4,085	$1,303,732	$0	$0	$1,415,031
Contingency						$283,518	$10,804	$3,447,646	$0	$0	$3,741,967
---Total 9111.4 EQUIPMENT - GROUTING FACILITY				7,507		$808,552	$30,810	$9,832,175	$0	$0	$10,671,536
--- 9111.5 EQUIPMENT - STORAGE FACILITY											
	GEN	U.C. per Lot		750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment			1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
	GEN	U.C. per Ea		400	CN-SKWK	13808	0	2500000	0	0	2513808
Smeared Canister Loadout Crane			1.00	400	$34.52	$13,808	$0	$2,500,000	$0	$0	$2,513,808
	GEN	U.C. per Ea		400	CN-SKWK	13808	0	250000	0	0	263808
Canister Storage Crane - Clean Environment			1.00	400	$34.52	$13,808	$0	$250,000	$0	$0	$263,808
	GEN	U.C. per Ea		200	CN-SKWK	6904	0	103000	0	0	109904
Canister Heater			2.00	400	$34.52	$13,808	$0	$206,000	$0	$0	$219,808
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	175000	0	0	178452
CO2 System			1.00	100	$34.52	$3,452	$0	$175,000	$0	$0	$178,452
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	25000	0	0	28452
Canister Transportation Cart			1.00	100	$34.52	$3,452	$0	$25,000	$0	$0	$28,452
	GEN	U.C. per Ea		120	CN-SKWK	4142.4	0	257500	0	0	261642.4
Canister Lifting Mechanism			2.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
	GEN	U.C. per Ea		80	CN-SKWK	2761.6	0	120000	0	0	122761.6
Canister Sealing Manipulator			1.00	80	$34.52	$2,762	$0	$120,000	$0	$0	$122,762

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.5 EQUIPMENT - STORAGE FACILITY											
	GEN	U.C. per Ea		120	CN-SKWK	4142.4	0	50000	0	0	54142.4
Decon Solution Pumping Station			1.00	120	$34.52	$4,142	$0	$50,000	$0	$0	$54,142
	GEN	U.C. per Lot		240	CN-SKWK	8284.8	0	515000	0	0	523284.8
Decon Cell Equipment			1.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
	GEN	U.C. per Lot		240	CN-SKWK	8284.8	0	500000	0	0	508284.8
Decon / Disassembly Equipment - Turntable, Manipulator Tools, W/ Rack & Etc.			1.00	240	$34.52	$8,285	$0	$500,000	$0	$0	$508,285
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	515000	0	0	518452
Smear Monitor			1.00	100	$34.52	$3,452	$0	$515,000	$0	$0	$518,452
	GEN	U.C. per Ea			CN-SKWK	0	0	0	42000	0	42000
Smear Station Module			1.00	0		$0	$0	$0	$42,000	$0	$42,000
	GEN	U.C. per Ea		80	CN-SKWK	2761.6	0	150000	0	0	152761.6
Shuttle Cart			1.00	80	$34.52	$2,762	$0	$150,000	$0	$0	$152,762
	GEN	U.C. per Ea		40	CN-SKWK	1380.8	0	41200	0	0	42580.8
Glove Box			1.00	40	$34.52	$1,381	$0	$41,200	$0	$0	$42,581
	GEN	U.C. per Ea		24	CN-SKWK	828.48	0	3000	0	0	3828.48
Cameras			30.00	720	$34.52	$24,854	$0	$90,000	$0	$0	$114,854
	GEN	U.C. per Ea		200	CN-SKWK	6904	0	103000	0	0	109904
Weld Station Module			1.00	200	$34.52	$6,904	$0	$103,000	$0	$0	$109,904
	GEN	U.C. per Ea		400	CN-SKWK	13808	0	2575000	0	0	2588808
HLW Canister Transfer Cart			1.00	400	$34.52	$13,808	$0	$2,575,000	$0	$0	$2,588,808
	GEN	U.C. per Ea		200	CN-SKWK	6904	0	7000	0	0	13904
Empty Canister Receiving Crane			2.00	400	$34.52	$13,808	$0	$14,000	$0	$0	$27,808
	GEN	U.C. per Ea		200	CN-SKWK	6904	0	250000	0	0	256904
PaR Manipulator			1.00	200	$34.52	$6,904	$0	$250,000	$0	$0	$256,904
	GEN	U.C. per Ea			CN-SKWK	0	0	0	2060000	0	2060000
Canister Fill Monitoring Instruments			2.00	0		$0	$0	$0	$4,120,000	$0	$4,120,000
	GEN	U.C. per Ea		100	CN-SKWK	3452	0	1030000	0	0	1033452
Canister Welder Leak Check Module			1.00	100	$34.52	$3,452	$0	$1,030,000	$0	$0	$1,033,452

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.5 EQUIPMENT - STORAGE FACILITY											
	GEN	U.C. per Lot		300	CN-SKWK	10356	0	1000000	0	0	1010356
Misc. Equipment			1.00	300	$34.52	$10,356	$0	$1,000,000	$0	$0	$1,010,356
Subtotal						$193,657	$0	$11,374,200	$4,162,000	$0	$15,729,857
Sales Tax						$0	$0	$568,710	$0	$0	$568,710
INEEL ORG Labor/Subcontractor Overheads						$56,219	$0	$3,467,027	$1,208,229	$0	$4,731,474
Subtotal Estimate											$21,030,041
Escalation						$64,118	$0	$3,954,190	$1,378,001	$0	$5,396,309
Contingency						$169,557	$0	$10,456,628	$3,644,044	$0	$14,270,229
—Total 9111.5 EQUIPMENT - STORAGE FACILITY				5,610		$483,551	$0	$29,820,755	$10,392,273	$0	$40,696,579
— 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY											
	GEN	U.C. per EA		1000	CN-SKWK	34520	0	2500000	0	0	2534520
GANTRY CRANE			2.00	2,000	$34.52	$69,040	$0	$5,000,000	$0	$0	$5,069,040
	GEN	U.C. per EA		500	CN-SKWK	17260	0	300000	0	0	317260
TRANSFER CART IN TUNNEL			1.00	500	$34.52	$17,260	$0	$300,000	$0	$0	$317,260
	GEN	U.C. per EA		300	CN-SKWK	10356	0	250000	0	0	260356
5 TON DECONTAMINATABLE BRIDGE CRANE			2.00	600	$34.52	$20,712	$0	$500,000	$0	$0	$520,712
	GEN	U.C. per EA		1000	CN-SKWK	34520	0	1000000	0	0	1034520
CASK MANUVERING HYDRAULIC PLATFORM			1.00	1,000	$34.52	$34,520	$0	$1,000,000	$0	$0	$1,034,520
Subtotal						$141,532	$0	$6,800,000	$0	$0	$6,941,532
Sales Tax						$0	$0	$340,000	$0	$0	$340,000
INEEL ORG Labor/Subcontractor Overheads						$41,087	$0	$2,072,742	$0	$0	$2,113,829
Subtotal Estimate											$9,395,361
Escalation						$46,860	$0	$2,363,990	$0	$0	$2,410,850
Contingency						$18,358	$0	$926,139	$0	$0	$944,497
—Total 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY				4,100		$247,837	$0	$12,502,870	$0	$0	$12,750,707
— 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX											
	HVAC	U.C. per Ea		10	CN-SHEE	354.8	500	5700	0	0	6554.8
Vent. Centrifugal Fans - 20 hp			5.00	50	$35.48	$1,774	$2,500	$28,500	$0	$0	$32,774
	HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 25 hp			7.00	84	$35.48	$2,980	$3,500	$63,000	$0	$0	$69,480
	HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 30 hp			5.00	60	$35.48	$2,129	$2,500	$45,000	$0	$0	$49,629
	HVAC	U.C. per Ea		18	CN-SHEE	638.64	500	13000	0	0	14138.64
Vent. Centrifugal Fans - 40 hp			5.00	90	$35.48	$3,193	$2,500	$65,000	$0	$0	$70,693

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX										
HVAC	U.C. per Ea		14	CN-SHEE	496.72	500	15000	0	0	15996.72
Vent. Centrifugal Fans - 50 hp		14.00	196	$35.48	$6,954	$7,000	$210,000	$0	$0	$223,954
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	27000	0	0	28919.2
Vent. Centrifugal Fans - 60 hp		3.00	120	$35.48	$4,258	$1,500	$81,000	$0	$0	$86,758
HVAC	U.C. per Ea		30	CN-SHEE	1064.4	500	72000	0	0	73564.4
*HEPA Filter Bank - Single Stage - 4X4 - 12 Filters Per Bank Memo: Each Filter is 24" x 24".		2.00	60	$35.48	$2,129	$1,000	$144,000	$0	$0	$147,129
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	96000	0	0	97919.2
*HEPA Filter Bank - Single Stage - 4X4 - 16 Filters Per Bank Memo: Each Filter is 24" x 24".		23.00	920	$35.48	$32,642	$11,500	$2,208,000	$0	$0	$2,252,142
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	144000	0	0	145919.2
*HEPA Filter Bank - Dual Stage - 4X4 - 12 Filters Per Bank Memo: Each Filter is 24" x 24".		2.00	80	$35.48	$2,838	$1,000	$288,000	$0	$0	$291,838
HVAC	U.C. per Ea		50	CN-SHEE	1774	500	192000	0	0	194274
*HEPA Filter Bank - Dual Stage - 4X4 - 16 Filters Per Bank Memo: Each Filter is 24" x 24".		4.00	200	$35.48	$7,096	$2,000	$768,000	$0	$0	$777,096
HVAC	U.C. per Ea		60	CN-SHEE	2128.8	0	35000	0	0	37128.8
Chiller (Complete With Compressor & Fans) - 80 Ton		1.00	60	$35.48	$2,129	$0	$35,000	$0	$0	$37,129
HVAC	U.C. per Ea		48	CN-SHEE	1703.04	0	21000	0	0	22703.04
Chiller (Complete With Compressor & Fans) - 40 Ton		1.00	48	$35.48	$1,703	$0	$21,000	$0	$0	$22,703
HVAC	U.C. per Ea		0.9	CN-SHEE	31.932	0	150	0	0	181.932
Actuated Air Dampers		100.00	90	$35.48	$3,193	$0	$15,000	$0	$0	$18,193
HVAC	U.C. per Lot		100	CN-SHEE	3548	0	2500	0	0	6048
Pre-Filters		1.00	100	$35.48	$3,548	$0	$2,500	$0	$0	$6,048
HVAC	U.C. per Lot		100	CN-SHEE	3548	0	5000	0	0	8548
Heating Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
HVAC	U.C. per Lot		100	CN-SHEE	3548	0	5000	0	0	8548
Cooling Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX										
	HVAC	U.C. per Lot	40	CN-SHEE	1419.2	0	2000	0	0	3419.2
Heat Recovery Coil		1.00	40	$35.48	$1,419	$0	$2,000	$0	$0	$3,419
Subtotal					$85,081	$35,000	$3,986,000	$0	$0	$4,106,081
Sales Tax					$0	$0	$199,300	$0	$0	$199,300
INEEL ORG Labor/Subcontractor Overheads					$38,827	$15,972	$1,909,987	$0	$0	$1,964,786
Subtotal Estimate										$6,270,168
Escalation					$31,795	$13,080	$1,564,051	$0	$0	$1,608,925
Contingency					$40,483	$16,654	$1,991,428	$0	$0	$2,048,564
---Total 9115.2.1 HVAC EQUIPMENT - NEW - GFF - UNEX			2,398		$198,186	$80,706	$9,650,765	$0	$0	$9,927,657
--- 9115.2.1 HVAC - TFD FACILITY - HOT CELL										
	HVAC	U.C. per Lot	1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork		1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The hot cell is approximately 77' x 51' x 77' high.										
	HVAC	U.C. per Lot	700	CN-SHEE	24836	3000	125000	0	0	152836
HVAC Equipment		1.00	700	$35.48	$24,836	$3,000	$125,000	$0	$0	$152,836
	HVAC	U.C. per Lot	300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters		1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers		1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal		1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance		1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal					$92,248	$3,000	$306,500	$0	$0	$401,748
Sales Tax					$0	$0	$15,325	$0	$0	$15,325
INEEL ORG Labor/Subcontractor Overheads					$42,098	$1,369	$146,867	$0	$0	$190,334
Subtotal Estimate										$607,407
Escalation					$34,473	$1,121	$120,266	$0	$0	$155,861
Contingency					$43,893	$1,427	$153,129	$0	$0	$198,450
---Total 9115.2.1 HVAC - TFD FACILITY - HOT CELL			2,600		$212,712	$6,918	$742,087	$0	$0	$961,717
--- 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS										
Memo: The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.										
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	0	140000	0	0	281920
(*)Sheet Metal Ductwork		1.00	4,000	$35.48	$141,920	$0	$140,000	$0	$0	$281,920
Memo: Includes all corridors and equipment areas - approximately 72,500 square feet of floor space.										

Project Name:	CONSTRUCTION DETAIL ITEM REPORT	Client:	*V. J. Balls*
UNEX Feasibility Study - Option B - Modified UNEX In GFF		Prepared By:	*Rowley / Mitchell / Marler*
Project Location: *INTEC*		Estimate Type:	*Planning*
Estimate Number: *2570 - Option B*			

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS										
Memo:	***The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.***									
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	15000	525000	0	0	681920
HVAC Equipment		1.00	4,000	$35.48	$141,920	$15,000	$525,000	$0	$0	$681,920
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	13000	0	0	20096
Diffusers, Grilles, Dampers, Registers		1.00	200	$35.48	$7,096	$0	$13,000	$0	$0	$20,096
	HVAC	U.C. per Lot	350	CN-SHEE	12418	0	5000	0	0	17418
Misc. Sheet Metal		1.00	350	$35.48	$12,418	$0	$5,000	$0	$0	$17,418
	HVAC	U.C. per Lot	300	CN-SHEE	10644	0	0	0	0	10644
Test & Balance		1.00	300	$35.48	$10,644	$0	$0	$0	$0	$10,644
Subtotal					$313,998	$15,000	$683,000	$0	$0	$1,011,998
Sales Tax					$0	$0	$34,150	$0	$0	$34,150
INEEL ORG Labor/Subcontractor Overheads					$143,295	$6,845	$327,276	$0	$0	$477,416
Subtotal Estimate										$1,523,564
Escalation					$117,341	$5,606	$268,000	$0	$0	$390,947
Contingency					$149,405	$7,137	$341,231	$0	$0	$497,773
---Total 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS			8,850		$724,039	$34,588	$1,653,656	$0	$0	$2,412,283
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY										
	PIPE	U.C. per Sf	0.1	CN-PIPE	3.758	0	5	0	0	8.758
Process Piping		13,700.00	1,370	$37.58	$51,485	$0	$68,500	$0	$0	$119,985
	PIPE	U.C. per Sf	0.05	CN-PIPE	1.879	0	3	0	0	4.879
Building Plumbing		13,700.00	685	$37.58	$25,742	$0	$41,100	$0	$0	$66,842
Subtotal					$77,227	$0	$109,600	$0	$0	$186,827
Sales Tax					$0	$0	$5,480	$0	$0	$5,480
INEEL ORG Labor/Subcontractor Overheads					$37,149	$0	$55,358	$0	$0	$92,507
Subtotal Estimate										$284,814
Escalation					$29,349	$0	$43,734	$0	$0	$73,083
Contingency					$37,369	$0	$55,685	$0	$0	$93,053
---Total 9115.2.3 PLUMBING / PIPING - TFD FACILITY			2,055		$181,094	$0	$269,857	$0	$0	$450,951
--- 9115.4.2 HVAC - NEW - BOILER HOUSE										
	HVAC	U.C. per LOT	200	CN-SHEE	7096	240	36700	1000	0	45036
HVAC		1.00	200	$35.48	$7,096	$240	$36,700	$1,000	$0	$45,036

Memo: Based on AFC estimate #2547-A. This will be a two boiler system vs. a four in estimate 2547-A; all quantities are halved.

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.2 HVAC - NEW - BOILER HOUSE										
Subtotal					$7,096	$240	$36,700	$1,000	$0	$45,036
Sales Tax					$0	$0	$1,835	$0	$0	$1,835
INEEL ORG Labor/Subcontractor Overheads					$3,238	$110	$17,586	$456	$0	$21,390
Subtotal Estimate										$68,261
Escalation					$2,652	$90	$14,401	$374	$0	$17,516
Contingency					$3,376	$114	$18,336	$476	$0	$22,302
---Total 9115.4.2 HVAC - NEW - BOILER HOUSE			200		$16,362	$553	$88,857	$2,306	$0	$108,079
--- 9115.4.3 PLUMBING - BOILER HOUSE										
	PIPE	U.C. per Lot	40	CN-PIPE	1503.2	0	600	0	0	2103.2
Building Drain		1.00	40	$37.58	$1,503	$0	$600	$0	$0	$2,103
	PIPE	U.C. per Lot	20	CN-PIPE	751.6	0	300	0	0	1051.6
Building Water		1.00	20	$37.58	$752	$0	$300	$0	$0	$1,052
Subtotal					$2,255	$0	$900	$0	$0	$3,155
Sales Tax					$0	$0	$45	$0	$0	$45
INEEL ORG Labor/Subcontractor Overheads					$1,085	$0	$455	$0	$0	$1,539
Subtotal Estimate										$4,739
Escalation					$857	$0	$359	$0	$0	$1,216
Contingency					$1,091	$0	$457	$0	$0	$1,548
---Total 9115.4.3 PLUMBING - BOILER HOUSE			60		$5,287	$0	$2,216	$0	$0	$7,503
--- 9115.4.4 PIPING - NEW - BOILER HOUSE										
	PIPE	U.C. per LOT	2325	CN-PIPE	87373.5	1820	89150	0	0	178343.5
STEAM & SUPPORT PIPING		1.00	2,325	$37.58	$87,374	$1,820	$89,150	$0	$0	$178,344
	INSUL	U.C. per LOT	175	CN-ASBE	6461	0	8920	0	0	15381
PIPE INSULATION		1.00	175	$36.92	$6,461	$0	$8,920	$0	$0	$15,381
Subtotal					$93,835	$1,820	$98,070	$0	$0	$193,725
Sales Tax					$0	$0	$4,904	$0	$0	$4,904
INEEL ORG Labor/Subcontractor Overheads					$44,739	$875	$48,956	$0	$0	$94,571
Subtotal Estimate										$293,199
Escalation					$35,558	$692	$38,985	$0	$0	$75,235
Contingency					$45,274	$881	$49,638	$0	$0	$95,793
---Total 9115.4.4 PIPING - NEW - BOILER HOUSE			2,500		$219,406	$4,268	$240,553	$0	$0	$464,227
--- 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE										
	FP	U.C. per SF			0	0	0	3.5	0	3.5
FIRE SPRINKLER SYSTEM - BOILER BUILDING		3,120.00	0		$0	$0	$0	$10,920	$0	$10,920

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE										
Subtotal					$0	$0	$0	$10,920	$0	$10,920
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$4,579	$0	$4,579
Subtotal Estimate										$15,499
Escalation					$0	$0	$0	$3,977	$0	$3,977
Contingency					$0	$0	$0	$5,064	$0	$5,064
--Total 9115.4.5 FIRE PROTECTION - NEW - BOILER HOUSE			0		$0	$0	$0	$24,540	$0	$24,540
--- 9115.4 MECHANICAL - NEW - STORAGE FACILITY										
	PIPE	U.C. per LOT			0	0	0	40000	0	40000
MISC. PIPING - ALLOW		1.00	0		$0	$0	$0	$40,000	$0	$40,000
	FP	U.C. per SF			0	0	0	3.5	0	3.5
FIRE PROTECTION		20,440.00	0		$0	$0	$0	$71,540	$0	$71,540
	HVAC	U.C. per SF	0.18	CN-SHEE	6.386	0	11.2	0	0	17.586
HVAC		20,440.00	3,679	$35.48	$130,538	$0	$228,928	$0	$0	$359,466
Subtotal					$130,538	$0	$228,928	$111,540	$0	$471,006
Sales Tax					$0	$0	$11,446	$0	$0	$11,446
INEEL ORG Labor/Subcontractor Overheads					$59,572	$0	$109,696	$49,240	$0	$218,509
Subtotal Estimate										$700,961
Escalation					$48,782	$0	$89,828	$41,256	$0	$179,867
Contingency					$62,112	$0	$114,374	$52,530	$0	$229,015
---Total 9115.4 MECHANICAL - NEW - STORAGE FACILITY			3,679		$301,004	$0	$554,273	$254,566	$0	$1,109,843
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF										
	ELEC	U.C. per Ea	96	CN-ELEC	3275.52	2500	200000	0	0	205775.52
4000 amp, 480/277 double ended 3R walk-in switchgear		1.00	96	$34.12	$3,276	$2,500	$200,000	$0	$0	$205,776
	ELEC	U.C. per Ea	24	CN-ELEC	818.88	2500	75000	0	0	78318.88
2500 kVA 13.8-480/277 transformers		2.00	48	$34.12	$1,638	$5,000	$150,000	$0	$0	$156,638
	ELEC	U.C. per Ls	32	CN-ELEC	1091.84	0	10000	0	0	11091.84
4000 amp armor clad busway		1.00	32	$34.12	$1,092	$0	$10,000	$0	$0	$11,092
	ELEC	U.C. per Ea	24	CN-ELEC	818.88	0	12000	0	0	12818.88
800 amp 480 volt standby power panels		1.00	24	$34.12	$819	$0	$12,000	$0	$0	$12,819
	ELEC	U.C. per Ea	16	CN-ELEC	545.92	0	10000	0	0	10545.92
1200 amp 480 volt normal power panels		2.00	32	$34.12	$1,092	$0	$20,000	$0	$0	$21,092
	ELEC	U.C. per Ls			0	0	0	0	35000	35000
Vault and equipment pads for main gear and transformers		1.00	0		$0	$0	$0	$0	$35,000	$35,000

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF										
	ELEC	U.C. per Ea	12	CN-ELEC	409.44	0	5000	0	0	5409.44
480 volt power panels		6.00	72	$34.12	$2,457	$0	$30,000	$0	$0	$32,457
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers		4.00	32	$34.12	$1,092	$0	$6,800	$0	$0	$7,892
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads		4.00	32	$34.12	$1,092	$0	$10,000	$0	$0	$11,092
Subtotal					$12,556	$7,500	$438,800	$0	$35,000	$493,856
Sales Tax					$0	$0	$21,940	$0	$0	$21,940
INEEL ORG Labor/Subcontractor Overheads					$5,265	$3,145	$193,202	$0	$0	$201,612
Subtotal Estimate										$717,408
Escalation					$4,573	$2,732	$167,802	$0	$8,981	$184,087
Contingency					$6,718	$4,013	$246,523	$0	$13,194	$270,449
---Total 9116.2.1 SWITCHGEAR AND TRANSFORMERS - GFF			368		$29,113	$17,389	$1,068,267	$0	$57,175	$1,171,944
--- 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - GFF										
	ELEC	U.C. per Lf			0	0	0	0	125	125
15kV electrical duct bank, 2 runs of 200 lf.		400.00	0		$0	$0	$0	$0	$50,000	$50,000
	ELEC	U.C. per Ls			0	0	0	0	25000	25000
600 volt feeders		1.00	0		$0	$0	$0	$0	$25,000	$25,000
	ELEC	U.C. per Ls			0	0	0	0	100000	100000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$100,000	$100,000
Subtotal					$0	$0	$0	$0	$175,000	$175,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$175,000
Escalation					$0	$0	$0	$0	$44,905	$44,905
Contingency					$0	$0	$0	$0	$65,972	$65,972
---Total 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - GFF			0		$0	$0	$0	$0	$285,877	$285,877
--- 9116.2.3 MISC. COSTS - GFF										
	ELEC	U.C. per Ls	120	CN-ELEC	4094.4	0	0	0	0	4094.4
Testing of systems and equipment		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Ls	120	CN-ELEC	4094.4	0	0	0	0	4094.4
Material handling		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		89,100.00	0		$0	$0	$0	$178,200	$0	$178,200

Project Name: *UNEX Feasibility Study - Option B - Modified UNEX in GFF*
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

C[illegible] REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.3 MISC. COSTS - GFF										
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		89,100.00	0		$0	$0	$0	$89,100	$0	$89,100
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		89,100.00	0		$0	$0	$0	$89,100	$0	$89,100
Subtotal					$8,189	$0	$0	$356,400	$0	$364,589
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$3,434	$0	$0	$149,449	$0	$152,883
Subtotal Estimate										$517,472
Escalation					$2,982	$0	$0	$129,801	$0	$132,783
Contingency					$4,381	$0	$0	$190,695	$0	$195,077
---Total 9116.2.3 MISC. COSTS - GFF			240		$18,986	$0	$0	$826,345	$0	$845,332
--- 9116.2.4 LIGHTING - GFF										
	ELEC	U.C. per Sf			0	0	0	4	0	4
Lighting		89,100.00	0		$0	$0	$0	$356,400	$0	$356,400
Subtotal					$0	$0	$0	$356,400	$0	$356,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$149,449	$0	$149,449
Subtotal Estimate										$505,849
Escalation					$0	$0	$0	$129,801	$0	$129,801
Contingency					$0	$0	$0	$190,695	$0	$190,695
---Total 9116.2.4 LIGHTING - GFF			0		$0	$0	$0	$826,345	$0	$826,345
--- 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD										
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers		2.00	16	$34.12	$546	$0	$3,400	$0	$0	$3,946
	ELEC	U.C. per Ea	8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads		2.00	16	$34.12	$546	$0	$5,000	$0	$0	$5,546
Subtotal					$1,092	$0	$8,400	$0	[illegible]	$9,492
Sales Tax					$0	$0	$420	$0	$0	$420
INEEL ORG Labor/Subcontractor Overheads					$458	$0	$3,698	$0	$0	$4,156
Subtotal Estimate										$14,068
Escalation					$398	$0	$3,212	$0	$0	$3,610
Contingency					$584	$0	$4,719	$0	$0	$5,303
---Total 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD			32		$2,532	$0	$20,450	$0	$0	$22,981

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD											
	ELEC	U.C. per Ls				0	0	0	0	35000	35000
Branch power and lighting circuits			1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal						$0	$0	$0	$0	$35,000	$35,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$35,000
Escalation						$0	$0	$0	$0	$8,981	$8,981
Contingency						$0	$0	$0	$0	$13,194	$13,194
---Total 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD				0		$0	$0	$0	$0	$57,175	$57,175
--- 9116.3.3 MISC. COSTS - TFD											
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Testing of systems and equipment			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Material handling			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Sf				0	0	0	2	0	2
Lightning Protection			13,700.00	0		$0	$0	$0	$27,400	$0	$27,400
	ELEC	U.C. per Sf				0	0	0	1	0	1
Grounding Grid			13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
	ELEC	U.C. per Sf				0	0	0	1	0	1
Wiring Devices & Enclosures			13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
Subtotal						$6,142	$0	$0	$54,800	$0	$60,942
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$2,575	$0	$0	$22,979	$0	$25,555
Subtotal Estimate											$86,496
Escalation						$2,237	$0	$0	$19,958	$0	$22,195
Contingency						$3,286	$0	$0	$29,321	$0	$32,607
---Total 9116.3.3 MISC. COSTS - TFD				180		$14,240	$0	$0	$127,059	$0	$141,299
--- 9116.3.4 LIGHTING - TFD											
	ELEC	U.C. per Sf				0	0	0	0	3.9	3.9
Lighting			13,700.00	0		$0	$0	$0	$0	$53,430	$53,430

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.3.4 LIGHTING - TFD										
Subtotal					$0	$0	$0	$0	$53,430	$53,430
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$53,430
Escalation					$0	$0	$0	$0	$13,710	$13,710
Contingency					$0	$0	$0	$0	$20,142	$20,142
—Total 9116.3.4 LIGHTING - TFD			**0**		**$0**	**$0**	**$0**	**$0**	**$87,282**	**$87,282**
— 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
	ELEC	U.C. per Ls			0	0	0	0	12000	12000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$12,000	$12,000
Subtotal					$0	$0	$0	$0	$12,000	$12,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$12,000
Escalation					$0	$0	$0	$0	$3,079	$3,079
Contingency					$0	$0	$0	$0	$4,524	$4,524
—Total 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE			**0**		**$0**	**$0**	**$0**	**$0**	**$19,603**	**$19,603**
— 9116.4.3 MISC. COSTS - BOILER HOUSE										
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Testing of systems and equipment		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Material handling		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		3,120.00	0		$0	$0	$0	$6,240	$0	$6,240
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.4.3 MISC. COSTS - BOILER HOUSE										
	ELEC	U.C. per Lot	100	CN-ELEC	3412	0	3000	0	0	6412
Boiler Controls		1.00	100	$34.12	$3,412	$0	$3,000	$0	$0	$6,412
Subtotal					$6,142	$0	$3,000	$12,480	$0	$21,622
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$2,575	$0	$1,321	$5,233	$0	$9,129
Subtotal Estimate										$30,901
Escalation					$2,237	$0	$1,147	$4,545	$0	$7,929
Contingency					$3,286	$0	$1,685	$6,678	$0	$11,649
---Total 9116.4.3 MISC. COSTS - BOILER HOUSE			180		$14,240	$0	$7,304	$28,936	$0	$50,479
--- 9116.4.4 LIGHTING - BOILER HOUSE										
	ELEC	U.C. per Sf			0	0	0	3	0	3
Lighting		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360
Subtotal					$0	$0	$0	$9,360	$0	$9,360
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$3,925	$0	$3,925
Subtotal Estimate										$13,285
Escalation					$0	$0	$0	$3,409	$0	$3,409
Contingency					$0	$0	$0	$5,008	$0	$5,008
---Total 9116.4.4 LIGHTING - BOILER HOUSE			0		$0	$0	$0	$21,702	$0	$21,702
--- 9116.5.1 SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE										
	ELEC	U.C. per LOT	480	CN-ELEC	16377.6	0	100000	0	0	116377.6
SWITCHGEAR AND TRANSFORMERS		1.00	480	$34.12	$16,378	$0	$100,000	$0	$0	$116,378
Subtotal					$16,378	$0	$100,000	$0	$0	$116,378
Sales Tax					$0	$0	$5,000	$0	$0	$5,000
INEEL ORG Labor/Subcontractor Overheads					$6,868	$0	$44,030	$0	$0	$50,897
Subtotal Estimate										$172,275
Escalation					$5,965	$0	$38,241	$0	$0	$44,206
Contingency					$8,763	$0	$56,181	$0	$0	$64,944
---Total 9116.5.1 SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE			480		$37,973	$0	$243,452	$0	$0	$281,425
--- 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE										
	ELEC	U.C. per Ls			0	0	0	0	21000	21000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$21,000	$21,000

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE										
Subtotal					$0	$0	$0	$0	$21,000	$21,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$21,000
Escalation					$0	$0	$0	$0	$5,389	$5,389
Contingency					$0	$0	$0	$0	$7,917	$7,917
---Total 9116.5.2 RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE			0		$0	$0	$0	$0	$34,305	$34,305
--- 9116.5.3 MISC. COSTS - INTERIM STORAGE										
	ELEC	U.C. per Ls	100	CN-ELEC	3412	0	0	0	0	3412
Testing of systems and equipment		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Ls	100	CN-ELEC	3412	0	0	0	0	3412
Material handling		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		20,440.00	0		$0	$0	$0	$40,880	$0	$40,880
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per LOT	100	CN-ELEC	3412	0	2500	4750	0	10662
INSTRUMENTATION & CONTROLS		1.00	100	$34.12	$3,412	$0	$2,500	$4,750	$0	$10,662
Subtotal					$10,236	$0	$2,500	$86,510	$0	$99,246
Sales Tax					$0	$0	$125	$0	$0	$125
INEEL ORG Labor/Subcontractor Overheads					$4,292	$0	$1,101	$36,276	$0	$41,669
Subtotal Estimate										$141,040
Escalation					$3,728	$0	$956	$31,507	$0	$36,191
Contingency					$5,477	$0	$1,405	$46,288	$0	$53,169
---Total 9116.5.3 MISC. COSTS - INTERIM STORAGE			300		$23,733	$0	$6,086	$200,581	$0	$230,401
--- 9116.5.4 LIGHTING - INTERIM STORAGE										
	ELEC	U.C. per Sf			0	0	0	3.5	0	3.5
Lighting		20,440.00	0		$0	$0	$0	$71,540	$0	$71,540

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.5.4 LIGHTING - INTERIM STORAGE										
Subtotal					$0	$0	$0	$71,540	$0	$71,540
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$29,999	$0	$29,999
Subtotal Estimate										$101,539
Escalation					$0	$0	$0	$26,055	$0	$26,055
Contingency					$0	$0	$0	$38,278	$0	$38,278
---Total 9116.5.4 LIGHTING - INTERIM STORAGE			0		$0	$0	$0	$165,872	$0	$165,872
--- 9116.6 ELECTRICAL - TRANSFER TUNNEL										
	ELEC	U.C. per SF		CN-ELEC	0	0	0	2.75	0	2.75
LIGHTING		1,500.00	0		$0	$0	$0	$4,125	$0	$4,125
	ELEC	U.C. per SF	0.03	CN-ELEC	1.024	0	2	0	0	3.024
VOICE PAGING / EVAC.		1,500.00	45	$34.12	$1,535	$0	$3,000	$0	$0	$4,535
Subtotal					$1,535	$0	$3,000	$4,125	$0	$8,660
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$644	$0	$1,321	$1,730	$0	$3,694
Subtotal Estimate										$12,505
Escalation					$559	$0	$1,147	$1,502	$0	$3,209
Contingency					$822	$0	$1,685	$2,207	$0	$4,714
---Total 9116.6 ELECTRICAL - TRANSFER TUNNEL			45		$3,560	$0	$7,304	$9,564	$0	$20,428
--- 9301.1 CONSTRUCTION SUPPORT										
	BWI	U.C. per Lot			169700	0	0	0	0	169700
Construction Support - .1% Of TCC		1.00	0		$169,700	$0	$0	$0	$0	$169,700
	7620	U.C. per Wk	60	U60	1479.6	0	0	0	0	1479.6
Radiological Control Technicians - 1.5 FTE		104.00	6,240	$24.66	$153,878	$0	$0	$0	$0	$153,878
	7610	U.C. per Hr	0.1	Z03	5.232	0	0	0	0	5.232
Radiation Control - Management Support - 10% OF RCT Total		6,240.00	624	$52.32	$32,648	$0	$0	$0	$0	$32,648
Subtotal					$356,226	$0	$0	$0	$0	$356,226
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$166,008	$0	$0	$0	$0	$166,008
Subtotal Estimate										$522,234
Escalation					$134,005	$0	$0	$0	$0	$134,005
Contingency					$236,246	$0	$0	$0	$0	$236,246
---Total 9301.1 CONSTRUCTION SUPPORT			6,864		$892,486	$0	$0	$0	$0	$892,486

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9301.2 CONSTRUCTION QUALITY CONTROL										
	BWI	U.C. per Lot			169700	0	0	0	0	169700
Construction Quality Control - .1% Of TCC		1.00	0		$169,700	$0	$0	$0	$0	$169,700
Subtotal					$169,700	$0	$0	$0	$0	$169,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$169,700
Escalation					$43,545	$0	$0	$0	$0	$43,545
Contingency					$76,768	$0	$0	$0	$0	$76,768
---Total 9301.2 CONSTRUCTION QUALITY CONTROL			**0**		**$290,013**	**$0**	**$0**	**$0**	**$0**	**$290,013**
--- 9301.3 CONSTRUCTION DOCUMENTATION										
	BWI	U.C. per Lot			848500	0	0	0	0	848500
PM Construction Document Control - .5% Of TCC		1.00	0		$848,500	$0	$0	$0	$0	$848,500
Subtotal					$848,500	$0	$0	$0	$0	$848,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$848,500
Escalation					$217,725	$0	$0	$0	$0	$217,725
Contingency					$383,841	$0	$0	$0	$0	$383,841
---Total 9301.3 CONSTRUCTION DOCUMENTATION			**0**		**$1,450,066**	**$0**	**$0**	**$0**	**$0**	**$1,450,066**
--- OPC3100 TESTING AND TURNOVER PLANNING										
	BWI	U.C. per Lot			339400	0	0	0	0	339400
Testing & Turnover Planning - .2% Of TCC		1.00	0		$339,400	$0	$0	$0	$0	$339,400
Subtotal					$339,400	$0	$0	$0	$0	$339,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$339,400
Escalation					$125,306	$0	$0	$0	$0	$125,306
Contingency					$474,001	$0	$0	$0	$0	$474,001
---Total OPC3100 TESTING AND TURNOVER PLANNING			**0**		**$938,707**	**$0**	**$0**	**$0**	**$0**	**$938,707**
--- OPC3200 S. O. TESTING										
	BWI	U.C. per Lot			8485500	0	0	0	0	8485500
SO Testing - 5% Of TCC		1.00	0		$8,485,500	$0	$0	$0	$0	$8,485,500

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number:*2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— OPC3200 S. O. TESTING										
Subtotal					$8,485,500	$0	$0	$0	$0	$8,485,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,485,500
Escalation					$3,132,847	$0	$0	$0	$0	$3,132,847
Contingency					$11,850,714	$0	$0	$0	$0	$11,850,714
—Total OPC3200 S. O. TESTING			0		$23,469,060	$0	$0	$0	$0	$23,469,060
— OPC3300 ORR SUPPORT										
BWI	U.C. per Lot				373400	0	0	0	0	373400
ORR Support - .22% Of TCC		1.00	0		$373,400	$0	$0	$0	$0	$373,400
Subtotal					$373,400	$0	$0	$0	$0	$373,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$373,400
Escalation					$137,859	$0	$0	$0	$0	$137,859
Contingency					$521,484	$0	$0	$0	$0	$521,484
—Total OPC3300 ORR SUPPORT			0		$1,032,744	$0	$0	$0	$0	$1,032,744
— OPC3400 FACILITY ACCEPTANCE REVIEW										
BWI	U.C. per Lot				254600	0	0	0	0	254600
Facility Acceptance Review - .15% Of TCC		1.00	0		$254,600	$0	$0	$0	$0	$254,600
Subtotal					$254,600	$0	$0	$0	$0	$254,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$254,600
Escalation					$93,998	$0	$0	$0	$0	$93,998
Contingency					$355,570	$0	$0	$0	$0	$355,570
—Total OPC3400 FACILITY ACCEPTANCE REVIEW			0		$704,169	$0	$0	$0	$0	$704,169
— OPC3500 RADIOLOGICAL CONTROL SUPPORT										
BWI	U.C. per Lot				186700	0	0	0	0	186700
Radiological Control Support - .11% Of TCC		1.00	0		$186,700	$0	$0	$0	$0	$186,700

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3500 RADIOLOGICAL CONTROL SUPPORT										
Subtotal					$186,700	$0	$0	$0	$0	$186,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$186,700
Escalation					$68,930	$0	$0	$0	$0	$68,930
Contingency					$260,742	$0	$0	$0	$0	$260,742
---Total OPC3500 RADIOLOGICAL CONTROL SUPPORT			0		$516,372	$0	$0	$0	$0	$516,372
--- OPC3600 OPERATOR TRAINING										
	BWI	U.C. per Lot			3394200	0	0	0	0	3394200
Operator Training - 2% Of TCC		1.00	0		$3,394,200	$0	$0	$0	$0	$3,394,200
Subtotal					$3,394,200	$0	$0	$0	$0	$3,394,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,394,200
Escalation					$1,253,139	$0	$0	$0	$0	$1,253,139
Contingency					$4,740,285	$0	$0	$0	$0	$4,740,285
---Total OPC3600 OPERATOR TRAINING			0		$9,387,624	$0	$0	$0	$0	$9,387,624
--- OPC3700 OPERATING PROCEDURES										
	BWI	U.C. per Lot			746700	0	0	0	0	746700
Operating Procedures - .44% Of TCC		1.00	0		$746,700	$0	$0	$0	$0	$746,700
Subtotal					$746,700	$0	$0	$0	$0	$746,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$746,700
Escalation					$275,682	$0	$0	$0	$0	$275,682
Contingency					$1,042,829	$0	$0	$0	$0	$1,042,829
---Total OPC3700 OPERATING PROCEDURES			0		$2,065,211	$0	$0	$0	$0	$2,065,211
--- OPC3800 START-UP COORDINATION										
	BWI	U.C. per Lot			220600	0	0	0	0	220600
Startup Coordination - .13% Of TCC		1.00	0		$220,600	$0	$0	$0	$0	$220,600

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX in GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— OPC3800 START-UP COORDINATION										
Subtotal					$220,600	$0	$0	$0	$0	$220,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$220,600
Escalation					$81,446	$0	$0	$0	$0	$81,446
Contingency					$308,086	$0	$0	$0	$0	$308,086
---Total OPC3800 START-UP COORDINATION			0		$610,132	$0	$0	$0	$0	$610,132
— OPC3900 SPARES										
	BWI	U.C. per Lot			1000000	0	0	0	0	1000000
Spares		1.00	0		$1,000,000	$0	$0	$0	$0	$1,000,000
Subtotal					$1,000,000	$0	$0	$0	$0	$1,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,000,000
Escalation					$369,200	$0	$0	$0	$0	$369,200
Contingency					$1,396,584	$0	$0	$0	$0	$1,396,584
---Total OPC3900 SPARES			0		$2,765,784	$0	$0	$0	$0	$2,765,784
— GAPIF Non-Org G&A and PIF										
PF	NOGAPIF	U.C. per $			0	0	0	0	1	1
Procurement Fee %		1,364,080.00	0		$0	$0	$0	$0	$1,364,080	$1,364,080
Subtotal					$0	$0	$0	$0	$1,364,080	$1,364,080
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,364,080
Escalation					$0	$0	$0	$0	$0	$0
Contingency					$0	$0	$0	$0	$941,215	$941,215
---Total GAPIF Non-Org G&A and PIF			0		$0	$0	$0	$0	$2,305,295	$2,305,295

Project Name:
UNEX Feasibility Study - Option B - Modified UNEX In GFF
Project Location: *INTEC*
Estimate Number: *2570 - Option B*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
Subtotal	MODIFIED UNEX IN GFF - OPTION B				$**,***,***	$430,270	$94,703,382	$15,102,019	$1,695,510	$**,***,***
Sales Tax					$0	$0	$4,735,169	$0	$0	$4,735,169
INEEL ORG Labor/Subcontractor Overheads					$4,463,407	$141,596	$32,330,226	$4,553,188	$0	$41,488,417
Subtotal Estimate										$**,***,***
Escalation					$31,290,424	$146,741	$33,811,868	$5,043,526	$85,045	$70,377,604
Contingency					$81,671,787	$421,957	$57,212,909	$8,868,042	$1,066,158	$**,***,***
Total MODIFIED UNEX IN GFF - OPTION B			368,957		$253,944,530	$1,140,564	$222,793,555	$33,566,775	$2,846,713	$514,292,137

MODIFIED UNEX PROCESS IN A GREEN FIELD FACILITY

@RISK Sensitivity Report

OPTION B

Sensitivity Ranking
Step-Wise Regression

Rank	Name	Cell	Regression	Weight	Amount	Level Markup
- *PROJECT DEVELOPMENT / Contingency at F3, for Simulation 1*						
1	SPECIALTIES	B20	0.5982	0.1958	$29,626,395	30%
2	EQUIPMENT	B21	0.5141	0.1683	$25,463,132	54%
3	PROJECT ACCEPTANCE/CLOSEOUT	B26	0.4271	0.1398	$21,152,768	102%
4	TECHNICAL DEVELOPMENT	B4	0.2314	0.0757	$11,458,234	98%
5	PROJECT MANAGEMENT	B10	0.2176	0.0712	$10,775,264	38%
6	GENERAL CONDITIONS	B13	0.1800	0.0589	$8,913,993	42%
7	CONSTRUCTION MANAGEMENT	B6	0.1764	0.0578	$8,737,719	37%
8	TITLE II DESIGN	B8	0.1288	0.0422	$6,380,361	28%
9	PROJECT EXECUTION	B5	0.1103	0.0361	$5,460,670	45%
10	TITLE I DESIGN	B7	0.0849	0.0278	$4,202,496	36%
11	QUALITY ASSURANCE	B9	0.0667	0.0218	$3,302,560	31%
12	CONCRETE	B15	0.0563	0.0184	$2,787,452	26%
13	METALS	B16	0.0404	0.0132	$2,002,704	26%
14	PROJECT DEVELOPMENT	B3	0.0387	0.0127	$1,915,094	34%
15	MECHANICAL	B23	0.0384	0.0126	$1,903,797	26%
16	SITEWORK	B14	0.0230	0.0075	$1,140,918	68%
17	ELECTRICAL	B24	0.0219	0.0072	$1,086,604	30%
18	CONVEYING SYSTEMS	B22	0.0202	0.0066	$1,002,749	8%
19	Non-Org G&A and PIF	B27	0.0191	0.0062	$944,689	69%
20	CONSTRUCTION AE SUPPORT	B11	0.0186	0.0061	$920,577	28%
21	THERMAL & MOISTURE PROTECTION	B17	0.0175	0.0057	$864,580	26%
22	CONSTRUCTION MISCELLANEOUS	B25	0.0143	0.0047	$706,334	36%
23	FINISHES	B19	0.0080	0.0026	$397,278	25%
24	DOORS & WINDOWS	B18	0.0027	0.0009	$135,282	26%

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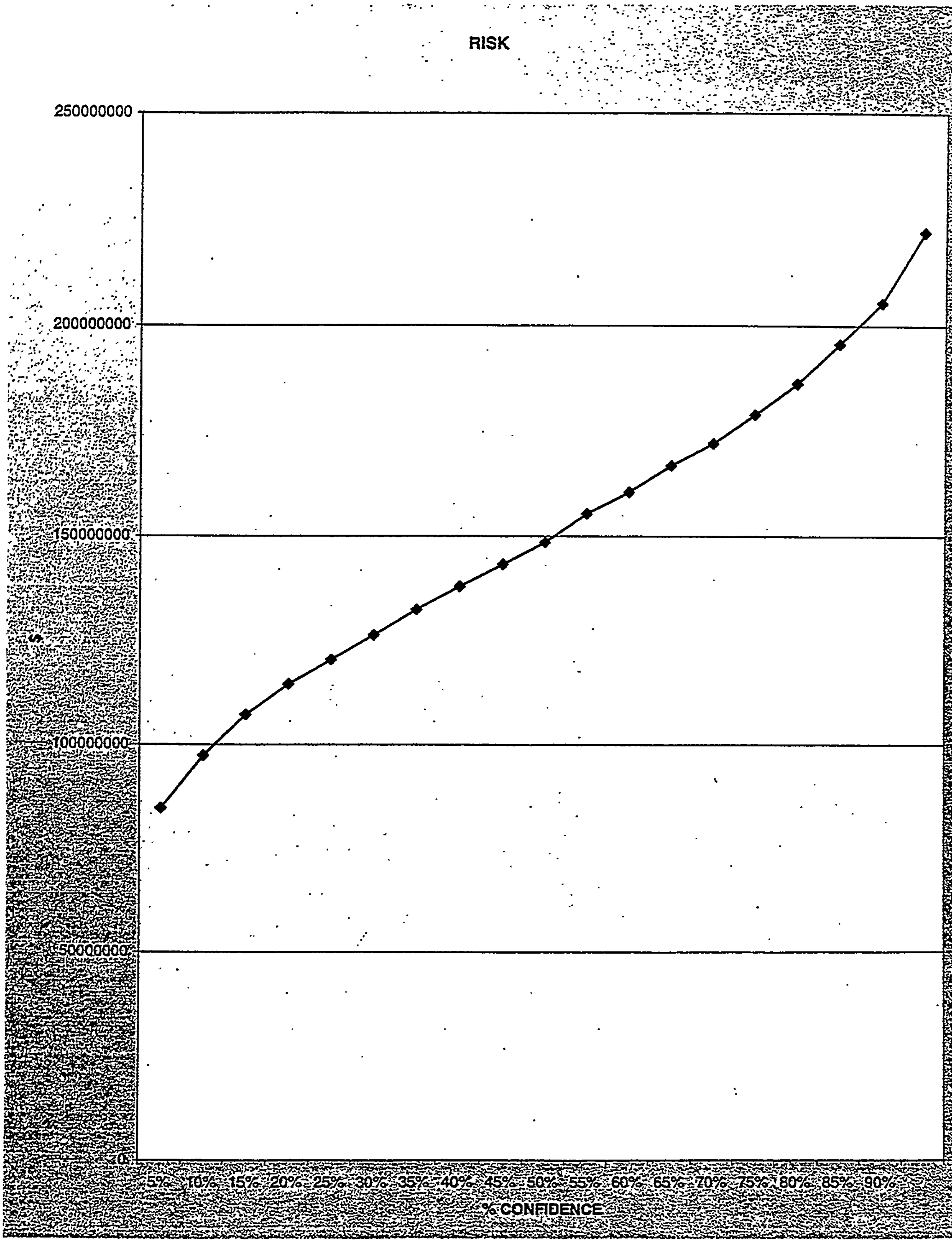
MODIFIED UNEX PROCESS IN NWCF

@RISK Output Details Report

Output Statistics

Outputs	- PROJECT DEVELOPMENT / Contingency
Simulation#	1
Statistics / Cell	F3
Minimum	30304452
Maximum	303403552
Mean	150794511.3
Standard Deviation	42379377.74
Variance	1.79601E+15
Skewness	0.246673946
Kurtosis	2.992241848
NumErrs	0
Mode	160080732.8
5%	84663352.54
10%	97345008.06
15%	107218848.2
20%	114527584.2
25%	120403432
30%	126284140.7
35%	132415159.4
40%	137991648.2
45%	143257467.1
50%	148516368
55%	155394592.1
60%	160426048.4
65%	166772639.2
70%	171966221.6
75%	178819536
80%	186178864.2
85%	195579794.7
90%	205467870.1
95%	222348651.7

MODIFIED UNEX PROCESS IN NWCF



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Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Project Number: *2570 - Option C*

TPC Summary Report 2

ESTIMATE ELEMENT	Estimate Subtotal	Escalation	Contingency	TOTAL
		24.17%	*41.54%*	
Total Estimated Cost (TEC)	$260,647,313	$62,998,496	$134,452,995	$458,098,804
		14.03%	*52.88%*	
Other Project Cost (OPC)	$83,900,600	$11,768,246	$50,590,186	$146,259,031
		21.70%	*44.13%*	
Total Project Cost (TPC)	**$344,547,913**	**$74,766,742**	**$185,043,181**	**$604,357,835**
Rounded TPC (Rounded to the nearest $ 1000000)				**$604,000,000**

	Remarks
Type of Estimate: Planning	
Estimator: Rowley / Mitchell / Marler	
Checked By: RDA	
Approved By: [signature]	

INEEL

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC1000	**PROJECT DEVELOPMENT**	**$16,418,300**	**$978,531**	**$13,666,762**	**78.56%**	**$31,063,593**
OPC1001	--PROJECT DEVELOPMENT	$5,418,300	$322,931	$1,894,606	33.00%	$7,635,837
OPC1001.1	----CONCEPTUAL DESIGN	$3,472,400	$206,955	$1,214,187	33.00%	$4,893,542
OPC1001.2	----PROJECT EXECUTION PLAN	$173,600	$10,347	$60,702	33.00%	$244,649
OPC1001.3	----WORK PACKAGE DEVELOPMENT	$399,300	$23,798	$139,622	33.00%	$562,721
OPC1001.4	----TASK BASELINE AGREEMENT	$573,000	$34,151	$200,360	33.00%	$807,511
OPC1001.5	----PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)	$800,000	$47,680	$279,734	33.00%	$1,127,414
OPC1600	--TECHNICAL DEVELOPMENT	$11,000,000	$655,600	$11,772,156	101.00%	$23,427,756
OPC2000	**PROJECT EXECUTION**	**$52,158,600**	**$5,132,205**	**$15,312,777**	**26.73%**	**$72,603,582**
OPC2001	--PROJECT EXECUTION	$9,708,600	$0	$4,368,870	45.00%	$14,077,470
OPC2001.1	----PROJECT SUPPORT	$5,208,600	$0	$2,343,870	45.00%	$7,552,470
OPC2001.2	----PERMITTING	$4,500,000	$0	$2,025,000	45.00%	$6,525,000
OPC2300	--DECON SOLUTION PROCESSING	$42,450,000	$5,132,205	$10,943,907	23.00%	$58,526,112
1000	**CONSTRUCTION MANAGEMENT**	**$18,751,000**	**$4,811,507**	**$13,666,254**	**58.00%**	**$37,228,760**
1100	--CONSTRUCTION SUPERVISION & ENGINEERING	$15,626,000	$4,009,632	$11,388,666	58.00%	$31,024,298
1110	--CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$347,200	$89,092	$253,049	58.00%	$689,341
1200	--CM PROJECT CONTROLS	$1,215,300	$311,846	$885,745	58.00%	$2,412,891
1300	--CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)	$868,100	$222,754	$632,696	58.00%	$1,723,550
1400	--CM TRAINING	$347,200	$89,092	$253,049	58.00%	$689,341
1500	--CM - OTHER DIRECT COSTS	$347,200	$89,092	$253,049	58.00%	$689,341
2000	**TITLE I DESIGN**	**$10,417,300**	**$1,259,452**	**$4,904,236**	**42.00%**	**$16,580,987**

Project Name: **Project Summary Report**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
2400	--DESIGN ACTIVITIES	$10,417,300	$1,259,452	$4,904,236	42.00%	$16,580,987
3000	**TITLE II DESIGN**	**$19,619,200**	**$3,009,585**	**$7,467,499**	**33.00%**	**$30,096,284**
3400	--DESIGN ACTIVITIES	$19,619,200	$3,009,585	$7,467,499	33.00%	$30,096,284
4000	**QUALITY ASSURANCE**	**$8,681,100**	**$2,227,570**	**$3,490,774**	**32.00%**	**$14,399,445**
4100	--QUALITY ASSURANCE	$8,681,100	$2,227,570	$3,490,774	32.00%	$14,399,445
5000	**PROJECT MANAGEMENT**	**$22,903,900**	**$5,877,141**	**$12,375,848**	**43.00%**	**$41,156,888**
5100	--PM ADMINISTRATION	$13,889,700	$3,564,097	$7,505,133	43.00%	$24,958,930
5110	--PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$69,400	$17,808	$37,499	43.00%	$124,707
5200	--PM PROJECT CONTROLS	$3,472,400	$891,018	$1,876,270	43.00%	$6,239,688
5300	--PM RECORDS MANAGEMENT	$3,472,400	$891,018	$1,876,270	43.00%	$6,239,688
5400	--SAFETY ANALYSIS	$2,000,000	$513,200	$1,080,676	43.00%	$3,593,876
6000	**CONSTRUCTION AE SUPPORT**	**$2,604,300**	**$668,263**	**$916,318**	**28.00%**	**$4,188,881**
8000	**GOVERNMENT FURNISHED EQUIPMENT**	**$158,420**	**$40,651**	**$266,754**	**134.00%**	**$465,825**
8300	--GFE LABOR	$158,420	$40,651	$266,754	134.00%	$465,825
9000	**CONSTRUCTION**	**$175,776,804**	**$45,104,328**	**$90,150,610**	**40.81%**	**$311,031,742**
9100	--CONSTRUCTION SUBCONTRACTS	$173,621,412	$44,551,254	$87,902,585	40.29%	$306,075,251
9101	----GENERAL CONDITIONS	$17,288,999	$4,436,357	$9,776,410	45.00%	$31,501,766
9101.1	------GENERAL CONDITIONS	$15,880,864	$4,075,030	$8,980,152	45.00%	$28,936,046
9101.2	------GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$1,408,135	$361,327	$796,258	45.00%	$2,565,720
9102	----SITEWORK	$920,348	$236,161	$740,166	64.00%	$1,896,674

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9102.1	------SITEWORK - UTILITIES	$71,860	$18,439	$57,791	64.00%	$148,090
9102.2	------SITEWORK - TFD FACILITY	$353,216	$90,635	$284,065	64.00%	$727,916
9102.3	------SITEWORK - BOILER HOUSE	$75,158	$19,285	$60,444	64.00%	$154,887
9102.4	------SITEWORK - STORAGE FACILITY	$158,102	$40,569	$127,150	64.00%	$325,821
9102.5	------SITEWORK - TUNNEL	$197,085	$50,572	$158,500	64.00%	$406,157
9102.6	------SITEWORK - PAVING	$64,927	$16,660	$52,216	64.00%	$133,803
9103	**----CONCRETE**	**$4,104,590**	**$1,053,238**	**$1,341,035**	**26.00%**	**$6,498,863**
9103.2	------CONCRETE - TFD FACILITY	$2,670,605	$685,277	$872,529	26.00%	$4,228,411
9103.3	------CONCRETE - BOILER HOUSE	$48,364	$12,410	$15,801	26.00%	$76,576
9103.4	------CONCRETE - STORAGE FACILITY	$1,292,540	$331,666	$422,293	26.00%	$2,046,499
9103.5	------CONCRETE - TUNNEL	$93,081	$23,885	$30,411	26.00%	$147,377
9105	**----METALS**	**$4,812,980**	**$1,235,011**	**$1,572,478**	**26.00%**	**$7,620,468**
9105.1	------METALS - DEMOLITION	$10,882	$2,792	$3,555	26.00%	$17,229
9105.1.1	--------METALS DEMOLITION - CALCINER CELL	$10,882	$2,792	$3,555	26.00%	$17,229
9105.3	------METALS - TFD FACILITY	$546,606	$140,259	$178,585	26.00%	$865,451
9105.4	------METALS - BOILER HOUSE	$151,151	$38,785	$49,383	26.00%	$239,319
9105.5	------METALS - STORAGE FACILITY	$4,104,341	$1,053,174	$1,340,954	26.00%	$6,498,469
9107	**----THERMAL & MOISTURE PROTECTION**	**$1,287,364**	**$330,338**	**$420,602**	**26.00%**	**$2,038,304**
9107.1	------THERMAL & MOISTURE PROTECTION - TFD FACILITY	$721,911	$185,242	$235,860	26.00%	$1,143,014
9107.2	------THERMAL & MOISTURE PROTECTION - BOILER HOUSE	$85,532	$21,948	$27,945	26.00%	$135,424
9107.3	------THERMAL & MOISTURE PROTECTION - STORAGE FACILITY	$479,921	$123,148	$156,798	26.00%	$759,866
9108	**----DOORS & WINDOWS**	**$281,930**	**$72,343**	**$92,111**	**26.00%**	**$446,385**

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9108.2	------DOORS & WINDOWS - TFD FACILITY	$184,721	$47,399	$60,351	26.00%	$292,472
9108.3	------DOORS & WINDOWS - BOILER HOUSE	$35,221	$9,038	$11,507	26.00%	$55,766
9108.4	------DOORS & WINDOWS - STORAGE FACILITY	$61,988	$15,906	$20,253	26.00%	$98,147
9109	**----FINISHES**	**$955,827**	**$245,265**	**$312,284**	**26.00%**	**$1,513,377**
9109.1	------FINISHES - NWCF	$152,711	$39,186	$49,893	26.00%	$241,790
9109.2	------FINISHES - TFD FACILITY	$500,276	$128,371	$163,448	26.00%	$792,095
9109.3	------FINISHES - BOILER HOUSE	$1,902	$488	$621	26.00%	$3,011
9109.4	------FINISHES - STORAGE FACILITY	$300,938	$77,221	$98,321	26.00%	$476,481
9110	**----SPECIALTIES**	**$76,586,759**	**$19,652,162**	**$28,871,677**	**30.00%**	**$125,110,599**
9110.1	------SPECIALTIES - NWCF	$1,765,256	$452,965	$665,466	30.00%	$2,883,687
9110.2	------SPECIALTIES - TFD FACILITY	$18,398,054	$4,720,941	$6,935,699	30.00%	$30,054,694
9110.3	------SPECIALTIES - BOILER HOUSE	$62,343	$15,997	$23,502	30.00%	$101,843
9110.4	------SPECIALTIES - STORAGE FACILITY	$56,361,106	$14,462,260	$21,247,010	30.00%	$92,070,376
9111	**----EQUIPMENT**	**$38,884,077**	**$9,977,654**	**$33,714,594**	**69.00%**	**$82,576,325**
9111.1	------EQUIPMENT - IN NWCF	$8,867,890	$2,275,500	$7,688,939	69.00%	$18,832,329
9111.1.1	--------EQUIPMENT - CALCINER CELL	$406,709	$104,361	$352,638	69.00%	$863,709
9111.1.2	--------EQUIPMENT - OFF GAS CELL	$1,423,784	$365,343	$1,234,498	69.00%	$3,023,624
9111.1.3	--------EQUIPMENT - BLEND & HOLD CELL	$234,834	$60,258	$203,614	69.00%	$498,706
9111.1.4	--------EQUIPMENT - VALVE CUBICLE	$14,665	$3,763	$12,716	69.00%	$31,144
9111.1.5	--------EQUIPMENT - STORAGE AREA	$1,273,359	$326,744	$1,104,071	69.00%	$2,704,174
9111.6	--------EQUIPMENT - GROUT FACILITY	$5,514,538	$1,415,031	$4,781,403	69.00%	$11,710,972
9111.2	------EQUIPMENT - THIN FILM DRYER FACILITY	$1,621,050	$415,962	$1,405,538	69.00%	$3,442,550

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9111.3	------EQUIPMENT - BOILER HOUSE	$1,373,665	$352,482	$1,191,042	69.00%	$2,917,189
9111.6	------EQUIPMENT - STORAGE FACILITY	$22,081,543	$5,666,124	$19,145,890	69.00%	$46,893,558
9111.7	------EQUIPMENT DEMOLITION	$4,939,928	$1,267,586	$4,283,185	69.00%	$10,490,699
9111.7.1	--------EQUIPMENT DEMOLITION - CALCINER CELL	$1,280,172	$328,492	$1,109,978	69.00%	$2,718,642
9111.7.2	--------EQUIPMENT DEMOLITION - OFF GAS CELL	$1,298,236	$333,127	$1,125,641	69.00%	$2,757,005
9111.7.3	--------EQUIPMENT DEMOLITION - BLEND & HOLD CELL	$1,553,883	$398,726	$1,347,301	69.00%	$3,299,910
9111.7.4	--------EQUIPMENT DEMOLITION - VALVE CUBICLE	$807,637	$207,240	$700,265	69.00%	$1,715,142
9114	**----CONVEYING SYSTEMS**	**$9,865,129**	**$2,531,392**	**$1,115,687**	**9.00%**	**$13,512,208**
9114.4	------CONVEYING SYSTEMS - STORAGE FACILITY	$9,865,129	$2,531,392	$1,115,687	9.00%	$13,512,208
9115	**----MECHANICAL**	**$16,133,906**	**$4,139,960**	**$8,312,285**	**41.00%**	**$28,586,151**
9115.1	------MECHANICAL DEMOLITION	$5,129,215	$1,316,157	$2,642,603	41.00%	$9,087,975
9115.1.1	--------MECHANICAL DEMO - CALCINER CELL	$1,984,201	$509,146	$1,022,272	41.00%	$3,515,618
9115.1.3	--------MECHANICAL DEMO - OFF GAS CELL	$1,094,474	$280,842	$563,880	41.00%	$1,939,196
9115.1.4	--------MECHANICAL DEMO - BLEND & HOLD CELL	$1,094,474	$280,842	$563,880	41.00%	$1,939,196
9115.1.5	--------MECHANICAL DEMO - VALVE CUBICLE	$956,066	$245,327	$492,571	41.00%	$1,693,963
9115.2	------MECHANICAL - NEW - NWCF	$7,073,412	$1,815,037	$3,644,264	41.00%	$12,532,714
9115.2.1	--------HVAC - NEW - NWCF	$6,561,337	$1,683,639	$3,380,440	41.00%	$11,625,416
9115.2.2	--------PIPING - NEW - NWCF	$428,065	$109,841	$220,542	41.00%	$758,448
9115.2.3	--------FIRE PROTECTION - NEW - NWCF	$84,010	$21,557	$43,283	41.00%	$148,850
9115.2	------MECHANICAL - NEW - TFD FACILITY	$2,766,709	$709,937	$1,425,425	41.00%	$4,902,071
9115.2.1	--------HVAC - TFD FACILITY - HOT CELL	$877,596	$225,191	$452,143	41.00%	$1,554,929
9115.2.2	--------HVAC - TFD FACILITY - OPERATING CORRIDORS	$1,523,564	$390,947	$784,949	41.00%	$2,699,460

Project Name: **Project Summary Report**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option C***

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9115.2.3	--------PLUMBING / PIPING - TFD FACILITY	$365,549	$93,800	$188,333	41.00%	$647,682
9115.3	------MECHANICAL - NEW - BOILER HOUSE	$400,820	$102,850	$206,505	41.00%	$710,175
9115.3.1	--------HVAC - BOILER HOUSE	$68,261	$17,516	$35,168	41.00%	$120,945
9115.3.2	--------PLUMBING - BOILER HOUSE	$4,739	$1,216	$2,442	41.00%	$8,397
9115.3.3	--------PIPING - BOILER HOUSE	$310,107	$79,573	$159,769	41.00%	$549,449
9115.3.4	--------FIRE PROTECTION - BOILER HOUSE	$17,713	$4,545	$9,126	41.00%	$31,384
9115.4	------MECHANICAL - NEW - STORAGE FACILITY	$763,750	$195,978	$393,489	41.00%	$1,353,217
9115.4.1	--------HVAC - STORAGE FACILITY	$558,843	$143,399	$287,919	41.00%	$990,162
9115.4.2	--------PIPING / PLUMBING - STORAGE FACILITY	$88,862	$22,802	$45,782	41.00%	$157,447
9115.4.3	--------FIRE PROTECTION - STORAGE FACILITY	$116,044	$29,777	$59,787	41.00%	$205,608
9116	**----ELECTRICAL**	**$2,499,503**	**$641,372**	**$1,633,255**	**52.00%**	**$4,774,131**
9116.1	------ELECTRICAL - DEMOLITION	$889,519	$228,251	$581,240	52.00%	$1,699,010
9116.1.1	--------ELECTRICAL DEMO - CALCINER CELL	$222,380	$57,063	$145,310	52.00%	$424,753
9116.1.3	--------ELECTRICAL DEMO - OFF GAS CELL	$222,380	$57,063	$145,310	52.00%	$424,753
9116.1.4	--------ELECTRICAL DEMO - BLEND & HOLD CELL	$222,380	$57,063	$145,310	52.00%	$424,753
9116.1.5	--------ELECTRICAL DEMO - VALVE CUBICLE	$222,380	$57,063	$145,310	52.00%	$424,753
9116.2	------ELECTRICAL - NEW - NWCF	$733,960	$188,334	$479,593	52.00%	$1,401,887
9116.2.1	--------SWITCHGEAR AND TRANSFORMERS - NWCF	$483,791	$124,141	$316,124	52.00%	$924,056
9116.2.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF	$125,000	$32,075	$81,679	52.00%	$238,754
9116.2.3	--------MISC. COSTS - NWCF	$125,169	$32,118	$81,789	52.00%	$239,077
9116.3	------ELECTRICAL - NEW - TFD FACILITY	$266,774	$68,454	$174,318	52.00%	$509,546
9116.3.1	--------SWITCHGEAR AND TRANSFORMERS - TFD	$14,068	$3,610	$9,193	52.00%	$26,871

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9116.3.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - TFD	$35,000	$8,981	$22,870	52.00%	$66,851
9116.3.3	--------MISC. COSTS - TFD	$164,276	$42,153	$107,343	52.00%	$313,772
9116.3.4	--------LIGHTING - TFD	$53,430	$13,710	$34,913	52.00%	$102,053
9116.4	------ELECTRICAL - BOILER HOUSE	$60,157	$15,436	$39,309	52.00%	$114,902
9116.4.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE	$12,000	$3,079	$7,841	52.00%	$22,920
9116.4.3	--------MISC. COSTS - BOILER HOUSE	$34,872	$8,948	$22,787	52.00%	$66,607
9116.4.4	--------LIGHTING - BOILER HOUSE	$13,285	$3,409	$8,681	52.00%	$25,375
9116.5	------ELECTRICAL - STORAGE FACILITY	$536,588	$137,689	$350,624	52.00%	$1,024,900
	--------SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE	$172,275	$44,206	$112,570	52.00%	$329,051
	--------RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE	$21,000	$5,389	$13,722	52.00%	$40,111
	--------MISC. COSTS - INTERIM STORAGE	$241,774	$62,039	$157,983	52.00%	$461,797
9116.5	--------LIGHTING - INTERIM STORAGE	$101,539	$26,055	$66,349	52.00%	$193,942
9116.6	------ELECTRICAL - TRANSFER TUNNEL	$12,505	$3,209	$8,171	52.00%	$23,885
9301	**--CONSTRUCTION MISCELLANEOUS**	**$2,155,391**	**$553,073**	**$2,248,026**	**83.00%**	**$4,956,491**
9301.1	----CONSTRUCTION SUPPORT	$1,113,691	$285,773	$1,161,556	83.00%	$2,561,020
9301.2	----CONSTRUCTION QUALITY CONTROL	$173,600	$44,546	$181,061	83.00%	$399,207
9301.3	----CONSTRUCTION DOCUMENTATION	$868,100	$222,754	$905,409	83.00%	$1,996,264
OPC3000	**PROJECT ACCEPTANCE/CLOSEOUT**	**$15,323,700**	**$5,657,510**	**$21,610,646**	**103.00%**	**$42,591,856**
OPC3100	**--TESTING AND TURNOVER PLANNING**	**$347,200**	**$128,186**	**$489,648**	**103.00%**	**$965,034**
OPC3200	**--S. O. TESTING**	**$8,681,100**	**$3,205,062**	**$12,242,747**	**103.00%**	**$24,128,909**
OPC3300	**--ORR SUPPORT**	**$382,000**	**$141,034**	**$538,725**	**103.00%**	**$1,061,760**
OPC3400	**--FACILITY ACCEPTANCE REVIEW**	**$260,400**	**$96,140**	**$367,236**	**103.00%**	**$723,776**

Project Name:

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF

Project Location: ***INTEC***

Estimate Number: ***2570 - Option C***

Project Summary Report

Client: ***V. J. Balls***

Prepared By: ***Rowley / Mitchell / Marler***

Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC3500	--RADIOLOGICAL CONTROL SUPPORT	$191,000	$70,517	$269,363	103.00%	$530,880
OPC3600	--OPERATOR TRAINING	$3,472,400	$1,282,010	$4,897,042	103.00%	$9,651,452
OPC3700	--OPERATING PROCEDURES	$763,900	$282,032	$1,077,310	103.00%	$2,123,242
OPC3800	--START-UP COORDINATION	$225,700	$83,328	$318,299	103.00%	$627,328
OPC3900	--SPARES	$1,000,000	$369,200	$1,410,276	103.00%	$2,779,476
GAPIF	Non-Org G&A and PIF	$1,735,289	$0	$1,214,702	70.00%	$2,949,991
Total	UNEX IN NWCF - OPTION C	$344,547,913	$74,766,742	$185,043,181	44.13%	$604,357,835

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.1 CONCEPTUAL DESIGN									
BWI	U.C. per LOT			3472400	0	0	0	0	3472400
CONCEPTUAL DESIGN (2% OF TCC)	1.00	0		$3,472,400	$0	$0	$0	$0	$3,472,400
Subtotal				$3,472,400	$0	$0	$0	$0	$3,472,400
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$3,472,400
Escalation				$206,955	$0	$0	$0	$0	$206,955
Contingency				$1,214,187	$0	$0	$0	$0	$1,214,187
---Total OPC1001.1 CONCEPTUAL DESIGN		0		$4,893,542	$0	$0	$0	$0	$4,893,542
--- OPC1001.2 PROJECT EXECUTION PLAN									
7810-1	U.C. per LOT			173600	0	0	0	0	173600
ACDC/SOW,CPDS,PEP,DC,/SOW REVIEWS @ .1% OF TCC	1.00	0		$173,600	$0	$0	$0	$0	$173,600
Subtotal				$173,600	$0	$0	$0	$0	$173,600
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$173,600
Escalation				$10,347	$0	$0	$0	$0	$10,347
Contingency				$60,702	$0	$0	$0	$0	$60,702
---Total OPC1001.2 PROJECT EXECUTION PLAN		0		$244,649	$0	$0	$0	$0	$244,649
--- OPC1001.3 WORK PACKAGE DEVELOPMENT									
BWI	U.C. per Lot			399300	0	0	0	0	399300
Work Package Development - .23% Of TCC	1.00	0		$399,300	$0	$0	$0	$0	$399,300
Subtotal				$399,300	$0	$0	$0	$0	$399,300
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$399,300
Escalation				$23,798	$0	$0	$0	$0	$23,798
Contingency				$139,622	$0	$0	$0	$0	$139,622
---Total OPC1001.3 WORK PACKAGE DEVELOPMENT		0		$562,721	$0	$0	$0	$0	$562,721
--- OPC1001.4 TASK BASELINE AGREEMENT									
BWI	U.C. per Lot			573000	0	0	0	0	573000
Task Baseline Agreement - .33% Of TCC	1.00	0		$573,000	$0	$0	$0	$0	$573,000

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.4 TASK BASELINE AGREEMENT										
Subtotal					$573,000	$0	$0	$0	$0	$573,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$573,000
Escalation					$34,151	$0	$0	$0	$0	$34,151
Contingency					$200,360	$0	$0	$0	$0	$200,360
---Total OPC1001.4 TASK BASELINE AGREEMENT			0		$807,511	$0	$0	$0	$0	$807,511
--- OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)										
	BWI	U.C. per Lot			800000	0	0	0	0	800000
Preliminary Safety Analysis Report (PSAR)		1.00	0		$800,000	$0	$0	$0	$0	$800,000
Subtotal					$800,000	$0	$0	$0	$0	$800,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$800,000
Escalation					$47,680	$0	$0	$0	$0	$47,680
Contingency					$279,734	$0	$0	$0	$0	$279,734
---Total OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)			0		$1,127,414	$0	$0	$0	$0	$1,127,414
--- OPC1600 TECHNICAL DEVELOPMENT										
	BWI	U.C. per Lot			11000000	0	0	0	0	11000000
(*)Modified UNEX Process Development		1.00	0		$11,000,000	$0	$0	$0	$0	$11,000,000
Memo: Cost for process development is per the HLW SBW Process Development Costs (Arlin L. Olson).										
Subtotal					$11,000,000	$0	$0	$0	$0	$11,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$11,000,000
Escalation					$655,600	$0	$0	$0	$0	$655,600
Contingency					$11,772,156	$0	$0	$0	$0	$11,772,156
---Total OPC1600 TECHNICAL DEVELOPMENT			0		$23,427,756	$0	$0	$0	$0	$23,427,756
--- OPC2001.1 PROJECT SUPPORT										
	BWI	U.C. per Lot			5208600	0	0	0	0	5208600
Project Support - 3% OF TCC		1.00	0		$5,208,600	$0	$0	$0	$0	$5,208,600

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC2001.1 PROJECT SUPPORT										
Subtotal					$5,208,600	$0	$0	$0	$0	$5,208,600
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$5,208,600
Escalation					$0	$0	$0	$0	$0	$0
Contingency					$2,343,870	$0	$0	$0	$0	$2,343,870
---Total OPC2001.1 PROJECT SUPPORT			0		$7,552,470	$0	$0	$0	$0	$7,552,470
--- OPC2001.2 PERMITTING										
	BWI	U.C. per Lot			1500000	0	0	0	0	1500000
Permitting		1.00	0		$1,500,000	$0	$0	$0	$0	$1,500,000
	BWI	U.C. per Lot			2500000	0	0	0	0	2500000
WIPP Certification		1.00	0		$2,500,000	$0	$0	$0	$0	$2,500,000
	BWI	U.C. per Lot			500000	0	0	0	0	500000
Hanford Certification		1.00	0		$500,000	$0	$0	$0	$0	$500,000
Subtotal					$4,500,000	$0	$0	$0	$0	$4,500,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$4,500,000
Escalation					$0	$0	$0	$0	$0	$0
Contingency					$2,025,000	$0	$0	$0	$0	$2,025,000
---Total OPC2001.2 PERMITTING			0		$6,525,000	$0	$0	$0	$0	$6,525,000
--- OPC2300 DECON SOLUTION PROCESSING										
	BWI	U.C. per Gal			0	0	0	1.15	0	1.15
(*)Process Decon Solution Through Evaporator		1,000,000.00	0		$0	$0	$0	$1,150,000	$0	$1,150,000
Memo: Per discussions - approximately 1,000,000 gallons of decon solution will be used to decon the NWCF areas. This solution will be sent to the evaporator for volume reduction.										
	BWI	U.C. per Gal			0	0	0	413	0	413
(*)Allowance For Liquid Sent To The Tank Farm		100,000.00	0		$0	$0	$0	$41,300,000	$0	$41,300,000
Memo: Per Anna Poloski - The liquid sent to the evaporator will be reduced to 10% of its original volume. The costs to send liquid to the evaporator and to send / maintain liquid in the tank farm are per Anna Poloski.										
Subtotal					$0	$0	$0	$42,450,000	$0	$42,450,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$42,450,000
Escalation					$0	$0	$0	$5,132,205	$0	$5,132,205
Contingency					$0	$0	$0	$10,943,907	$0	$10,943,907
---Total OPC2300 DECON SOLUTION PROCESSING			0		$0	$0	$0	$58,526,112	$0	$58,526,112

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1100 CONSTRUCTION SUPERVISION & ENGINEERING											
00401400	BWI	U.C. per Lot		1		15626000	0	0	0	0	15626000
Construction Management - 9% Of TCC			1.00	1	$***.**	$15,626,000	$0	$0	$0	$0	$15,626,000
Subtotal						$15,626,000	$0	$0	$0	$0	$15,626,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$15,626,000
Escalation						$4,009,632	$0	$0	$0	$0	$4,009,632
Contingency						$11,388,666	$0	$0	$0	$0	$11,388,666
---Total 1100 CONSTRUCTION SUPERVISION & ENGINEERING				**1**		**$31,024,298**	**$0**	**$0**	**$0**	**$0**	**$31,024,298**
--- 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE											
00401400	BWI	U.C. per Lot		1		347200	0	0	0	0	347200
CM - Conduct Of Operations / Conduct Of Maintenance - .2% Of TCC			1.00	1	$***.**	$347,200	$0	$0	$0	$0	$347,200
Subtotal						$347,200	$0	$0	$0	$0	$347,200
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$347,200
Escalation						$89,092	$0	$0	$0	$0	$89,092
Contingency						$253,049	$0	$0	$0	$0	$253,049
---Total 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE				**1**		**$689,341**	**$0**	**$0**	**$0**	**$0**	**$689,341**
--- 1200 CM PROJECT CONTROLS											
	BWI	U.C. per Lot				1215300	0	0	0	0	1215300
CM Project Controls - .7% Of TCC			1.00	0		$1,215,300	$0	$0	$0	$0	$1,215,300
Subtotal						$1,215,300	$0	$0	$0	$0	$1,215,300
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$1,215,300
Escalation						$311,846	$0	$0	$0	$0	$311,846
Contingency						$885,745	$0	$0	$0	$0	$885,745
---Total 1200 CM PROJECT CONTROLS				**0**		**$2,412,891**	**$0**	**$0**	**$0**	**$0**	**$2,412,891**
--- 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)											
	BWI	U.C. per Lot				868100	0	0	0	0	868100
CM - ES&H - .5% Of TCC			1.00	0		$868,100	$0	$0	$0	$0	$868,100

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)										
Subtotal					$868,100	$0	$0	$0	$0	$868,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$868,100
Escalation					$222,754	$0	$0	$0	$0	$222,754
Contingency					$632,696	$0	$0	$0	$0	$632,696
---Total 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)			0		$1,723,550	$0	$0	$0	$0	$1,723,550
--- 1400 CM TRAINING										
	BWI	U.C. per Lot			347200	0	0	0	0	347200
CM - Training - .2% Of TCC		1.00	0		$347,200	$0	$0	$0	$0	$347,200
Subtotal					$347,200	$0	$0	$0	$0	$347,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$347,200
Escalation					$89,092	$0	$0	$0	$0	$89,092
Contingency					$253,049	$0	$0	$0	$0	$253,049
---Total 1400 CM TRAINING			0		$689,341	$0	$0	$0	$0	$689,341
--- 1500 CM - OTHER DIRECT COSTS										
	BWI	U.C. per Lot			347200	0	0	0	0	347200
CM - Other Direct Costs - .2% Of TCC		1.00	0		$347,200	$0	$0	$0	$0	$347,200
Subtotal					$347,200	$0	$0	$0	$0	$347,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$347,200
Escalation					$89,092	$0	$0	$0	$0	$89,092
Contingency					$253,049	$0	$0	$0	$0	$253,049
---Total 1500 CM - OTHER DIRECT COSTS			0		$689,341	$0	$0	$0	$0	$689,341
--- 2400 DESIGN ACTIVITIES										
	BWI	U.C. per Lot			10417300	0	0	0	0	10417300
Title I Design - 6% Of TCC		1.00	0		$10,417,300	$0	$0	$0	$0	$10,417,300

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 2400 DESIGN ACTIVITIES										
Subtotal					$10,417,300	$0	$0	$0	$0	$10,417,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$10,417,300
Escalation					$1,259,452	$0	$0	$0	$0	$1,259,452
Contingency					$4,904,236	$0	$0	$0	$0	$4,904,236
---Total 2400 DESIGN ACTIVITIES			**0**		**$16,580,987**	**$0**	**$0**	**$0**	**$0**	**$16,580,987**
--- 3400 DESIGN ACTIVITIES										
BWI	U.C. per Lot				19619200	0	0	0	0	19619200
Title II Design - 11.3% Of TCC		1.00	0		$19,619,200	$0	$0	$0	$0	$19,619,200
Subtotal					$19,619,200	$0	$0	$0	$0	$19,619,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$19,619,200
Escalation					$3,009,585	$0	$0	$0	$0	$3,009,585
Contingency					$7,467,499	$0	$0	$0	$0	$7,467,499
---Total 3400 DESIGN ACTIVITIES			**0**		**$30,096,284**	**$0**	**$0**	**$0**	**$0**	**$30,096,284**
--- 4100 QUALITY ASSURANCE										
BWI	U.C. per Lot		0.1		8681100	0	0	0	0	8681100
Quality Assurance - 5% Of TCC		1.00	0	$***.**	$8,681,100	$0	$0	$0	$0	$8,681,100
Subtotal					$8,681,100	$0	$0	$0	$0	$8,681,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,681,100
Escalation					$2,227,570	$0	$0	$0	$0	$2,227,570
Contingency					$3,490,774	$0	$0	$0	$0	$3,490,774
---Total 4100 QUALITY ASSURANCE			**0**		**$14,399,445**	**$0**	**$0**	**$0**	**$0**	**$14,399,445**
--- 5100 PM ADMINISTRATION										
BWI	U.C. per Lot		8		13889700	0	0	0	0	13889700
Project Management - 8% Of TCC		1.00	8	$***.**	$13,889,700	$0	$0	$0	$0	$13,889,700

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5100 PM ADMINISTRATION										
Subtotal					$13,889,700	$0	$0	$0	$0	$13,889,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$13,889,700
Escalation					$3,564,097	$0	$0	$0	$0	$3,564,097
Contingency					$7,505,133	$0	$0	$0	$0	$7,505,133
---Total 5100 PM ADMINISTRATION			8		$24,958,930	$0	$0	$0	$0	$24,958,930
--- 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	BWI	U.C. per Lot	0.1		69400	0	0	0	0	69400
PM Conduct Of Operations / Conduct Of Maintenance - .04% Of TCC		1.00	0	$***.**	$69,400	$0	$0	$0	$0	$69,400
Subtotal					$69,400	$0	$0	$0	$0	$69,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$69,400
Escalation					$17,808	$0	$0	$0	$0	$17,808
Contingency					$37,499	$0	$0	$0	$0	$37,499
---Total 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			0		$124,707	$0	$0	$0	$0	$124,707
--- 5200 PM PROJECT CONTROLS										
	BWI	U.C. per Lot			3472400	0	0	0	0	3472400
PM Project Controls - 2% Of TCC		1.00	0		$3,472,400	$0	$0	$0	$0	$3,472,400
Subtotal					$3,472,400	$0	$0	$0	$0	$3,472,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,472,400
Escalation					$891,018	$0	$0	$0	$0	$891,018
Contingency					$1,876,270	$0	$0	$0	$0	$1,876,270
---Total 5200 PM PROJECT CONTROLS			0		$6,239,688	$0	$0	$0	$0	$6,239,688
--- 5300 PM RECORDS MANAGEMENT										
	BWI	U.C. per Lot			3472400	0	0	0	0	3472400
PM Records Management - 2% Of TCC		1.00	0		$3,472,400	$0	$0	$0	$0	$3,472,400

Project Name:
Universal Solvent Extraction (UNEX) Feasib.lity Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5300 PM RECORDS MANAGEMENT											
Subtotal						$3,472,400	$0	$0	$0	$0	$3,472,400
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$3,472,400
Escalation						$891,018	$0	$0	$0	$0	$891,018
Contingency						$1,876,270	$0	$0	$0	$0	$1,876,270
---Total 5300 PM RECORDS MANAGEMENT				0		$6,239,688	$0	$0	$0	$0	$6,239,688
--- 5400 SAFETY ANALYSIS											
	BWI	U.C. per Lot				2000000	0	0	0	0	2000000
Safety Analysis Report (SAR)			1.00	0		$2,000,000	$0	$0	$0	$0	$2,000,000
Subtotal						$2,000,000	$0	$0	$0	$0	$2,000,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$2,000,000
Escalation						$513,200	$0	$0	$0	$0	$513,200
Contingency						$1,080,676	$0	$0	$0	$0	$1,080,676
---Total 5400 SAFETY ANALYSIS				0		$3,593,876	$0	$0	$0	$0	$3,593,876
--- 6000 CONSTRUCTION AE SUPPORT											
	BWI	U.C. per Lot				2604300	0	0	0	0	2604300
Construction AE Support - 1.5% Of TCC			1.00	0		$2,604,300	$0	$0	$0	$0	$2,604,300
Subtotal						$2,604,300	$0	$0	$0	$0	$2,604,300
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$2,604,300
Escalation						$668,263	$0	$0	$0	$0	$668,263
Contingency						$916,318	$0	$0	$0	$0	$916,318
---Total 6000 CONSTRUCTION AE SUPPORT				0		$4,188,881	$0	$0	$0	$0	$4,188,881
--- 8300 GFE LABOR											
	2440	U.C. per Lot		1200	U21	20940	0	0	0	0	20940
Allowance To Decontaminate The Calciner Cell			1.00	1,200	$17.45	$20,940	$0	$0	$0	$0	$20,940
	2440	U.C. per Chng				0	0	45	0	0	45
Clothing Allowance - Calcinier Cell			240.00	0		$0	$0	$10,800	$0	$0	$10,800
	2440	U.C. per Lot		800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Off-Gas Cell			1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 8300 GFE LABOR										
	2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Off-Gas Cell		200.00	0		$0	$0	$9,000	$0	$0	$9,000
	2440	U.C. per Lot	800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Blend & Hold Cell		1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960
	2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Blend & Hold Cell		200.00	0		$0	$0	$9,000	$0	$0	$9,000
	2440	U.C. per Lot	800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Valve Cubicle		1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960
	2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Valve Cubicle		200.00	0		$0	$0	$9,000	$0	$0	$9,000
Subtotal					$62,820	$0	$37,800	$0	$0	$100,620
Sales Tax					$0	$0	$1,890	$0	$0	$1,890
INEEL ORG Labor/Subcontractor Overheads					$55,910	$0	$0	$0	$0	$55,910
Subtotal Estimate										$158,420
Escalation					$30,466	$0	$10,184	$0	$0	$40,651
Contingency					$199,922	$0	$66,832	$0	$0	$266,754
---Total 8300 GFE LABOR			3,600		$349,118	$0	$116,706	$0	$0	$465,825
--- 9101.1 GENERAL CONDITIONS										
	GEN	U.C. per Lot	56339	CN-SUPR	2253560	0	0	0	0	2253560
Supervision - 15% Of Labor Hours		1.00	56,339	$40.00	$2,253,560	$0	$0	$0	$0	$2,253,560
	GEN	U.C. per Lot	26291	CN-LABR	791096.19	0	0	0	0	791096.19
Training - 7% Of Labor Hours		1.00	26,291	$30.09	$791,096	$0	$0	$0	$0	$791,096
	GEN	U.C. per Lot	1878	CN-LABR	56509.02	10000	0	0	0	66509.02
Mobilization & Demobilization - .5% Of Labor Hours		1.00	1,878	$30.09	$56,509	$10,000	$0	$0	$0	$66,509
	GEN	U.C. per Lot			0	0	8200600	0	0	8200600
(*)Material Adjustment - Additional 10% On Material & Subcontracts		1.00	0		$0	$0	$8,200,600	$0	$0	$8,200,600
Memo: Adjustment for DOE/RW/0333P Quality Standards.										
Subtotal					$3,101,165	$10,000	$8,200,600	$0	$0	$11,311,765
Sales Tax					$0	$0	$410,030	$0	$0	$410,030
INEEL ORG Labor/Subcontractor Overheads					$1,100,340	$3,548	$3,055,181	$0	$0	$4,159,069
Subtotal Estimate										$15,880,864
Escalation					$1,078,106	$3,476	$2,993,447	$0	$0	$4,075,030
Contingency					$2,375,825	$7,661	$6,596,666	$0	$0	$8,980,152
---Total 9101.1 GENERAL CONDITIONS			84,508		$7,655,436	$24,686	$21,255,924	$0	$0	$28,936,046

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	GEN U.C. per Hr		0.08	CN-SKWK	2.762	0	0	0	0	2.762
(*)Labor Adjustment		376,360.00	30,109	$34.52	$1,039,356	$0	$0	$0	$0	$1,039,356
Memo: Conduct of Operations / Conduct of Maintenance - Add 8% to construction labor hours.										
Subtotal					$1,039,356	$0	$0	$0	$0	$1,039,356
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$368,779	$0	$0	$0	$0	$368 779
Subtotal Estimate										**$1,408,135**
Escalation					$361,327	$0	$0	$0	$0	$361,327
Contingency					$796,258	$0	$0	$0	$0	$796,258
---Total 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			**30,109**		**$2,565,720**	**$0**	**$0**	**$0**	**$0**	**$2,565,720**
--- 9102.1 SITEWORK - UTILITIES										
	GEN U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Firewater		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN U.C. per Lf		0.5	CN-LABR	15.045	2	12	0	0	29.045
Piping - Firewater		300.00	150	$30.09	$4,514	$600	$3,600	$0	$0	$8,714
	GEN U.C. per Cy		0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Sewer		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN U.C. per Lf		0.03	CN-LABR	0.903	2	5	0	0	7.903
Piping - Sewer		300.00	9	$30.09	$271	$600	$1,500	$0	$0	$2,371
Subtotal					$38,485	$9,200	$5,100	$0	$0	$52,785
Sales Tax					$0	$0	$255	$0	$0	$255
INEEL ORG Labor/Subcontractor Overheads					$13,655	$3,264	$1,900	$0	$0	$18,819
Subtotal Estimate										**$71,860**
Escalation					$13,379	$3,198	$1,862	$0	$0	$18,439
Contingency					$41,932	$10,024	$5,835	$0	$0	$57,791
---Total 9102.1 SITEWORK - UTILITIES			**1,279**		**$107,452**	**$25,687**	**$14,951**	**$0**	**$0**	**$148,090**
--- 9102.2 SITEWORK - TFD FACILITY										
	GEN U.C. per Sf		0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		27,000.00	810	$30.09	$24,373	$13,500	$0	$0	$0	$37,873

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.2 SITEWORK - TFD FACILITY										
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		8,550.00	5,985	$30.09	$180,089	$42,750	$0	$0	$0	$222,839
Subtotal					$204,462	$56,250	$0	$0	$0	$260,712
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$72,546	$19,958	$0	$0	$0	$92,504
Subtotal Estimate										$353,216
Escalation					$71,080	$19,555	$0	$0	$0	$90,635
Contingency					$222,776	$61,289	$0	$0	$0	$284,065
---Total 9102.2 SITEWORK - TFD FACILITY			6,795		$570,864	$157,052	$0	$0	$0	$727,916
--- 9102.3 SITEWORK - BOILER HOUSE										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		4,000.00	120	$30.09	$3,611	$2,000	$0	$0	$0	$5,611
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		500.00	350	$30.09	$10,532	$2,500	$0	$0	$0	$13,032
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Steam & Condensate		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.05	CN-LABR	1.505	2	5	0	0	8.505
Piping - Steam & Condensate		600.00	30	$30.09	$903	$1,200	$3,000	$0	$0	$5,103
	GEN	U.C. per Cf	0.17	CN-LABR	5.115	0	16.55	0	0	21.665
Gilsulate Insulation		477.00	81	$30.09	$2,440	$0	$7,894	$0	$0	$10,334
Subtotal					$34,335	$9,700	$10,894	$0	$0	$54,930
Sales Tax					$0	$0	$545	$0	$0	$545
INEEL ORG Labor/Subcontractor Overheads					$12,183	$3,442	$4,059	$0	$0	$19,683
Subtotal Estimate										$75,158
Escalation					$11,937	$3,372	$3,977	$0	$0	$19,285
Contingency					$37,411	$10,569	$12,464	$0	$0	$60,444
---Total 9102.3 SITEWORK - BOILER HOUSE			1,141		$95,866	$27,083	$31,938	$0	$0	$154,887
--- 9102.4 SITEWORK - STORAGE FACILITY										
	GEN	U.C. per CY	0.012	CN-ENGR	0.391	2	0	0	0	2.391
BUILDING EXCAVATION		17,160.00	206	$32.56	$6,705	$34,320	$0	$0	$0	$41,025
	GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BACKFILL		12,240.00	734	$32.56	$23,912	$24,480	$0	$0	$0	$48,392

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.4 SITEWORK - STORAGE FACILITY										
	GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BERM FILL		6,900.00	414	$32.56	$13,480	$13,800	$0	$0	$0	$27,280
Subtotal					$44,097	$72,600	$0	$0	$0	$116,697
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$15,646	$25,760	$0	$0	$0	$41,406
Subtotal Estimate										$158,102
Escalation					$15,330	$25,239	$0	$0	$0	$40,569
Contingency					$48,047	$79,103	$0	$0	$0	$127,150
---Total 9102.4 SITEWORK - STORAGE FACILITY			**1,354**		**$123,119**	**$202,702**	**$0**	**$0**	**$0**	**$325,821**
--- 9102.5 SITEWORK - TUNNEL										
	GEN	U.C. per Cy	0.6	CN-LABR	18.054	12	0	0	0	30.054
(*)Excavate & Backfill For Tunnel		4,500.00	2,700	$30.09	$81,243	$54,000	$0	$0	$0	$135,243
Memo: Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.										
	GEN	U.C. per Cy	3	CN-LABR	90.27	12	0	0	0	102.27
Allowance For Hand Excavation		100.00	300	$30.09	$9,027	$1,200	$0	$0	$0	$10,227
Subtotal					$90,270	$55,200	$0	$0	$0	$145,470
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$32,029	$19,586	$0	$0	$0	$51,615
Subtotal Estimate										$197,085
Escalation					$31,382	$19,190	$0	$0	$0	$50,572
Contingency					$98,356	$60,145	$0	$0	$0	$158,500
---Total 9102.5 SITEWORK - TUNNEL			**3,000**		**$252,037**	**$154,120**	**$0**	**$0**	**$0**	**$406,157**
--- 9102.6 SITEWORK - PAVING										
	GEN	U.C. per Sf	0.05	CN-SKWK	1.726	1.2	0	0	0	2.926
Pavement Removal		7,050.00	353	$34.52	$12,168	$8,460	$0	$0	$0	$20,628
	GEN	U.C. per Sf	0.03	CN-SKWK	1.036	1	2	0	0	4.036
New Pavement		6,600.00	198	$34.52	$6,835	$6,600	$13,200	$0	$0	$26,635
Subtotal					$19,003	$15,060	$13,200	$0	$0	$47,263
Sales Tax					$0	$0	$660	$0	$0	$660
INEEL ORG Labor/Subcontractor Overheads					$6,743	$5,344	$4,918	$0	$0	$17,004
Subtotal Estimate										$64,927
Escalation					$6,606	$5,236	$4,818	$0	$0	$16,660
Contingency					$20,705	$16,409	$15,102	$0	$0	$52,216
---Total 9102.6 SITEWORK - PAVING			**551**		**$53,058**	**$42,048**	**$38,698**	**$0**	**$0**	**$133,803**

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.2 CONCRETE - TFD FACILITY											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings			430.00	2,150	$34.52	$74,218	$0	$77,400	$0	$0	$151,618
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 12" Thick			725.00	3,625	$34.52	$125,135	$0	$130,500	$0	$0	$255,635
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 24" Thick			585.00	2,925	$34.52	$100,971	$0	$105,300	$0	$0	$206,271
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Shielding Walls - 24" Thick			1,005.00	5,025	$34.52	$173,463	$0	$180,900	$0	$0	$354,363
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick			200.00	1,000	$34.52	$34,520	$0	$36,000	$0	$0	$70,520
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping			170.00	850	$34.52	$29,342	$0	$30,600	$0	$0	$59,942
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.			250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Lot		120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads			1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
	GEN	U.C. per Sf			CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 12" Thick			36,345.00	0		$0	$0	$0	$445,226	$0	$445,226
	GEN	U.C. per Sf			CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels			13,700.00	0		$0	$0	$123,300	$0	$0	$123,300
	GEN	U.C. per Ea		8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels			170.00	1,360	$34.52	$46,947	$0	$0	$0	$0	$46,947
	GEN	U.C. per Day		20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams			24.00	480	$34.52	$16,570	$0	$0	$0	$0	$16,570
	GEN	U.C. per Ea		8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels			170.00	1,360	$34.52	$46,947	$0	$3,400	$0	$0	$50,347
	GEN	U.C. per Ea		250	CN-SKWK	8630	0	45000	0	0	53630
Stairwell			1.00	250	$34.52	$8,630	$0	$45,000	$0	$0	$53,630

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.2 CONCRETE - TFD FACILITY										
GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		250.00	50	$34.52	$1,726	$0	$1,250	$0	$0	$2,976
Subtotal					$705,761	$0	$781,150	$445,226	$0	$1,932,138
Sales Tax					$0	$0	$39,058	$0	$0	$39,058
INEEL ORG Labor/Subcontractor Overheads					$250,415	$0	$291,022	$157,973	$0	$699,410
Subtotal Estimate										$2,670,605
Escalation					$245,355	$0	$285,141	$154,781	$0	$685,277
Contingency					$312,398	$0	$363,056	$197,075	$0	$872,529
---Total 9103.2 CONCRETE - TFD FACILITY			20,445		$1,513,929	$0	$1,759,427	$955,055	$0	$4,228,411
--- 9103.3 CONCRETE - BOILER HOUSE										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings & Floors		92.00	460	$34.52	$15,879	$0	$16,560	$0	$0	$32,439
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Lot		20	CN-SKWK	690.4	0	500	0	0	1190.4
Misc. Concrete Pads		1.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide		100.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
Subtotal					$17,260	$0	$17,560	$0	$0	$34,820
Sales Tax					$0	$0	$878	$0	$0	$878
INEEL ORG Labor/Subcontractor Overheads					$6,124	$0	$6,542	$0	$0	$12,666
Subtotal Estimate										$48,364
Escalation					$6,000	$0	$6,410	$0	$0	$12,410
Contingency					$7,640	$0	$8,161	$0	$0	$15,801
---Total 9103.3 CONCRETE - BOILER HOUSE			500		$37,024	$0	$39,551	$0	$0	$76,576
--- 9103.4 CONCRETE - STORAGE FACILITY										
GEN	U.C. per EA				0	0	0	75000	0	75000
Hatch Plugs		3.00	0		$0	$0	$0	$225,000	$0	$225,000
GEN	U.C. per Sf			CN-SKWK	0	0	0	8.5	0	8.5
Precast Concrete Walls - 6" Thick		17,160.00	0		$0	$0	$0	$145,860	$0	$145,860
GEN	U.C. per Sf			CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels		20,440.00	0		$0	$0	$183,960	$0	$0	$183,960
GEN	U.C. per Ea		8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels		126.00	1,008	$34.52	$34,796	$0	$0	$0	$0	$34,796
GEN	U.C. per Day		20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams		22.00	440	$34.52	$15,189	$0	$0	$0	$0	$15,189

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.4 CONCRETE - STORAGE FACILITY											
	GEN	U.C. per Ea		8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels			126.00	1,008	$34.52	$34,796	$0	$2,520	$0	$0	$37,316
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings			260.00	1,300	$34.52	$44,876	$0	$46,800	$0	$0	$91,676
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick			380.00	1,900	$34.52	$65,588	$0	$68,400	$0	$0	$133,988
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Partition Wall - 12" Thick			180.00	900	$34.52	$31,068	$0	$32,400	$0	$0	$63,468
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide			500.00	100	$34.52	$3,452	$0	$2,500	$0	$0	$5,952
Subtotal						$229,765	$0	$336,580	$370,860	$0	$937,205
Sales Tax						$0	$0	$16,829	$0	$0	$16,829
INEEL ORG Labor/Subcontractor Overheads						$81,524	$0	$125,395	$131,587	$0	$338,506
Subtotal Estimate											$1,292,540
Escalation						$79,877	$0	$122,861	$128,928	$0	$331,666
Contingency						$101,703	$0	$156,433	$164,157	$0	$422,293
---Total 9103.4 CONCRETE - STORAGE FACILITY				6,658		$492,869	$0	$758,098	$795,532	$0	$2,046,499
--- 9103.5 CONCRETE - TUNNEL											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete For Tunnel - 12" Thick All Surfaces			190.00	950	$34.52	$32,794	$0	$34,200	$0	$0	$66,994
Memo: Includes formwork, concrete, and rebar. Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.											
Subtotal						$32,794	$0	$34,200	$0	$0	$66,994
Sales Tax						$0	$0	$1,710	$0	$0	$1,710
INEEL ORG Labor/Subcontractor Overheads						$11,636	$0	$12,741	$0	$0	$24,377
Subtotal Estimate											$93,081
Escalation						$11,401	$0	$12,484	$0	$0	$23,885
Contingency						$14,516	$0	$15,895	$0	$0	$30,411
---Total 9103.5 CONCRETE - TUNNEL				950		$70,346	$0	$77,031	$0	$0	$147,377
--- 9105.1.1 METALS DEMOLITION - CALCINER CELL											
	GEN	U.C. per Lot		60	CN-IRON	2409.6	0	0	0	0	2409.6
Remove Support Steel For Installation Of New Wall			1.00	60	$40.16	$2,410	$0	$0	$0	$0	$2,410
	GEN	U.C. per Box		10	CN-IRON	401.6	0	0	0	0	401.6
Allowance To "Hot Box" Material			2.00	20	$40.16	$803	$0	$0	$0	$0	$803

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9105.1.1 METALS DEMOLITION - CALCINER CELL										
	GEN	U.C. per Lot	120	CN-IRON	4819.2	0	0	0	0	4819.2
Labor Adjustment For Working In "Hot" Area - 200%		1.00	120	$40.16	$4,819	$0	$0	$0	$0	$4,819
Subtotal					$8,032	$0	$0	$0	$0	$8,032
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$2,850	$0	$0	$0	$0	$2,850
Subtotal Estimate										$10,882
Escalation					$2,792	$0	$0	$0	$0	$2,792
Contingency					$3,555	$0	$0	$0	$0	$3,555
---Total 9105.1.1 METALS DEMOLITION - CALCINER CELL			**200**		**$17,229**	**$0**	**$0**	**$0**	**$0**	**$17,229**
— 9105.3 METALS - TFD FACILITY										
	STEEL	U.C. per Sf	2	CN-IRON	80.32	0	10	0	0	90.32
Liner Plate - 4' Up From Floor		1,025.00	2,050	$40.16	$82,328	$0	$10,250	$0	$0	$92,578
	STEEL	U.C. per Lot	200	CN-IRON	8032	0	25000	0	0	33032
Misc. Embeds		1.00	200	$40.16	$8,032	$0	$25,000	$0	$0	$33,032
	STEEL	U.C. per Lot	1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals		1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
	STEEL	U.C. per Sf	0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure		13,700.00	548	$40.16	$22,008	$0	$32,880	$0	$0	$54,888
	STEEL	U.C. per Ea	10	CN-IRON	401.6	0	3000	0	0	3401.6
Stairway		1.00	10	$40.16	$402	$0	$3,000	$0	$0	$3,402
Subtotal					$152,929	$0	$221,130	$0	$0	$374,059
Sales Tax					$0	$0	$11,057	$0	$0	$11,057
INEEL ORG Labor/Subcontractor Overheads					$64,128	$0	$97,363	$0	$0	$161,491
Subtotal Estimate										$546,606
Escalation					$55,697	$0	$84,562	$0	$0	$140,259
Contingency					$70,916	$0	$107,669	$0	$0	$178,585
---Total 9105.3 METALS - TFD FACILITY			**3,808**		**$343,670**	**$0**	**$521,781**	**$0**	**$0**	**$865,451**
— 9105.4 METALS - BOILER HOUSE										
	GEN	U.C. per Sf			0	0	0	18	0	18
Pre-Engineered Metal Building		3,120.00	0		$0	$0	$0	$56,160	$0	$56,160
	GEN	U.C. per Lot	40	CN-IRON	1606.4	0	1200	0	0	2806.4
Misc. Metals		1.00	40	$40.16	$1,606	$0	$1,200	$0	$0	$2,806
	STEEL	U.C. per EA	40	CN-IRON	1606.4	0	275	0	0	1881.4
BOILER STACK SUPPORTS		2.00	80	$40.16	$3,213	$0	$550	$0	$0	$3,763

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9105.4 METALS - BOILER HOUSE									
STEEL	U.C. per LBS	0.018	CN-IRON	0.723	0	1.62	0	0	2.343
BOILER BUILDING PLATFORMS	11,000.00	198	$40.16	$7,952	$0	$17,820	$0	$0	$25,772
STEEL	U.C. per LBS	0.012	CN-IRON	0.482	0	0.4	0	0	0.882
BOILER BUILDING ROOF FRAMING	21,840.00	262	$40.16	$10,525	$0	$8,736	$0	$0	$19,261
Subtotal				$23,296	$0	$28,306	$56,160	$0	$107,762
Sales Tax				$0	$0	$1,415	$0	$0	$1,415
INEEL ORG Labor/Subcontractor Overheads				$9,665	$0	$12,382	$19,926	$0	$41,973
Subtotal Estimate									$151,151
Escalation				$8,458	$0	$10,804	$19,524	$0	$38,785
Contingency				$10,769	$0	$13,756	$24,859	$0	$49,383
—Total 9105.4 METALS - BOILER HOUSE		580		$52,188	$0	$66,662	$120,469	$0	$239,319
— 9105.5 METALS - STORAGE FACILITY									
STEEL	U.C. per TON	6	CN-IRON	240.96	0	1100	0	0	1340.96
CHARGE FACE SLAB FRAME	780.00	4,680	$40.16	$187,949	$0	$858,000	$0	$0	$1,045,949
STEEL	U.C. per TON	10	CN-IRON	401.6	0	1200	0	0	1601.6
BUILDING STRUCTURAL STEEL	756.00	7,560	$40.16	$303,610	$0	$907,200	$0	$0	$1,210,810
STEEL	U.C. per LF	3.85	CN-IRON	154.616	0	161	0	0	315.616
GANTRY CRANE RAILS, EMBEDS, ETC.	400.00	1,540	$40.16	$61,846	$0	$64,400	$0	$0	$126,246
STEEL	U.C. per LF	2	CN-IRON	80.32	0	92	0	0	172.32
RAILROAD TRACKS - WITHIN BUILDING	180.00	360	$40.16	$14,458	$0	$16,560	$0	$0	$31,018
STEEL	U.C. per LF	2	CN-IRON	80.32	0	92	0	0	172.32
TRANSFER CART RAILS	210.00	420	$40.16	$16,867	$0	$19,320	$0	$0	$36,187
STEEL	U.C. per SF	0.25	CN-IRON	10.04	0	40	0	0	50.04
BIRD SCREEN AND VENT LOUVERS	2,300.00	575	$40.16	$23,092	$0	$92,000	$0	$0	$115,092
STEEL	U.C. per SF		CN-IRON	0	0	0	12	0	12
AIR OUTLET WALL (INSIDE)	12,600.00	0		$0	$0	$0	$151,200	$0	$151,200

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.5 METALS - STORAGE FACILITY										
STEEL	U.C. per Lot		750	CN-IRON	30120	0	45000	0	0	75120
(*)Misc. Steel		1.00	750	$40.16	$30,120	$0	$45,000	$0	$0	$75,120
Memo: Handrails, stairways, grating, and etc.										
Subtotal					$637,942	$0	$2,002,480	$151,200	$0	$2,791,622
Sales Tax					$0	$0	$100,124	$0	$0	$100,124
INEEL ORG Labor/Subcontractor Overheads					$267,508	$0	$881,685	$63,403	$0	$1,212,596
Subtotal Estimate										$4,104,341
Escalation					$232,338	$0	$765,769	$55,067	$0	$1,053,174
Contingency					$295,825	$0	$975,015	$70,114	$0	$1,340,954
---Total 9105.5 METALS - STORAGE FACILITY			15,885		$1,433,613	$0	$4,725,072	$339,784	$0	$6,498,469
--- 9107.1 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
GEN	U.C. per Sf		0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,000.00	66	$34.64	$2,286	$0	$1,200	$0	$0	$3,486
GEN	U.C. per Sf		0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		37,000.00	2,220	$34.64	$76,901	$0	$77,700	$0	$0	$154,601
GEN	U.C. per Sf		0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		37,000.00	2,960	$30.09	$89,066	$0	$166,500	$0	$0	$255,566
GEN	U.C. per Hr		0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		1,290.00	323	$30.09	$9,704	$0	$0	$0	$0	$9,704
GEN	U.C. per Lot				0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
GEN	U.C. per Sf		0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		13,700.00	274	$30.09	$8,245	$0	$13,015	$0	$0	$21,260
ROOF	U.C. per Sf		0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		13,700.00	192	$29.95	$5,744	$0	$30,140	$0	$0	$35,884
ROOF	U.C. per Lot		200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$197,937	$3,000	$293,555	$0	$0	$494,492
Sales Tax					$0	$0	$14,678	$0	$0	$14,678
INEEL ORG Labor/Subcontractor Overheads					$77,972	$1,064	$133,706	$0	$0	$212,742
Subtotal Estimate										$721,911
Escalation					$70,798	$1,043	$113,401	$0	$0	$185,242
Contingency					$90,144	$1,328	$144,388	$0	$0	$235,860
---Total 9107.1 THERMAL & MOISTURE PROTECTION - TFD FACILITY			6,234		$436,850	$6,435	$699,729	$0	$0	$1,143,014

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.2 THERMAL & MOISTURE PROTECTION - BOILER HOUSE										
	INSUL	U.C. per SF			0	0	0	1.9	0	1.9
EXTERIOR WALL INSULATION W/ Z-GIRTS		6,720.00	0		$0	$0	$0	$12,768	$0	$12,768
	INSUL	U.C. per SF			0	0	0	1	0	1
ROOF INSULATION		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	GEN	U.C. per SF	0.023	CN-SHEE	0.816	0	3	0	0	3.816
EXTERIOR WALL METAL SIDING		6,720.00	155	$35.48	$5,484	$0	$20,160	$0	$0	$25,644
	GEN	U.C. per SF	0.016	CN-SHEE	0.568	0	5	0	0	5.568
STANDING SEAM METAL ROOF		3,120.00	50	$35.48	$1,771	$0	$15,600	$0	$0	$17,371
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		950.00	31	$34.64	$1,086	$0	$570	$0	$0	$1,656
Subtotal					$8,341	$0	$36,330	$15,888	$0	$60,559
Sales Tax					$0	$0	$1,817	$0	$0	$1,817
INEEL ORG Labor/Subcontractor Overheads					$2,959	$0	$13,535	$6,662	$0	$23,157
Subtotal Estimate										$85,532
Escalation					$2,900	$0	$13,261	$5,786	$0	$21,948
Contingency					$3,692	$0	$16,885	$7,368	$0	$27,945
---Total 9107.2 THERMAL & MOISTURE PROTECTION - BOILER HOUSE			236		$17,892	$0	$81,828	$35,704	$0	$135,424
--- 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,300.00	76	$34.64	$2,629	$0	$1,380	$0	$0	$4,009
	GEN	U.C. per Sf	0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		17,200.00	1,032	$34.64	$35,748	$0	$36,120	$0	$0	$71,868
	GEN	U.C. per Sf	0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		17,200.00	1,376	$30.09	$41,404	$0	$77,400	$0	$0	$118,804
	GEN	U.C. per Hr	0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		2,408.00	602	$30.09	$18,114	$0	$0	$0	$0	$18,114
	GEN	U.C. per Lot			0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
	GEN	U.C. per Sf	0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		20,500.00	410	$30.09	$12,337	$0	$19,475	$0	$0	$31,812
	ROOF	U.C. per Sf	0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		20,500.00	287	$29.95	$8,596	$0	$45,100	$0	$0	$53,696

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY											
	ROOF	U.C. per Lot		200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.			1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal						$124,818	$3,000	$184,475	$0	$0	$312,293
Sales Tax						$0	$0	$9,224	$0	$0	$9,224
INEEL ORG Labor/Subcontractor Overheads						$53,909	$1,064	$103,430	$0	$0	$158,404
Subtotal Estimate											$479,921
Escalation						$45,861	$1,043	$76,243	$0	$0	$123,148
Contingency						$58,393	$1,328	$97,077	$0	$0	$156,798
---Total 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY				3,983		$282,982	$6,435	$470,448	$0	$0	$759,866
--- 9108.2 DOORS & WINDOWS - TFD FACILITY											
	GEN	U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware			12.00	120	$34.64	$4,157	$0	$12,000	$0	$0	$16,157
	GEN	U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware			6.00	90	$34.64	$3,118	$0	$10,800	$0	$0	$13,918
	GEN	U.C. per Ea		12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors			4.00	48	$34.64	$1,663	$0	$8,000	$0	$0	$9,663
	GEN	U.C. per Ea		40	CN-CARP	1385.6	500	25000	0	0	26885.6
3' x 7' Shielding Doors			2.00	80	$34.64	$2,771	$1,000	$50,000	$0	$0	$53,771
	GEN	U.C. per Ea		75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door			2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal						$16,904	$1,000	$112,800	$0	$0	$130,704
Sales Tax						$0	$0	$5,640	$0	$0	$5,640
INEEL ORG Labor/Subcontractor Overheads						$5,998	$355	$42,024	$0	$0	$48,377
Subtotal Estimate											$184,721
Escalation						$5,877	$348	$41,175	$0	$0	$47,399
Contingency						$7,483	$443	$52,426	$0	$0	$60,351
---Total 9108.2 DOORS & WINDOWS - TFD FACILITY				488		$36,261	$2,145	$254,066	$0	$0	$292,472
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE											
	GEN	U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware			3.00	30	$34.64	$1,039	$0	$3,000	$0	$0	$4,039
	GEN	U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware			1.00	15	$34.64	$520	$0	$1,800	$0	$0	$2,320

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE											
	GEN	U.C. per Ea		75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door			1.00	75	$34.64	$2,598	$0	$16,000	$0	$0	$18,598
Subtotal						$4,157	$0	$20,800	$0	$0	$24,957
Sales Tax						$0	$0	$1,040	$0	$0	$1,040
INEEL ORG Labor/Subcontractor Overheads						$1,475	$0	$7,749	$0	$0	$9,224
Subtotal Estimate											$35,221
Escalation						$1,445	$0	$7,593	$0	$0	$9,038
Contingency						$1,840	$0	$9,667	$0	$0	$11,507
---Total 9108.3 DOORS & WINDOWS - BOILER HOUSE				120		$8,917	$0	$46,849	$0	$0	$55,766
--- 9108.4 DOORS & WINDOWS - STORAGE FACILITY											
	GEN	U.C. per EA		75	CN-SKWK	2589	0	16000	0	0	18589
OVERHEAD DOORS			2.00	150	$34.52	$5,178	$0	$32,000	$0	$0	$37,178
	GEN	U.C. per EA		10	CN-SKWK	345.2	0	1000	0	0	1345.2
PERSONNEL DOORS			5.00	50	$34.52	$1,726	$0	$5,000	$0	$0	$6,726
Subtotal						$6,904	$0	$37,000	$0	$0	$43,904
Sales Tax						$0	$0	$1,850	$0	$0	$1,850
INEEL ORG Labor/Subcontractor Overheads						$2,450	$0	$13,785	$0	$0	$16,234
Subtotal Estimate											$61,988
Escalation						$2,400	$0	$13,506	$0	$0	$15,906
Contingency						$3,056	$0	$17,197	$0	$0	$20,253
---Total 9108.4 DOORS &'WINDOWS - STORAGE FACILITY				200		$14,810	$0	$83,337	$0	$0	$98,147
--- 9109.1 FINISHES - NWCF											
	PAINT	U.C. per Lot		200	CN-PAIN	6078	0	2500	0	0	8578
Misc. Painting			1.00	200	$30.39	$6,078	$0	$2,500	$0	$0	$8,578
	GEN	U.C. per Sf				0	0	0	7	0	7
RCRA Floor - Grouting Facility			14,800.00	0		$0	$0	$0	$103,600	$0	$103,600
Subtotal						$6,078	$0	$2,500	$103,600	$0	$112,178
Sales Tax						$0	$0	$125	$0	$0	$125
INEEL ORG Labor/Subcontractor Overheads						$2,549	$0	$1,101	$36,759	$0	$40,408
Subtotal Estimate											$152,711
Escalation						$2,214	$0	$956	$36,016	$0	$39,186
Contingency						$2,818	$0	$1,217	$45,857	$0	$49,893
---Total 9109.1 FINISHES - NWCF				200		$13,659	$0	$5,899	$222,232	$0	$241,790

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.2 FINISHES - TFD FACILITY										
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		100,000.00	3,000	$30.39	$91,170	$0	$75,000	$0	$0	$166,170
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Hot Cell		26,000.00	2,080	$30.39	$63,211	$0	$39,000	$0	$0	$102,211
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting		30,000.00	330	$30.39	$10,029	$0	$15,000	$0	$0	$25,029
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		20.00	80	$30.39	$2,431	$0	$1,000	$0	$0	$3,431
	PAINT	U.C. per Lot	80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint		1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
Subtotal					$210,177	$0	$135,520	$0	$0	$345,697
Sales Tax					$0	$0	$6,776	$0	$0	$6,776
INEEL ORG Labor/Subcontractor Overheads					$88,134	$0	$59,669	$0	$0	$147,803
Subtotal Estimate										$500,276
Escalation					$76,547	$0	$51,824	$0	$0	$128,371
Contingency					$97,463	$0	$65,985	$0	$0	$163,448
---Total 9109.2 FINISHES - TFD FACILITY			**6,916**		**$472,320**	**$0**	**$319,774**	**$0**	**$0**	**$792,095**
--- 9109.3 FINISHES - BOILER HOUSE										
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		4.00	16	$30.39	$486	$0	$200	$0	$0	$686
	PAINT	U.C. per Lot	16	CN-PAIN	486.24	0	150	0	0	636.24
Touch-Up Paint		1.00	16	$30.39	$486	$0	$150	$0	$0	$636
Subtotal					$972	$0	$350	$0	$0	$1,322
Sales Tax					$0	$0	$18	$0	$0	$18
INEEL ORG Labor/Subcontractor Overheads					$408	$0	$154	$0	$0	$562
Subtotal Estimate										$1,902
Escalation					$354	$0	$134	$0	$0	$488
Contingency					$451	$0	$170	$0	$0	$621
---Total 9109.3 FINISHES - BOILER HOUSE			**32**		**$2,185**	**$0**	**$826**	**$0**	**$0**	**$3,011**

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.4 FINISHES - STORAGE FACILITY										
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		2,500.00	75	$30.39	$2,279	$0	$1,875	$0	$0	$4,154
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Remote Handling Area		22,000.00	1,760	$30.39	$53,486	$0	$33,000	$0	$0	$86,486
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Floor Painting - Decontaminable - Remote Handling Area		17,600.00	1,408	$30.39	$42,789	$0	$26,400	$0	$0	$69,189
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		7.00	28	$30.39	$851	$0	$350	$0	$0	$1,201
	PAINT	U.C. per Lot	40	CN-PAIN	1215.6	0	150	0	0	1365.6
Touch-Up Paint		1.00	40	$30.39	$1,216	$0	$150	$0	$0	$1,366
Subtotal					$141,526	$0	$67,145	$0	$0	$208,671
Sales Tax					$0	$0	$3,357	$0	$0	$3,357
INEEL ORG Labor/Subcontractor Overheads					$59,346	$0	$29,564	$0	$0	$88,910
Subtotal Estimate										$300,938
Escalation					$51,544	$0	$25,677	$0	$0	$77,221
Contingency					$65,628	$0	$32,693	$0	$0	$98,321
---Total 9109.4 FINISHES - STORAGE FACILITY			4,657		$318,045	$0	$158,436	$0	$0	$476,481
--- 9110.1 SPECIALTIES - NWCF										
	GEN	U.C. per Lf	0.25	CN-LABR	7.523	0	80	0	0	87.523
Storage Racks		4,700.00	1,175	$30.09	$35,356	$0	$376,000	$0	$0	$411,356
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	750000	0	0	763808
Auto Retrieval System With Three Fork Lifts		1.00	400	$34.52	$13,808	$0	$750,000	$0	$0	$763,808

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.1 SPECIALTIES - NWCF											
	GEN	U.C. per Ea		550	CN-SKWK	18986	0	50000	0	0	68986
Truck Loading Station			1.00	550	$34.52	$18,986	$0	$50,000	$0	$0	$68,986
Subtotal						$68,150	$0	$1,176,000	$0	$0	$1,244,150
Sales Tax						$0	$0	$58,800	$0	$0	$58,800
INEEL ORG Labor/Subcontractor Overheads						$24,181	$0	$438,126	$0	$0	$462,306
Subtotal Estimate											$1,765,256
Escalation						$23,692	$0	$429,273	$0	$0	$452,965
Contingency						$34,807	$0	$630,659	$0	$0	$665,466
---Total 9110.1 SPECIALTIES - NWCF				**2,125**		**$150,829**	**$0**	**$2,732,858**	**$0**	**$0**	**$2,883,687**
--- 9110.2 SPECIALTIES - TFD FACILITY											
	GEN	U.C. per Ea		120	CN-IRON	4819.2	0	75000	0	0	79819.2
20 Ton O.H. Crane			1.00	120	$40.16	$4,819	$0	$75,000	$0	$0	$79,819
	GEN	U.C. per Ea		80	CN-IRON	3212.8	0	50000	0	0	53212.8
Hot Cell O.H. Crane			1.00	80	$40.16	$3,213	$0	$50,000	$0	$0	$53,213
	GEN	U.C. per Ea		100	CN-MILL	3292	0	170000	0	0	173292
Shielding Windows - 2' Thick			8.00	800	$32.92	$26,336	$0	$1,360,000	$0	$0	$1,386,336
	GEN	U.C. per Ea		200	CN-MILL	6584	0	1419000	0	0	1425584
PaR Manipulators - Model 4350 - Wall Mounted			4.00	800	$32.92	$26,336	$0	$5,676,000	$0	$0	$5,702,336
	GEN	U.C. per Lot				0	0	0	6000000	0	6000000
Robotic / Remote Handling Allowance			1.00	0		$0	$0	$0	$6,000,000	$0	$6,000,000
Subtotal						$60,704	$0	$7,161,000	$6,000,000	$0	$13,221,704
Sales Tax						$0	$0	$358,050	$0	$0	$358,050
INEEL ORG Labor/Subcontractor Overheads						$21,539	$0	$2,667,872	$2,128,890	$0	$4,818,300
Subtotal Estimate											$18,398,054
Escalation						$21,103	$0	$2,613,964	$2,085,873	$0	$4,720,941
Contingency						$31,004	$0	$3,840,266	$3,064,429	$0	$6,935,699
---Total 9110.2 SPECIALTIES - TFD FACILITY				**1,800**		**$134,350**	**$0**	**$16,641,152**	**$13,279,192**	**$0**	**$30,054,694**
--- 9110.3 SPECIALTIES - BOILER HOUSE											
	GEN	U.C. per Ea		100	CN-IRON	4016	0	40000	0	0	44016
10 Ton O.H. Crane			1.00	100	$40.16	$4,016	$0	$40,000	$0	$0	$44,016

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9110.3 SPECIALTIES - BOILER HOUSE										
Subtotal					$4,016	$0	$40,000	$0	$0	$44,016
Sales Tax					$0	$0	$2,000	$0	$0	$2,000
INEEL ORG Labor/Subcontractor Overheads					$1,425	$0	$14,902	$0	$0	$16,327
Subtotal Estimate										$62,343
Escalation					$1,396	$0	$14,601	$0	$0	$15,997
Contingency					$2,051	$0	$21,451	$0	$0	$23,502
---Total 9110.3 SPECIALTIES - BOILER HOUSE			100		$8,888	$0	$92,954	$0	$0	$101,843
--- 9110.4 SPECIALTIES - STORAGE FACILITY										
GEN	U.C. per EA		50	CN-IRON	2008	0	23100	0	0	25108
VAULT TUBE ASSEMBLIES		1,584.00	79,200	$40.16	$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Subtotal					$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Sales Tax					$0	$0	$1,829,520	$0	$0	$1,829,520
INEEL ORG Labor/Subcontractor Overheads					$1,128,550	$0	$13,631,964	$0	$0	$14,760,514
Subtotal Estimate										$56,361,106
Escalation					$1,105,746	$0	$13,356,513	$0	$0	$14,462,260
Contingency					$1,624,491	$0	$19,622,519	$0	$0	$21,247,010
---Total 9110.4 SPECIALTIES - STORAGE FACILITY			79,200		$7,039,459	$0	$85,030,917	$0	$0	$92,070,376
--- 9111.1.1 EQUIPMENT - CALCINER CELL										
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Filter Feed Pump - P-201-2a & 2b (Skid Mounted)		2.00	20	$37.58	$752	$0	$15,000	$0	$0	$15,752
PIPE	U.C. per Ea		6	CN-PIPE	225.48	500	5500	0	0	6225.48
SBW Slurry XFR Pump - P-201-6a, b - 30 hp		2.00	12	$37.58	$451	$1,000	$11,000	$0	$0	$12,451
PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	15000	0	0	15300.64
SBW Day Tank - T-201-2a, b - 1179 Gal. - SST		2.00	16	$37.58	$601	$0	$30,000	$0	$0	$30,601
PIPE	U.C. per Ea		40	CN-PIPE	1503.2	0	100000	0	0	101503.2
Cross Flow Filter - CF-201-1, 2 (36"x60"x65")		2.00	80	$37.58	$3,006	$0	$200,000	$0	$0	$203,006
Subtotal					$4,810	$1,000	$256,000	$0	$0	$261,810
Sales Tax					$0	$0	$12,800	$0	$0	$12,800
INEEL ORG Labor/Subcontractor Overheads					$2,314	$481	$129,304	$0	$0	$132,099
Subtotal Estimate										$406,709
Escalation					$1,828	$380	$102,153	$0	$0	$104,361
Contingency					$6,177	$1,284	$345,177	$0	$0	$352,638
---Total 9111.1.1 EQUIPMENT - CALCINER CELL			128		$15,129	$3,145	$845,434	$0	$0	$863,709

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - OFF GAS CELL										
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	1200	0	0	1275.16
Extraction Feed Pump - P-201-5 - .375 hp		1.00	2	$37.58	$75	$0	$1,200	$0	$0	$1,275
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	500	0	0	575.16
Solvent Feed Pump - P-202-5 - .25 hp		1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	8500	0	0	8725.48
UNEX Solvent Tank - T-202-5 - 500 Gal. - SST		1.00	6	$37.58	$225	$0	$8,500	$0	$0	$8,725
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Extraction Contactor - CON-202-1-14 (3'x13'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Scrubbing Contactor - SB-202-1-2 (3'x2'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Stripping Contactor - SP-202-1-8 (3'x7'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
Subtotal					$2,631	$3,000	$910,200	$0	$0	$915,831
Sales Tax					$0	$0	$45,510	$0	$0	$45,510
INEEL ORG Labor/Subcontractor Overheads					$1,265	$1,443	$459,735	$0	$0	$462,443
Subtotal Estimate										$1,423,784
Escalation					$1,000	$1,140	$363,203	$0	$0	$365,343
Contingency					$3,378	$3,852	$1,227,267	$0	$0	$1,234,498
---Total 9111.1.2 EQUIPMENT - OFF GAS CELL			70		$8,274	$9,436	$3,005,915	$0	$0	$3,023,624
--- 9111.1.3 EQUIPMENT - BLEND & HOLD CELL										
	PIPE	U.C. per Ea	12	CN-PIPE	450.96	500	31000	0	0	31950.96
SBW Feed Tank - T-201-1 - 4718 Gal. SST		1.00	12	$37.58	$451	$500	$31,000	$0	$0	$31,951
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	500	21000	0	0	21875.8
Extraction Feed Tank - T-201-5a, b, c - 2359 Gal. SST		3.00	30	$37.58	$1,127	$1,500	$63,000	$0	$0	$65,627
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	250	18600	0	0	19150.64
UNEX Raffinate Tank - T-202-6a, b - 1761 Gal. SST		2.00	16	$37.58	$601	$500	$37,200	$0	$0	$38,301

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.3 EQUIPMENT - BLEND & HOLD CELL									
PIPE	U.C. per Ea	6	CN-PIPE	225.48	250	14900	0	0	15375.48
UNEX Strip Effluent Tank - T-202-14 - 1124 Gal. SST	1.00	6	$37.58	$225	$250	$14,900	$0	$0	$15,375
Subtotal				$2,405	$2,750	$146,100	$0	$0	$151,255
Sales Tax				$0	$0	$7,305	$0	$0	$7,305
INEEL ORG Labor/Subcontractor Overheads				$1,157	$1,323	$73,794	$0	$0	$76,274
Subtotal Estimate									$234,834
Escalation				$914	$1,045	$58,299	$0	$0	$60,258
Contingency				$3,089	$3,531	$196,994	$0	$0	$203,614
---Total 9111.1.3 EQUIPMENT - BLEND & HOLD CELL		64		$7,565	$8,649	$482,492	$0	$0	$498,706
--- 9111.1.4 EQUIPMENT - VALVE CUBICLE									
PIPE	U.C. per Ea	16	CN-PIPE	601.28	0	4500	0	0	5101.28
SBW XFR Pump - P201-1 - 30 hp	1.00	16	$37.58	$601	$0	$4,500	$0	$0	$5,101
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	600	0	0	712.74
Raffinate XFR Pump - P-202-6a - .25 hp	1.00	3	$37.58	$113	$0	$600	$0	$0	$713
PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	2800	0	0	2950.32
Raffinate Off Spec. XFR Pump - P-202-6b - 2 hp	1.00	4	$37.58	$150	$0	$2,800	$0	$0	$2,950
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	600	0	0	712.74
Strip Effluent XFR Pump - P-202-14 - .25 hp	1.00	3	$37.58	$113	$0	$600	$0	$0	$713
Subtotal				$977	$0	$8,500	$0	$0	$9,477
Sales Tax				$0	$0	$425	$0	$0	$425
INEEL ORG Labor/Subcontractor Overheads				$470	$0	$4,293	$0	$0	$4,763
Subtotal Estimate									$14,665
Escalation				$371	$0	$3,392	$0	$0	$3,763
Contingency				$1,255	$0	$11,461	$0	$0	$12,716
---Total 9111.1.4 EQUIPMENT - VALVE CUBICLE		26		$3,073	$0	$28,071	$0	$0	$31,144
--- 9111.1.5 EQUIPMENT - STORAGE AREA									
PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	600	0	0	675.16
HF Pump - P-201-4 - .125 hp	1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
Dicarbolide Feed Pump - P-202-1 - .75 hp	1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
PEG Feed Pump - P-202-2 - .75 hp	1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
CMPO Feed Pump - P-202-3 - .75 hp	1.00	3	$37.58	$113	$0	$800	$0	$0	$913

Project Name: **CONSTRUCTION DETAIL ITEM REPORT** Client: *V. J. Balls*
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF Prepared By: *Rowley / Mitchell / Marler*
Project Location: *INTEC* Estimate Type: *Planning*
Estimate Number: *2570 - Option C*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.5 EQUIPMENT - STORAGE AREA										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
FS-13 Feed Pump - P-202-4 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Acid Feed Pump - P-202-7 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Aluminum Nitrate Feed Pump - P-202-8 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Makeup XFR Pump - P-202-9 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Solution Feed Pump - P-202-10 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Makeup XFR Pump - P-202-12 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Solution Feed Pump - P-202-13 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		16	CN-PIPE	601.28	500	20500	0	0	21601.28
HF Storage Tank - T-201-3 - 4000 Gal. - C-276		1.00	16	$37.58	$601	$500	$20,500	$0	$0	$21,601
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	4000	0	0	4112.74
HF Makeup Tank - T-201-4 - 237 Gal. - C-276		1.00	3	$37.58	$113	$0	$4,000	$0	$0	$4,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Dicarbolide Feed Tank - T-202-1 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
PEG 400 Feed Tank - T-202-2 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Ph2Bu2CMPO Feed Tank - T-202-3a, b - 55 Gal. SST		2.00	6	$37.58	$225	$0	$4,000	$0	$0	$4,225
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
FS-13 Tank - T-202-4 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Recycle Acid Tank - T-202-7 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Aluminum Nitrate Tank - T-202-8 -55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	11900	0	0	12775.8
UNEX Scrub Makeup Tank - T-202-9 - 807 Gal. SST		1.00	10	$37.58	$376	$500	$11,900	$0	$0	$12,776
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	12500	0	0	13375.8
UNEX Scrub Solution Tank - T-202-10 - 888 Gal. SST		1.00	10	$37.58	$376	$500	$12,500	$0	$0	$13,376

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.1.5 EQUIPMENT - STORAGE AREA										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
DPTA Storage Tank - T-202-11 - 55 Gal. SST (UNEX Only)		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	15000	0	0	15950.96
UNEX Strip Makeup Tank - T-202-12 - 1132 Gal. SST		1.00	12	$37.58	$451	$500	$15,000	$0	$0	$15,951
PIPE	U.C. per Ea		12	CN-PIPE	450.96	500	16000	0	0	16950.96
UNEX Strip Solution Feed Tank - T-202-13 - 1245 Gal. SST		1.00	12	$37.58	$451	$500	$16,000	$0	$0	$16,951
GEN	U.C. per Lot		750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment		1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
Subtotal					$30,212	$2,500	$853,700	$0	$0	$886,412
Sales Tax					$0	$0	$42,685	$0	$0	$42,685
INEEL ORG Labor/Subcontractor Overheads					$11,265	$1,203	$331,795	$0	$0	$344,263
Subtotal Estimate										$1,273,359
Escalation					$10,643	$950	$315,151	$0	$0	$326,744
Contingency					$35,963	$3,210	$1,064,898	$0	$0	$1,104,071
—Total 9111.1.5 EQUIPMENT - STORAGE AREA			865		$88,082	$7,863	$2,608,229	$0	$0	$2,704,174
— 9111.6 EQUIPMENT - GROUT FACILITY										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)		1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp		1.00	2	$37.58	$75	$0	$800	$0	$0	$875
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp		3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
PIPE	U.C. per Ea		24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST		1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST		1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST		1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST		3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY											
B-105	PIPE	U.C. per EA		80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF			1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF			1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	3700	0	0	3812.74
CaOH Day Storage Tank - T-205-6b - 46 CF (UNEX Only)			1.00	3	$37.58	$113	$0	$3,700	$0	$0	$3,813
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF			1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')			1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea		40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")			1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503
	PIPE	U.C. per Ea		60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")			1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255
B-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3			1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr			4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3			1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA		80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3			2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER			2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN			2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3			3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN			3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627

Project Name:

CONSTRUCTION DETAIL ITEM REPORT

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.6 EQUIPMENT - GROUT FACILITY											
M-101A,B&C	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3			3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764
B-106A	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3			1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK			2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127
P-106	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
P-115	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA		50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3			1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN			1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -			1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY			1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH		1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.6 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per LOT		100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT			1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per LOT		100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL			1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT			3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA			14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION			1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per LOT		500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE			1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA		400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE			1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE			1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR			1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT			2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS			9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY											
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,113	$10,750	$3,267,200	$0	$0	$3,560,063
Sales Tax						$0	$0	$163,360	$0	$0	$163,360
INEEL ORG Labor/Subcontractor Overheads						$135,708	$5,171	$1,650,237	$0	$0	$1,791,115
Subtotal Estimate											$5,514,538
Escalation						$107,213	$4,085	$1,303,732	$0	$0	$1,415,031
Contingency						$362,273	$13,805	$4,405,325	$0	$0	$4,781,403
---Total 9111.6 EQUIPMENT - GROUT FACILITY				7,507		$887,307	$33,811	$10,789,854	$0	$0	$11,710,972
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY											
	PIPE	U.C. per Ea		100	CN-PIPE	3758	3000	1000000	0	0	1006758
Thin Film Dryer -TFD203-1 (12'x12'x25')			1.00	100	$37.58	$3,758	$3,000	$1,000,000	$0	$0	$1,006,758
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	500	0	0	575.16
TFD Feed Pump - P-203-2 - .25 hp			1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Strip Cystallizer Condensate Pump - P-203-1 - Skid Mounted			1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	10000	0	0	10225.48
TFD Vacuum Pump - VP-203-1			1.00	6	$37.58	$225	$0	$10,000	$0	$0	$10,225
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	1500	0	0	1575.16
Chrystallizer Condensate Tank - T-203-1 - 10 Gal - SST			1.00	2	$37.58	$75	$0	$1,500	$0	$0	$1,575
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15000	0	0	15800.64
Strip Feed Tank - T-203-2 - 1124 Gal. - SST (NWCF Only)			1.00	8	$37.58	$301	$500	$15,000	$0	$0	$15,801
Subtotal						$4,810	$3,500	$1,034,500	$0	$0	$1,042,810
Sales Tax						$0	$0	$51,725	$0	$0	$51,725
INEEL ORG Labor/Subcontractor Overheads						$2,314	$1,684	$522,518	$0	$0	$526,515
Subtotal Estimate											$1,621,050
Escalation						$1,828	$1,330	$412,803	$0	$0	$415,962
Contingency						$6,177	$4,494	$1,394,867	$0	$0	$1,405,538
---Total 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY				128		$15,129	$11,008	$3,416,413	$0	$0	$3,442,550
--- 9111.3 EQUIPMENT - BOILER HOUSE											
	GEN	U.C. per EA		60	CN-BOILMK	1384.8	0	200000	0	0	201384.8
BOILERS			2.00	120	$23.08	$2,770	$0	$400,000	$0	$0	$402,770
	GEN	U.C. per EA		40	CN-BOILMK	923.2	0	20000	0	0	20923.2
FEED WATER HEATER			2.00	80	$23.08	$1,846	$0	$40,000	$0	$0	$41,846

LEVEL / Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.3 EQUIPMENT - BOILER HOUSE									
PIPE	U.C. per LOT	500	CN-PIPE	18790	0	100000	0	0	118790
CHEMICAL FEED SYSTEM	1.00	500	$37.58	$18,790	$0	$100,000	$0	$0	$118,790
PIPE	U.C. per LOT	1800	CN-PIPE	67644	0	250000	0	0	317644
WATER TREATMENT SYSTEM	1.00	1,800	$37.58	$67,644	$0	$250,000	$0	$0	$317,644
TANK	U.C. per BBL			0	0	0	65	0	65
OIL STORAGE TANK, ~750 BBL	750.00	0		$0	$0	$0	$48,750	$0	$48,750
Subtotal				$91,050	$0	$790,000	$48,750	$0	$929,800
Sales Tax				$0	$0	$39,500	$0	$0	$39,500
INEEL ORG Labor/Subcontractor Overheads				$43,216	$0	$340,707	$20,442	$0	$404,365
Subtotal Estimate									$1,373,665
Escalation				$34,453	$0	$300,275	$17,755	$0	$352,482
Contingency				$116,416	$0	$1,014,632	$59,993	$0	$1,191,042
—Total 9111.3 EQUIPMENT - BOILER HOUSE		2,500		$285,135	$0	$2,485,114	$146,941	$0	$2,917,189
— 9111.6 EQUIPMENT - STORAGE FACILITY									
GEN	U.C. per Lot	750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment	1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
GEN	U.C. per Ea	400	CN-SKWK	13808	0	2500000	0	0	2513808
Smeared Canister Loadout Crane	1.00	400	$34.52	$13,808	$0	$2,500,000	$0	$0	$2,513,808
GEN	U.C. per Ea	400	CN-SKWK	13808	0	250000	0	0	263808
Canister Storage Crane - Clean Environment	1.00	400	$34.52	$13,808	$0	$250,000	$0	$0	$263,808
GEN	U.C. per Ea	200	CN-SKWK	6904	0	103000	0	0	109904
Canister Heater	2.00	400	$34.52	$13,808	$0	$206,000	$0	$0	$219,808
GEN	U.C. per Ea	100	CN-SKWK	3452	0	175000	0	0	178452
CO2 System	1.00	100	$34.52	$3,452	$0	$175,000	$0	$0	$178,452
GEN	U.C. per Ea	100	CN-SKWK	3452	0	25000	0	0	28452
Canister Transportation Cart	1.00	100	$34.52	$3,452	$0	$25,000	$0	$0	$28,452
GEN	U.C. per Ea	120	CN-SKWK	4142.4	0	257500	0	0	261642.4
Canister Lifting Mechanism	2.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	120000	0	0	122761.6
Canister Sealing Manipulator	1.00	80	$34.52	$2,762	$0	$120,000	$0	$0	$122,762
GEN	U.C. per Ea	120	CN-SKWK	4142.4	0	50000	0	0	54142.4
Decon Solution Pumping Station	1.00	120	$34.52	$4,142	$0	$50,000	$0	$0	$54,142
GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	515000	0	0	523284.8
Decon Cell Equipment	1.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - STORAGE FACILITY										
	GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	500000	0	0	508284.8
Decon / Disassembly Equipment - Turntable, Manipulator Tools, W/ Rack & Etc.		1.00	240	$34.52	$8,285	$0	$500,000	$0	$0	$508,285
	GEN	U.C. per Ea	100	CN-SKWK	3452	0	515000	0	0	518452
Smear Monitor		1.00	100	$34.52	$3,452	$0	$515,000	$0	$0	$518,452
	GEN	U.C. per Ea		CN-SKWK	0	0	0	42000	0	42000
Smear Station Module		1.00	0		$0	$0	$0	$42,000	$0	$42,000
	GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	150000	0	0	152761.6
Shuttle Cart		1.00	80	$34.52	$2,762	$0	$150,000	$0	$0	$152,762
	GEN	U.C. per Ea	40	CN-SKWK	1380.8	0	41200	0	0	42580.8
Glove Box		1.00	40	$34.52	$1,381	$0	$41,200	$0	$0	$42,581
	GEN	U.C. per Ea	24	CN-SKWK	828.48	0	3000	0	0	3828.48
Cameras		30.00	720	$34.52	$24,854	$0	$90,000	$0	$0	$114,854
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	103000	0	0	109904
Weld Station Module		1.00	200	$34.52	$6,904	$0	$103,000	$0	$0	$109,904
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	2575000	0	0	2588808
HLW Canister Transfer Cart		1.00	400	$34.52	$13,808	$0	$2,575,000	$0	$0	$2,588,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	7000	0	0	13904
Empty Canister Receiving Crane		2.00	400	$34.52	$13,808	$0	$14,000	$0	$0	$27,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	250000	0	0	256904
PaR Manipulator		1.00	200	$34.52	$6,904	$0	$250,000	$0	$0	$256,904
	GEN	U.C. per Ea		CN-SKWK	0	0	0	2060000	0	2060000
Canister Fill Monitoring Instruments		2.00	0		$0	$0	$0	$4,120,000	$0	$4,120,000
	GEN	U.C. per Ea	100	CN-SKWK	3452	0	1030000	0	0	1033452
Canister Welder Leak Check Module		1.00	100	$34.52	$3,452	$0	$1,030,000	$0	$0	$1,033,452
	GEN	U.C. per Lot	300	CN-SKWK	10356	0	1000000	0	0	1010356
Misc. Equipment		1.00	300	$34.52	$10,356	$0	$1,000,000	$0	$0	$1,010,356
Subtotal					$193,657	$0	$11,374,200	$4,162,000	$0	$15,729,857
Sales Tax					$0	$0	$568,710	$0	$0	$568,710
INEEL ORG Labor/Subcontractor Overheads					$68,712	$0	$4,237,524	$1,476,740	$0	$5,782,976
Subtotal Estimate										$22,081,543
Escalation					$67,324	$0	$4,151,899	$1,446,901	$0	$5,666,124
Contingency					$227,489	$0	$14,029,310	$4,889,092	$0	$19,145,890
---Total 9111.6 EQUIPMENT - STORAGE FACILITY			5,610		$557,182	$0	$34,361,643	$11,974,733	$0	$46,893,558

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL											
	PIPE	U.C. per Lot			CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility			1.00	0		$0	$0	$0	$250,000	$0	$250,000
	PIPE	U.C. per Lot		50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers			1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
	PIPE	U.C. per Lot			CN-PIPE	0	0	5000	0	0	5000
Portable Crane			1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation			1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot			CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation			1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations			1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Cyclone Bracket Supports			1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot		300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Calciner			1.00	300	$37.58	$11,274	$0	$0	$0	$0	$11,274
	PIPE	U.C. per Lot		200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent			1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
	PIPE	U.C. per Lot		2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Calciner			1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Box		20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Materials			10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot		5000	CN-PIPE	187900	0	0	0	0	187900
Labor Adjustment For Working In "Hot" Area - 200%			1.00	5,000	$37.58	$187,900	$0	$0	$0	$0	$187,900
	PIPE	U.C. per Lot		1875	CN-PIPE	70462.5	0	0	0	0	70462.5
Burn-Out Allowance - 25% Of Hot Work			1.00	1,875	$37.58	$70,463	$0	$0	$0	$0	$70,463
	PIPE	U.C. per Lot		2500	CN-PIPE	93950	0	0	0	0	93950
Mock-Up Training - 100% Of Unadjusted Work			1.00	2,500	$37.58	$93,950	$0	$0	$0	$0	$93,950

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL										
	PIPE	U.C. per Lot			0	0	37000	0	0	37000
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$37,000	$0	$0	$37,000
Subtotal					$463,174	$0	$144,000	$250,000	$0	$857,174
Sales Tax					$0	$0	$7,200	$0	$0	$7,200
INEEL ORG Labor/Subcontractor Overheads					$222,805	$0	$72,733	$120,260	$0	$415,798
Subtotal Estimate										$1,280,172
Escalation					$176,022	$0	$57,461	$95,009	$0	$328,492
Contingency					$594,780	$0	$194,162	$321,035	$0	$1,109,978
---Total 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL			12,325		$1,456,781	$0	$475,557	$786,304	$0	$2,718,642
--- 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL										
	PIPE	U.C. per Lot	50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
	PIPE	U.C. per Lot		CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Ea	200	CN-PIPE	7516	0	0	0	0	7516
Cut Tank Bracket Supports		3.00	600	$37.58	$22,548	$0	$0	$0	$0	$22,548
	PIPE	U.C. per Ea	300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Tanks		3.00	900	$37.58	$33,822	$0	$0	$0	$0	$33,822
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent		1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
	PIPE	U.C. per Lot	2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Tanks - 3 Ea.		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Box	20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Other Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	7900	CN-PIPE	296882	0	0	0	0	296882
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,900	$37.58	$296,882	$0	$0	$0	$0	$296,882
	PIPE	U.C. per Lot	2960	CN-PIPE	111236.8	0	0	0	0	111236.8
Burn-Out Allowance - 25% Of Hot Work		1.00	2,960	$37.58	$111,237	$0	$0	$0	$0	$111,237

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL										
PIPE	U.C. per Lot		3950	CN-PIPE	148441	0	0	0	0	148441
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,950	$37.58	$148,441	$0	$0	$0	$0	$148,441
PIPE	U.C. per Lot				0	0	56400	0	0	56400
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$56,400	$0	$0	$56,400
Subtotal					$705,001	$0	$163,400	$0	$0	$868,401
Sales Tax					$0	$0	$8,170	$0	$0	$8,170
INEEL ORG Labor/Subcontractor Overheads					$339,134	$0	$82,532	$0	$0	$421,666
Subtotal Estimate										$1,298,236
Escalation					$267,925	$0	$65,203	$0	$0	$333,127
Contingency					$905,321	$0	$220,320	$0	$0	$1,125,641
---Total 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL			18,760		$2,217,380	$0	$539,625	$0	$0	$2,757,005
--- 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL										
PIPE	U.C. per Lot			CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility		1.00	0		$0	$0	$0	$250,000	$0	$250,000
PIPE	U.C. per Lot		50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
PIPE	U.C. per Lot			CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
PIPE	U.C. per Lot			CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Tank Bracket Supports		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
PIPE	U.C. per Ea		300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Tanks		3.00	900	$37.58	$33,822	$0	$0	$0	$0	$33,822
PIPE	U.C. per Lot		200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent		1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
PIPE	U.C. per Lot		2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Tanks - 3 Ea.		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
PIPE	U.C. per Box		20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Other Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
-- 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL										
	PIPE	U.C. per Lot	7100	CN-PIPE	266818	0	0	0	0	266818
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,100	$37.58	$266,818	$0	$0	$0	$0	$266,818
	PIPE	U.C. per Lot	3550	CN-PIPE	133409	0	0	0	0	133409
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,550	$37.58	$133,409	$0	$0	$0	$0	$133,409
	PIPE	U.C. per Lot	2660	CN-PIPE	99962.8	0	0	0	0	99962.8
Burn-Out Allowance - 25% Of Hot Work		1.00	2,660	$37.58	$99,963	$0	$0	$0	$0	$99,963
	PIPE	U.C. per Lot			0	0	50700	0	0	50700
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$50,700	$0	$0	$50,700
Subtotal					$633,599	$0	$157,700	$250,000	$0	$1,041,299
Sales Tax					$0	$0	$7,885	$0	$0	$7,885
INEEL ORG Labor/Subcontractor Overheads					$304,786	$0	$79,653	$120,260	$0	$504,699
Subtotal Estimate										$1,553,883
Escalation					$240,790	$0	$62,928	$95,009	$0	$398,726
Contingency					$813,631	$0	$212,635	$321,035	$0	$1,347,301
---Total 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL			16,860		$1,992,805	$0	$520,801	$786,304	$0	$3,299,910
-- 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE										
	PIPE	U.C. per Lot		CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility		1.00	0		$0	$0	$0	$250,000	$0	$250,000
	PIPE	U.C. per Lot	50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
	PIPE	U.C. per Lot		CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Box	20	CN-PIPE	751.6	0	0	0	0	751.6
Cut Up & "Hot Box" Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	750	CN-PIPE	28185	0	0	0	0	28185
Demo Materials		1.00	750	$37.58	$28,185	$0	$0	$0	$0	$28,185
	PIPE	U.C. per Lot	2000	CN-PIPE	75160	0	0	0	0	75160
Labor Adjustment For Working In "Hot" Area - 200%		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE										
PIPE	U.C. per Lot		750	CN-PIPE	28185	0	0	0	0	28185
Burn-Out Allowance - 25% Of Hot Work		1.00	750	$37.58	$28,185	$0	$0	$0	$0	$28,185
PIPE	U.C. per Lot		1000	CN-PIPE	37580	0	0	0	0	37580
Mock-Up Training - 100% Of Unadjusted Work		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
PIPE	U.C. per Lot				0	0	14250	0	0	14250
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$14,250	$0	$0	$14,250
Subtotal					$178,505	$0	$111,250	$250,000	$0	$539,755
Sales Tax					$0	$0	$5,563	$0	$0	$5,563
INEEL ORG Labor/Subcontractor Overheads					$85,868	$0	$56,191	$120,260	$0	$262,320
Subtotal Estimate										$807,637
Escalation					$67,838	$0	$44,393	$95,009	$0	$207,240
Contingency					$229,226	$0	$150,004	$321,035	$0	$700,265
---Total 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE			**4,750**		**$561,437**	**$0**	**$367,401**	**$786,304**	**$0**	**$1,715,142**
--- 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY										
GEN	U.C. per EA		1000	CN-SKWK	34520	0	2500000	0	0	2534520
GANTRY CRANE		2.00	2,000	$34.52	$69,040	$0	$5,000,000	$0	$0	$5,069,040
GEN	U.C. per EA		500	CN-SKWK	17260	0	300000	0	0	317260
TRANSFER CART IN TUNNEL		1.00	500	$34.52	$17,260	$0	$300,000	$0	$0	$317,260
GEN	U.C. per EA		300	CN-SKWK	10356	0	250000	0	0	260356
5 TON DECONTAMINATABLE BRIDGE CRANE		2.00	600	$34.52	$20,712	$0	$500,000	$0	$0	$520,712
GEN	U.C. per EA		1000	CN-SKWK	34520	0	1000000	0	0	1034520
CASK MANUVERING HYDRAULIC PLATFORM		1.00	1,000	$34.52	$34,520	$0	$1,000,000	$0	$0	$1,034,520
Subtotal					$141,532	$0	$6,800,000	$0	$0	$6,941,532
Sales Tax					$0	$0	$340,000	$0	$0	$340,000
INEEL ORG Labor/Subcontractor Overheads					$50,218	$0	$2,533,379	$0	$0	$2,583,597
Subtotal Estimate										$9,865,129
Escalation					$49,203	$0	$2,482,189	$0	$0	$2,531,392
Contingency					$21,686	$0	$1,094,001	$0	$0	$1,115,687
---Total 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY			**4,100**		**$262,638**	**$0**	**$13,249,569**	**$0**	**$0**	**$13,512,208**
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - 4"		2.00	8	$37.58	$301	$0	$60	$0	$0	$361

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL										
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - 8"		1.00	6	$37.58	$225	$0	$50	$0	$0	$275
	PIPE	U.C. per Lf	0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf	0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - 4"		60.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Lf	0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - 8"		30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Large Knife Gate Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line	10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot	400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Ea	80	CN-PIPE	3006.4	0	0	0	0	3006.4
Cut 16" Pipe		5.00	400	$37.58	$15,032	$0	$0	$0	$0	$15,032
	PIPE	U.C. per Ea	160	CN-PIPE	6012.8	0	0	0	0	6012.8
Cut 16" Pipe At Cyclone		1.00	160	$37.58	$6,013	$0	$0	$0	$0	$6,013
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Calciner Pipes		200.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Piping At Bottom Of Calciner		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	20	0	0	95.16
Plug Calciner Pipe Ends		250.00	500	$37.58	$18,790	$0	$5,000	$0	$0	$23,790
	PIPE	U.C. per Lot	1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot	13770	CN-PIPE	517476.6	0	0	0	0	517476.6
Labor Adjustment For Working In "Hot" Area - 200%		1.00	13,770	$37.58	$517,477	$0	$0	$0	$0	$517,477

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL										
PIPE	U.C. per Lot		5165	CN-PIPE	194100.7	0	0	0	0	194100.7
Burn-Out Allowance - 25% Of Hot Work		1.00	5,165	$37.58	$194,101	$0	$0	$0	$0	$194,101
PIPE	U.C. per Lot		6885	CN-PIPE	258738.3	0	0	0	0	258738.3
Mock-Up Training - 100% Of Unadjusted Work		1.00	6,885	$37.58	$258,738	$0	$0	$0	$0	$258,738
PIPE	U.C. per Lot			CN-PIPE	0	0	98000	0	0	98000
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$98,000	$0	$0	$98,000
Subtotal					$1,229,016	$0	$105,446	$0	$0	$1,334,462
Sales Tax					$0	$0	$5,272	$0	$0	$5,272
INEEL ORG Labor/Subcontractor Overheads					$591,206	$0	$53,260	$0	$0	$644,466
Subtotal Estimate										$1,984,201
Escalation					$467,069	$0	$42,077	$0	$0	$509,146
Contingency					$937,789	$0	$84,483	$0	$0	$1,022,272
---Total 9115.1.1 MECHANICAL DEMO - CALCINER CELL			**32,704**		**$3,225,081**	**$0**	**$290,538**	**$0**	**$0**	**$3,515,618**
--- 9115.1.3 MECHANICAL DEMO - OFF GAS CELL										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium		12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large		10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
PIPE	U.C. per Lf		0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
PIPE	U.C. per Lf		0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium		60.00	15	$37.58	$564	$0	$0	$0	$0	$564
PIPE	U.C. per Lf		0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large		30.00	15	$37.58	$564	$0	$0	$0	$0	$564
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
PIPE	U.C. per Line		10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: ***INTEC***
Estimate Number:***2570 - Option C***

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.3 MECHANICAL DEMO - OFF GAS CELL										
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot	400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Pipes @ Tanks		9.00	90	$37.58	$3,382	$0	$0	$0	$0	$3,382
	PIPE	U.C. per Lot	1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot	7600	CN-PIPE	285608	0	0	0	0	285608
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,600	$37.58	$285,608	$0	$0	$0	$0	$285,608
	PIPE	U.C. per Lot	2850	CN-PIPE	107103	0	0	0	0	107103
Burn-Out Allowance - 25% Of Hot Work		1.00	2,850	$37.58	$107,103	$0	$0	$0	$0	$107,103
	PIPE	U.C. per Lot	3800	CN-PIPE	142804	0	0	0	0	142804
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,800	$37.58	$142,804	$0	$0	$0	$0	$142,804
	PIPE	U.C. per Lot		CN-PIPE	0	0	54300	0	0	54300
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$54,300	$0	$0	$54,300
Subtotal					$678,620	$0	$57,496	$0	$0	$736,116
Sales Tax					$0	$0	$2,875	$0	$0	$2,875
INEEL ORG Labor/Subcontractor Overheads					$326,443	$0	$29,041	$0	$0	$355,484
Subtotal Estimate										$1,094,474
Escalation					$257,899	$0	$22,943	$0	$0	$280,842
Contingency					$517,814	$0	$46,065	$0	$0	$563,880
---Total 9115.1.3 MECHANICAL DEMO - OFF GAS CELL			18,058		$1,780,776	$0	$158,420	$0	$0	$1,939,196
--- 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium		12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large		10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
	PIPE	U.C. per Lf	0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf	0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium		60.00	15	$37.58	$564	$0	$0	$0	$0	$564

CONSTRUCTION DETAIL ITEM REPORT

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL										
	PIPE	U.C. per Lf	0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large		30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line	10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot	400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Pipes @ Tanks		9.00	90	$37.58	$3,382	$0	$0	$0	$0	$3,382
	PIPE	U.C. per Lot	1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot	7600	CN-PIPE	285608	0	0	0	0	285608
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,600	$37.58	$285,608	$0	$0	$0	$0	$285,608
	PIPE	U.C. per Lot	2850	CN-PIPE	107103	0	0	0	0	107103
Burn-Out Allowance - 25% Of Hot Work		1.00	2,850	$37.58	$107,103	$0	$0	$0	$0	$107,103
	PIPE	U.C. per Lot	3800	CN-PIPE	142804	0	0	0	0	142804
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,800	$37.58	$142,804	$0	$0	$0	$0	$142,804
	PIPE	U.C. per Lot		CN-PIPE	0	0	54300	0	0	54300
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$54,300	$0	$0	$54,300
Subtotal					$678,620	$0	$57,496	$0	$0	$736,116
Sales Tax					$0	$0	$2,875	$0	$0	$2,875
INEEL ORG Labor/Subcontractor Overheads					$326,443	$0	$29,041	$0	$0	$355,484
Subtotal Estimate										$1,094,474
Escalation					$257,899	$0	$22,943	$0	$0	$280,842
Contingency					$517,814	$0	$46,065	$0	$0	$563,880
---Total 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL			18,058		$1,780,776	$0	$158,420	$0	$0	$1,939,196

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium		12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large		10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
	PIPE	U.C. per Lf	0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf	0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium		60.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Lf	0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large		30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line	10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot	400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Lot	1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot	7436	CN-PIPE	279444.88	0	0	0	0	279444.88
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,436	$37.58	$279,445	$0	$0	$0	$0	$279,445
	PIPE	U.C. per Lot	892	CN-PIPE	33521.36	0	0	0	0	33521.36
Burn-Out Allowance - 25% Of Hot Work		1.00	892	$37.58	$33,521	$0	$0	$0	$0	$33,521
	PIPE	U.C. per Lot	3718	CN-PIPE	139722.44	0	0	0	0	139722.44
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,718	$37.58	$139,722	$0	$0	$0	$0	$139,722

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE										
PIPE	U.C. per Lot			CN-PIPE	0	0	47400	0	0	47400
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$47,400	$0	$0	$47,400
Subtotal					$592,411	$0	$50,596	$0	$0	$643,007
Sales Tax					$0	$0	$2,530	$0	$0	$2,530
INEEL ORG Labor/Subcontractor Overheads					$284,973	$0	$25,556	$0	$0	$310,529
Subtotal Estimate										$956,066
Escalation					$225,137	$0	$20,190	$0	$0	$245,327
Contingency					$452,034	$0	$40,537	$0	$0	$492,571
---Total 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE			15,764		$1,554,555	$0	$139,408	$0	$0	$1,693,963
--- 9115.2.1 HVAC - NEW - NWCF										
HVAC	U.C. per Ea		10	CN-SHEE	354.8	500	5700	0	0	6554.8
Vent. Centrifugal Fans - 20 hp		5.00	50	$35.48	$1,774	$2,500	$28,500	$0	$0	$32,774
HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 25 hp		7.00	84	$35.48	$2,980	$3,500	$63,000	$0	$0	$69,480
HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 30 hp		5.00	60	$35.48	$2,129	$2,500	$45,000	$0	$0	$49,629
HVAC	U.C. per Ea		18	CN-SHEE	638.64	500	13000	0	0	14138.64
Vent. Centrifugal Fans - 40 hp		5.00	90	$35.48	$3,193	$2,500	$65,000	$0	$0	$70,693
HVAC	U.C. per Ea		14	CN-SHEE	496.72	500	15000	0	0	15996.72
Vent. Centrifugal Fans - 50 hp		14.00	196	$35.48	$6,954	$7,000	$210,000	$0	$0	$223,954
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	27000	0	0	28919.2
Vent. Centrifugal Fans - 60 hp		3.00	120	$35.48	$4,258	$1,500	$81,000	$0	$0	$86,758
HVAC	U.C. per Ea		30	CN-SHEE	1064.4	500	72000	0	0	73564.4
*HEPA Filter Bank - Single Stage - 4X4 - 12 Filters Per Bank		2.00	60	$35.48	$2,129	$1,000	$144,000	$0	$0	$147,129
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	96000	0	0	97919.2
*HEPA Filter Bank - Single Stage - 4X4 - 16 Filters Per Bank		23.00	920	$35.48	$32,642	$11,500	$2,208,000	$0	$0	$2,252,142
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	144000	0	0	145919.2
*HEPA Filter Bank - Dual Stage - 4X4 - 12 Filters Per Bank		2.00	80	$35.48	$2,838	$1,000	$288,000	$0	$0	$291,838
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		50	CN-SHEE	1774	500	192000	0	0	194274
*HEPA Filter Bank - Dual Stage - 4X4 - 16 Filters Per Bank		4.00	200	$35.48	$7,096	$2,000	$768,000	$0	$0	$777,096
Memo: Each Filter is 24" x 24".										

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF

Project Location: ***INTEC***

Estimate Number: ***2570 - Option C***

Client: ***V. J. Balls***

Prepared By: ***Rowley / Mitchell / Marler***

Estimate Type: ***Planning***

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC - NEW - NWCF										
	HVAC	U.C. per Ea	60	CN-SHEE	2128.8	0	35000	0	0	37128.8
Chiller (Complete With Compressor & Fans) - 80 Ton		1.00	60	$35.48	$2,129	$0	$35,000	$0	$0	$37,129
	HVAC	U.C. per Ea	48	CN-SHEE	1703.04	0	21000	0	0	22703.04
Chiller (Complete With Compressor & Fans) - 40 Ton		1.00	48	$35.48	$1,703	$0	$21,000	$0	$0	$22,703
	HVAC	U.C. per Ea	0.9	CN-SHEE	31.932	0	150	0	0	181.932
Actuated Air Dampers		100.00	90	$35.48	$3,193	$0	$15,000	$0	$0	$18,193
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	2500	0	0	6048
Pre-Filters		1.00	100	$35.48	$3,548	$0	$2,500	$0	$0	$6,048
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	5000	0	0	8548
Heating Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	5000	0	0	8548
Cooling Coils		1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
	HVAC	U.C. per Lot	40	CN-SHEE	1419.2	0	2000	0	0	3419.2
Heat Recovery Coil		1.00	40	$35.48	$1,419	$0	$2,000	$0	$0	$3,419
	HVAC	U.C. per Lot	3500	CN-SHEE	124180	0	65000	0	0	189180
Sheet Metal Ductwork		1.00	3,500	$35.48	$124,180	$0	$65,000	$0	$0	$189,180
	HVAC	U.C. per Lot			0	0	0	7500	0	7500
Test & Balance		1.00	0		$0	$0	$0	$7,500	$0	$7,500
Subtotal					$209,261	$35,000	$4,051,000	$7,500	$0	$4,302,761
Sales Tax					$0	$0	$202,550	$0	$0	$202,550
INEEL ORG Labor/Subcontractor Overheads					$95,498	$15,972	$1,941,133	$3,423	$0	$2,056,026
Subtotal Estimate										$6,561,337
Escalation					$78,201	$13,080	$1,589,556	$2,803	$0	$1,683,639
Contingency					$157,013	$26,261	$3,191,538	$5,627	$0	$3,380,440
---Total 9115.2.1 HVAC - NEW - NWCF			**5,898**		**$539,973**	**$90,313**	**$10,975,777**	**$19,353**	**$0**	**$11,625,416**
--- 9115.2.2 PIPING - NEW - NWCF										
	PIPE	U.C. per Lot	3500	CN-PIPE	131530	0	150000	0	0	281530
Piping Modifications		1.00	3,500	$37.58	$131,530	$0	$150,000	$0	$0	$281,530

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.2 PIPING - NEW - NWCF											
Subtotal						$131,530	$0	$150,000	$0	$0	$281,530
Sales Tax						$0	$0	$7,500	$0	$0	$7,500
INEEL ORG Labor/Subcontractor Overheads						$63,271	$0	$75,764	$0	$0	$139,035
Subtotal Estimate											$428,065
Escalation						$49,986	$0	$59,855	$0	$0	$109,841
Contingency						$100,363	$0	$120,179	$0	$0	$220,542
---Total 9115.2.2 PIPING - NEW - NWCF				**3,500**		**$345,150**	**$0**	**$413,298**	**$0**	**$0**	**$758,448**
--- 9115.2.3 FIRE PROTECTION - NEW - NWCF											
	FP	U.C. per Lot		750	CN-SPRI	27690	0	30000	0	0	57690
Fire Protection Modifications			1.00	750	$36.92	$27,690	$0	$30,000	$0	$0	$57,690
Subtotal						$27,690	$0	$30,000	$0	$0	$57,690
Sales Tax						$0	$0	$1,500	$0	$0	$1,500
INEEL ORG Labor/Subcontractor Overheads						$11,611	$0	$13,209	$0	$0	$24,820
Subtotal Estimate											$84,010
Escalation						$10,085	$0	$11,472	$0	$0	$21,557
Contingency						$20,248	$0	$23,034	$0	$0	$43,283
---Total 9115.2.3 FIRE PROTECTION - NEW - NWCF				**750**		**$69,634**	**$0**	**$79,215**	**$0**	**$0**	**$148,850**
--- 9115.2.1 HVAC - TFD FACILITY - HOT CELL											
	HVAC	U.C. per Lot		1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork			1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The hot cell is approximately 77' x 51' x 77' high.											
	HVAC	U.C. per Lot		750	CN-SHEE	26610	3000	300000	0	0	329610
HVAC Equipment			1.00	750	$35.48	$26,610	$3,000	$300,000	$0	$0	$329,610
	HVAC	U.C. per Lot		300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters			1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers			1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal			1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC - TFD FACILITY - HOT CELL										
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance		1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal					$94,022	$3,000	$481,500	$0	$0	$578,522
Sales Tax					$0	$0	$24,075	$0	$0	$24,075
INEEL ORG Labor/Subcontractor Overheads					$42,908	$1,369	$230,722	$0	$0	$274,999
Subtotal Estimate										$877,596
Escalation					$35,136	$1,121	$188,934	$0	$0	$225,191
Contingency					$70,547	$2,251	$379,345	$0	$0	$452,143
---Total 9115.2.1 HVAC - TFD FACILITY - HOT CELL			2,650		$242,613	$7,741	$1,304,576	$0	$0	$1,554,929
--- 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS										
Memo: The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.										
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	0	140000	0	0	281920
(*)Sheet Metal Ductwork		1.00	4,000	$35.48	$141,920	$0	$140,000	$0	$0	$281,920
Memo: Includes all corridors and equipment areas - approximately 72,500 square feet of floor space.										
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	15000	525000	0	0	681920
HVAC Equipment		1.00	4,000	$35.48	$141,920	$15,000	$525,000	$0	$0	$681,920
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	13000	0	0	20096
Diffusers, Grilles, Dampers, Registers		1.00	200	$35.48	$7,096	$0	$13,000	$0	$0	$20,096
	HVAC	U.C. per Lot	350	CN-SHEE	12418	0	5000	0	0	17418
Misc. Sheet Metal		1.00	350	$35.48	$12,418	$0	$5,000	$0	$0	$17,418
	HVAC	U.C. per Lot	300	CN-SHEE	10644	0	0	0	0	10644
Test & Balance		1.00	300	$35.48	$10,644	$0	$0	$0	$0	$10,644
Subtotal					$313,998	$15,000	$683,000	$0	$0	$1,011,998
Sales Tax					$0	$0	$34,150	$0	$0	$34,150
INEEL ORG Labor/Subcontractor Overheads					$143,295	$6,845	$327,276	$0	$0	$477,416
Subtotal Estimate										$1,523,564
Escalation					$117,341	$5,606	$268,000	$0	$0	$390,947
Contingency					$235,600	$11,255	$538,094	$0	$0	$784,949
---Total 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS			8,850		$810,234	$38,706	$1,850,520	$0	$0	$2,699,460
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY										
	PIPE	U.C. per Sf	0.15	CN-PIPE	5.637	0	7	0	0	12.637
Process Piping		13,700.00	2,055	$37.58	$77,227	$0	$95,900	$0	$0	$173,127

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY										
	PIPE	U.C. per Sf	0.05	CN-PIPE	1.879	0	3	0	0	4.879
Building Plumbing		13,700.00	685	$37.58	$25,742	$0	$41,100	$0	$0	$66,842
Subtotal					$102,969	$0	$137,000	$0	$0	$239,969
Sales Tax					$0	$0	$6,850	$0	$0	$6,850
INEEL ORG Labor/Subcontractor Overheads					$49,532	$0	$69,198	$0	$0	$118,730
Subtotal Estimate										$365,549
Escalation					$39,132	$0	$54,668	$0	$0	$93,800
Contingency					$78,570	$0	$109,763	$0	$0	$188,333
---Total 9115.2.3 PLUMBING / PIPING - TFD FACILITY			2,740		$270,203	$0	$377,479	$0	$0	$647,682
--- 9115.3.1 HVAC - BOILER HOUSE										
	HVAC	U.C. per LOT	200	CN-SHEE	7096	240	36700	1000	0	45036
HVAC		1.00	200	$35.48	$7,096	$240	$36,700	$1,000	$0	$45,036
Memo: Based on AFC estimate #2547-A. This will be a two boiler system vs. a four in estimate 2547-A; all quantities are halved.										
Subtotal					$7,096	$240	$36,700	$1,000	$0	$45,036
Sales Tax					$0	$0	$1,835	$0	$0	$1,835
INEEL ORG Labor/Subcontractor Overheads					$3,238	$110	$17,586	$456	$0	$21,390
Subtotal Estimate										$68,261
Escalation					$2,652	$90	$14,401	$374	$0	$17,516
Contingency					$5,324	$180	$28,914	$750	$0	$35,168
---Total 9115.3.1 HVAC - BOILER HOUSE			200		$18,310	$619	$99,435	$2,580	$0	$120,945
--- 9115.3.2 PLUMBING - BOILER HOUSE										
	PIPE	U.C. per Lot	40	CN-PIPE	1503.2	0	600	0	0	2103.2
Building Drain		1.00	40	$37.58	$1,503	$0	$600	$0	$0	$2,103
	PIPE	U.C. per Lot	20	CN-PIPE	751.6	0	300	0	0	1051.6
Building Water		1.00	20	$37.58	$752	$0	$300	$0	$0	$1,052
Subtotal					$2,255	$0	$900	$0	$0	$3,155
Sales Tax					$0	$0	$45	$0	$0	$45
INEEL ORG Labor/Subcontractor Overheads					$1,085	$0	$455	$0	$0	$1,539
Subtotal Estimate										$4,739
Escalation					$857	$0	$359	$0	$0	$1,216
Contingency					$1,721	$0	$721	$0	$0	$2,442
---Total 9115.3.2 PLUMBING - BOILER HOUSE			60		$5,917	$0	$2,480	$0	$0	$8,397
--- 9115.3.3 PIPING - BOILER HOUSE										
	PIPE	U.C. per Ea	200	CN-PIPE	7516	2000	50000	0	0	59516
Boilers		2.00	400	$37.58	$15,032	$4,000	$100,000	$0	$0	$119,032

Project Name: **CONSTRUCTION DETAIL ITEM REPORT** Client: *V. J. Balls*

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF Prepared By: *Rowley / Mitchell / Marler*

Project Location: *INTEC* Estimate Type: *Planning*

Estimate Number:*2570 - Option C*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.3.3 PIPING - BOILER HOUSE										
	PIPE	U.C. per LOT	750	CN-PIPE	28185	0	40000	0	0	68185
STEAM & SUPPORT PIPING		1.00	750	$37.58	$28,185	$0	$40,000	$0	$0	$68,185
	INSUL	U.C. per LOT	175	CN-ASBE	6461	0	8920	0	0	15381
PIPE INSULATION		1.00	175	$36.92	$6,461	$0	$8,920	$0	$0	$15,381
Subtotal					$49,678	$4,000	$148,920	$0	$0	$202,598
Sales Tax					$0	$0	$7,446	$0	$0	$7,446
INEEL ORG Labor/Subcontractor Overheads					$23,498	$1,924	$74,640	$0	$0	$100,063
Subtotal Estimate										$310,107
Escalation					$18,777	$1,520	$59,276	$0	$0	$79,573
Contingency					$37,701	$3,052	$119,016	$0	$0	$159,769
---Total 9115.3.3 PIPING - BOILER HOUSE			1,325		$129,654	$10,496	$409,298	$0	$0	$549,449
--- 9115.3.4 FIRE PROTECTION - BOILER HOUSE										
	FP	U.C. per SF			0	0	0	4	0	4
FIRE SPRINKLER SYSTEM - BOILER BUILDING		3,120.00	0		$0	$0	$0	$12,480	$0	$12,480
Subtotal					$0	$0	$0	$12,480	$0	$12,480
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$5,233	$0	$5,233
Subtotal Estimate										$17,713
Escalation					$0	$0	$0	$4,545	$0	$4,545
Contingency					$0	$0	$0	$9,126	$0	$9,126
---Total 9115.3.4 FIRE PROTECTION - BOILER HOUSE			0		$0	$0	$0	$31,384	$0	$31,384
--- 9115.4.1 HVAC - STORAGE FACILITY										
	HVAC	U.C. per Lot	1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork		1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The Interim Storage Facility is approximately 140' x 146' x 36' high.										
	HVAC	U.C. per Lot	500	CN-SHEE	17740	3000	100000	0	0	120740
HVAC Equipment		1.00	500	$35.48	$17,740	$3,000	$100,000	$0	$0	$120,740
	HVAC	U.C. per Lot	300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters		1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot	100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers		1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal		1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.1 HVAC - STORAGE FACILITY											
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance			1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal						$85,152	$3,000	$281,500	$0	$0	$369,652
Sales Tax						$0	$0	$14,075	$0	$0	$14,075
INEEL ORG Labor/Subcontractor Overheads						$38,860	$1,369	$134,887	$0	$0	$175,116
Subtotal Estimate											$558,843
Escalation						$31,821	$1,121	$110,457	$0	$0	$143,399
Contingency						$63,892	$2,251	$221,777	$0	$0	$287,919
---Total 9115.4.1 HVAC - STORAGE FACILITY				2,400		$219,725	$7,741	$762,696	$0	$0	$990,162
--- 9115.4.2 PIPING / PLUMBING - STORAGE FACILITY											
	PIPE	U.C. per LOT				0	0	0	60000	0	60000
MISC. PIPING - ALLOW			1.00	0		$0	$0	$0	$60,000	$0	$60,000
Subtotal						$0	$0	$0	$60,000	$0	$60,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$28,862	$0	$28,862
Subtotal Estimate											$88,862
Escalation						$0	$0	$0	$22,802	$0	$22,802
Contingency						$0	$0	$0	$45,782	$0	$45,782
---Total 9115.4.2 PIPING / PLUMBING - STORAGE FACILITY				0		$0	$0	$0	$157,447	$0	$157,447
--- 9115.4.3 FIRE PROTECTION - STORAGE FACILITY											
	FP	U.C. per SF				0	0	0	4	0	4
FIRE PROTECTION			20,440.00	0		$0	$0	$0	$81,760	$0	$81,760
Subtotal						$0	$0	$0	$81,760	$0	$81,760
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$34,284	$0	$34,284
Subtotal Estimate											$116,044
Escalation						$0	$0	$0	$29,777	$0	$29,777
Contingency						$0	$0	$0	$59,787	$0	$59,787
---Total 9115.4.3 FIRE PROTECTION - STORAGE FACILITY				0		$0	$0	$0	$205,608	$0	$205,608
--- 9116.1.1 ELECTRICAL DEMO - CALCINER CELL											
	ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell			1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
	ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.1.1 ELECTRICAL DEMO - CALCINER CELL											
	ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%			1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
	ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work			1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
	ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work			1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
	ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost			1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal						$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax						$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads						$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate											$222,380
Escalation						$56,068	$0	$994	$0	$0	$57,063
Contingency						$142,778	$0	$2,532	$0	$0	$145,310
---Total 9116.1.1 ELECTRICAL DEMO - CALCINER CELL				4,512		$417,352	$0	$7,401	$0	$0	$424,753
--- 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL											
	ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell			1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
	ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%			1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
	ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work			1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
	ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work			1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL										
ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal					$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax					$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads					$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate										$222,380
Escalation					$56,068	$0	$994	$0	$0	$57,063
Contingency					$142,778	$0	$2,532	$0	$0	$145,310
---Total 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL			**4,512**		**$417,352**	**$0**	**$7,401**	**$0**	**$0**	**$424,753**
--- 9116.1.4 ELECTRICAL DEMO - BLEND & HOLD CELL										
ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell		1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%		1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work		1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work		1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal					$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax					$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads					$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate										$222,380
Escalation					$56,068	$0	$994	$0	$0	$57,063
Contingency					$142,778	$0	$2,532	$0	$0	$145,310
---Total 9116.1.4 ELECTRICAL DEMO - BLEND & HOLD CELL			**4,512**		**$417,352**	**$0**	**$7,401**	**$0**	**$0**	**$424,753**
--- 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE										
ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell		1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE										
ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%		1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work		1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work		1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal					$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax					$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads					$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate										$222,380
Escalation					$56,068	$0	$994	$0	$0	$57,063
Contingency					$142,778	$0	$2,532	$0	$0	$145,310
—Total 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE			4,512		$417,352	$0	$7,401	$0	$0	$424,753
— 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF										
ELEC	U.C. per Ea		72	CN-ELEC	2456.64	2500	150000	0	0	154956.64
2000 amp, 480/277 double ended 3R walk-in switchgear		1.00	72	$34.12	$2,457	$2,500	$150,000	$0	$0	$154,957
ELEC	U.C. per Ea		24	CN-ELEC	818.88	2500	50000	0	0	53318.88
1500 kVA 13.8-480/277 transformers		2.00	48	$34.12	$1,638	$5,000	$100,000	$0	$0	$106,638
ELEC	U.C. per Ls		24	CN-ELEC	818.88	0	7500	0	0	8318.88
2000 amp armor clad busway		1.00	24	$34.12	$819	$0	$7,500	$0	$0	$8,319
ELEC	U.C. per Ea		16	CN-ELEC	545.92	0	10000	0	0	10545.92
1200 amp 480 volt normal power panels		2.00	32	$34.12	$1,092	$0	$20,000	$0	$0	$21,092
ELEC	U.C. per Ea		12	CN-ELEC	409.44	0	5000	0	0	5409.44
480 volt power panels		2.00	24	$34.12	$819	$0	$10,000	$0	$0	$10,819

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF										
	ELEC	U.C. per Ls			0	0	0	0	35000	35000
Vault and equipment pads for main gear and transformers		1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal					$6,824	$7,500	$287,500	$0	$35,000	$336,824
Sales Tax					$0	$0	$14,375	$0	$0	$14,375
INEEL ORG Labor/Subcontractor Overheads					$2,862	$3,145	$126,585	$0	$0	$132,592
Subtotal Estimate										$483,791
Escalation					$2,485	$2,732	$109,943	$0	$8,981	$124,141
Contingency					$6,329	$6,956	$279,970	$0	$22,870	$316,124
---Total 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF			200		$18,500	$20,332	$818,373	$0	$66,851	$924,056
--- 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF										
	ELEC	U.C. per Lf			0	0	0	0	125	125
15kV electrical duct bank, 2 runs of 200 lf.		400.00	0		$0	$0	$0	$0	$50,000	$50,000
	ELEC	U.C. per Ls			0	0	0	0	25000	25000
600 volt feeders		1.00	0		$0	$0	$0	$0	$25,000	$25,000
	ELEC	U.C. per Ls			0	0	0	0	50000	50000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$50,000	$50,000
Subtotal					$0	$0	$0	$0	$125,000	$125,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$125,000
Escalation					$0	$0	$0	$0	$32,075	$32,075
Contingency					$0	$0	$0	$0	$81,679	$81,679
---Total 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF			0		$0	$0	$0	$0	$238,754	$238,754
--- 9116.2.3 MISC. COSTS - NWCF										
	ELEC	U.C. per Ls	120	CN-ELEC	4094.4	0	0	0	0	4094.4
Testing of systems and equipment		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Ls	120	CN-ELEC	4094.4	0	0	0	0	4094.4
Material handling		1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Lot			0	0	0	40000	0	40000
Voice Paging / Evac.		1.00	0		$0	$0	$0	$40,000	$0	$40,000

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.3 MISC. COSTS - NWCF											
	ELEC	U.C. per Lot				0	0	0	40000	0	40000
Wiring Devices & Enclosures			1.00	0		$0	$0	$0	$40,000	$0	$40,000
Subtotal						$8,189	$0	$0	$80,000	$0	$88,189
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$3,434	$0	$0	$33,546	$0	$36,980
Subtotal Estimate											**$125,169**
Escalation						$2,982	$0	$0	$29,136	$0	$32,118
Contingency						$7,595	$0	$0	$74,195	$0	$81,789
---Total 9116.2.3 MISC. COSTS - NWCF				**240**		**$22,200**	**$0**	**$0**	**$216,877**	**$0**	**$239,077**
--- 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD											
	ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers			2.00	16	$34.12	$546	$0	$3,400	$0	$0	$3,946
	ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads			2.00	16	$34.12	$546	$0	$5,000	$0	$0	$5,546
Subtotal						$1,092	$0	$8,400	$0	$0	$9,492
Sales Tax						$0	$0	$420	$0	$0	$420
INEEL ORG Labor/Subcontractor Overheads						$458	$0	$3,698	$0	$0	$4,156
Subtotal Estimate											**$14,068**
Escalation						$398	$0	$3,212	$0	$0	$3,610
Contingency						$1,013	$0	$8,180	$0	$0	$9,193
---Total 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD				**32**		**$2,960**	**$0**	**$23,911**	**$0**	**$0**	**$26,871**
--- 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD											
	ELEC	U.C. per Ls				0	0	0	0	35000	35000
Branch power and lighting circuits			1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal						$0	$0	$0	$0	$35,000	$35,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											**$35,000**
Escalation						$0	$0	$0	$0	$8,981	$8,981
Contingency						$0	$0	$0	$0	$22,870	$22,870
---Total 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD				**0**		**$0**	**$0**	**$0**	**$0**	**$66,851**	**$66,851**
--- 9116.3.3 MISC. COSTS - TFD											
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Testing of systems and equipment			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.3.3 MISC. COSTS - TFD										
	ELEC	U.C. per Ls	90	CN-ELEC	3070.8	0	0	0	0	3070.8
Material handling		1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Sf			0	0	0	4	0	4
Voice Paging / Evac.		13,700.00	0		$0	$0	$0	$54,800	$0	$54,800
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		13,700.00	0		$0	$0	$0	$27,400	$0	$27,400
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
Subtotal					$6,142	$0	$0	$109,600	$0	$115,742
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$2,575	$0	$0	$45,959	$0	$48,534
Subtotal Estimate										$164,276
Escalation					$2,237	$0	$0	$39,916	$0	$42,153
Contingency					$5,696	$0	$0	$101,647	$0	$107,343
---Total 9116.3.3 MISC. COSTS - TFD			180		$16,650	$0	$0	$297,122	$0	$313,772
--- 9116.3.4 LIGHTING - TFD										
	ELEC	U.C. per Sf			0	0	0	0	3.9	3.9
Lighting		13,700.00	0		$0	$0	$0	$0	$53,430	$53,430
Subtotal					$0	$0	$0	$0	$53,430	$53,430
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$53,430
Escalation					$0	$0	$0	$0	$13,710	$13,710
Contingency					$0	$0	$0	$0	$34,913	$34,913
---Total 9116.3.4 LIGHTING - TFD			0		$0	$0	$0	$0	$102,053	$102,053
--- 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
	ELEC	U.C. per Ls			0	0	0	0	12000	12000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$12,000	$12,000

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
Subtotal					$0	$0	$0	$0	$12,000	$12,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$12,000
Escalation					$0	$0	$0	$0	$3,079	$3,079
Contingency					$0	$0	$0	$0	$7,841	$7,841
---Total 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE			0		$0	$0	$0	$0	$22,920	$22,920
— 9116.4.3 MISC. COSTS - BOILER HOUSE										
ELEC	U.C. per Ls		40	CN-ELEC	1364.8	0	0	0	0	1364.8
Testing of systems and equipment		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
ELEC	U.C. per Ls		40	CN-ELEC	1364.8	0	0	0	0	1364.8
Material handling		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
ELEC	U.C. per Sf				0	0	0	3	0	3
Voice Paging / Evac.		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360
ELEC	U.C. per Sf				0	0	0	2	0	2
Lightning Protection		3,120.00	0		$0	$0	$0	$6,240	$0	$6,240
ELEC	U.C. per Sf				0	0	0	1	0	1
Grounding Grid		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
ELEC	U.C. per Sf				0	0	0	1	0	1
Wiring Devices & Enclosures		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
Subtotal					$2,730	$0	$0	$21,840	$0	$24,570
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$1,145	$0	$0	$9,158	$0	$10,303
Subtotal Estimate										$34,872
Escalation					$994	$0	$0	$7,954	$0	$8,948
Contingency					$2,532	$0	$0	$20,255	$0	$22,787
---Total 9116.4.3 MISC. COSTS - BOILER HOUSE			80		$7,400	$0	$0	$59,207	$0	$66,607
— 9116.4.4 LIGHTING - BOILER HOUSE										
ELEC	U.C. per Sf				0	0	0	3	0	3
Lighting		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360

Project Name: **CONSTRUCTION DETAIL ITEM REPORT** V. J. Balls

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX in NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option C*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.4.4 LIGHTING - BOILER HOUSE										
Subtotal					$0	$0	$0	$9,360	$0	$9,360
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$3,925	$0	$3,925
Subtotal Estimate										$13,285
Escalation					$0	$0	$0	$3,409	$0	$3,409
Contingency					$0	$0	$0	$8,681	$0	$8,681
---Total 9116.4.4 LIGHTING - BOILER HOUSE			0		$0	$0	$0	$25,375	$0	$25,375
--- SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE										
ELEC	U.C. per LOT		480	CN-ELEC	16377.6	0	100000	0	0	116377.6
SWITCHGEAR AND TRANSFORMERS		1.00	480	$34.12	$16,378	$0	$100,000	$0	$0	$116,378
Subtotal					$16,378	$0	$100,000	$0	$0	$116,378
Sales Tax					$0	$0	$5,000	$0	$0	$5,000
INEEL ORG Labor/Subcontractor Overheads					$6,868	$0	$44,030	$0	$0	$50,897
Subtotal Estimate										$172,275
Escalation					$5,965	$0	$38,241	$0	$0	$44,206
Contingency					$15,189	$0	$97,381	$0	$0	$112,570
---Total SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE			480		$44,399	$0	$284,651	$0	$0	$329,051
--- RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE										
ELEC	U.C. per Ls				0	0	0	0	21000	21000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$21,000	$21,000
Subtotal					$0	$0	$0	$0	$21,000	$21,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$21,000
Escalation					$0	$0	$0	$0	$5,389	$5,389
Contingency					$0	$0	$0	$0	$13,722	$13,722
---Total RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE			0		$0	$0	$0	$0	$40,111	$40,111
--- MISC. COSTS - INTERIM STORAGE										
ELEC	U.C. per Ls		100	CN-ELEC	3412	0	0	0	0	3412
Testing of systems and equipment		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
ELEC	U.C. per Ls		100	CN-ELEC	3412	0	0	0	0	3412
Material handling		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
ELEC	U.C. per Sf				0	0	0	4	0	4
Voice Paging / Evac.		20,440.00	0		$0	$0	$0	$81,760	$0	$81,760

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- MISC. COSTS - INTERIM STORAGE										
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		20,440.00	0		$0	$0	$0	$40,880	$0	$40,880
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
Subtotal					$6,824	$0	$0	$163,520	$0	$170,344
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$2,862	$0	$0	$68,569	$0	$71,430
Subtotal Estimate										$241,774
Escalation					$2,485	$0	$0	$59,554	$0	$62,039
Contingency					$6,329	$0	$0	$151,654	$0	$157,983
---Total MISC. COSTS - INTERIM STORAGE			200		$18,500	$0	$0	$443,297	$0	$461,797
--- 9116.5 LIGHTING - INTERIM STORAGE										
	ELEC	U.C. per Sf			0	0	0	3.5	0	3.5
Lighting		20,440.00	0		$0	$0	$0	$71,540	$0	$71,540
Subtotal					$0	$0	$0	$71,540	$0	$71,540
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$29,999	$0	$29,999
Subtotal Estimate										$101,539
Escalation					$0	$0	$0	$26,055	$0	$26,055
Contingency					$0	$0	$0	$66,349	$0	$66,349
---Total 9116.5 LIGHTING - INTERIM STORAGE			0		$0	$0	$0	$193,942	$0	$193,942
--- 9116.6 ELECTRICAL - TRANSFER TUNNEL										
	ELEC	U.C. per SF		CN-ELEC	0	0	0	2.75	0	2.75
LIGHTING		1,500.00	0		$0	$0	$0	$4,125	$0	$4,125
	ELEC	U.C. per SF	0.03	CN-ELEC	1.024	0	2	0	0	3.024
VOICE PAGING / EVAC.		1,500.00	45	$34.12	$1,535	$0	$3,000	$0	$0	$4,535
Subtotal					$1,535	$0	$3,000	$4,125	$0	$8,660
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$644	$0	$1,321	$1,730	$0	$3,694
Subtotal Estimate										$12,505
Escalation					$559	$0	$1,147	$1,502	$0	$3,209
Contingency					$1,424	$0	$2,921	$3,826	$0	$8,171
---Total 9116.6 ELECTRICAL - TRANSFER TUNNEL			45		$4,162	$0	$8,540	$11,183	$0	$23,885

Project Name:
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9301.1 CONSTRUCTION SUPPORT									
BWI	U.C. per Lot			173600	0	0	0	0	173600
Construction Support - .1% Of TCC	1.00	0		$173,600	$0	$0	$0	$0	$173,600
7620	U.C. per Wk	160	U60	3945.6	0	0	0	0	3945.6
Radiological Control Technicians - 4 FTE - 2 Years	104.00	16,640	$24.66	$410,342	$0	$0	$0	$0	$410,342
7610	U.C. per Hr	0.1	Z03	5.232	0	0	0	0	5.232
Radiation Control - Management Support - 10% OF RCT Total	16,640.00	1,664	$52.32	$87,060	$0	$0	$0	$0	$87,060
Subtotal				$671,003	$0	$0	$0	$0	$671,003
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$442,689	$0	$0	$0	$0	$442,689
Subtotal Estimate									$1,113,691
Escalation				$285,773	$0	$0	$0	$0	$285,773
Contingency				$1,161,556	$0	$0	$0	$0	$1,161,556
---Total 9301.1 CONSTRUCTION SUPPORT		**18,304**		**$2,561,020**	**$0**	**$0**	**$0**	**$0**	**$2,561,020**
--- 9301.2 CONSTRUCTION QUALITY CONTROL									
BWI	U.C. per Lot			173600	0	0	0	0	173600
Construction Quality Control - .1% Of TCC	1.00	0		$173,600	$0	$0	$0	$0	$173,600
Subtotal				$173,600	$0	$0	$0	$0	$173,600
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$173,600
Escalation				$44,546	$0	$0	$0	$0	$44,546
Contingency				$181,061	$0	$0	$0	$0	$181,061
---Total 9301.2 CONSTRUCTION QUALITY CONTROL		**0**		**$399,207**	**$0**	**$0**	**$0**	**$0**	**$399,207**
--- 9301.3 CONSTRUCTION DOCUMENTATION									
BWI	U.C. per Lot			868100	0	0	0	0	868100
PM Construction Document Control - .5% Of TCC	1.00	0		$868,100	$0	$0	$0	$0	$868,100
Subtotal				$868,100	$0	$0	$0	$0	$868,100
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$868,100
Escalation				$222,754	$0	$0	$0	$0	$222,754
Contingency				$905,409	$0	$0	$0	$0	$905,409
---Total 9301.3 CONSTRUCTION DOCUMENTATION		**0**		**$1,996,264**	**$0**	**$0**	**$0**	**$0**	**$1,996,264**

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3100 TESTING AND TURNOVER PLANNING									
BWI	U.C. per Lot			347200	0	0	0	0	347200
Testing & Turnover Planning - .2% Of TCC	1.00	0		$347,200	$0	$0	$0	$0	$347,200
Subtotal				$347,200	$0	$0	$0	$0	$347,200
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$347,200
Escalation				$128,186	$0	$0	$0	$0	$128,186
Contingency				$489,648	$0	$0	$0	$0	$489,648
---Total OPC3100 TESTING AND TURNOVER PLANNING		0		$965,034	$0	$0	$0	$0	$965,034
--- OPC3200 S. O. TESTING									
BWI	U.C. per Lot			8681100	0	0	0	0	8681100
SO Testing - 5% Of TCC	1.00	0		$8,681,100	$0	$0	$0	$0	$8,681,100
Subtotal				$8,681,100	$0	$0	$0	$0	$8,681,100
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$8,681,100
Escalation				$3,205,062	$0	$0	$0	$0	$3,205,062
Contingency				$12,242,747	$0	$0	$0	$0	$12,242,747
---Total OPC3200 S. O. TESTING		0		$24,128,909	$0	$0	$0	$0	$24,128,909
--- OPC3300 ORR SUPPORT									
BWI	U.C. per Lot			382000	0	0	0	0	382000
ORR Support - .22% Of TCC	1.00	0		$382,000	$0	$0	$0	$0	$382,000
Subtotal				$382,000	$0	$0	$0	$0	$382,000
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$382,000
Escalation				$141,034	$0	$0	$0	$0	$141,034
Contingency				$538,725	$0	$0	$0	$0	$538,725
---Total OPC3300 ORR SUPPORT		0		$1,061,760	$0	$0	$0	$0	$1,061,760
--- OPC3400 FACILITY ACCEPTANCE REVIEW									
BWI	U.C. per Lot			260400	0	0	0	0	260400
Facility Acceptance Review - .15% Of TCC	1.00	0		$260,400	$0	$0	$0	$0	$260,400

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3400 FACILITY ACCEPTANCE REVIEW										
Subtotal					$260,400	$0	$0	$0	$0	$260,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$260,400
Escalation					$96,140	$0	$0	$0	$0	$96,140
Contingency					$367,236	$0	$0	$0	$0	$367,236
---Total OPC3400 FACILITY ACCEPTANCE REVIEW			0		$723,776	$0	$0	$0	$0	$723,776
--- OPC3500 RADIOLOGICAL CONTROL SUPPORT										
	BWI	U.C. per Lot			191000	0	0	0	0	191000
Radiological Control Support - .11% Of TCC		1.00	0		$191,000	$0	$0	$0	$0	$191,000
Subtotal					$191,000	$0	$0	$0	$0	$191,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$191,000
Escalation					$70,517	$0	$0	$0	$0	$70,517
Contingency					$269,363	$0	$0	$0	$0	$269,363
---Total OPC3500 RADIOLOGICAL CONTROL SUPPORT			0		$530,880	$0	$0	$0	$0	$530,880
--- OPC3600 OPERATOR TRAINING										
	BWI	U.C. per Lot			3472400	0	0	0	0	3472400
Operator Training - 2% Of TCC		1.00	0		$3,472,400	$0	$0	$0	$0	$3,472,400
Subtotal					$3,472,400	$0	$0	$0	$0	$3,472,400
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,472,400
Escalation					$1,282,010	$0	$0	$0	$0	$1,282,010
Contingency					$4,897,042	$0	$0	$0	$0	$4,897,042
---Total OPC3600 OPERATOR TRAINING			0		$9,651,452	$0	$0	$0	$0	$9,651,452
--- OPC3700 OPERATING PROCEDURES										
	BWI	U.C. per Lot			763900	0	0	0	0	763900
Operating Procedures - .44% Of TCC		1.00	0		$763,900	$0	$0	$0	$0	$763,900

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
Universal Solvent Extraction (UNEX) Feasibility Study - Option C - UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option C*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3700 OPERATING PROCEDURES										
Subtotal					$763,900	$0	$0	$0	$0	$763,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$763,900
Escalation					$282,032	$0	$0	$0	$0	$282,032
Contingency					$1,077,310	$0	$0	$0	$0	$1,077,310
---Total OPC3700 OPERATING PROCEDURES			0		$2,123,242	$0	$0	$0	$0	$2,123,242
--- OPC3800 START-UP COORDINATION										
	BWI	U.C. per Lot			225700	0	0	0	0	225700
Startup Coordination - .13% Of TCC		1.00	0		$225,700	$0	$0	$0	$0	$225,700
Subtotal					$225,700	$0	$0	$0	$0	$225,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$225,700
Escalation					$83,328	$0	$0	$0	$0	$83,328
Contingency					$318,299	$0	$0	$0	$0	$318,299
---Total OPC3800 START-UP COORDINATION			0		$627,328	$0	$0	$0	$0	$627,328
--- OPC3900 SPARES										
	BWI	U.C. per Lot			1000000	0	0	0	0	1000000
Spares		1.00	0		$1,000,000	$0	$0	$0	$0	$1,000,000
Subtotal					$1,000,000	$0	$0	$0	$0	$1,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,000,000
Escalation					$369,200	$0	$0	$0	$0	$369,200
Contingency					$1,410,276	$0	$0	$0	$0	$1,410,276
---Total OPC3900 SPARES			0		$2,779,476	$0	$0	$0	$0	$2,779,476
--- GAPIF Non-Org G&A and PIF										
PF	NOGAPIF	U.C. per $			0	0	0	0	1	1
Procurement Fee %		1,735,289.00	0		$0	$0	$0	$0	$1,735,289	$1,735,289

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- GAPIF Non-Org G&A and PIF									
Subtotal				$0	$0	$0	$0	$1,735,289	$1,735,289
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$1,735,289
Escalation				$0	$0	$0	$0	$0	$0
Contingency				$0	$0	$0	$0	$1,214,702	$1,214,702
---Total GAPIF Non-Org G&A and PIF		0		$0	$0	$0	$0	$2,949,991	$2,949,991
Subtotal UNEX IN NWCF - OPTION C				$**,***,***	$326,250	$90,244,479	$55,176,409	$2,016,719	$**,***,***
Sales Tax				$0	$0	$4,512,224	$0	$0	$4,512,224
INEEL ORG Labor/Subcontractor Overheads				$7,835,424	$125,424	$35,427,140	$4,668,307	$0	$48,056,296
Subtotal Estimate									$**,***,***
Escalation				$31,577,764	$115,900	$33,405,174	$9,595,689	$72,215	$74,766,742
Contingency				$98,537,616	$330,681	$63,798,649	$20,977,637	$1,398,598	$**,***,***
Total UNEX IN NWCF - OPTION C		512,121		$282,166,340	$898,255	$227,387,667	$90,418,043	$3,487,532	$604,357,835

UNEX PROCESS IN NWCF

@RISK Sensitivity Report

OPTION C

Sensitivity Ranking
Step-Wise Regression

Rank	Name	Cell	Regression	Weight	Amount	Level Markup
- PROJECT DEVELOPMENT / Contingency at F3, for Simulation 1						
1	EQUIPMENT	B22	0.5736	0.1809	$33,718,762	69%
2	SPECIALTIES	B21	0.5122	0.1616	$30,112,217	30%
3	PROJECT ACCEPTANCE/CLOSEOUT	B27	0.3737	0.1179	$21,969,386	103%
4	CONSTRUCTION MANAGEMENT	B7	0.2387	0.0753	$14,032,818	58%
5	PROJECT MANAGEMENT	B11	0.2129	0.0671	$12,514,353	43%
6	TECHNICAL DEVELOPMENT	B4	0.2012	0.0635	$11,828,407	101%
7	DECON SOLUTION PROCESSING	B6	0.1872	0.0590	$11,004,388	23%
8	GENERAL CONDITIONS	B14	0.1819	0.0574	$10,691,107	45%
9	TITLE II DESIGN	B9	0.1286	0.0406	$7,559,116	33%
10	MECHANICAL	B24	0.1060	0.0334	$6,233,004	41%
11	TITLE I DESIGN	B8	0.0856	0.0270	$5,031,267	42%
12	PROJECT EXECUTION	B5	0.0743	0.0234	$4,366,246	45%
13	QUALITY ASSURANCE	B10	0.0603	0.0190	$3,547,107	32%
14	CONSTRUCTION MISCELLANEOUS	B26	0.0386	0.0122	$2,268,488	83%
15	PROJECT DEVELOPMENT	B3	0.0325	0.0103	$1,911,477	33%
16	ELECTRICAL	B25	0.0276	0.0087	$1,624,106	52%
17	METALS	B17	0.0272	0.0086	$1,598,187	26%
18	CONCRETE	B16	0.0231	0.0073	$1,356,287	26%
19	Non-Org G&A and PIF	B28	0.0208	0.0066	$1,223,347	70%
20	CONVEYING SYSTEMS	B23	0.0182	0.0058	$1,072,602	9%
21	CONSTRUCTION AE SUPPORT	B12	0.0159	0.0050	$936,896	28%
22	SITEWORK	B15	0.0126	0.0040	$738,256	64%
23	THERMAL & MOISTURE PROTECTION	B18	0.0071	0.0022	$417,965	26%
24	FINISHES	B20	0.0052	0.0016	$306,666	26%
25	GOVERNMENT FURNISHED EQUIPMENT	B13	0.0036	0.0011	$212,380	134%
26	DOORS & WINDOWS	B19	0.0016	0.0005	$91,313	26%

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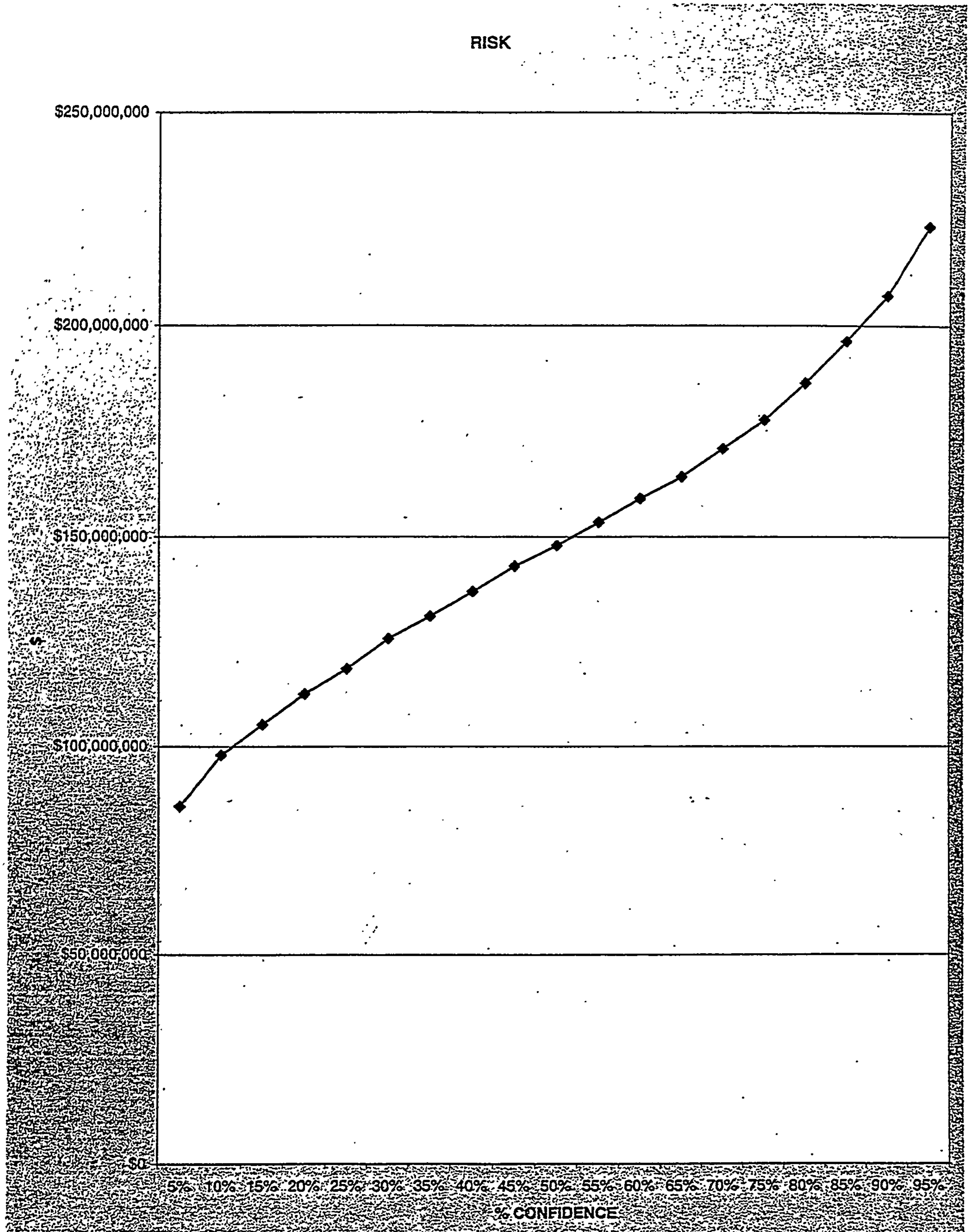
UNEX PROCESS IN NWCF

@RISK Output Details Report

Output Statistics

Outputs	Contingency
Simulation#	1
Statistics / Cell	F3
Minimum	$33,466,366
Maximum	$288,671,744
Mean	$150,103,611
Standard Deviation	41961010.78
Variance	1.76073E+15
Skewness	0.284612116
Kurtosis	2.774579693
NumErrs	0
Mode	155403016.8
5%	$85,583,616
10%	$97,936,112
15%	$105,284,384
20%	$112,584,632
25%	$118,574,696
30%	$125,720,907
35%	$131,076,118
40%	$136,934,048
45%	$142,941,072
50%	$147,863,808
55%	$153,410,978
60%	$158,985,186
65%	$164,211,294
70%	$170,829,630
75%	$177,672,192
80%	$186,365,136
85%	$196,340,250
90%	$207,195,669
95%	$223,625,421

UNEX PROCESS IN NWCF



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Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Project Number: *2570 - Option D*

TPC Summary Report 2

ESTIMATE ELEMENT	Estimate Subtotal	Escalation	Contingency	TOTAL
Total Estimated Cost (TEC)	$262,325,469	*24.17%* $63,404,363	*41.06%* $133,742,854	$459,472,685
Other Project Cost (OPC)	$84,058,300	*17.02%* $14,304,517	*52.40%* $51,539,367	$149,902,184
Total Project Cost (TPC)	$346,383,769	*22.43%* $77,708,880	*43.69%* $185,282,221	$609,374,869
Rounded TPC (Rounded to the nearest $ 1000000)				$609,000,000

	Remarks
Type of Estimate: Planning	
Estimator: Rowley / Mitchell / Marler	
Checked By: RAA	
Approved By: DM	

INEEL

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC1000	**PROJECT DEVELOPMENT**	**$16,448,500**	**$980,331**	**$13,677,322**	**78.48%**	**$31,106,153**
OPC1001	--PROJECT DEVELOPMENT	$5,448,500	$324,731	$1,905,166	33.00%	$7,678,397
OPC1001.1	----CONCEPTUAL DESIGN	$3,495,100	$208,308	$1,222,125	33.00%	$4,925,533
OPC1001.2	----PROJECT EXECUTION PLAN	$174,800	$10,418	$61,122	33.00%	$246,340
OPC1001.3	----WORK PACKAGE DEVELOPMENT	$401,900	$23,953	$140,532	33.00%	$566,385
OPC1001.4	----TASK BASELINE AGREEMENT	$576,700	$34,371	$201,654	33.00%	$812,725
OPC1001.5	----PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)	$800,000	$47,680	$279,734	33.00%	$1,127,414
OPC1600	--TECHNICAL DEVELOPMENT	$11,000,000	$655,600	$11,772,156	101.00%	$23,427,756
OPC2000	**PROJECT EXECUTION**	**$52,192,600**	**$7,632,156**	**$16,330,630**	**27.30%**	**$76,155,386**
OPC2001	--PROJECT EXECUTION	$9,742,600	$2,499,951	$5,386,723	44.00%	$17,629,274
OPC2001.1	----PROJECT SUPPORT	$5,242,600	$1,345,251	$2,898,655	44.00%	$9,486,506
OPC2001.2	----PERMITTING	$4,500,000	$1,154,700	$2,488,068	44.00%	$8,142,768
OPC2300	--DECON SOLUTION PROCESSING	$42,450,000	$5,132,205	$10,943,907	23.00%	$58,526,112
1000	**CONSTRUCTION MANAGEMENT**	**$18,873,500**	**$4,842,940**	**$13,992,700**	**59.00%**	**$37,709,140**
1100	--CONSTRUCTION SUPERVISION & ENGINEERING	$15,727,900	$4,035,779	$11,660,571	59.00%	$31,424,250
1110	--CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$349,500	$89,682	$259,117	59.00%	$698,299
1200	--CM PROJECT CONTROLS	$1,223,300	$313,899	$906,947	59.00%	$2,444,146
1300	--CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)	$873,800	$224,217	$647,830	59.00%	$1,745,847
1400	--CM TRAINING	$349,500	$89,682	$259,117	59.00%	$698,299
1500	--CM - OTHER DIRECT COSTS	$349,500	$89,682	$259,117	59.00%	$698,299
2000	**TITLE I DESIGN**	**$10,485,200**	**$1,267,661**	**$5,053,730**	**43.00%**	**$16,806,591**

Project Summary Report

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
2400	--DESIGN ACTIVITIES	$10,485,200	$1,267,661	$5,053,730	43.00%	$16,806,591
3000	**TITLE II DESIGN**	**$19,747,200**	**$3,029,220**	**$7,288,455**	**32.00%**	**$30,064,875**
3400	--DESIGN ACTIVITIES	$19,747,200	$3,029,220	$7,288,455	32.00%	$30,064,875
4000	**QUALITY ASSURANCE**	**$8,737,700**	**$2,242,094**	**$3,403,736**	**31.00%**	**$14,383,530**
4100	--QUALITY ASSURANCE	$8,737,700	$2,242,094	$3,403,736	31.00%	$14,383,530
5000	**PROJECT MANAGEMENT**	**$23,040,400**	**$5,912,167**	**$12,449,604**	**43.00%**	**$41,402,170**
5100	--PM ADMINISTRATION	$13,980,300	$3,587,345	$7,554,087	43.00%	$25,121,732
5110	--PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$69,900	$17,936	$37,770	43.00%	$125,606
5200	--PM PROJECT CONTROLS	$3,495,100	$896,843	$1,888,535	43.00%	$6,280,478
5300	--PM RECORDS MANAGEMENT	$3,495,100	$896,843	$1,888,535	43.00%	$6,280,478
5400	--SAFETY ANALYSIS	$2,000,000	$513,200	$1,080,676	43.00%	$3,593,876
6000	**CONSTRUCTION AE SUPPORT**	**$2,621,300**	**$672,626**	**$922,299**	**28.00%**	**$4,216,225**
8000	**GOVERNMENT FURNISHED EQUIPMENT**	**$158,420**	**$40,651**	**$258,791**	**130.00%**	**$457,862**
8300	--GFE LABOR	$158,420	$40,651	$258,791	130.00%	$457,862
9000	**CONSTRUCTION**	**$176,917,400**	**$45,397,005**	**$89,169,939**	**40.11%**	**$311,484,343**
9100	--CONSTRUCTION SUBCONTRACTS	$174,753,908	$44,841,853	$86,913,465	39.58%	$306,509,226
9101	----GENERAL CONDITIONS	$17,284,734	$4,435,263	$9,339,599	43.00%	$31,059,596
9101.1	------GENERAL CONDITIONS	$15,879,604	$4,074,706	$8,580,353	43.00%	$28,534,663
9101.2	------GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE	$1,405,130	$360,556	$759,245	43.00%	$2,524,932
9102	----SITEWORK	$913,302	$234,353	$768,929	67.00%	$1,916,585

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option D***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9102.1	------SITEWORK - UTILITIES	$71,860	$18,439	$60,500	67.00%	$150,799
9102.2	------SITEWORK - TFD FACILITY	$353,216	$90,635	$297,380	67.00%	$741,231
9102.3	------SITEWORK - BOILER HOUSE	$68,112	$17,478	$57,345	67.00%	$142,935
9102.4	------SITEWORK - STORAGE FACILITY	$158,102	$40,569	$133,110	67.00%	$331,781
9102.5	------SITEWORK - TUNNEL	$197,085	$50,572	$165,930	67.00%	$413,587
9102.6	------SITEWORK - PAVING	$64,927	$16,660	$54,664	67.00%	$136,251
9103	**----CONCRETE**	**$4,104,590**	**$1,053,238**	**$1,341,035**	**26.00%**	**$6,498,863**
9103.2	------CONCRETE - TFD FACILITY	$2,670,605	$685,277	$872,529	26.00%	$4,228,411
9103.3	------CONCRETE - BOILER HOUSE	$48,364	$12,410	$15,801	26.00%	$76,576
9103.4	------CONCRETE - STORAGE FACILITY	$1,292,540	$331,666	$422,293	26.00%	$2,046,499
9103.5	------CONCRETE - TUNNEL	$93,081	$23,885	$30,411	26.00%	$147,377
9105	**----METALS**	**$4,812,980**	**$1,235,011**	**$1,572,478**	**26.00%**	**$7,620,468**
9105.1	------METALS - DEMOLITION	$10,882	$2,792	$3,555	26.00%	$17,229
9105.1.1	--------METALS DEMOLITION - CALCINER CELL	$10,882	$2,792	$3,555	26.00%	$17,229
9105.3	------METALS - TFD FACILITY	$546,606	$140,259	$178,585	26.00%	$865,451
9105.4	------METALS - BOILER HOUSE	$151,151	$38,785	$49,383	26.00%	$239,319
9105.5	------METALS - STORAGE FACILITY	$4,104,341	$1,053,174	$1,340,954	26.00%	$6,498,469
9107	**----THERMAL & MOISTURE PROTECTION**	**$1,287,364**	**$330,338**	**$420,602**	**26.00%**	**$2,038,304**
9107.1	------THERMAL & MOISTURE PROTECTION - TFD FACILITY	$721,911	$185,242	$235,860	26.00%	$1,143,014
9107.2	------THERMAL & MOISTURE PROTECTION - BOILER HOUSE	$85,532	$21,948	$27,945	26.00%	$135,424
9107.3	------THERMAL & MOISTURE PROTECTION - STORAGE FACILITY	$479,921	$123,148	$156,798	26.00%	$759,866
9108	**----DOORS & WINDOWS**	**$281,930**	**$72,343**	**$92,111**	**26.00%**	**$446,385**

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: ***INTEC***
Estimate Number: ***2570 - Option D***

Project Summary Report

Client: ***V. J. Balls***
Prepared By: ***Rowley / Mitchell / Marler***
Estimate Type: ***Planning***

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9108.2	------DOORS & WINDOWS - TFD FACILITY	$184,721	$47,399	$60,351	26.00%	$292,472
9108.3	------DOORS & WINDOWS - BOILER HOUSE	$35,221	$9,038	$11,507	26.00%	$55,766
9108.4	------DOORS & WINDOWS - STORAGE FACILITY	$61,988	$15,906	$20,253	26.00%	$98,147
9109	**----FINISHES**	**$955,827**	**$245,265**	**$312,284**	**26.00%**	**$1,513,377**
9109.1	------FINISHES - NWCF	$152,711	$39,186	$49,893	26.00%	$241,790
9109.2	------FINISHES - TFD FACILITY	$500,276	$128,371	$163,448	26.00%	$792,095
9109.3	------FINISHES - BOILER HOUSE	$1,902	$488	$621	26.00%	$3,011
9109.4	------FINISHES - STORAGE FACILITY	$300,938	$77,221	$98,321	26.00%	$476,481
9110	**----SPECIALTIES**	**$77,738,352**	**$19,947,661**	**$29,305,804**	**30.00%**	**$126,991,817**
9110.1	------SPECIALTIES - NWCF	$2,916,849	$748,463	$1,099,594	30.00%	$4,764,906
9110.2	------SPECIALTIES - TFD FACILITY	$18,398,054	$4,720,941	$6,935,699	30.00%	$30,054,694
9110.3	------SPECIALTIES - BOILER HOUSE	$62,343	$15,997	$23,502	30.00%	$101,843
9110.4	------SPECIALTIES - STORAGE FACILITY	$56,361,106	$14,462,260	$21,247,010	30.00%	$92,070,376
9111	**----EQUIPMENT**	**$38,876,290**	**$9,975,656**	**$32,730,804**	**67.00%**	**$81,582,750**
9111.1	------EQUIPMENT - IN NWCF	$8,860,103	$2,273,502	$7,459,515	67.00%	$18,593,120
9111.1.1	--------EQUIPMENT - CALCINER CELL	$406,709	$104,361	$342,417	67.00%	$853,487
9111.1.2	--------EQUIPMENT - OFF GAS CELL	$1,423,784	$365,343	$1,198,715	67.00%	$2,987,842
9111.1.3	--------EQUIPMENT - BLEND & HOLD CELL	$234,834	$60,258	$197,712	67.00%	$492,804
9111.1.4	--------EQUIPMENT - VALVE CUBICLE	$14,665	$3,763	$12,347	67.00%	$30,776
9111.1.5	--------EQUIPMENT - STORAGE AREA	$1,271,493	$326,265	$1,070,498	67.00%	$2,668,256
9111.6	--------EQUIPMENT - GROUT FACILITY	$5,508,618	$1,413,511	$4,637,826	67.00%	$11,559,955
9111.2	------EQUIPMENT - THIN FILM DRYER FACILITY	$1,621,050	$415,962	$1,364,798	67.00%	$3,401,810

Project Summary Report

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9111.3	------EQUIPMENT - BOILER HOUSE	$1,373,665	$352,482	$1,156,519	67.00%	$2,882,666
9111.6	------EQUIPMENT - STORAGE FACILITY	$22,081,543	$5,666,124	$18,590,937	67.00%	$46,338,604
9111.7	------EQUIPMENT DEMOLITION	$4,939,928	$1,267,586	$4,159,034	67.00%	$10,366,548
9111.7.1	--------EQUIPMENT DEMOLITION - CALCINER CELL	$1,280,172	$328,492	$1,077,805	67.00%	$2,686,469
9111.7.2	--------EQUIPMENT DEMOLITION - OFF GAS CELL	$1,298,236	$333,127	$1,093,014	67.00%	$2,724,378
9111.7.3	--------EQUIPMENT DEMOLITION - BLEND & HOLD CELL	$1,553,883	$398,726	$1,308,248	67.00%	$3,260,858
9111.7.4	--------EQUIPMENT DEMOLITION - VALVE CUBICLE	$807,637	$207,240	$679,967	67.00%	$1,694,844
9114	**----CONVEYING SYSTEMS**	**$9,865,129**	**$2,531,392**	**$1,115,687**	9.00%	**$13,512,208**
9114.4	------CONVEYING SYSTEMS - STORAGE FACILITY	$9,865,129	$2,531,392	$1,115,687	9.00%	$13,512,208
9115	**----MECHANICAL**	**$16,133,906**	**$4,139,960**	**$8,312,285**	41.00%	**$28,586,151**
9115.1	------MECHANICAL DEMOLITION	$5,129,215	$1,316,157	$2,642,603	41.00%	$9,087,975
9115.1.1	--------MECHANICAL DEMO - CALCINER CELL	$1,984,201	$509,146	$1,022,272	41.00%	$3,515,618
9115.1.3	--------MECHANICAL DEMO - OFF GAS CELL	$1,094,474	$280,842	$563,880	41.00%	$1,939,196
9115.1.4	--------MECHANICAL DEMO - BLEND & HOLD CELL	$1,094,474	$280,842	$563,880	41.00%	$1,939,196
9115.1.5	--------MECHANICAL DEMO - VALVE CUBICLE	$956,066	$245,327	$492,571	41.00%	$1,693,963
9115.2	------MECHANICAL - NEW - NWCF	$7,073,412	$1,815,037	$3,644,264	41.00%	$12,532,714
9115.2.1	--------HVAC - NEW - NWCF	$6,561,337	$1,683,639	$3,380,440	41.00%	$11,625,416
9115.2.2	--------PIPING - NEW - NWCF	$428,065	$109,841	$220,542	41.00%	$758,448
9115.2.3	--------FIRE PROTECTION - NEW - NWCF	$84,010	$21,557	$43,283	41.00%	$148,850
9115.2	------MECHANICAL - NEW - TFD FACILITY	$2,766,709	$709,937	$1,425,425	41.00%	$4,902,071
9115.2.1	--------HVAC - TFD FACILITY - HOT CELL	$877,596	$225,191	$452,143	41.00%	$1,554,929
9115.2.2	--------HVAC - TFD FACILITY - OPERATING CORRIDORS	$1,523,564	$390,947	$784,949	41.00%	$2,699,460

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9115.2.3	--------PLUMBING / PIPING - TFD FACILITY	$365,549	$93,800	$188,333	41.00%	$647,682
9115.3	------MECHANICAL - NEW - BOILER HOUSE	$400,820	$102,850	$206,505	41.00%	$710,175
9115.3.1	--------HVAC - BOILER HOUSE	$68,261	$17,516	$35,168	41.00%	$120,945
9115.3.2	--------PLUMBING - BOILER HOUSE	$4,739	$1,216	$2,442	41.00%	$8,397
9115.3.3	--------PIPING - BOILER HOUSE	$310,107	$79,573	$159,769	41.00%	$549,449
9115.3.4	--------FIRE PROTECTION - BOILER HOUSE	$17,713	$4,545	$9,126	41.00%	$31,384
9115.4	------MECHANICAL - NEW - STORAGE FACILITY	$763,750	$195,978	$393,489	41.00%	$1,353,217
9115.4.1	--------HVAC - STORAGE FACILITY	$558,843	$143,399	$287,919	41.00%	$990,162
9115.4.2	--------PIPING / PLUMBING - STORAGE FACILITY	$88,862	$22,802	$45,782	41.00%	$157,447
9115.4.3	--------FIRE PROTECTION - STORAGE FACILITY	$116,044	$29,777	$59,787	41.00%	$205,608
9116	**----ELECTRICAL**	**$2,499,503**	**$641,372**	**$1,601,846**	**51.00%**	**$4,742,722**
9116.1	------ELECTRICAL - DEMOLITION	$889,519	$228,251	$570,063	51.00%	$1,687,833
9116.1.1	--------ELECTRICAL DEMO - CALCINER CELL	$222,380	$57,063	$142,516	51.00%	$421,958
9116.1.3	--------ELECTRICAL DEMO - OFF GAS CELL	$222,380	$57,063	$142,516	51.00%	$421,958
9116.1.4	--------ELECTRICAL DEMO - BLEND & HOLD CELL	$222,380	$57,063	$142,516	51.00%	$421,958
9116.1.5	--------ELECTRICAL DEMO - VALVE CUBICLE	$222,380	$57,063	$142,516	51.00%	$421,958
9116.2	------ELECTRICAL - NEW - NWCF	$733,960	$188,334	$470,370	51.00%	$1,392,664
9116.2.1	--------SWITCHGEAR AND TRANSFORMERS - NWCF	$483,791	$124,141	$310,045	51.00%	$917,976
9116.2.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF	$125,000	$32,075	$80,108	51.00%	$237,183
9116.2.3	--------MISC. COSTS - NWCF	$125,169	$32,118	$80,217	51.00%	$237,504
9116.3	------ELECTRICAL - NEW - TFD FACILITY	$266,774	$68,454	$170,966	51.00%	$506,194
9116.3.1	--------SWITCHGEAR AND TRANSFORMERS - TFD	$14,068	$3,610	$9,016	51.00%	$26,694

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

Project Summary Report

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
9116.3.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - TFD	$35,000	$8,981	$22,430	51.00%	$66,411
9116.3.3	--------MISC. COSTS - TFD	$164,276	$42,153	$105,279	51.00%	$311,707
9116.3.4	--------LIGHTING - TFD	$53,430	$13,710	$34,241	51.00%	$101,382
9116.4	------ELECTRICAL - BOILER HOUSE	$60,157	$15,436	$38,553	51.00%	$114,146
9116.4.2	--------RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE	$12,000	$3,079	$7,690	51.00%	$22,770
9116.4.3	--------MISC. COSTS - BOILER HOUSE	$34,872	$8,948	$22,349	51.00%	$66,169
9116.4.4	--------LIGHTING - BOILER HOUSE	$13,285	$3,409	$8,514	51.00%	$25,208
9116.5	------ELECTRICAL - STORAGE FACILITY	$536,588	$137,689	$343,881	51.00%	$1,018,158
	--------SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE	$172,275	$44,206	$110,405	51.00%	$326,886
	--------RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE	$21,000	$5,389	$13,458	51.00%	$39,847
	--------MISC. COSTS - INTERIM STORAGE	$241,774	$62,039	$154,945	51.00%	$458,759
9116.5	--------LIGHTING - INTERIM STORAGE	$101,539	$26,055	$65,073	51.00%	$192,667
9116.6	------ELECTRICAL - TRANSFER TUNNEL	$12,505	$3,209	$8,014	51.00%	$23,728
9301	**--CONSTRUCTION MISCELLANEOUS**	**$2,163,491**	**$555,152**	**$2,256,474**	**83.00%**	**$4,975,117**
9301.1	----CONSTRUCTION SUPPORT	$1,114,891	$286,081	$1,162,807	83.00%	$2,563,780
9301.2	----CONSTRUCTION QUALITY CONTROL	$174,800	$44,854	$182,313	83.00%	$401,966
9301.3	----CONSTRUCTION DOCUMENTATION	$873,800	$224,217	$911,354	83.00%	$2,009,371
OPC3000	**PROJECT ACCEPTANCE/CLOSEOUT**	**$15,417,200**	**$5,692,030**	**$21,531,415**	**102.00%**	**$42,640,645**
OPC3100	**--TESTING AND TURNOVER PLANNING**	**$349,500**	**$129,035**	**$488,106**	**102.00%**	**$966,642**
OPC3200	**--S. O. TESTING**	**$8,737,700**	**$3,225,959**	**$12,202,932**	**102.00%**	**$24,166,591**
OPC3300	**--ORR SUPPORT**	**$384,500**	**$141,957**	**$536,987**	**102.00%**	**$1,063,444**
OPC3400	**--FACILITY ACCEPTANCE REVIEW**	**$262,100**	**$96,767**	**$366,045**	**102.00%**	**$724,912**

LEVEL		Estimate Subtotal	Escalation	Contingency	Contingency %	TOTAL
OPC3500	--RADIOLOGICAL CONTROL SUPPORT	$192,200	$70,960	$268,423	102.00%	$531,584
OPC3600	--OPERATOR TRAINING	$3,495,100	$1,290,391	$4,881,201	102.00%	$9,666,692
OPC3700	--OPERATING PROCEDURES	$768,900	$283,878	$1,073,833	102.00%	$2,126,611
OPC3800	--START-UP COORDINATION	$227,200	$83,882	$317,304	102.00%	$628,386
OPC3900	--SPARES	$1,000,000	$369,200	$1,396,584	102.00%	$2,765,784
GAPIF	Non-Org G&A and PIF	$1,744,349	$0	$1,203,601	69.00%	$2,947,950
Total	MODIFIED UNEX IN NWCF - OPTION D	$346,383,769	$77,708,880	$185,282,221	43.69%	$609,374,869

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.1 CONCEPTUAL DESIGN									
BWI	U.C. per LOT			3495100	0	0	0	0	3495100
CONCEPTUAL DESIGN (2% OF TCC)	1.00	0		$3,495,100	$0	$0	$0	$0	$3,495,100
Subtotal				$3,495,100	$0	$0	$0	$0	$3,495,100
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$3,495,100
Escalation				$208,308	$0	$0	$0	$0	$208,308
Contingency				$1,222,125	$0	$0	$0	$0	$1,222,125
---Total OPC1001.1 CONCEPTUAL DESIGN		0		$4,925,533	$0	$0	$0	$0	$4,925,533
--- OPC1001.2 PROJECT EXECUTION PLAN									
BWI	U.C. per LOT			174800	0	0	0	0	174800
ACDC/SOW,CPDS,PEP,DC,/SOW REVIEWS @ .1% OF TCC	1.00	0		$174,800	$0	$0	$0	$0	$174,800
Subtotal				$174,800	$0	$0	$0	$0	$174,800
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$174,800
Escalation				$10,418	$0	$0	$0	$0	$10,418
Contingency				$61,122	$0	$0	$0	$0	$61,122
---Total OPC1001.2 PROJECT EXECUTION PLAN		0		$246,340	$0	$0	$0	$0	$246,340
--- OPC1001.3 WORK PACKAGE DEVELOPMENT									
BWI	U.C. per Lot			401900	0	0	0	0	401900
Work Package Development - .23% Of TCC	1.00	0		$401,900	$0	$0	$0	$0	$401,900
Subtotal				$401,900	$0	$0	$0	$0	$401,900
Sales Tax				$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads				$0	$0	$0	$0	$0	$0
Subtotal Estimate									$401,900
Escalation				$23,953	$0	$0	$0	$0	$23,953
Contingency				$140,532	$0	$0	$0	$0	$140,532
---Total OPC1001.3 WORK PACKAGE DEVELOPMENT		0		$566,385	$0	$0	$0	$0	$566,385
--- OPC1001.4 TASK BASELINE AGREEMENT									
BWI	U.C. per Lot			576700	0	0	0	0	576700
Task Baseline Agreement - .33% Of TCC	1.00	0		$576,700	$0	$0	$0	$0	$576,700

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC1001.4 TASK BASELINE AGREEMENT										
Subtotal					$576,700	$0	$0	$0	$0	$576,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										**$576,700**
Escalation					$34,371	$0	$0	$0	$0	$34,371
Contingency					$201,654	$0	$0	$0	$0	$201,654
---Total OPC1001.4 TASK BASELINE AGREEMENT			**0**		**$812,725**	**$0**	**$0**	**$0**	**$0**	**$812,725**
--- OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)										
	BWI	U.C. per Lot			800000	0	0	0	0	800000
Preliminary Safety Analysis Report (PSAR)		1.00	0		$800,000	$0	$0	$0	$0	$800,000
Subtotal					$800,000	$0	$0	$0	$0	$800,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										**$800,000**
Escalation					$47,680	$0	$0	$0	$0	$47,680
Contingency					$279,734	$0	$0	$0	$0	$279,734
---Total OPC1001.5 PRELIMINARY SAFETY ANALYSIS REPORT (PSAR)			**0**		**$1,127,414**	**$0**	**$0**	**$0**	**$0**	**$1,127,414**
--- OPC1600 TECHNICAL DEVELOPMENT										
	BWI	U.C. per Lot			11000000	0	0	0	0	11000000
(*)Modified UNEX Process Development		1.00	0		$11,000,000	$0	$0	$0	$0	$11,000,000
Memo: Cost for process development is per the HLW SBW Process Development Costs (Arlin L. Olson).										
Subtotal					$11,000,000	$0	$0	$0	$0	$11,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										**$11,000,000**
Escalation					$655,600	$0	$0	$0	$0	$655,600
Contingency					$11,772,156	$0	$0	$0	$0	$11,772,156
---Total OPC1600 TECHNICAL DEVELOPMENT			**0**		**$23,427,756**	**$0**	**$0**	**$0**	**$0**	**$23,427,756**
--- OPC2001.1 PROJECT SUPPORT										
	BWI	U.C. per Lot			5242600	0	0	0	0	5242600
Project Support - 3% OF TCC		1.00	0		$5,242,600	$0	$0	$0	$0	$5,242,600

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**

UNEX Feasibility Study - Option D - Modified UNEX in NWCF

Project Location: *INTEC*

Estimate Number: *2570 - Option D*

Client: *V. J. Balls*

Prepared By: *Rowley / Mitchell / Marler*

Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC2001.1 PROJECT SUPPORT											
Subtotal						$5,242,600	$0	$0	$0	$0	$5,242,600
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$5,242,600
Escalation						$1,345,251	$0	$0	$0	$0	$1,345,251
Contingency						$2,898,655	$0	$0	$0	$0	$2,898,655
---Total OPC2001.1 PROJECT SUPPORT				0		$9,486,506	$0	$0	$0	$0	$9,486,506
--- OPC2001.2 PERMITTING											
	BWI	U.C. per Lot				1500000	0	0	0	0	1500000
Permitting			1.00	0		$1,500,000	$0	$0	$0	$0	$1,500,000
	BWI	U.C. per Lot				2500000	0	0	0	0	2500000
WIPP Certification			1.00	0		$2,500,000	$0	$0	$0	$0	$2,500,000
	BWI	U.C. per Lot				500000	0	0	0	0	500000
Hanford Certification			1.00	0		$500,000	$0	$0	$0	$0	$500,000
Subtotal						$4,500,000	$0	$0	$0	$0	$4,500,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$4,500,000
Escalation						$1,154,700	$0	$0	$0	$0	$1,154,700
Contingency						$2,488,068	$0	$0	$0	$0	$2,488,068
---Total OPC2001.2 PERMITTING				0		$8,142,768	$0	$0	$0	$0	$8,142,768
--- OPC2300 DECON SOLUTION PROCESSING											
	BWI	U.C. per Gal				0	0	0	1.15	0	1.15
(*)Process Decon Solution Through Evaporator			1,000,000.00	0		$0	$0	$0	$1,150,000	$0	$1,150,000
Memo: Per discussions - approximately 1,000,000 gallons of decon solution will be used to decon the NWCF areas. This solution will be sent to the evaporator for volume reduction.											
	BWI	U.C. per Gal				0	0	0	413	0	413
(*)Allowance For Liquid Sent To The Tank Farm			100,000.00	0		$0	$0	$0	$41,300,000	$0	$41,300,000
Memo: Per Anna Poloski - The liquid sent to the evaporator will be reduced to 10% of its original volume. The costs to send liquid to the evaporator and to send / maintain liquid in the tank farm are per Anna Poloski.											
Subtotal						$0	$0	$0	$42,450,000	$0	$42,450,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$42,450,000
Escalation						$0	$0	$0	$5,132,205	$0	$5,132,205
Contingency						$0	$0	$0	$10,943,907	$0	$10,943,907
---Total OPC2300 DECON SOLUTION PROCESSING				0		$0	$0	$0	$58,526,112	$0	$58,526,112

Project Name.
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1100 CONSTRUCTION SUPERVISION & ENGINEERING										
00401400	BWI	U.C. per Lot	1		15727900	0	0	0	0	15727900
Construction Management - 9% Of TCC		1.00	1	$***.**	$15,727,900	$0	$0	$0	$0	$15,727,900
Subtotal					$15,727,900	$0	$0	$0	$0	$15,727,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$15,727,900
Escalation					$4,035,779	$0	$0	$0	$0	$4,035,779
Contingency					$11,660,571	$0	$0	$0	$0	$11,660,571
---Total 1100 CONSTRUCTION SUPERVISION & ENGINEERING			1		$31,424,250	$0	$0	$0	$0	$31,424,250
--- 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
00401400	BWI	U.C. per Lot	1		349500	0	0	0	0	349500
CM - Conduct Of Operations / Conduct Of Maintenance - .2% Of TCC		1.00	1	$***.**	$349,500	$0	$0	$0	$0	$349,500
Subtotal					$349,500	$0	$0	$0	$0	$349,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$349,500
Escalation					$89,682	$0	$0	$0	$0	$89,682
Contingency					$259,117	$0	$0	$0	$0	$259,117
---Total 1110 CM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			1		$698,299	$0	$0	$0	$0	$698,299
--- 1200 CM PROJECT CONTROLS										
	BWI	U.C. per Lot			1223300	0	0	0	0	1223300
CM Project Controls - .7% Of TCC		1.00	0		$1,223,300	$0	$0	$0	$0	$1,223,300
Subtotal					$1,223,300	$0	$0	$0	$0	$1,223,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,223,300
Escalation					$313,899	$0	$0	$0	$0	$313,899
Contingency					$906,947	$0	$0	$0	$0	$906,947
---Total 1200 CM PROJECT CONTROLS			0		$2,444,146	$0	$0	$0	$0	$2,444,146
--- 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)										
	BWI	U.C. per Lot			873800	0	0	0	0	873800
CM - ES&H - .5% Of TCC		1.00	0		$873,800	$0	$0	$0	$0	$873,800

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)										
Subtotal					$873,800	$0	$0	$0	$0	$873,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$873,800
Escalation					$224,217	$0	$0	$0	$0	$224,217
Contingency					$647,830	$0	$0	$0	$0	$647,830
---Total 1300 CM ENVIRONMENTAL SAFETY & HEALTH (ES&H)			0		$1,745,847	$0	$0	$0	$0	$1,745,847
--- 1400 CM TRAINING										
	BWI	U.C. per Lot			349500	0	0	0	0	349500
CM - Training - .2% Of TCC		1.00	0		$349,500	$0	$0	$0	$0	$349,500
Subtotal					$349,500	$0	$0	$0	$0	$349,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$349,500
Escalation					$89,682	$0	$0	$0	$0	$89,682
Contingency					$259,117	$0	$0	$0	$0	$259,117
---Total 1400 CM TRAINING			0		$698,299	$0	$0	$0	$0	$698,299
--- 1500 CM - OTHER DIRECT COSTS										
	BWI	U.C. per Lot			349500	0	0	0	0	349500
CM - Other Direct Costs - .2% Of TCC		1.00	0		$349,600	$0	$0	$0	$0	$349,500
Subtotal					$349,500	$0	$0	$0	$0	$349,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$349,500
Escalation					$89,682	$0	$0	$0	$0	$89,682
Contingency					$259,117	$0	$0	$0	$0	$259,117
---Total 1500 CM - OTHER DIRECT COSTS			0		$698,299	$0	$0	$0	$0	$698,299
--- 2400 DESIGN ACTIVITIES										
	BWI	U.C. per Lot			10485200	0	0	0	0	10485200
Title I Design - 6% Of TCC		1.00	0		$10,485,200	$0	$0	$0	$0	$10,485,200

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 2400 DESIGN ACTIVITIES										
Subtotal					$10,485,200	$0	$0	$0	$0	$10,485,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$10,485,200
Escalation					$1,267,661	$0	$0	$0	$0	$1,267,661
Contingency					$5,053,730	$0	$0	$0	$0	$5,053,730
---Total 2400 DESIGN ACTIVITIES			0		$16,806,591	$0	$0	$0	$0	$16,806,591
--- 3400 DESIGN ACTIVITIES										
	BWI	U.C. per Lot			19747200	0	0	0	0	19747200
Title II Design - 11.3% Of TCC		1.00	0		$19,747,200	$0	$0	$0	$0	$19,747,200
Subtotal					$19,747,200	$0	$0	$0	$0	$19,747,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$19,747,200
Escalation					$3,029,220	$0	$0	$0	$0	$3,029,220
Contingency					$7,288,455	$0	$0	$0	$0	$7,288,455
---Total 3400 DESIGN ACTIVITIES			0		$30,064,875	$0	$0	$0	$0	$30,064,875
--- 4100 QUALITY ASSURANCE										
	BWI	U.C. per Lot	0.1		8737700	0	0	0	0	8737700
Quality Assurance - 5% Of TCC		1.00	0	$***.**	$8,737,700	$0	$0	$0	$0	$8,737,700
Subtotal					$8,737,700	$0	$0	$0	$0	$8,737,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,737,700
Escalation					$2,242,094	$0	$0	$0	$0	$2,242,094
Contingency					$3,403,736	$0	$0	$0	$0	$3,403,736
---Total 4100 QUALITY ASSURANCE			0		$14,383,530	$0	$0	$0	$0	$14,383,530
--- 5100 PM ADMINISTRATION										
	BWI	U.C. per Lot			13980300	0	0	0	0	13980300
Project Management - 8% Of TCC		1.00	0		$13,980,300	$0	$0	$0	$0	$13,980,300

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 5100 PM ADMINISTRATION										
Subtotal					$13,980,300	$0	$0	$0	$0	$13,980,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$13,980,300
Escalation					$3,587,345	$0	$0	$0	$0	$3,587,345
Contingency					$7,554,087	$0	$0	$0	$0	$7,554,087
—Total 5100 PM ADMINISTRATION			0		$25,121,732	$0	$0	$0	$0	$25,121,732
— 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	BWI	U.C. per Lot			69900	0	0	0	0	69900
PM Conduct Of Operations / Conduct Of Maintenance - .04% Of TCC		1.00	0		$69,900	$0	$0	$0	$0	$69,900
Subtotal					$69,900	$0	$0	$0	$0	$69,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$69,900
Escalation					$17,936	$0	$0	$0	$0	$17,936
Contingency					$37,770	$0	$0	$0	$0	$37,770
—Total 5110 PM - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			0		$125,606	$0	$0	$0	$0	$125,606
— 5200 PM PROJECT CONTROLS										
	BWI	U.C. per Lot			3495100	0	0	0	0	3495100
PM Project Controls - 2% Of TCC		1.00	0		$3,495,100	$0	$0	$0	$0	$3,495,100
Subtotal					$3,495,100	$0	$0	$0	$0	$3,495,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,495,100
Escalation					$896,843	$0	$0	$0	$0	$896,843
Contingency					$1,888,535	$0	$0	$0	$0	$1,888,535
—Total 5200 PM PROJECT CONTROLS			0		$6,280,478	$0	$0	$0	$0	$6,280,478
— 5300 PM RECORDS MANAGEMENT										
	BWI	U.C. per Lot			3495100	0	0	0	0	3495100
PM Records Management - 2% Of TCC		1.00	0		$3,495,100	$0	$0	$0	$0	$3,495,100

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 5300 PM RECORDS MANAGEMENT										
Subtotal					$3,495,100	$0	$0	$0	$0	$3,495,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,495,100
Escalation					$896,843	$0	$0	$0	$0	$896,843
Contingency					$1,888,535	$0	$0	$0	$0	$1,888,535
---Total 5300 PM RECORDS MANAGEMENT			0		$6,280,478	$0	$0	$0	$0	$6,280,478
--- 5400 SAFETY ANALYSIS										
	BWI	U.C. per Lot			2000000	0	0	0	0	2000000
Safety Analysis Report (SAR)		1.00	0		$2,000,000	$0	$0	$0	$0	$2,000,000
Subtotal					$2,000,000	$0	$0	$0	$0	$2,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$2,000,000
Escalation					$513,200	$0	$0	$0	$0	$513,200
Contingency					$1,080,676	$0	$0	$0	$0	$1,080,676
---Total 5400 SAFETY ANALYSIS			0		$3,593,876	$0	$0	$0	$0	$3,593,876
--- 6000 CONSTRUCTION AE SUPPORT										
	BWI	U.C. per Lot			2621300	0	0	0	0	2621300
Construction AE Support - 1.5% Of TCC		1.00	0		$2,621,300	$0	$0	$0	$0	$2,621,300
Subtotal					$2,621,300	$0	$0	$0	$0	$2,621,300
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$2,621,300
Escalation					$672,626	$0	$0	$0	$0	$672,626
Contingency					$922,299	$0	$0	$0	$0	$922,299
---Total 6000 CONSTRUCTION AE SUPPORT			0		$4,216,225	$0	$0	$0	$0	$4,216,225
--- 8300 GFE LABOR										
	2440	U.C. per Lot	1200	U21	20940	0	0	0	0	20940
Allowance To Decontaminate The Calciner Cell		1.00	1,200	$17.45	$20,940	$0	$0	$0	$0	$20,940
	2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Calcinier Cell		240.00	0		$0	$0	$10,800	$0	$0	$10,800
	2440	U.C. per Lot	800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Off-Gas Cell		1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 8300 GFE LABOR									
2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Off-Gas Cell	200.00	0		$0	$0	$9,000	$0	$0	$9,000
2440	U.C. per Lot	800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Blend & Hold Cell	1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960
2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Blend & Hold Cell	200.00	0		$0	$0	$9,000	$0	$0	$9,000
2440	U.C. per Lot	800	U21	13960	0	0	0	0	13960
Allowance To Decontaminate The Valve Cubicle	1.00	800	$17.45	$13,960	$0	$0	$0	$0	$13,960
2440	U.C. per Chng			0	0	45	0	0	45
Clothing Allowance - Valve Cubicle	200.00	0		$0	$0	$9,000	$0	$0	$9,000
Subtotal				$62,820	$0	$37,800	$0	$0	$100,620
Sales Tax				$0	$0	$1,890	$0	$0	$1,890
INEEL ORG Labor/Subcontractor Overheads				$55,910	$0	$0	$0	$0	$55,910
Subtotal Estimate									$158,420
Escalation				$30,466	$0	$10,184	$0	$0	$40,651
Contingency				$193,955	$0	$64,837	$0	$0	$258,791
—Total 8300 GFE LABOR		3,600		$343,150	$0	$114,711	$0	$0	$457,862
— 9101.1 GENERAL CONDITIONS									
GEN	U.C. per Lot	56333	CN-SUPR	2253320	0	0	0	0	2253320
Supervision - 15% Of Labor Hours	1.00	56,333	$40.00	$2,253,320	$0	$0	$0	$0	$2,253,320
GEN	U.C. per Lot	26289	CN-LABR	791036.01	0	0	0	0	791036.01
Training - 7% Of Labor Hours	1.00	26,289	$30.09	$791,036	$0	$0	$0	$0	$791,036
GEN	U.C. per Lot	1878	CN-LABR	56509.02	10000	0	0	0	66509.02
Mobilization & Demobilization - .5% Of Labor Hours	1.00	1,878	$30.09	$56,509	$10,000	$0	$0	$0	$66,509
GEN	U.C. per Lot			0	0	8200000	0	0	8200000
(*)Material Adjustment - Additional 10% On Material & Subcontracts	1.00	0		$0	$0	$8,200,000	$0	$0	$8,200,000
Memo: Adjustment for DOE/RW/0333P Quality Standards.									
Subtotal				$3,100,865	$10,000	$8,200,000	$0	$0	$11,310,865
Sales Tax				$0	$0	$410,000	$0	$0	$410,000
INEEL ORG Labor/Subcontractor Overheads				$1,100,233	$3,548	$3,054,957	$0	$0	$4,158,739
Subtotal Estimate									$15,879,604
Escalation				$1,078,002	$3,476	$2,993,228	$0	$0	$4,074,706
Contingency				$2,270,013	$7,321	$6,303,020	$0	$0	$8,580,353
—Total 9101.1 GENERAL CONDITIONS		84,500		$7,549,113	$24,345	$20,961,205	$0	$0	$28,534,663

LEVEL	Org/Contractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE										
	GEN	U.C. per Hr	0.08	CN-SKWK	2.762	0	0	0	0	2.762
(*)Labor Adjustment		375,557.00	30,045	$34.52	$1,037,138	$0	$0	$0	$0	$1,037,138
Memo: Conduct of Operations / Conduct of Maintenance - Add 8% to construction labor hours.										
Subtotal					$1,037,138	$0	$0	$0	$0	$1,037,138
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$367,992	$0	$0	$0	$0	$367,992
Subtotal Estimate										$1,405,130
Escalation					$360,556	$0	$0	$0	$0	$360,556
Contingency					$759,245	$0	$0	$0	$0	$759,245
---Total 9101.2 GC - CONDUCT OF OPERATIONS/CONDUCT OF MAINTENANCE			30,045		$2,524,932	$0	$0	$0	$0	$2,524,932
--- 9102.1 SITEWORK - UTILITIES										
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Firewater		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.5	CN-LABR	15.045	2	12	0	0	29.045
Piping - Firewater		300.00	150	$30.09	$4,514	$600	$3,600	$0	$0	$8,714
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Sewer		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.03	CN-LABR	0.903	2	5	0	0	7.903
Piping - Sewer		300.00	9	$30.09	$271	$600	$1,500	$0	$0	$2,371
Subtotal					$38,485	$9,200	$5,100	$0	$0	$52,785
Sales Tax					$0	$0	$255	$0	$0	$255
INEEL ORG Labor/Subcontractor Overheads					$13,655	$3,264	$1,900	$0	$0	$18,819
Subtotal Estimate										$71,860
Escalation					$13,379	$3,198	$1,862	$0	$0	$18,439
Contingency					$43,898	$10,494	$6,108	$0	$0	$60,500
---Total 9102.1 SITEWORK - UTILITIES			1,279		$109,417	$26,157	$15,225	$0	$0	$150,799
--- 9102.2 SITEWORK - TFD FACILITY										
	GEN	U.C per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		27,000.00	810	$30.09	$24,373	$13,500	$0	$0	$0	$37,873

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.2 SITEWORK - TFD FACILITY										
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		8,550.00	5,985	$30.09	$180,089	$42,750	$0	$0	$0	$222,839
Subtotal					$204,462	$56,250	$0	$0	$0	$260,712
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$72,546	$19,958	$0	$0	$0	$92,504
Subtotal Estimate										$353,216
Escalation					$71,080	$19,555	$0	$0	$0	$90,635
Contingency					$233,219	$64,161	$0	$0	$0	$297,380
---Total 9102.2 SITEWORK - TFD FACILITY			6,795		$581,306	$159,925	$0	$0	$0	$741,231
--- 9102.3 SITEWORK - BOILER HOUSE										
	GEN	U.C. per Sf	0.03	CN-LABR	0.903	0.5	0	0	0	1.403
Site Grading		4,000.00	120	$30.09	$3,611	$2,000	$0	$0	$0	$5,611
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
Excavation & Backfill		500.00	350	$30.09	$10,532	$2,500	$0	$0	$0	$13,032
	GEN	U.C. per Cy	0.7	CN-LABR	21.063	5	0	0	0	26.063
(*)Excavation & Backfill - Steam & Condensate		800.00	560	$30.09	$16,850	$4,000	$0	$0	$0	$20,850
Memo: Assume utilities to be 300 feet. Trench to be 6' to bottom of trench.										
	GEN	U.C. per Lf	0.05	CN-LABR	1.505	2	5	0	0	8.505
Piping - Steam & Condensate		6.00	0	$30.09	$9	$12	$30	$0	$0	$51
	GEN	U.C. per Cf	0.17	CN-LABR	5.115	0	16.55	0	0	21.665
Gilsulate Insulation		477.00	81	$30.09	$2,440	$0	$7,894	$0	$0	$10,334
Subtotal					$33,442	$8,512	$7,924	$0	$0	$49,878
Sales Tax					$0	$0	$396	$0	$0	$396
INEEL ORG Labor/Subcontractor Overheads					$11,866	$3,020	$2,952	$0	$0	$17,838
Subtotal Estimate										$68,112
Escalation					$11,626	$2,959	$2,893	$0	$0	$17,478
Contingency					$38,145	$9,709	$9,491	$0	$0	$57,345
---Total 9102.3 SITEWORK - BOILER HOUSE			1,111		$95,078	$24,201	$23,656	$0	$0	$142,935
--- 9102.4 SITEWORK - STORAGE FACILITY										
	GEN	U.C. per CY	0.012	CN-ENGR	0.391	2	0	0	0	2.391
BUILDING EXCAVATION		17,160.00	206	$32.56	$6,705	$34,320	$0	$0	$0	$41,025
	GEN	U.C. per CY	0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BACKFILL		12,240.00	734	$32.56	$23,912	$24,480	$0	$0	$0	$48,392

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9102.4 SITEWORK - STORAGE FACILITY										
GEN	U.C. per CY		0.06	CN-ENGR	1.954	2	0	0	0	3.954
BUILDING BERM FILL		6,900.00	414	$32.56	$13,480	$13,800	$0	$0	$0	$27,280
Subtotal					$44,097	$72,600	$0	$0	$0	$116,697
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$15,646	$25,760	$0	$0	$0	$41,406
Subtotal Estimate										$158,102
Escalation					$15,330	$25,239	$0	$0	$0	$40,569
Contingency					$50,299	$82,811	$0	$0	$0	$133,110
---Total 9102.4 SITEWORK - STORAGE FACILITY			**1,354**		**$125,372**	**$206,410**	**$0**	**$0**	**$0**	**$331,781**
--- 9102.5 SITEWORK - TUNNEL										
GEN	U.C. per Cy		0.6	CN-LABR	18.054	12	0	0	0	30.054
(*)Excavate & Backfill For Tunnel		4,500.00	2,700	$30.09	$81,243	$54,000	$0	$0	$0	$135,243
Memo: Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.										
GEN	U.C. per Cy		3	CN-LABR	90.27	12	0	0	0	102.27
Allowance For Hand Excavation		100.00	300	$30.09	$9,027	$1,200	$0	$0	$0	$10,227
Subtotal					$90,270	$55,200	$0	$0	$0	$145,470
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$32,029	$19,586	$0	$0	$0	$51,615
Subtotal Estimate										$197,085
Escalation					$31,382	$19,190	$0	$0	$0	$50,572
Contingency					$102,966	$62,964	$0	$0	$0	$165,930
---Total 9102.5 SITEWORK - TUNNEL			**3,000**		**$256,647**	**$156,940**	**$0**	**$0**	**$0**	**$413,587**
--- 9102.6 SITEWORK - PAVING										
GEN	U.C. per Sf		0.05	CN-SKWK	1.726	1.2	0	0	0	2.926
Pavement Removal		7,050.00	353	$34.52	$12,168	$8,460	$0	$0	$0	$20,628
GEN	U.C. per Sf		0.03	CN-SKWK	1.036	1	2	0	0	4.036
New Pavement		6,600.00	198	$34.52	$6,835	$6,600	$13,200	$0	$0	$26,635
Subtotal					$19,003	$15,060	$13,200	$0	$0	$47,263
Sales Tax					$0	$0	$660	$0	$0	$660
INEEL ORG Labor/Subcontractor Overheads					$6,743	$5,344	$4,918	$0	$0	$17,004
Subtotal Estimate										$64,927
Escalation					$6,606	$5,236	$4,818	$0	$0	$16,660
Contingency					$21,676	$17,178	$15,809	$0	$0	$54,664
---Total 9102.6 SITEWORK - PAVING			**551**		**$54,028**	**$42,817**	**$39,405**	**$0**	**$0**	**$136,251**

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9103.2 CONCRETE - TFD FACILITY										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings		430.00	2,150	$34.52	$74,218	$0	$77,400	$0	$0	$151,618
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 12" Thick		725.00	3,625	$34.52	$125,135	$0	$130,500	$0	$0	$255,635
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 24" Thick		585.00	2,925	$34.52	$100,971	$0	$105,300	$0	$0	$206,271
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Shielding Walls - 24" Thick		1,005.00	5,025	$34.52	$173,463	$0	$180,900	$0	$0	$354,363
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Walls - 12" Thick		200.00	1,000	$34.52	$34,520	$0	$36,000	$0	$0	$70,520
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Roof Topping		170.00	850	$34.52	$29,342	$0	$30,600	$0	$0	$59,942
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Misc.		250.00	1,250	$34.52	$43,150	$0	$45,000	$0	$0	$88,150
Memo: Includes formwork, concrete, and rebar.										
GEN	U.C. per Lot		120	CN-SKWK	4142.4	0	2500	0	0	6642.4
Misc. Concrete Pads		1.00	120	$34.52	$4,142	$0	$2,500	$0	$0	$6,642
GEN	U.C. per Sf			CN-SKWK	0	0	0	12.25	0	12.25
Precast Concrete Walls - 12" Thick		36,345.00	0		$0	$0	$0	$445,226	$0	$445,226
GEN	U.C. per Sf			CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels		13,700.00	0		$0	$0	$123,300	$0	$0	$123,300
GEN	U.C. per Ea		8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels		170.00	1,360	$34.52	$46,947	$0	$0	$0	$0	$46,947
GEN	U.C. per Day		20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams		24.00	480	$34.52	$16,570	$0	$0	$0	$0	$16,570
GEN	U.C. per Ea		8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels		170.00	1,360	$34.52	$46,947	$0	$3,400	$0	$0	$50,347
GEN	U.C. per Ea		250	CN-SKWK	8630	0	45000	0	0	53630
Stairwell		1.00	250	$34.52	$8,630	$0	$45,000	$0	$0	$53,630

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.2 CONCRETE - TFD FACILITY									
GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide	250.00	50	$34.52	$1,726	$0	$1,250	$0	$0	$2,976
Subtotal				$705,761	$0	$781,150	$445,226	$0	$1,932,138
Sales Tax				$0	$0	$39,058	$0	$0	$39,058
INEEL ORG Labor/Subcontractor Overheads				$250,415	$0	$291,022	$157,973	$0	$699,410
Subtotal Estimate									$2,670,605
Escalation				$245,355	$0	$285,141	$154,781	$0	$685,277
Contingency				$312,398	$0	$363,056	$197,075	$0	$872,529
---Total 9103.2 CONCRETE - TFD FACILITY		20,445		$1,513,929	$0	$1,759,427	$955,055	$0	$4,228,411
--- 9103.3 CONCRETE - BOILER HOUSE									
GEN	U.C. per Cy	5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings & Floors	92.00	460	$34.52	$15,879	$0	$16,560	$0	$0	$32,439
Memo: Includes formwork, concrete, and rebar.									
GEN	U.C. per Lot	20	CN-SKWK	690.4	0	500	0	0	1190.4
Misc. Concrete Pads	1.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
GEN	U.C. per Lf	0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide	100.00	20	$34.52	$690	$0	$500	$0	$0	$1,190
Subtotal				$17,260	$0	$17,560	$0	$0	$34,820
Sales Tax				$0	$0	$878	$0	$0	$878
INEEL ORG Labor/Subcontractor Overheads				$6,124	$0	$6,542	$0	$0	$12,666
Subtotal Estimate									$48,364
Escalation				$6,000	$0	$6,410	$0	$0	$12,410
Contingency				$7,640	$0	$8,161	$0	$0	$15,801
---Total 9103.3 CONCRETE - BOILER HOUSE		500		$37,024	$0	$39,551	$0	$0	$76,576
--- 9103.4 CONCRETE - STORAGE FACILITY									
GEN	U.C. per EA			0	0	0	75000	0	75000
Hatch Plugs	3.00	0		$0	$0	$0	$225,000	$0	$225,000
GEN	U.C. per Sf		CN-SKWK	0	0	0	8.5	0	8.5
Precast Concrete Walls - 6" Thick	17,160.00	0		$0	$0	$0	$145,860	$0	$145,860
GEN	U.C. per Sf		CN-SKWK	0	0	9	0	0	9
Pre-Stressed Concrete Double Tee Roof Panels	20,440.00	0		$0	$0	$183,960	$0	$0	$183,960
GEN	U.C. per Ea	8	CN-SKWK	276.16	0	0	0	0	276.16
Installation Of Pre-Stressed / Precast Panels	126.00	1,008	$34.52	$34,796	$0	$0	$0	$0	$34,796
GEN	U.C. per Day	20	CN-SKWK	690.4	0	0	0	0	690.4
Craning For Panels & Beams	22.00	440	$34.52	$15,189	$0	$0	$0	$0	$15,189

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9103.4 CONCRETE - STORAGE FACILITY											
	GEN	U.C. per Ea		8	CN-SKWK	276.16	0	20	0	0	296.16
Welding & Patching Of Panels			126.00	1,008	$34.52	$34,796	$0	$2,520	$0	$0	$37,316
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Footings			260.00	1,300	$34.52	$44,876	$0	$46,800	$0	$0	$91,676
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Floors - 6" Thick			380.00	1,900	$34.52	$65,588	$0	$68,400	$0	$0	$133,988
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete Partition Wall - 12" Thick			180.00	900	$34.52	$31,068	$0	$32,400	$0	$0	$63,468
Memo: Includes formwork, concrete, and rebar.											
	GEN	U.C. per Lf		0.2	CN-SKWK	6.904	0	5	0	0	11.904
Concrete Sidewalks - 5' Wide			500.00	100	$34.52	$3,452	$0	$2,500	$0	$0	$5,952
Subtotal						$229,765	$0	$336,580	$370,860	$0	$937,205
Sales Tax						$0	$0	$16,829	$0	$0	$16,829
INEEL ORG Labor/Subcontractor Overheads						$81,524	$0	$125,395	$131,587	$0	$338,506
Subtotal Estimate											$1,292,540
Escalation						$79,877	$0	$122,861	$128,928	$0	$331,666
Contingency						$101,703	$0	$156,433	$164,157	$0	$422,293
---Total 9103.4 CONCRETE - STORAGE FACILITY				6,656		$492,869	$0	$758,098	$795,532	$0	$2,046,499
--- 9103.5 CONCRETE - TUNNEL											
	GEN	U.C. per Cy		5	CN-SKWK	172.6	0	180	0	0	352.6
(*)Concrete For Tunnel - 12" Thick All Surfaces			190.00	950	$34.52	$32,794	$0	$34,200	$0	$0	$66,994
Memo: Includes formwork, concrete, and rebar. Tunnel bottom to be 23' below existing grade. Tunnel shall be 10' wide at the bottom, 15' high and 100' long.											
Subtotal						$32,794	$0	$34,200	$0	$0	$66,994
Sales Tax						$0	$0	$1,710	$0	$0	$1,710
INEEL ORG Labor/Subcontractor Overheads						$11,636	$0	$12,741	$0	$0	$24,377
Subtotal Estimate											$93,081
Escalation						$11,401	$0	$12,484	$0	$0	$23,885
Contingency						$14,516	$0	$15,895	$0	$0	$30,411
---Total 9103.5 CONCRETE - TUNNEL				950		$70,346	$0	$77,031	$0	$0	$147,377
--- 9105.1.1 METALS DEMOLITION - CALCINER CELL											
	GEN	U.C. per Lot		60	CN-IRON	2409.6	0	0	0	0	2409.6
Remove Support Steel For Installation Of New Wall			1.00	60	$40.16	$2,410	$0	$0	$0	$0	$2,410
	GEN	U.C. per Box		10	CN-IRON	401.6	0	0	0	0	401.6
Allowance To "Hot Box" Material			2.00	20	$40.16	$803	$0	$0	$0	$0	$803

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.1.1 METALS DEMOLITION - CALCINER CELL											
	GEN	U.C. per Lot		120	CN-IRON	4819.2	0	0	0	0	4819.2
Labor Adjustment For Working In "Hot" Area - 200%			1.00	120	$40.16	$4,819	$0	$0	$0	$0	$4,819
Subtotal						$8,032	$0	$0	$0	$0	$8,032
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$2,850	$0	$0	$0	$0	$2,850
Subtotal Estimate											$10,882
Escalation						$2,792	$0	$0	$0	$0	$2,792
Contingency						$3,555	$0	$0	$0	$0	$3,555
---Total 9105.1.1 METALS DEMOLITION - CALCINER CELL				200		$17,229	$0	$0	$0	$0	$17,229
--- 9105.3 METALS - TFD FACILITY											
	STEEL	U.C. per Sf		2	CN-IRON	80.32	0	10	0	0	90.32
Liner Plate - 4' Up From Floor			1,025.00	2,050	$40.16	$82,328	$0	$10,250	$0	$0	$92,578
	STEEL	U.C. per Lot		200	CN-IRON	8032	0	25000	0	0	33032
Misc. Embeds			1.00	200	$40.16	$8,032	$0	$25,000	$0	$0	$33,032
	STEEL	U.C. per Lot		1000	CN-IRON	40160	0	150000	0	0	190160
Grating & Misc. Metals			1.00	1,000	$40.16	$40,160	$0	$150,000	$0	$0	$190,160
	STEEL	U.C. per Sf		0.04	CN-IRON	1.606	0	2.4	0	0	4.006
Structural Steel - Superstructure			13,700.00	548	$40.16	$22,008	$0	$32,880	$0	$0	$54,888
	STEEL	U.C. per Ea		10	CN-IRON	401.6	0	3000	0	0	3401.6
Stairway			1.00	10	$40.16	$402	$0	$3,000	$0	$0	$3,402
Subtotal						$152,929	$0	$221,130	$0	$0	$374,059
Sales Tax						$0	$0	$11,057	$0	$0	$11,057
INEEL ORG Labor/Subcontractor Overheads						$64,128	$0	$97,363	$0	$0	$161,491
Subtotal Estimate											$546,606
Escalation						$55,697	$0	$84,562	$0	$0	$140,259
Contingency						$70,916	$0	$107,669	$0	$0	$178,585
---Total 9105.3 METALS - TFD FACILITY				3,808		$343,670	$0	$521,781	$0	$0	$865,451
--- 9105.4 METALS - BOILER HOUSE											
	GEN	U.C. per Sf				0	0	0	18	0	18
Pre-Engineered Metal Building			3,120.00	0		$0	$0	$0	$56,160	$0	$56,160
	GEN	U.C. per Lot		40	CN-IRON	1606.4	0	1200	0	0	2806.4
Misc. Metals			1.00	40	$40.16	$1,606	$0	$1,200	$0	$0	$2,806
	STEEL	U.C. per EA		40	CN-IRON	1606.4	0	275	0	0	1881.4
BOILER STACK SUPPORTS			2.00	80	$40.16	$3,213	$0	$550	$0	$0	$3,763

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.4 METALS - BOILER HOUSE										
	STEEL	U.C. per LBS	0.018	CN-IRON	0.723	0	1.62	0	0	2.343
BOILER BUILDING PLATFORMS		11,000.00	198	$40.16	$7,952	$0	$17,820	$0	$0	$25,772
	STEEL	U.C. per LBS	0.012	CN-IRON	0.482	0	0.4	0	0	0.882
BOILER BUILDING ROOF FRAMING		21,840.00	262	$40.16	$10,525	$0	$8,736	$0	$0	$19,261
Subtotal					$23,296	$0	$28,306	$56,160	$0	$107,762
Sales Tax					$0	$0	$1,415	$0	$0	$1,415
INEEL ORG Labor/Subcontractor Overheads					$9,665	$0	$12,382	$19,926	$0	$41,973
Subtotal Estimate										$151,151
Escalation					$8,458	$0	$10,804	$19,524	$0	$38,785
Contingency					$10,769	$0	$13,756	$24,859	$0	$49,383
---Total 9105.4 METALS - BOILER HOUSE			580		$52,188	$0	$66,662	$120,469	$0	$239,319
--- 9105.5 METALS - STORAGE FACILITY										
	STEEL	U.C. per TON	6	CN-IRON	240.96	0	1100	0	0	1340.96
CHARGE FACE SLAB FRAME		780.00	4,680	$40.16	$187,949	$0	$858,000	$0	$0	$1,045,949
	STEEL	U.C. per TON	10	CN-IRON	401.6	0	1200	0	0	1601.6
BUILDING STRUCTURAL STEEL		756.00	7,560	$40.16	$303,610	$0	$907,200	$0	$0	$1,210,810
	STEEL	U.C. per LF	3.85	CN-IRON	154.616	0	161	0	0	315.616
GANTRY CRANE RAILS, EMBEDS, ETC.		400.00	1,540	$40.16	$61,846	$0	$64,400	$0	$0	$126,246
	STEEL	U.C. per LF	2	CN-IRON	80.32	0	92	0	0	172.32
RAILROAD TRACKS - WITHIN BUILDING		180.00	360	$40.16	$14,458	$0	$16,560	$0	$0	$31,018
	STEEL	U.C. per LF	2	CN-IRON	80.32	0	92	0	0	172.32
TRANSFER CART RAILS		210.00	420	$40.16	$16,867	$0	$19,320	$0	$0	$36,187
	STEEL	U.C. per SF	0.25	CN-IRON	10.04	0	40	0	0	50.04
BIRD SCREEN AND VENT LOUVERS		2,300.00	575	$40.16	$23,092	$0	$92,000	$0	$0	$115,092
	STEEL	U.C. per SF		CN-IRON	0	0	0	12	0	12
AIR OUTLET WALL (INSIDE)		12,600.00	0		$0	$0	$0	$151,200	$0	$151,200

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9105.5 METALS - STORAGE FACILITY										
	STEEL	U.C. per Lot	750	CN-IRON	30120	0	45000	0	0	75120
(*)Misc. Steel		1.00	750	$40.16	$30,120	$0	$45,000	$0	$0	$75,120
Memo: Handrails, stairways, grating, and etc.										
Subtotal					$637,942	$0	$2,002,480	$151,200	$0	$2,791,622
Sales Tax					$0	$0	$100,124	$0	$0	$100,124
INEEL ORG Labor/Subcontractor Overheads					$267,508	$0	$881,685	$63,403	$0	$1,212,596
Subtotal Estimate										$4,104,341
Escalation					$232,338	$0	$765,769	$55,067	$0	$1,053,174
Contingency					$295,825	$0	$975,015	$70,114	$0	$1,340,954
---Total 9105.5 METALS - STORAGE FACILITY			**15,885**		**$1,433,613**	**$0**	**$4,725,072**	**$339,784**	**$0**	**$6,498,469**
--- 9107.1 THERMAL & MOISTURE PROTECTION - TFD FACILITY										
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,000.00	66	$34.64	$2,286	$0	$1,200	$0	$0	$3,486
	GEN	U.C. per Sf	0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		37,000.00	2,220	$34.64	$76,901	$0	$77,700	$0	$0	$154,601
	GEN	U.C. per Sf	0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		37,000.00	2,960	$30.09	$89,066	$0	$166,500	$0	$0	$255,566
	GEN	U.C. per Hr	0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		1,290.00	323	$30.09	$9,704	$0	$0	$0	$0	$9,704
	GEN	U.C. per Lot			0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
	GEN	U.C. per Sf	0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		13,700.00	274	$30.09	$8,245	$0	$13,015	$0	$0	$21,260
	ROOF	U.C. per Sf	0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		13,700.00	192	$29.95	$5,744	$0	$30,140	$0	$0	$35,884
	ROOF	U.C. per Lot	200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$197,937	$3,000	$293,555	$0	$0	$494,492
Sales Tax					$0	$0	$14,678	$0	$0	$14,678
INEEL ORG Labor/Subcontractor Overheads					$77,972	$1,064	$133,706	$0	$0	$212,742
Subtotal Estimate										$721,911
Escalation					$70,798	$1,043	$113,401	$0	$0	$185,242
Contingency					$90,144	$1,328	$144,388	$0	$0	$235,860
---Total 9107.1 THERMAL & MOISTURE PROTECTION - TFD FACILITY			**6,234**		**$436,850**	**$6,435**	**$699,729**	**$0**	**$0**	**$1,143,014**

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.2 THERMAL & MOISTURE PROTECTION - BOILER HOUSE										
	INSUL	U.C. per SF			0	0	0	1.9	0	1.9
EXTERIOR WALL INSULATION W/ Z-GIRTS		6,720.00	0		$0	$0	$0	$12,768	$0	$12,768
	INSUL	U.C. per SF			0	0	0	1	0	1
ROOF INSULATION		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	GEN	U.C. per SF	0.023	CN-SHEE	0.816	0	3	0	0	3.816
EXTERIOR WALL METAL SIDING		6,720.00	155	$35.48	$5,484	$0	$20,160	$0	$0	$25,644
	GEN	U.C. per SF	0.016	CN-SHEE	0.568	0	5	0	0	5.568
STANDING SEAM METAL ROOF		3,120.00	50	$35.48	$1,771	$0	$15,600	$0	$0	$17,371
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		950.00	31	$34.64	$1,086	$0	$570	$0	$0	$1,656
Subtotal					$8,341	$0	$36,330	$15,888	$0	$60,559
Sales Tax					$0	$0	$1,817	$0	$0	$1,817
INEEL ORG Labor/Subcontractor Overheads					$2,959	$0	$13,535	$6,662	$0	$23,157
Subtotal Estimate										$85,532
Escalation					$2,900	$0	$13,261	$5,786	$0	$21,948
Contingency					$3,692	$0	$16,885	$7,368	$0	$27,945
---Total 9107.2 THERMAL & MOISTURE PROTECTION - BOILER HOUSE			236		$17,892	$0	$81,828	$35,704	$0	$135,424
--- 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
	GEN	U.C. per Sf	0.033	CN-CARP	1.143	0	0.6	0	0	1.743
2" Thick Foundation Insulation Board		2,300.00	76	$34.64	$2,629	$0	$1,380	$0	$0	$4,009
	GEN	U.C. per Sf	0.06	CN-CARP	2.078	0	2.1	0	0	4.178
3" Thick Extruded Polystyrene Insulation Board		17,200.00	1,032	$34.64	$35,748	$0	$36,120	$0	$0	$71,868
	GEN	U.C. per Sf	0.08	CN-LABR	2.407	0	4.5	0	0	6.907
Stucco Finish - 1/2" Thick		17,200.00	1,376	$30.09	$41,404	$0	$77,400	$0	$0	$118,804
	GEN	U.C. per Hr	0.25	CN-LABR	7.523	0	0	0	0	7.523
High Work Allowance - Add 25% To Labor		2,408.00	602	$30.09	$18,114	$0	$0	$0	$0	$18,114
	GEN	U.C. per Lot			0	3000	0	0	0	3000
Manlift Allowance		1.00	0		$0	$3,000	$0	$0	$0	$3,000
	GEN	U.C. per Sf	0.02	CN-LABR	0.602	0	0.95	0	0	1.552
4" Rigid Roof Insulation - 2 Ea. 2" Layers Of Polyisocyanurate Insulation Board		20,500.00	410	$30.09	$12,337	$0	$19,475	$0	$0	$31,812
	ROOF	U.C. per Sf	0.014	CN-ROFC	0.419	0	2.2	0	0	2.619
EPDM Single Ply Membrane Roofing		20,500.00	287	$29.95	$8,596	$0	$45,100	$0	$0	$53,696

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY										
ROOF	U.C. per Lot		200	CN-ROFC	5990	0	5000	0	0	10990
Redwood, Flashing, & Etc.		1.00	200	$29.95	$5,990	$0	$5,000	$0	$0	$10,990
Subtotal					$124,818	$3,000	$184,475	$0	$0	$312,293
Sales Tax					$0	$0	$9,224	$0	$0	$9,224
INEEL ORG Labor/Subcontractor Overheads					$53,909	$1,064	$103,430	$0	$0	$158,404
Subtotal Estimate										$479,921
Escalation					$45,861	$1,043	$76,243	$0	$0	$123,148
Contingency					$58,393	$1,328	$97,077	$0	$0	$156,798
---Total 9107.3 THERMAL & MOISTURE PROTECTION - STORAGE FACILITY			3,983		$282,982	$6,435	$470,448	$0	$0	$759,866
--- 9108.2 DOORS & WINDOWS - TFD FACILITY										
GEN	U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		12.00	120	$34.64	$4,157	$0	$12,000	$0	$0	$16,157
GEN	U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		6.00	90	$34.64	$3,118	$0	$10,800	$0	$0	$13,918
GEN	U.C. per Ea		12	CN-CARP	415.68	0	2000	0	0	2415.68
Exterior Doors		4.00	48	$34.64	$1,663	$0	$8,000	$0	$0	$9,663
GEN	U.C. per Ea		40	CN-CARP	1385.6	500	25000	0	0	26885.6
3' x 7' Shielding Doors		2.00	80	$34.64	$2,771	$1,000	$50,000	$0	$0	$53,771
GEN	U.C. per Ea		75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		2.00	150	$34.64	$5,196	$0	$32,000	$0	$0	$37,196
Subtotal					$16,904	$1,000	$112,800	$0	$0	$130,704
Sales Tax					$0	$0	$5,640	$0	$0	$5,640
INEEL ORG Labor/Subcontractor Overheads					$5,998	$355	$42,024	$0	$0	$48,377
Subtotal Estimate										$184,721
Escalation					$5,877	$348	$41,175	$0	$0	$47,399
Contingency					$7,483	$443	$52,426	$0	$0	$60,351
---Total 9108.2 DOORS & WINDOWS - TFD FACILITY			488		$36,261	$2,145	$254,066	$0	$0	$292,472
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
GEN	U.C. per Ea		10	CN-CARP	346.4	0	1000	0	0	1346.4
Single HM Doors & Hardware		3.00	30	$34.64	$1,039	$0	$3,000	$0	$0	$4,039
GEN	U.C. per Ea		15	CN-CARP	519.6	0	1800	0	0	2319.6
Double HM Doors & Hardware		1.00	15	$34.64	$520	$0	$1,800	$0	$0	$2,320

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9108.3 DOORS & WINDOWS - BOILER HOUSE										
	GEN	U.C. per Ea	75	CN-CARP	2598	0	16000	0	0	18598
12'x12' Overhead Roll-Up Door		1.00	75	$34.64	$2,598	$0	$16,000	$0	$0	$18,598
Subtotal					$4,157	$0	$20,800	$0	$0	$24,957
Sales Tax					$0	$0	$1,040	$0	$0	$1,040
INEEL ORG Labor/Subcontractor Overheads					$1,475	$0	$7,749	$0	$0	$9,224
Subtotal Estimate										$35,221
Escalation					$1,445	$0	$7,593	$0	$0	$9,038
Contingency					$1,840	$0	$9,667	$0	$0	$11,507
---Total 9108.3 DOORS & WINDOWS - BOILER HOUSE			120		$8,917	$0	$46,849	$0	$0	$55,766
--- 9108.4 DOORS & WINDOWS - STORAGE FACILITY										
	GEN	U.C. per EA	75	CN-SKWK	2589	0	16000	0	0	18589
OVERHEAD DOORS		2.00	150	$34.52	$5,178	$0	$32,000	$0	$0	$37,178
	GEN	U.C. per EA	10	CN-SKWK	345.2	0	1000	0	0	1345.2
PERSONNEL DOORS		5.00	50	$34.52	$1,726	$0	$5,000	$0	$0	$6,726
Subtotal					$6,904	$0	$37,000	$0	$0	$43,904
Sales Tax					$0	$0	$1,850	$0	$0	$1,850
INEEL ORG Labor/Subcontractor Overheads					$2,450	$0	$13,785	$0	$0	$16,234
Subtotal Estimate										$61,988
Escalation					$2,400	$0	$13,506	$0	$0	$15,906
Contingency					$3,056	$0	$17,197	$0	$0	$20,253
---Total 9108.4 DOORS & WINDOWS - STORAGE FACILITY			200		$14,810	$0	$83,337	$0	$0	$98,147
--- 9109.1 FINISHES - NWCF										
	PAINT	U.C. per Lot	200	CN-PAIN	6078	0	2500	0	0	8578
Misc. Painting		1.00	200	$30.39	$6,078	$0	$2,500	$0	$0	$8,578
	GEN	U.C. per Sf			0	0	0	7	0	7
RCRA Floor - Grouting Facility		14,800.00	0		$0	$0	$0	$103,600	$0	$103,600
Subtotal					$6,078	$0	$2,500	$103,600	$0	$112,178
Sales Tax					$0	$0	$125	$0	$0	$125
INEEL ORG Labor/Subcontractor Overheads					$2,549	$0	$1,101	$36,759	$0	$40,408
Subtotal Estimate										$152,711
Escalation					$2,214	$0	$956	$36,016	$0	$39,186
Contingency					$2,818	$0	$1,217	$45,857	$0	$49,893
---Total 9109.1 FINISHES - NWCF			200		$13,659	$0	$5,899	$222,232	$0	$241,790

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.2 FINISHES - TFD FACILITY										
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		100,000.00	3,000	$30.39	$91,170	$0	$75,000	$0	$0	$166,170
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Hot Cell		26,000.00	2,080	$30.39	$63,211	$0	$39,000	$0	$0	$102,211
	PAINT	U.C. per Sf	0.011	CN-PAIN	0.334	0	0.5	0	0	0.834
Floor Painting		30,000.00	330	$30.39	$10,029	$0	$15,000	$0	$0	$25,029
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		20.00	80	$30.39	$2,431	$0	$1,000	$0	$0	$3,431
	PAINT	U.C. per Lot	80	CN-PAIN	2431.2	0	150	0	0	2581.2
Touch-Up Paint		1.00	80	$30.39	$2,431	$0	$150	$0	$0	$2,581
Subtotal					$210,177	$0	$135,520	$0	$0	$345,697
Sales Tax					$0	$0	$6,776	$0	$0	$6,776
INEEL ORG Labor/Subcontractor Overheads					$88,134	$0	$59,669	$0	$0	$147,803
Subtotal Estimate										$500,276
Escalation					$76,547	$0	$51,824	$0	$0	$128,371
Contingency					$97,463	$0	$65,985	$0	$0	$163,448
---Total 9109.2 FINISHES - TFD FACILITY			**6,916**		**$472,320**	**$0**	**$319,774**	**$0**	**$0**	**$792,095**
--- 9109.3 FINISHES - BOILER HOUSE										
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		4.00	16	$30.39	$486	$0	$200	$0	$0	$686
	PAINT	U.C. per Lot	16	CN-PAIN	486.24	0	150	0	0	636.24
Touch-Up Paint		1.00	16	$30.39	$486	$0	$150	$0	$0	$636
Subtotal					$972	$0	$350	$0	$0	$1,322
Sales Tax					$0	$0	$18	$0	$0	$18
INEEL ORG Labor/Subcontractor Overheads					$408	$0	$154	$0	$0	$562
Subtotal Estimate										$1,902
Escalation					$354	$0	$134	$0	$0	$488
Contingency					$451	$0	$170	$0	$0	$621
---Total 9109.3 FINISHES - BOILER HOUSE			**32**		**$2,185**	**$0**	**$826**	**$0**	**$0**	**$3,011**

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9109.4 FINISHES - STORAGE FACILITY										
	PAINT	U.C. per SF	0.08	CN-PAIN	2.431	0	0.1	0	0	2.531
Paint Structural Steel		13,700.00	1,096	$30.39	$33,307	$0	$1,370	$0	$0	$34,677
	PAINT	U.C. per Sf	0.03	CN-PAIN	0.912	0	0.75	0	0	1.662
Building Painting		2,500.00	75	$30.39	$2,279	$0	$1,875	$0	$0	$4,154
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Decontaminable Coating - Remote Handling Area		22,000.00	1,760	$30.39	$53,486	$0	$33,000	$0	$0	$86,486
	PAINT	U.C. per Sf	0.08	CN-PAIN	2.431	0	1.5	0	0	3.931
Floor Painting - Decontaminable - Remote Handling Area		17,600.00	1,408	$30.39	$42,789	$0	$26,400	$0	$0	$69,189
	PAINT	U.C. per Lot	250	CN-PAIN	7597.5	0	4000	0	0	11597.5
Pipe Painting / I.D.		1.00	250	$30.39	$7,598	$0	$4,000	$0	$0	$11,598
	PAINT	U.C. per Ea	4	CN-PAIN	121.56	0	50	0	0	171.56
Paint Doors & Frames		7.00	28	$30.39	$851	$0	$350	$0	$0	$1,201
	PAINT	U.C. per Lot	40	CN-PAIN	1215.6	0	150	0	0	1365.6
Touch-Up Paint		1.00	40	$30.39	$1,216	$0	$150	$0	$0	$1,366
Subtotal					$141,526	$0	$67,145	$0	$0	$208,671
Sales Tax					$0	$0	$3,357	$0	$0	$3,357
INEEL ORG Labor/Subcontractor Overheads					$59,346	$0	$29,564	$0	$0	$88,910
Subtotal Estimate										$300,938
Escalation					$51,544	$0	$25,677	$0	$0	$77,221
Contingency					$65,628	$0	$32,693	$0	$0	$98,321
---Total 9109.4 FINISHES - STORAGE FACILITY			4,657		$318,045	$0	$158,436	$0	$0	$476,481
--- 9110.1 SPECIALTIES - NWCF										
	GEN	U.C. per Lf	0.25	CN-LABR	7.523	0	80	0	0	87.523
Storage Racks		4,700.00	1,175	$30.09	$35,356	$0	$376,000	$0	$0	$411,356
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	750000	0	0	763808
Auto Retrieval System With Three Fork Lifts		1.00	400	$34.52	$13,808	$0	$750,000	$0	$0	$763,808
	GEN	U.C. per Ea	550	CN-SKWK	18986	0	50000	0	0	68986
Truck Loading Station		1.00	550	$34.52	$18,986	$0	$50,000	$0	$0	$68,986

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- **9110.1 SPECIALTIES - NWCF**											
	GEN	U.C. per Ea				0	0	0	850000	0	850000
TRU-Pak Assembly			1.00	0		$0	$0	$0	$850,000	$0	$850,000
Subtotal						$68,150	$0	$1,176,000	$850,000	$0	$2,094,150
Sales Tax						$0	$0	$58,800	$0	$0	$58,800
INEEL ORG Labor/Subcontractor Overheads						$24,181	$0	$438,126	$301,593	$0	$763,899
Subtotal Estimate											$2,916,849
Escalation						$23,692	$0	$429,273	$295,499	$0	$748,463
Contingency						$34,807	$0	$630,659	$434,127	$0	$1,099,594
---Total 9110.1 SPECIALTIES - NWCF				2,125		$150,829	$0	$2,732,858	$1,881,219	$0	$4,764,906
--- **9110.2 SPECIALTIES - TFD FACILITY**											
	GEN	U.C. per Ea		120	CN-IRON	4819.2	0	75000	0	0	79819.2
20 Ton O.H. Crane			1.00	120	$40.16	$4,819	$0	$75,000	$0	$0	$79,819
	GEN	U.C. per Ea		80	CN-IRON	3212.8	0	50000	0	0	53212.8
Hot Cell O.H. Crane			1.00	80	$40.16	$3,213	$0	$50,000	$0	$0	$53,213
	GEN	U.C. per Ea		100	CN-MILL	3292	0	170000	0	0	173292
Shielding Windows - 2' Thick			8.00	800	$32.92	$26,336	$0	$1,360,000	$0	$0	$1,386,336
	GEN	U.C. per Ea		200	CN-MILL	6584	0	1419000	0	0	1425584
PaR Manipulators - Model 4350 - Wall Mounted			4.00	800	$32.92	$26,336	$0	$5,676,000	$0	$0	$5,702,336
	GEN	U.C. per Lot				0	0	0	6000000	0	6000000
Robotic / Remote Handling Allowance			1.00	0		$0	$0	$0	$6,000,000	$0	$6,000,000
Subtotal						$60,704	$0	$7,161,000	$6,000,000	$0	$13,221,704
Sales Tax						$0	$0	$358,050	$0	$0	$358,050
INEEL ORG Labor/Subcontractor Overheads						$21,539	$0	$2,667,872	$2,128,890	$0	$4,818,300
Subtotal Estimate											$18,398,054
Escalation						$21,103	$0	$2,613,964	$2,085,873	$0	$4,720,941
Contingency						$31,004	$0	$3,840,266	$3,064,429	$0	$6,935,699
---Total 9110.2 SPECIALTIES - TFD FACILITY				1,800		$134,350	$0	$16,641,152	$13,279,192	$0	$30,054,694
--- **9110.3 SPECIALTIES - BOILER HOUSE**											
	GEN	U.C. per Ea		100	CN-IRON	4016	0	40000	0	0	44016
10 Ton O.H. Crane			1.00	100	$40.16	$4,016	$0	$40,000	$0	$0	$44,016

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9110.3 SPECIALTIES - BOILER HOUSE										
Subtotal					$4,016	$0	$40,000	$0	$0	$44,016
Sales Tax					$0	$0	$2,000	$0	$0	$2,000
INEEL ORG Labor/Subcontractor Overheads					$1,425	$0	$14,902	$0	$0	$16,327
Subtotal Estimate										$62,343
Escalation					$1,396	$0	$14,601	$0	$0	$15,997
Contingency					$2,051	$0	$21,451	$0	$0	$23,502
—Total 9110.3 SPECIALTIES - BOILER HOUSE			100		$8,888	$0	$92,954	$0	$0	$101,843
— 9110.4 SPECIALTIES - STORAGE FACILITY										
GEN	U.C. per EA		50	CN-IRON	2008	0	23100	0	0	25108
VAULT TUBE ASSEMBLIES		1,584.00	79,200	$40.16	$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Subtotal					$3,180,672	$0	$36,590,400	$0	$0	$39,771,072
Sales Tax					$0	$0	$1,829,520	$0	$0	$1,829,520
INEEL ORG Labor/Subcontractor Overheads					$1,128,550	$0	$13,631,964	$0	$0	$14,760,514
Subtotal Estimate										$56,361,106
Escalation					$1,105,746	$0	$13,356,513	$0	$0	$14,462,260
Contingency					$1,624,491	$0	$19,622,519	$0	$0	$21,247,010
—Total 9110.4 SPECIALTIES - STORAGE FACILITY			79,200		$7,039,459	$0	$85,030,917	$0	$0	$92,070,376
— 9111.1.1 EQUIPMENT - CALCINER CELL										
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Filter Feed Pump - P-201-2a & 2b (Skid Mounted)		2.00	20	$37.58	$752	$0	$15,000	$0	$0	$15,752
PIPE	U.C. per Ea		6	CN-PIPE	225.48	500	5500	0	0	6225.48
SBW Slurry XFR Pump - P-201-6a, b - 30 hp		2.00	12	$37.58	$451	$1,000	$11,000	$0	$0	$12,451
PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	15000	0	0	15300.64
SBW Day Tank - T-201-2a, b - 1179 Gal. - SST		2.00	16	$37.58	$601	$0	$30,000	$0	$0	$30,601
PIPE	U.C. per Ea		40	CN-PIPE	1503.2	0	100000	0	0	101503.2
Cross Flow Filter - CF-201-1, 2 (36"x60"x65")		2.00	80	$37.58	$3,006	$0	$200,000	$0	$0	$203,006
Subtotal					$4,810	$1,000	$256,000	$0	$0	$261,810
Sales Tax					$0	$0	$12,800	$0	$0	$12,800
INEEL ORG Labor/Subcontractor Overheads					$2,314	$481	$129,304	$0	$0	$132,099
Subtotal Estimate										$406,709
Escalation					$1,828	$380	$102,153	$0	$0	$104,361
Contingency					$5,998	$1,247	$335,172	$0	$0	$342,417
—Total 9111.1.1 EQUIPMENT - CALCINER CELL			128		$14,950	$3,108	$835,429	$0	$0	$853,487

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.2 EQUIPMENT - OFF GAS CELL										
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	1200	0	0	1275.16
Extraction Feed Pump - P-201-5 - .375 hp		1.00	2	$37.58	$75	$0	$1,200	$0	$0	$1,275
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	500	0	0	575.16
Solvent Feed Pump - P-202-5 - .25 hp		1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	8500	0	0	8725.48
UNEX Solvent Tank - T-202-5 - 500 Gal. - SST		1.00	6	$37.58	$225	$0	$8,500	$0	$0	$8,725
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Extraction Contactor - CON-202-1-14 (3'x13'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Scrubbing Contactor - SB-202-1-2 (3'x2'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
	PIPE	U.C. per Ea	20	CN-PIPE	751.6	1000	300000	0	0	301751.6
Stripping Contactor - SP-202-1-8 (3'x7'x5')		1.00	20	$37.58	$752	$1,000	$300,000	$0	$0	$301,752
Subtotal					$2,631	$3,000	$910,200	$0	$0	$915,831
Sales Tax					$0	$0	$45,510	$0	$0	$45,510
INEEL ORG Labor/Subcontractor Overheads					$1,265	$1,443	$459,735	$0	$0	$462,443
Subtotal Estimate										$1,423,784
Escalation					$1,000	$1,140	$363,203	$0	$0	$365,343
Contingency					$3,280	$3,741	$1,191,694	$0	$0	$1,198,715
---Total 9111.1.2 EQUIPMENT - OFF GAS CELL			70		$8,176	$9,324	$2,970,342	$0	$0	$2,987,842
--- 9111.1.3 EQUIPMENT - BLEND & HOLD CELL										
	PIPE	U.C. per Ea	12	CN-PIPE	450.96	500	31000	0	0	31950.96
SBW Feed Tank - T-201-1 - 4718 Gal. SST		1.00	12	$37.58	$451	$500	$31,000	$0	$0	$31,951
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	500	21000	0	0	21875.8
Extraction Feed Tank - T-201-5a, b, c - 2359 Gal. SST		3.00	30	$37.58	$1,127	$1,500	$63,000	$0	$0	$65,627
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	250	18600	0	0	19150.64
UNEX Raffinate Tank - T-202-6a, b - 1761 Gal. SST		2.00	16	$37.58	$601	$500	$37,200	$0	$0	$38,301

Project Name:
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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.3 EQUIPMENT - BLEND & HOLD CELL										
PIPE	U.C. per Ea		6	CN-PIPE	225.48	250	14900	0	0	15375.48
UNEX Strip Effluent Tank - T-202-14 - 1124 Gal. SST		1.00	6	$37.58	$225	$250	$14,900	$0	$0	$15,375
Subtotal					$2,405	$2,750	$146,100	$0	$0	$151,255
Sales Tax					$0	$0	$7,305	$0	$0	$7,305
INEEL ORG Labor/Subcontractor Overheads					$1,157	$1,323	$73,794	$0	$0	$76,274
Subtotal Estimate										$234,834
Escalation					$914	$1,045	$58,299	$0	$0	$60,258
Contingency					$2,999	$3,429	$191,284	$0	$0	$197,712
---Total 9111.1.3 EQUIPMENT - BLEND & HOLD CELL			64		$7,475	$8,547	$476,782	$0	$0	$492,804
--- 9111.1.4 EQUIPMENT - VALVE CUBICLE										
PIPE	U.C. per Ea		16	CN-PIPE	601.28	0	4500	0	0	5101.28
SBW XFR Pump - P201-1 - 30 hp		1.00	16	$37.58	$601	$0	$4,500	$0	$0	$5,101
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Raffinate XFR Pump - P-202-6a - .25 hp		1.00	3	$37.58	$113	$0	$600	$0	$0	$713
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	2800	0	0	2950.32
Raffinate Off Spec. XFR Pump - P-202-6b - 2 hp		1.00	4	$37.58	$150	$0	$2,800	$0	$0	$2,950
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	600	0	0	712.74
Strip Effluent XFR Pump - P-202-14 - .25 hp		1.00	3	$37.58	$113	$0	$600	$0	$0	$713
Subtotal					$977	$0	$8,500	$0	$0	$9,477
Sales Tax					$0	$0	$425	$0	$0	$425
INEEL ORG Labor/Subcontractor Overheads					$470	$0	$4,293	$0	$0	$4,763
Subtotal Estimate										$14,665
Escalation					$371	$0	$3,392	$0	$0	$3,763
Contingency					$1,218	$0	$11,129	$0	$0	$12,347
---Total 9111.1.4 EQUIPMENT - VALVE CUBICLE			26		$3,037	$0	$27,739	$0	$0	$30,776
--- 9111.1.5 EQUIPMENT - STORAGE AREA										
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
HF Pump - P-201-4 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Dicarbolide Feed Pump - P-202-1 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
PEG Feed Pump - P-202-2 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
CMPO Feed Pump - P-202-3 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.5 EQUIPMENT - STORAGE AREA										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
FS-13 Feed Pump - P-202-4 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Acid Feed Pump - P-202-7 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
Aluminum Nitrate Feed Pump - P-202-8 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Makeup XFR Pump - P-202-9 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Scrub Solution Feed Pump - P-202-10 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	800	0	0	912.74
DTPA Feed Pump - P-202-11 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Makeup XFR Pump - P-202-12 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	600	0	0	675.16
Strip Solution Feed Pump - P-202-13 - .25 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
PIPE	U.C. per Ea		16	CN-PIPE	601.28	500	20500	0	0	21601.28
HF Storage Tank - T-201-3 - 4000 Gal. - C-276		1.00	16	$37.58	$601	$500	$20,500	$0	$0	$21,601
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	4000	0	0	4112.74
HF Makeup Tank - T-201-4 - 237 Gal. - C-276		1.00	3	$37.58	$113	$0	$4,000	$0	$0	$4,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Dicarbolide Feed Tank - T-202-1 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
PEG 400 Feed Tank - T-202-2 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Ph2Bu2CMPO Feed Tank - T-202-3a, b - 55 Gal. SST		2.00	6	$37.58	$225	$0	$4,000	$0	$0	$4,225
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
FS-13 Tank - T-202-4 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Recycle Acid Tank - T-202-7 - 55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	2000	0	0	2112.74
Aluminum Nitrate Tank - T-202-8 -55 Gal. SST		1.00	3	$37.58	$113	$0	$2,000	$0	$0	$2,113
PIPE	U.C. per Ea		10	CN-PIPE	375.8	500	11900	0	0	12775.8
UNEX Scrub Makeup Tank - T-202-9 - 807 Gal. SST		1.00	10	$37.58	$376	$500	$11,900	$0	$0	$12,776

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.1.5 EQUIPMENT - STORAGE AREA										
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	500	12500	0	0	13375.8
UNEX Scrub Solution Tank - T-202-10 - 888 Gal. SST		1.00	10	$37.58	$376	$500	$12,500	$0	$0	$13,376
	PIPE	U.C. per Ea	12	CN-PIPE	450.96	500	15000	0	0	15950.96
UNEX Strip Makeup Tank - T-202-12 - 1132 Gal. SST		1.00	12	$37.58	$451	$500	$15,000	$0	$0	$15,951
	PIPE	U.C. per Ea	12	CN-PIPE	450.96	500	16000	0	0	16950.96
UNEX Strip Solution Feed Tank - T-202-13 - 1245 Gal. SST		1.00	12	$37.58	$451	$500	$16,000	$0	$0	$16,951
	GEN	U.C. per Lot	750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment		1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
Subtotal					$30,212	$2,500	$852,500	$0	$0	$885,212
Sales Tax					$0	$0	$42,625	$0	$0	$42,625
INEEL ORG Labor/Subcontractor Overheads					$11,265	$1,203	$331,189	$0	$0	$343,656
Subtotal Estimate										$1,271,493
Escalation					$10,643	$950	$314,672	$0	$0	$326,265
Contingency					$34,920	$3,117	$1,032,461	$0	$0	$1,070,498
---Total 9111.1.5 EQUIPMENT - STORAGE AREA			865		$87,040	$7,770	$2,573,446	$0	$0	$2,668,256
--- 9111.6 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
LAW Evaporator Feed Pump - P-204-1 - .75 hp		1.00	3	$37.58	$113	$0	$800	$0	$0	$913
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	7500	0	0	7875.8
LAW Evaporator Recirc / XFR Pump - P-204-2 (Skid Mounted)		1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	800	0	0	875.16
LET&D Supply Pump - P-204-3 - .25 hp		1.00	2	$37.58	$75	$0	$800	$0	$0	$875
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	600	0	0	675.16
NaOH Feed Pump - P-205-1 - .125 hp		1.00	2	$37.58	$75	$0	$600	$0	$0	$675
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	800	0	0	912.74
Neutralization Tank Pump - P-205-2a, b, c - .75 hp		3.00	9	$37.58	$338	$0	$2,400	$0	$0	$2,738
	PIPE	U.C. per Ea	24	CN-PIPE	901.92	1000	45000	0	0	46901.92
LAW Evaporator Feed Tank - T-204-1 - 7884 Gal. - SST		1.00	24	$37.58	$902	$1,000	$45,000	$0	$0	$46,902
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	7500	0	0	7650.32
LET&D Feed Tank - T-204-3 - 352 Gal. - SST		1.00	4	$37.58	$150	$0	$7,500	$0	$0	$7,650
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	8000	0	0	8150.32
NaOH Storage Tank - T-205-1 - 400 Gal. - SST		1.00	4	$37.58	$150	$0	$8,000	$0	$0	$8,150
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	500	15400	0	0	16200.64
Neutralization Tank - T-205-2a, b, c - 1200 Gal. - SST		3.00	24	$37.58	$902	$1,500	$46,200	$0	$0	$48,602

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY											
B-105	PIPE	U.C. per EA		80	CN-PIPE	3006.4	1000	55000	0	0	59006.4
Slag Storage Bin - T-205-5 - 875 CF			1.00	80	$37.58	$3,006	$1,000	$55,000	$0	$0	$59,006
B-102	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
CaO Storage Bin - T-205-6 - 1071 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
B-103	PIPE	U.C. per EA		60	CN-PIPE	2254.8	1000	45000	0	0	48254.8
Portland Cement Bin - T-205-7 - 641 CF			1.00	60	$37.58	$2,255	$1,000	$45,000	$0	$0	$48,255
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	250	9600	0	0	10000.32
Slag Day Storage Tank - T-205-6a - 257 CF			1.00	4	$37.58	$150	$250	$9,600	$0	$0	$10,000
	PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	3100	0	0	3212.74
Portland Cement Day Storage Tank - T-205-6c - 28CF			1.00	3	$37.58	$113	$0	$3,100	$0	$0	$3,213
	PIPE	U.C. per Ea		20	CN-PIPE	751.6	1000	170000	0	0	171751.6
LAW Evaporator - EV-204-1 (8'x10'x8')			1.00	20	$37.58	$752	$1,000	$170,000	$0	$0	$171,752
	PIPE	U.C. per Ea		40	CN-PIPE	1503.2	2000	150000	0	0	153503.2
Vertical Auger - VA-205-1-6 (20"x40"x140")			1.00	40	$37.58	$1,503	$2,000	$150,000	$0	$0	$153,503
	PIPE	U.C. per Ea		60	CN-PIPE	2254.8	2000	150000	0	0	154254.8
Vertical Mixer - VM-205-1-6 (30"x60"x140")			1.00	60	$37.58	$2,255	$2,000	$150,000	$0	$0	$154,255
B-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	45000	0	0	47254.8
FLYASH BIN - 34 M3			1.00	60	$37.58	$2,255	$0	$45,000	$0	$0	$47,255
ED-101,2,3,4	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	3500	0	0	3875.8
AIR EDUCTOR - 9 Kg-S/hr			4.00	40	$37.58	$1,503	$0	$14,000	$0	$0	$15,503
B-107	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	4000	0	0	5127.4
CaO WEIGHT BIN - .4 M3			1.00	30	$37.58	$1,127	$0	$4,000	$0	$0	$5,127
T-104A&B	PIPE	U.C. per EA		80	CN-PIPE	3006.4	0	35000	0	0	38006.4
GROUT FEED TANK - 7 M3			2.00	160	$37.58	$6,013	$0	$70,000	$0	$0	$76,013
N-101A&B	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
pH SAMPLER/NEUTRALIZER			2.00	20	$37.58	$752	$0	$12,000	$0	$0	$12,752
P-105A&B	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	6000	0	0	6563.7
GROUT MIXER FEED PUMP - 2-16 L/MIN			2.00	30	$37.58	$1,127	$0	$12,000	$0	$0	$13,127
B-108A,B&C	PIPE	U.C. per EA		15	CN-PIPE	563.7	0	2000	0	0	2563.7
DRY INGREDIENT WEIGH BIN - .2 M3			3.00	45	$37.58	$1,691	$0	$6,000	$0	$0	$7,691
C-101A,B&C	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2500	0	0	2875.8
SOLIDS FEED CONVEYOR - 8 Kg/MIN			3.00	30	$37.58	$1,127	$0	$7,500	$0	$0	$8,627
M-101A,B&C	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
GROUT MIXER - .3 M3			3.00	180	$37.58	$6,764	$0	$60,000	$0	$0	$66,764

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY										
B-106A	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	2500	0	0	3251.6
DRY GROUT ADMIXTURES BIN - .4 M3		1.00	20	$37.58	$752	$0	$2,500	$0	$0	$3,252
B-106B&C	PIPE	U.C. per EA	15	CN-PIPE	563.7	0	500	0	0	1063.7
LIQUID GROUT ADMIXTURES TANK		2.00	30	$37.58	$1,127	$0	$1,000	$0	$0	$2,127
P-106	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON AGENT PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
P-115	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
METERING PUMP/ADMIXTURES - 1 L/MIN		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
T-106	PIPE	U.C. per EA	50	CN-PIPE	1879	0	10000	0	0	11879
MIXER WASH TANK - 1 M3		1.00	50	$37.58	$1,879	$0	$10,000	$0	$0	$11,879
P-116	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	8000	0	0	9127.4
DECON RETURN PUMP - 76 L/MIN		1.00	30	$37.58	$1,127	$0	$8,000	$0	$0	$9,127
F-105	PIPE	U.C. per EA	10	CN-PIPE	375.8	0	5000	0	0	5375.8
SPENT DECON SOLUTION FILTER -		1.00	10	$37.58	$376	$0	$5,000	$0	$0	$5,376
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
STORAGE AREA CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK		1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	35000	0	0	38758
MAIN INLET CONVEYOR		1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSVERSE SECTION LIFT		2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH INLET CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	50000	0	0	53758
MIXER BOOTH		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
MIXER BOOTH CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	50000	0	0	57516
FILL ASSEMBLY		1.00	200	$37.58	$7,516	$0	$50,000	$0	$0	$57,516
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	50000	0	0	53758
LID PLACEMENT BOOTH		1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.6 EQUIPMENT - GROUT FACILITY										
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
LID PLACEMENT OUTLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	15000	0	0	16503.2
LID PLACEMENT CONVEYOR		1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
DRUM RIM CLEANING MECHANISM		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	30000	0	0	33758
LID PLACEMENT ASSEMBLY		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758
	PIPE	U.C. per EA	200	CN-PIPE	7516	0	70000	0	0	77516
TRANSFER SECTION TUNNEL		1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION INLET CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSFER SECTION EXIT CONVEYOR		3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA	30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER TABLE		3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
TRANSVERSE CONVEYOR		2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	80000	0	0	83758
INSPECTION BOOTH		1.00	100	$37.58	$3,758	$0	$80,000	$0	$0	$83,758
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON INLET CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	20	CN-PIPE	751.6	0	5000	0	0	5751.6
INSPECT/DECON EXIT CONVEYOR		1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752
	PIPE	U.C. per EA	40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INSPECT/DECON CONVEYOR		1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA	100	CN-PIPE	3758	0	20000	0	0	23758
ROTATING TABLE		1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per LOT	100	CN-PIPE	3758	0	30000	0	0	33758
DECON EQUIPMENT		1.00	100	$37.58	$3,758	$0	$30,000	$0	$0	$33,758

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.6 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per LOT		100	CN-PIPE	3758	0	50000	0	0	53758
INSPECTION EQUIPMENT			1.00	100	$37.58	$3,758	$0	$50,000	$0	$0	$53,758
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	70000	0	0	77516
DISCHARGE SECTION TUNNEL			1.00	200	$37.58	$7,516	$0	$70,000	$0	$0	$77,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DISCHARGE SECTION INLET CONVEYOR			3.00	120	$37.58	$4,510	$0	$30,000	$0	$0	$34,510
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	35000	0	0	38758
MAIN DISCHARGE CONVEYOR			1.00	100	$37.58	$3,758	$0	$35,000	$0	$0	$38,758
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
TRANSFER SECTION LIFT			3.00	90	$37.58	$3,382	$0	$30,000	$0	$0	$33,382
	PIPE	U.C. per EA		200	CN-PIPE	7516	0	80000	0	0	87516
AIRLOCK			1.00	200	$37.58	$7,516	$0	$80,000	$0	$0	$87,516
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
AIRLOCK CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
TILT & PAN CAMERA			14.00	140	$37.58	$5,261	$0	$28,000	$0	$0	$33,261
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	15000	0	0	16503.2
CAMERA CONTROL STATION			1.00	40	$37.58	$1,503	$0	$15,000	$0	$0	$16,503
	PIPE	U.C. per LOT		500	CN-PIPE	18790	0	250000	0	0	268790
INLET STAGING, DRUM LIFT, CURE LINE & DRUM LIFT ENCLOSURE			1.00	500	$37.58	$18,790	$0	$250,000	$0	$0	$268,790
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET STAGING CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DRUM LIFT			2.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DRUM LIFT CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
CURE LINE CONVEYOR			2.00	80	$37.58	$3,006	$0	$20,000	$0	$0	$23,006
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
180 DEGREE CONVEYOR			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
CURE LINE CONVEYOR 13'			8.00	480	$37.58	$18,038	$0	$160,000	$0	$0	$178,038
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
STAGING CONVEYOR			1.00	20	$37.58	$752	$0	$5,000	$0	$0	$5,752

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - GROUT FACILITY											
	PIPE	U.C. per EA		400	CN-PIPE	15032	0	200000	0	0	215032
DRUM ELEVATOR & ENCLOSURE			1.00	400	$37.58	$15,032	$0	$200,000	$0	$0	$215,032
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
INLET INDEXING LIFT CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
INDEXING LIFT TABLE			1.00	30	$37.58	$1,127	$0	$10,000	$0	$0	$11,127
	PIPE	U.C. per EA		100	CN-PIPE	3758	0	20000	0	0	23758
INDEXING ARM			1.00	100	$37.58	$3,758	$0	$20,000	$0	$0	$23,758
	PIPE	U.C. per EA		70	CN-PIPE	2630.6	0	40000	0	0	42630.6
DEWATERING STATION 30' CONVEYOR			1.00	70	$37.58	$2,631	$0	$40,000	$0	$0	$42,631
	PIPE	U.C. per EA		20	CN-PIPE	751.6	0	5000	0	0	5751.6
90 DEG TRANSFER & LIFT			2.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		40	CN-PIPE	1503.2	0	10000	0	0	11503.2
DEWATERING STATION CONVEYOR			1.00	40	$37.58	$1,503	$0	$10,000	$0	$0	$11,503
	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	2000	0	0	2375.8
AIR HEATERS			9.00	90	$37.58	$3,382	$0	$18,000	$0	$0	$21,382
	PIPE	U.C. per EA		30	CN-PIPE	1127.4	0	10000	0	0	11127.4
DEWATERING STATION LINE LIFT			9.00	270	$37.58	$10,147	$0	$90,000	$0	$0	$100,147
	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	20000	0	0	22254.8
DRUM OFF LOAD CONVEYOR			1.00	60	$37.58	$2,255	$0	$20,000	$0	$0	$22,255
	PIPE	U.C. per EA		50	CN-PIPE	1879	0	20000	0	0	21879
HYDRAULIC DRUM LIFT			1.00	50	$37.58	$1,879	$0	$20,000	$0	$0	$21,879
E-104	PIPE	U.C. per EA		60	CN-PIPE	2254.8	0	50000	0	0	52254.8
VAPOR CONDENSER - 2 Kg/hr			1.00	60	$37.58	$2,255	$0	$50,000	$0	$0	$52,255
P-118	PIPE	U.C. per EA		10	CN-PIPE	375.8	0	6000	0	0	6375.8
CONDENSATE PUMP - 4 L/MIN			1.00	10	$37.58	$376	$0	$6,000	$0	$0	$6,376
Subtotal						$282,000	$10,750	$3,263,500	$0	$0	$3,556,250
Sales Tax						$0	$0	$163,175	$0	$0	$163,175
INEEL ORG Labor/Subcontractor Overheads						$135,653	$5,171	$1,648,368	$0	$0	$1,789,192
Subtotal Estimate											$5,508,618
Escalation						$107,170	$4,085	$1,302,256	$0	$0	$1,413,511
Contingency						$351,632	$13,404	$4,272,790	$0	$0	$4,637,826
---Total 9111.6 EQUIPMENT - GROUT FACILITY				7,504		$876,456	$33,411	$10,650,089	$0	$0	$11,559,955

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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY											
	PIPE	U.C. per Ea		100	CN-PIPE	3758	3000	1000000	0	0	1006758
Thin Film Dryer -TFD203-1 (12'x12'x25')			1.00	100	$37.58	$3,758	$3,000	$1,000,000	$0	$0	$1,006,758
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	500	0	0	575.16
TFD Feed Pump - P-203-2 - .25 hp			1.00	2	$37.58	$75	$0	$500	$0	$0	$575
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	7500	0	0	7875.8
Strip Cystallizer Condensate Pump - P-203-1 - Skid Mounted			1.00	10	$37.58	$376	$0	$7,500	$0	$0	$7,876
	PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	10000	0	0	10225.48
TFD Vacuum Pump - VP-203-1			1.00	6	$37.58	$225	$0	$10,000	$0	$0	$10,225
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	1500	0	0	1575.16
Chrystallizer Condensate Tank - T-203-1 - 10 Gal - SST			1.00	2	$37.58	$75	$0	$1,500	$0	$0	$1,575
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	500	15000	0	0	15800.64
Strip Feed Tank - T-203-2 - 1124 Gal. - SST (NWCF Only)			1.00	8	$37.58	$301	$500	$15,000	$0	$0	$15,801
Subtotal						$4,810	$3,500	$1,034,500	$0	$0	$1,042,810
Sales Tax						$0	$0	$51,725	$0	$0	$51,725
INEEL ORG Labor/Subcontractor Overheads						$2,314	$1,684	$522,518	$0	$0	$526,515
Subtotal Estimate											$1,621,050
Escalation						$1,828	$1,330	$412,803	$0	$0	$415,962
Contingency						$5,998	$4,364	$1,354,436	$0	$0	$1,364,798
—Total 9111.2 EQUIPMENT - THIN FILM DRYER FACILITY				128		$14,950	$10,878	$3,375,982	$0	$0	$3,401,810
--- 9111.3 EQUIPMENT - BOILER HOUSE											
	GEN	U.C. per EA		60	CN-BOILMK	1384.8	0	200000	0	0	201384.8
BOILERS			2.00	120	$23.08	$2,770	$0	$400,000	$0	$0	$402,770
	GEN	U.C. per EA		40	CN-BOILMK	923.2	0	20000	0	0	20923.2
FEED WATER HEATER			2.00	80	$23.08	$1,846	$0	$40,000	$0	$0	$41,846
	PIPE	U.C. per LOT		500	CN-PIPE	18790	0	100000	0	0	118790
CHEMICAL FEED SYSTEM			1.00	500	$37.58	$18,790	$0	$100,000	$0	$0	$118,790
	PIPE	U.C. per LOT		1800	CN-PIPE	67644	0	250000	0	0	317644
WATER TREATMENT SYSTEM			1.00	1,800	$37.58	$67,644	$0	$250,000	$0	$0	$317,644

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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.3 EQUIPMENT - BOILER HOUSE									
TANK	U.C. per BBL			0	0	0	65	0	65
OIL STORAGE TANK, ~750 BBL	750.00	0		$0	$0	$0	$48,750	$0	$48,750
Subtotal				$91,050	$0	$790,000	$48,750	$0	$929,800
Sales Tax				$0	$0	$39,500	$0	$0	$39,500
INEEL ORG Labor/Subcontractor Overheads				$43,216	$0	$340,707	$20,442	$0	$404,365
Subtotal Estimate									$1,373,665
Escalation				$34,453	$0	$300,275	$17,755	$0	$352,482
Contingency				$113,042	$0	$985,223	$58,255	$0	$1,156,519
—Total 9111.3 EQUIPMENT - BOILER HOUSE		**2,500**		**$281,760**	**$0**	**$2,455,705**	**$145,202**	**$0**	**$2,882,666**
— 9111.6 EQUIPMENT - STORAGE FACILITY									
GEN	U.C. per Lot	750	CN-SKWK	25890	0	750000	0	0	775890
Remote Handling Equipment	1.00	750	$34.52	$25,890	$0	$750,000	$0	$0	$775,890
GEN	U.C. per Ea	400	CN-SKWK	13808	0	2500000	0	0	2513808
Smeared Canister Loadout Crane	1.00	400	$34.52	$13,808	$0	$2,500,000	$0	$0	$2,513,808
GEN	U.C. per Ea	400	CN-SKWK	13808	0	250000	0	0	263808
Canister Storage Crane - Clean Environment	1.00	400	$34.52	$13,808	$0	$250,000	$0	$0	$263,808
GEN	U.C. per Ea	200	CN-SKWK	6904	0	103000	0	0	109904
Canister Heater	2.00	400	$34.52	$13,808	$0	$206,000	$0	$0	$219,808
GEN	U.C. per Ea	100	CN-SKWK	3452	0	175000	0	0	178452
CO2 System	1.00	100	$34.52	$3,452	$0	$175,000	$0	$0	$178,452
GEN	U.C. per Ea	100	CN-SKWK	3452	0	25000	0	0	28452
Canister Transportation Cart	1.00	100	$34.52	$3,452	$0	$25,000	$0	$0	$28,452
GEN	U.C. per Ea	120	CN-SKWK	4142.4	0	257500	0	0	261642.4
Canister Lifting Mechanism	2.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	120000	0	0	122761.6
Canister Sealing Manipulator	1.00	80	$34.52	$2,762	$0	$120,000	$0	$0	$122,762
GEN	U.C. per Ea	120	CN-SKWK	4142.4	0	50000	0	0	54142.4
Decon Solution Pumping Station	1.00	120	$34.52	$4,142	$0	$50,000	$0	$0	$54,142
GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	515000	0	0	523284.8
Decon Cell Equipment	1.00	240	$34.52	$8,285	$0	$515,000	$0	$0	$523,285
GEN	U.C. per Lot	240	CN-SKWK	8284.8	0	500000	0	0	508284.8
Decon / Disassembly Equipment - Turntable, Manipulator Tools, W/ Rack & Etc.	1.00	240	$34.52	$8,285	$0	$500,000	$0	$0	$508,285
GEN	U.C. per Ea	100	CN-SKWK	3452	0	515000	0	0	518452
Smear Monitor	1.00	100	$34.52	$3,452	$0	$515,000	$0	$0	$518,452

Project Name:
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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.6 EQUIPMENT - STORAGE FACILITY										
	GEN	U.C. per Ea		CN-SKWK	0	0	0	42000	0	42000
Smear Station Module		1.00	0		$0	$0	$0	$42,000	$0	$42,000
	GEN	U.C. per Ea	80	CN-SKWK	2761.6	0	150000	0	0	152761.6
Shuttle Cart		1.00	80	$34.52	$2,762	$0	$150,000	$0	$0	$152,762
	GEN	U.C. per Ea	40	CN-SKWK	1380.8	0	41200	0	0	42580.8
Glove Box		1.00	40	$34.52	$1,381	$0	$41,200	$0	$0	$42,581
	GEN	U.C. per Ea	24	CN-SKWK	828.48	0	3000	0	0	3828.48
Cameras		30.00	720	$34.52	$24,854	$0	$90,000	$0	$0	$114,854
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	103000	0	0	109904
Weld Station Module		1.00	200	$34.52	$6,904	$0	$103,000	$0	$0	$109,904
	GEN	U.C. per Ea	400	CN-SKWK	13808	0	2575000	0	0	2588808
HLW Canister Transfer Cart		1.00	400	$34.52	$13,808	$0	$2,575,000	$0	$0	$2,588,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	7000	0	0	13904
Empty Canister Receiving Crane		2.00	400	$34.52	$13,808	$0	$14,000	$0	$0	$27,808
	GEN	U.C. per Ea	200	CN-SKWK	6904	0	250000	0	0	256904
PaR Manipulator		1.00	200	$34.52	$6,904	$0	$250,000	$0	$0	$256,904
	GEN	U.C. per Ea		CN-SKWK	0	0	0	2060000	0	2060000
Canister Fill Monitoring Instruments		2.00	0		$0	$0	$0	$4,120,000	$0	$4,120,000
	GEN	U.C. per Ea	100	CN-SKWK	3452	0	1030000	0	0	1033452
Canister Welder Leak Check Module		1.00	100	$34.52	$3,452	$0	$1,030,000	$0	$0	$1,033,452
	GEN	U.C. per Lot	300	CN-SKWK	10356	0	1000000	0	0	1010356
Misc. Equipment		1.00	300	$34.52	$10,356	$0	$1,000,000	$0	$0	$1,010,356
Subtotal					$193,657	$0	$11,374,200	$4,162,000	$0	$15,729,857
Sales Tax					$0	$0	$568,710	$0	$0	$568,710
INEEL ORG Labor/Subcontractor Overheads					$68,712	$0	$4,237,524	$1,476,740	$0	$5,782,976
Subtotal Estimate										$22,081,543
Escalation					$67,324	$0	$4,151,899	$1,446,901	$0	$5,666,124
Contingency					$220,895	$0	$13,622,663	$4,747,379	$0	$18,590,937
---Total 9111.6 EQUIPMENT - STORAGE FACILITY			5,610		$550,589	$0	$33,954,996	$11,833,020	$0	$46,338,604
--- 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL										
	PIPE	U.C. per Lot		CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility		1.00	0		$0	$0	$0	$250,000	$0	$250,000
	PIPE	U.C. per Lot	50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879

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CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL										
	PIPE	U.C. per Lot		CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Cyclone Bracket Supports		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Calciner		1.00	300	$37.58	$11,274	$0	$0	$0	$0	$11,274
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent		1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
	PIPE	U.C. per Lot	2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Calciner		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Box	20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	5000	CN-PIPE	187900	0	0	0	0	187900
Labor Adjustment For Working In "Hot" Area - 200%		1.00	5,000	$37.58	$187,900	$0	$0	$0	$0	$187,900
	PIPE	U.C. per Lot	1875	CN-PIPE	70462.5	0	0	0	0	70462.5
Burn-Out Allowance - 25% Of Hot Work		1.00	1,875	$37.58	$70,463	$0	$0	$0	$0	$70,463
	PIPE	U.C. per Lot	2500	CN-PIPE	93950	0	0	0	0	93950
Mock-Up Training - 100% Of Unadjusted Work		1.00	2,500	$37.58	$93,950	$0	$0	$0	$0	$93,950
	PIPE	U.C. per Lot			0	0	37000	0	0	37000
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$37,000	$0	$0	$37,000
Subtotal					$463,174	$0	$144,000	$250,000	$0	$857,174
Sales Tax					$0	$0	$7,200	$0	$0	$7,200
INEEL ORG Labor/Subcontractor Overheads					$222,805	$0	$72,733	$120,260	$0	$415,798
Subtotal Estimate										$1,280,172
Escalation					$176,022	$0	$57,461	$95,009	$0	$328,492
Contingency					$577,540	$0	$188,534	$311,730	$0	$1,077,805
---Total 9111.7.1 EQUIPMENT DEMOLITION - CALCINER CELL			12,325		$1,439,541	$0	$469,929	$776,999	$0	$2,686,469

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL										
PIPE	U.C. per Lot		50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
PIPE	U.C. per Lot			CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
PIPE	U.C. per Lot			CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
PIPE	U.C. per Lot			CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
PIPE	U.C. per Ea		200	CN-PIPE	7516	0	0	0	0	7516
Cut Tank Bracket Supports		3.00	600	$37.58	$22,548	$0	$0	$0	$0	$22,548
PIPE	U.C. per Ea		300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Tanks		3.00	900	$37.58	$33,822	$0	$0	$0	$0	$33,822
PIPE	U.C. per Lot		200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent		1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
PIPE	U.C. per Lot		2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Tanks - 3 Ea.		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
PIPE	U.C. per Box		20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Other Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
PIPE	U.C. per Lot		7900	CN-PIPE	296882	0	0	0	0	296882
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,900	$37.58	$296,882	$0	$0	$0	$0	$296,882
PIPE	U.C. per Lot		2960	CN-PIPE	111236.8	0	0	0	0	111236.8
Burn-Out Allowance - 25% Of Hot Work		1.00	2,960	$37.58	$111,237	$0	$0	$0	$0	$111,237
PIPE	U.C. per Lot		3950	CN-PIPE	148441	0	0	0	0	148441
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,950	$37.58	$148,441	$0	$0	$0	$0	$148,441

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL										
	PIPE	U.C. per Lot			0	0	56400	0	0	56400
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$56,400	$0	$0	$56,400
Subtotal					$705,001	$0	$163,400	$0	$0	$868,401
Sales Tax					$0	$0	$8,170	$0	$0	$8,170
INEEL ORG Labor/Subcontractor Overheads					$339,134	$0	$82,532	$0	$0	$421,666
Subtotal Estimate										$1,298,236
Escalation					$267,925	$0	$65,203	$0	$0	$333,127
Contingency					$879,080	$0	$213,934	$0	$0	$1,093,014
---Total 9111.7.2 EQUIPMENT DEMOLITION - OFF GAS CELL			18,760		$2,191,139	$0	$533,239	$0	$0	$2,724,378
--- 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL										
	PIPE	U.C. per Lot		CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility		1.00	0		$0	$0	$0	$250,000	$0	$250,000
	PIPE	U.C. per Lot	50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
	PIPE	U.C. per Lot		CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Tank Bracket Supports		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Ea	300	CN-PIPE	11274	0	0	0	0	11274
Temporary Support of Tanks		3.00	900	$37.58	$33,822	$0	$0	$0	$0	$33,822
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	10000	0	0	17516
Demo Tent		1.00	200	$37.58	$7,516	$0	$10,000	$0	$0	$17,516
	PIPE	U.C. per Lot	2000	CN-PIPE	75160	0	0	0	0	75160
Cut Up And Hot-Box Tanks - 3 Ea.		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Box	20	CN-PIPE	751.6	0	0	0	0	751.6
"Hot Box" Other Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	7100	CN-PIPE	266818	0	0	0	0	266818
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,100	$37.58	$266,818	$0	$0	$0	$0	$266,818

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL										
	PIPE	U.C. per Lot	3550	CN-PIPE	133409	0	0	0	0	133409
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,550	$37.58	$133,409	$0	$0	$0	$0	$133,409
	PIPE	U.C. per Lot	2660	CN-PIPE	99962.8	0	0	0	0	99962.8
Burn-Out Allowance - 25% Of Hot Work		1.00	2,660	$37.58	$99,963	$0	$0	$0	$0	$99,963
	PIPE	U.C. per Lot			0	0	50700	0	0	50700
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$50,700	$0	$0	$50,700
Subtotal					$633,599	$0	$157,700	$250,000	$0	$1,041,299
Sales Tax					$0	$0	$7,885	$0	$0	$7,885
INEEL ORG Labor/Subcontractor Overheads					$304,786	$0	$79,653	$120,260	$0	$504,699
Subtotal Estimate										$1,553,883
Escalation					$240,790	$0	$62,928	$95,009	$0	$398,726
Contingency					$790,047	$0	$206,471	$311,730	$0	$1,308,248
—Total 9111.7.3 EQUIPMENT DEMOLITION - BLEND & HOLD CELL			16,860		$1,969,222	$0	$514,637	$776,999	$0	$3,260,858
— 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE										
	PIPE	U.C. per Lot		CN-PIPE	0	0	0	250000	0	250000
Mock-Up Facility		1.00	0		$0	$0	$0	$250,000	$0	$250,000
	PIPE	U.C. per Lot	50	CN-PIPE	1879	0	2000	0	0	3879
Lift & Bag Hatch Covers		1.00	50	$37.58	$1,879	$0	$2,000	$0	$0	$3,879
	PIPE	U.C. per Lot		CN-PIPE	0	0	5000	0	0	5000
Portable Crane		1.00	0		$0	$0	$5,000	$0	$0	$5,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Hydraulic Shears Modified For Remote Operation		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	50000	0	0	50000
Large Plasma Arc Modified For Remote Operation		1.00	0		$0	$0	$50,000	$0	$0	$50,000
	PIPE	U.C. per Lot		CN-PIPE	0	0	20000	0	0	20000
Misc. Remote Adaptations		1.00	0		$0	$0	$20,000	$0	$0	$20,000
	PIPE	U.C. per Box	20	CN-PIPE	751.6	0	0	0	0	751.6
Cut Up & "Hot Box" Materials		10.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	750	CN-PIPE	28185	0	0	0	0	28185
Demo Materials		1.00	750	$37.58	$28,185	$0	$0	$0	$0	$28,185
	PIPE	U.C. per Lot	2000	CN-PIPE	75160	0	0	0	0	75160
Labor Adjustment For Working In "Hot" Area - 200%		1.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Lot	750	CN-PIPE	28185	0	0	0	0	28185
Burn-Out Allowance - 25% Of Hot Work		1.00	750	$37.58	$28,185	$0	$0	$0	$0	$28,185

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By *Rowl.y / Mitchell / ` rler*
Estimate Type. *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE										
PIPE	U.C. per Lot		1000	CN-PIPE	37580	0	0	0	0	37580
Mock-Up Training - 100% Of Unadjusted Work		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
PIPE	U.C. per Lot				0	0	14250	0	0	14250
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$14,250	$0	$0	$14,250
Subtotal					$178,505	$0	$111,250	$250,000	$0	$539,755
Sales Tax					$0	$0	$5,563	$0	$0	$5,563
INEEL ORG Labor/Subcontractor Overheads					$85,868	$0	$56,191	$120,260	$0	$262,320
Subtotal Estimate										$807,637
Escalation					$67,838	$0	$44,393	$95,009	$0	$207,240
Contingency					$222,581	$0	$145,656	$311,730	$0	$679,967
---Total 9111.7.4 EQUIPMENT DEMOLITION - VALVE CUBICLE			4,750		$554,793	$0	$363,053	$776,999	$0	$1,694,844
--- 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY										
GEN	U.C. per EA		1000	CN-SKWK	34520	0	2500000	0	0	2534520
GANTRY CRANE		2.00	2,000	$34.52	$69,040	$0	$5,000,000	$0	$0	$5,069,040
GEN	U.C. per EA		500	CN-SKWK	17260	0	300000	0	0	317260
TRANSFER CART IN TUNNEL		1.00	500	$34.52	$17,260	$0	$300,000	$0	$0	$317,260
GEN	U.C. per EA		300	CN-SKWK	10356	0	250000	0	0	260356
5 TON DECONTAMINATABLE BRIDGE CRANE		2.00	600	$34.52	$20,712	$0	$500,000	$0	$0	$520,712
GEN	U.C. per EA		1000	CN-SKWK	34520	0	1000000	0	0	1034520
CASK MANUVERING HYDRAULIC PLATFORM		1.00	1,000	$34.52	$34,520	$0	$1,000,000	$0	$0	$1,034,520
Subtotal					$141,532	$0	$6,800,000	$0	$0	$6,941,532
Sales Tax					$0	$0	$340,000	$0	$0	$340,000
INEEL ORG Labor/Subcontractor Overheads					$50,218	$0	$2,533,379	$0	$0	$2,583,597
Subtotal Estimate										$9,865,129
Escalation					$49,203	$0	$2,482,189	$0	$0	$2,531,392
Contingency					$21,686	$0	$1,094,001	$0	$0	$1,115,687
---Total 9114.4 CONVEYING SYSTEMS - STORAGE FACILITY			4,100		$262,638	$0	$13,249,569	$0	$0	$13,512,208
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - 4"		2.00	8	$37.58	$301	$0	$60	$0	$0	$361
PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - 8"		1.00	6	$37.58	$225	$0	$50	$0	$0	$275

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL											
	PIPE	U.C. per Lf		0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small			900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf		0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - 4"			60.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Lf		0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - 8"			30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports			31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Large Knife Gate Valves			2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line		10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed			31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"			1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot		1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping			1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot		400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell			1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Ea		80	CN-PIPE	3006.4	0	0	0	0	3006.4
Cut 16" Pipe			5.00	400	$37.58	$15,032	$0	$0	$0	$0	$15,032
	PIPE	U.C. per Ea		160	CN-PIPE	6012.8	0	0	0	0	6012.8
Cut 16" Pipe At Cyclone			1.00	160	$37.58	$6,013	$0	$0	$0	$0	$6,013
	PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Calciner Pipes			200.00	2,000	$37.58	$75,160	$0	$0	$0	$0	$75,160
	PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Piping At Bottom Of Calciner			1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	20	0	0	95.16
Plug Calciner Pipe Ends			250.00	500	$37.58	$18,790	$0	$5,000	$0	$0	$23,790
	PIPE	U.C. per Lot		1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports			1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot		13770	CN-PIPE	517476.6	0	0	0	0	517476.6
Labor Adjustment For Working In "Hot" Area - 200%			1.00	13,770	$37.58	$517,477	$0	$0	$0	$0	$517,477
	PIPE	U.C. per Lot		5165	CN-PIPE	194100.7	0	0	0	0	194100.7
Burn-Out Allowance - 25% Of Hot Work			1.00	5,165	$37.58	$194,101	$0	$0	$0	$0	$194,101

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.1 MECHANICAL DEMO - CALCINER CELL										
	PIPE	U.C. per Lot	6885	CN-PIPE	258738.3	0	0	0	0	258738.3
Mock-Up Training - 100% Of Unadjusted Work		1.00	6,885	$37.58	$258,738	$0	$0	$0	$0	$258,738
	PIPE	U.C. per Lot		CN-PIPE	0	0	98000	0	0	98000
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$98,000	$0	$0	$98,000
Subtotal					$1,229,016	$0	$105,446	$0	$0	$1,334,462
Sales Tax					$0	$0	$5,272	$0	$0	$5,272
INEEL ORG Labor/Subcontractor Overheads					$591,206	$0	$53,260	$0	$0	$644,466
Subtotal Estimate										$1,984,201
Escalation					$467,069	$0	$42,077	$0	$0	$509,146
Contingency					$937,789	$0	$84,483	$0	$0	$1,022,272
---Total 9115.1.1 MECHANICAL DEMO - CALCINER CELL			32,704		$3,225,081	$0	$290,538	$0	$0	$3,515,618
--- 9115.1.3 MECHANICAL DEMO - OFF GAS CELL										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
	PIPE	U.C. per Ea	4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium		12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
	PIPE	U.C. per Ea	6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large		10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
	PIPE	U.C. per Lf	0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf	0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium		60.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Lf	0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large		30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line	10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.3 MECHANICAL DEMO - OFF GAS CELL										
PIPE	U.C. per Lot		400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
PIPE	U.C. per Ea		10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Pipes @ Tanks		9.00	90	$37.58	$3,382	$0	$0	$0	$0	$3,382
PIPE	U.C. per Lot		1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
PIPE	U.C. per Lot		7600	CN-PIPE	285608	0	0	0	0	285608
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,600	$37.58	$285,608	$0	$0	$0	$0	$285,608
PIPE	U.C. per Lot		2850	CN-PIPE	107103	0	0	0	0	107103
Burn-Out Allowance - 25% Of Hot Work		1.00	2,850	$37.58	$107,103	$0	$0	$0	$0	$107,103
PIPE	U.C. per Lot		3800	CN-PIPE	142804	0	0	0	0	142804
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,800	$37.58	$142,804	$0	$0	$0	$0	$142,804
PIPE	U.C. per Lot			CN-PIPE	0	0	54300	0	0	54300
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$54,300	$0	$0	$54,300
Subtotal					$678,620	$0	$57,496	$0	$0	$736,116
Sales Tax					$0	$0	$2,875	$0	$0	$2,875
INEEL ORG Labor/Subcontractor Overheads					$326,443	$0	$29,041	$0	$0	$355,484
Subtotal Estimate										$1,094,474
Escalation					$257,899	$0	$22,943	$0	$0	$280,842
Contingency					$517,814	$0	$46,065	$0	$0	$563,880
---Total 9115.1.3 MECHANICAL DEMO - OFF GAS CELL			18,058		$1,780,776	$0	$158,420	$0	$0	$1,939,196
--- 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL										
PIPE	U.C. per Ea		3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493
PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium		12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large		10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
PIPE	U.C. per Lf		0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small		900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
PIPE	U.C. per Lf		0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium		60.00	15	$37.58	$564	$0	$0	$0	$0	$564
PIPE	U.C. per Lf		0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large		30.00	15	$37.58	$564	$0	$0	$0	$0	$564

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL										
	PIPE	U.C. per Ea	2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports		31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea	8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves		2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line	10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed		31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot	200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"		1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot	1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping		1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot	400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell		1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Ea	10	CN-PIPE	375.8	0	0	0	0	375.8
Cut Pipes @ Tanks		9.00	90	$37.58	$3,382	$0	$0	$0	$0	$3,382
	PIPE	U.C. per Lot	1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports		1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot	7600	CN-PIPE	285608	0	0	0	0	285608
Labor Adjustment For Working In "Hot" Area - 200%		1.00	7,600	$37.58	$285,608	$0	$0	$0	$0	$285,608
	PIPE	U.C. per Lot	2850	CN-PIPE	107103	0	0	0	0	107103
Burn-Out Allowance - 25% Of Hot Work		1.00	2,850	$37.58	$107,103	$0	$0	$0	$0	$107,103
	PIPE	U.C. per Lot	3800	CN-PIPE	142804	0	0	0	0	142804
Mock-Up Training - 100% Of Unadjusted Work		1.00	3,800	$37.58	$142,804	$0	$0	$0	$0	$142,804
	PIPE	U.C. per Lot		CN-PIPE	0	0	54300	0	0	54300
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$54,300	$0	$0	$54,300
Subtotal					$678,620	$0	$57,496	$0	$0	$736,116
Sales Tax					$0	$0	$2,875	$0	$0	$2,875
INEEL ORG Labor/Subcontractor Overheads					$326,443	$0	$29,041	$0	$0	$355,484
Subtotal Estimate										$1,094,474
Escalation					$257,899	$0	$22,943	$0	$0	$280,842
Contingency					$517,814	$0	$46,065	$0	$0	$563,880
---Total 9115.1.4 MECHANICAL DEMO - BLEND & HOLD CELL			18,058		$1,780,776	$0	$158,420	$0	$0	$1,939,196
--- 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE										
	PIPE	U.C. per Ea	3	CN-PIPE	112.74	0	12	0	0	124.74
Cut & Cap Piping At Cell Wall - Small		28.00	84	$37.58	$3,157	$0	$336	$0	$0	$3,493

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE											
	PIPE	U.C. per Ea		4	CN-PIPE	150.32	0	30	0	0	180.32
Cut & Cap Piping At Cell Wall - Medium			12.00	48	$37.58	$1,804	$0	$360	$0	$0	$2,164
	PIPE	U.C. per Ea		6	CN-PIPE	225.48	0	50	0	0	275.48
Cut & Cap Piping At Cell Wall - Large			10.00	60	$37.58	$2,255	$0	$500	$0	$0	$2,755
	PIPE	U.C. per Lf		0.12	CN-PIPE	4.51	0	0	0	0	4.51
Remove Piping - Small			900.00	108	$37.58	$4,059	$0	$0	$0	$0	$4,059
	PIPE	U.C. per Lf		0.25	CN-PIPE	9.395	0	0	0	0	9.395
Remove Piping - Medium			60.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Lf		0.5	CN-PIPE	18.79	0	0	0	0	18.79
Remove Piping - Large			30.00	15	$37.58	$564	$0	$0	$0	$0	$564
	PIPE	U.C. per Ea		2	CN-PIPE	75.16	0	0	0	0	75.16
Remove Pipe Supports			31.00	62	$37.58	$2,330	$0	$0	$0	$0	$2,330
	PIPE	U.C. per Ea		8	CN-PIPE	300.64	0	0	0	0	300.64
Remove Valves			2.00	16	$37.58	$601	$0	$0	$0	$0	$601
	PIPE	U.C. per Line		10	CN-PIPE	375.8	0	0	0	0	375.8
Identify, Verify, And Isolate Piping To Be Removed			31.00	310	$37.58	$11,650	$0	$0	$0	$0	$11,650
	PIPE	U.C. per Lot		200	CN-PIPE	7516	0	0	0	0	7516
Cut Up Piping For "Hot Boxing"			1.00	200	$37.58	$7,516	$0	$0	$0	$0	$7,516
	PIPE	U.C. per Lot		1000	CN-PIPE	37580	0	0	0	0	37580
Bag & Box Piping			1.00	1,000	$37.58	$37,580	$0	$0	$0	$0	$37,580
	PIPE	U.C. per Lot		400	CN-PIPE	15032	0	2000	0	0	17032
Scaffolding In Cell			1.00	400	$37.58	$15,032	$0	$2,000	$0	$0	$17,032
	PIPE	U.C. per Lot		1400	CN-PIPE	52612	0	0	0	0	52612
Remove Misc. Piping & Supports			1.00	1,400	$37.58	$52,612	$0	$0	$0	$0	$52,612
	PIPE	U.C. per Lot		7436	CN-PIPE	279444.88	0	0	0	0	279444.88
Labor Adjustment For Working In "Hot" Area - 200%			1.00	7,436	$37.58	$279,445	$0	$0	$0	$0	$279,445
	PIPE	U.C. per Lot		892	CN-PIPE	33521.36	0	0	0	0	33521.36
Burn-Out Allowance - 25% Of Hot Work			1.00	892	$37.58	$33,521	$0	$0	$0	$0	$33,521
	PIPE	U.C. per Lot		3718	CN-PIPE	139722.44	0	0	0	0	139722.44
Mock-Up Training - 100% Of Unadjusted Work			1.00	3,718	$37.58	$139,722	$0	$0	$0	$0	$139,722

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE										
PIPE	U.C. per Lot			CN-PIPE	0	0	47400	0	0	47400
Small Tools & Consumables - 8% Of Labor Cost		1.00	0		$0	$0	$47,400	$0	$0	$47,400
Subtotal					$592,411	$0	$50,596	$0	$0	$643,007
Sales Tax					$0	$0	$2,530	$0	$0	$2,530
INEEL ORG Labor/Subcontractor Overheads					$284,973	$0	$25,556	$0	$0	$310,529
Subtotal Estimate										$956,066
Escalation					$225,137	$0	$20,190	$0	$0	$245,327
Contingency					$452,034	$0	$40,537	$0	$0	$492,571
---Total 9115.1.5 MECHANICAL DEMO - VALVE CUBICLE			15,764		$1,554,555	$0	$139,408	$0	$0	$1,693,963
--- 9115.2.1 HVAC - NEW - NWCF										
HVAC	U.C. per Ea		10	CN-SHEE	354.8	500	5700	0	0	6554.8
Vent. Centrifugal Fans - 20 hp		5.00	50	$35.48	$1,774	$2,500	$28,500	$0	$0	$32,774
HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 25 hp		7.00	84	$35.48	$2,980	$3,500	$63,000	$0	$0	$69,480
HVAC	U.C. per Ea		12	CN-SHEE	425.76	500	9000	0	0	9925.76
Vent. Centrifugal Fans - 30 hp		5.00	60	$35.48	$2,129	$2,500	$45,000	$0	$0	$49,629
HVAC	U.C. per Ea		18	CN-SHEE	638.64	500	13000	0	0	14138.64
Vent. Centrifugal Fans - 40 hp		5.00	90	$35.48	$3,193	$2,500	$65,000	$0	$0	$70,693
HVAC	U.C. per Ea		14	CN-SHEE	496.72	500	15000	0	0	15996.72
Vent. Centrifugal Fans - 50 hp		14.00	196	$35.48	$6,954	$7,000	$210,000	$0	$0	$223,954
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	27000	0	0	28919.2
Vent. Centrifugal Fans - 60 hp		3.00	120	$35.48	$4,258	$1,500	$81,000	$0	$0	$86,758
HVAC	U.C. per Ea		30	CN-SHEE	1064.4	500	72000	0	0	73564.4
*HEPA Filter Bank - Single Stage - 4X4 - 12 Filters Per Bank		2.00	60	$35.48	$2,129	$1,000	$144,000	$0	$0	$147,129
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	96000	0	0	97919.2
*HEPA Filter Bank - Single Stage - 4X4 - 16 Filters Per Bank		23.00	920	$35.48	$32,642	$11,500	$2,208,000	$0	$0	$2,252,142
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		40	CN-SHEE	1419.2	500	144000	0	0	145919.2
*HEPA Filter Bank - Dual Stage - 4X4 - 12 Filters Per Bank		2.00	80	$35.48	$2,838	$1,000	$288,000	$0	$0	$291,838
Memo: Each Filter is 24" x 24".										
HVAC	U.C. per Ea		50	CN-SHEE	1774	500	192000	0	0	194274
*HEPA Filter Bank - Dual Stage - 4X4 - 16 Filters Per Bank		4.00	200	$35.48	$7,096	$2,000	$768,000	$0	$0	$777,096
Memo: Each Filter is 24" x 24".										

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9115.2.1 HVAC - NEW - NWCF											
	HVAC	U.C. per Ea		60	CN-SHEE	2128.8	0	35000	0	0	37128.8
Chiller (Complete With Compressor & Fans) - 80 Ton			1.00	60	$35.48	$2,129	$0	$35,000	$0	$0	$37,129
	HVAC	U.C. per Ea		48	CN-SHEE	1703.04	0	21000	0	0	22703.04
Chiller (Complete With Compressor & Fans) - 40 Ton			1.00	48	$35.48	$1,703	$0	$21,000	$0	$0	$22,703
	HVAC	U.C. per Ea		0.9	CN-SHEE	31.932	0	150	0	0	181.932
Actuated Air Dampers			100.00	90	$35.48	$3,193	$0	$15,000	$0	$0	$18,193
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	2500	0	0	6048
Pre-Filters			1.00	100	$35.48	$3,548	$0	$2,500	$0	$0	$6,048
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	5000	0	0	8548
Heating Coils			1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	5000	0	0	8548
Cooling Coils			1.00	100	$35.48	$3,548	$0	$5,000	$0	$0	$8,548
	HVAC	U.C. per Lot		40	CN-SHEE	1419.2	0	2000	0	0	3419.2
Heat Recovery Coil			1.00	40	$35.48	$1,419	$0	$2,000	$0	$0	$3,419
	HVAC	U.C. per Lot		3500	CN-SHEE	124180	0	65000	0	0	189180
Sheet Metal Ductwork			1.00	3,500	$35.48	$124,180	$0	$65,000	$0	$0	$189,180
	HVAC	U.C. per Lot				0	0	0	7500	0	7500
Test & Balance			1.00	0		$0	$0	$0	$7,500	$0	$7,500
Subtotal						$209,261	$35,000	$4,051,000	$7,500	$0	$4,302,761
Sales Tax						$0	$0	$202,550	$0	$0	$202,550
INEEL ORG Labor/Subcontractor Overheads						$95,498	$15,972	$1,941,133	$3,423	$0	$2,056,026
Subtotal Estimate											$6,561,337
Escalation						$78,201	$13,080	$1,589,556	$2,803	$0	$1,683,639
Contingency						$157,013	$26,261	$3,191,538	$5,627	$0	$3,380,440
—Total 9115.2.1 HVAC - NEW - NWCF				5,898		$539,973	$90,313	$10,975,777	$19,353	$0	$11,625,416
— 9115.2.2 PIPING - NEW - NWCF											
	PIPE	U.C. per Lot		3500	CN-PIPE	131530	0	150000	0	0	281530
Piping Modifications			1.00	3,500	$37.58	$131,530	$0	$150,000	$0	$0	$281,530

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.2 PIPING - NEW - NWCF											
Subtotal						$131,530	$0	$150,000	$0	$0	$281,530
Sales Tax						$0	$0	$7,500	$0	$0	$7,500
INEEL ORG Labor/Subcontractor Overheads						$63,271	$0	$75,764	$0	$0	$139,035
Subtotal Estimate											$428,065
Escalation						$49,986	$0	$59,855	$0	$0	$109,841
Contingency						$100,363	$0	$120,179	$0	$0	$220,542
---Total 9115.2.2 PIPING - NEW - NWCF				**3,500**		**$345,150**	**$0**	**$413,298**	**$0**	**$0**	**$758,448**
--- 9115.2.3 FIRE PROTECTION - NEW - NWCF											
	FP	U.C. per Lot		750	CN-SPRI	27690	0	30000	0	0	57690
Fire Protection Modifications			1.00	750	$36.92	$27,690	$0	$30,000	$0	$0	$57,690
Subtotal						$27,690	$0	$30,000	$0	$0	$57,690
Sales Tax						$0	$0	$1,500	$0	$0	$1,500
INEEL ORG Labor/Subcontractor Overheads						$11,611	$0	$13,209	$0	$0	$24,820
Subtotal Estimate											$84,010
Escalation						$10,085	$0	$11,472	$0	$0	$21,557
Contingency						$20,248	$0	$23,034	$0	$0	$43,283
---Total 9115.2.3 FIRE PROTECTION - NEW - NWCF				**750**		**$69,634**	**$0**	**$79,215**	**$0**	**$0**	**$148,850**
--- 9115.2.1 HVAC - TFD FACILITY - HOT CELL											
	HVAC	U.C. per Lot		1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork			1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The hot cell is approximately 77' x 51' x 77' high.											
	HVAC	U.C. per Lot		750	CN-SHEE	26610	3000	300000	0	0	329610
HVAC Equipment			1.00	750	$35.48	$26,610	$3,000	$300,000	$0	$0	$329,610
	HVAC	U.C. per Lot		300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters			1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers			1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal			1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.1 HVAC - TFD FACILITY - HOT CELL										
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance		1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal					$94,022	$3,000	$481,500	$0	$0	$578,522
Sales Tax					$0	$0	$24,075	$0	$0	$24,075
INEEL ORG Labor/Subcontractor Overheads					$42,908	$1,369	$230,722	$0	$0	$274,999
Subtotal Estimate										$877,598
Escalation					$35,136	$1,121	$188,934	$0	$0	$225,191
Contingency					$70,547	$2,251	$379,345	$0	$0	$452,143
---Total 9115.2.1 HVAC - TFD FACILITY - HOT CELL			2,650		$242,613	$7,741	$1,304,576	$0	$0	$1,554,929
--- 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS										
Memo: The operating corridors and equipment areas are approximately 72,500 square feet of total floor area. Includes the floor area of all levels.										
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	0	140000	0	0	281920
(*)Sheet Metal Ductwork		1.00	4,000	$35.48	$141,920	$0	$140,000	$0	$0	$281,920
Memo: Includes all corridors and equipment areas - approximately 72,500 square feet of floor space.										
	HVAC	U.C. per Lot	4000	CN-SHEE	141920	15000	525000	0	0	681920
HVAC Equipment		1.00	4,000	$35.48	$141,920	$15,000	$525,000	$0	$0	$681,920
	HVAC	U.C. per Lot	200	CN-SHEE	7096	0	13000	0	0	20096
Diffusers, Grilles, Dampers, Registers		1.00	200	$35.48	$7,096	$0	$13,000	$0	$0	$20,096
	HVAC	U.C. per Lot	350	CN-SHEE	12418	0	5000	0	0	17418
Misc. Sheet Metal		1.00	350	$35.48	$12,418	$0	$5,000	$0	$0	$17,418
	HVAC	U.C. per Lot	300	CN-SHEE	10644	0	0	0	0	10644
Test & Balance		1.00	300	$35.48	$10,644	$0	$0	$0	$0	$10,644
Subtotal					$313,998	$15,000	$683,000	$0	$0	$1,011,998
Sales Tax					$0	$0	$34,150	$0	$0	$34,150
INEEL ORG Labor/Subcontractor Overheads					$143,295	$6,845	$327,276	$0	$0	$477,416
Subtotal Estimate										$1,523,564
Escalation					$117,341	$5,606	$268,000	$0	$0	$390,947
Contingency					$235,600	$11,255	$538,094	$0	$0	$784,949
---Total 9115.2.2 HVAC - TFD FACILITY - OPERATING CORRIDORS			8,850		$810,234	$38,706	$1,850,520	$0	$0	$2,699,460
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY										
	PIPE	U.C. per Sf	0.15	CN-PIPE	5.637	0	7	0	0	12.637
Process Piping		13,700.00	2,055	$37.58	$77,227	$0	$95,900	$0	$0	$173,127

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.2.3 PLUMBING / PIPING - TFD FACILITY											
	PIPE	U.C. per Sf		0.05	CN-PIPE	1.879	0	3	0	0	4.879
Building Plumbing			13,700.00	685	$37.58	$25,742	$0	$41,100	$0	$0	$66,842
Subtotal						$102,969	$0	$137,000	$0	$0	$239,969
Sales Tax						$0	$0	$6,850	$0	$0	$6,850
INEEL ORG Labor/Subcontractor Overheads						$49,532	$0	$69,198	$0	$0	$118,730
Subtotal Estimate											$365,549
Escalation						$39,132	$0	$54,668	$0	$0	$93,800
Contingency						$78,570	$0	$109,763	$0	$0	$188,333
---Total 9115.2.3 PLUMBING / PIPING - TFD FACILITY				2,740		$270,203	$0	$377,479	$0	$0	$647,682
--- 9115.3.1 HVAC - BOILER HOUSE											
	HVAC	U.C. per LOT		200	CN-SHEE	7096	240	36700	1000	0	45036
HVAC			1.00	200	$35.48	$7,096	$240	$36,700	$1,000	$0	$45,036
Memo: Based on AFC estimate #2547-A. This will be a two boiler system vs. a four in estimate 2547-A; all quantities are halved.											
Subtotal						$7,096	$240	$36,700	$1,000	$0	$45,036
Sales Tax						$0	$0	$1,835	$0	$0	$1,835
INEEL ORG Labor/Subcontractor Overheads						$3,238	$110	$17,586	$456	$0	$21,390
Subtotal Estimate											$68,261
Escalation						$2,652	$90	$14,401	$374	$0	$17,516
Contingency						$5,324	$180	$28,914	$750	$0	$35,168
---Total 9115.3.1 HVAC - BOILER HOUSE				200		$18,310	$619	$99,435	$2,580	$0	$120,945
--- 9115.3.2 PLUMBING - BOILER HOUSE											
	PIPE	U.C. per Lot		40	CN-PIPE	1503.2	0	600	0	0	2103.2
Building Drain			1.00	40	$37.58	$1,503	$0	$600	$0	$0	$2,103
	PIPE	U.C. per Lot		20	CN-PIPE	751.6	0	300	0	0	1051.6
Building Water			1.00	20	$37.58	$752	$0	$300	$0	$0	$1,052
Subtotal						$2,255	$0	$900	$0	$0	$3,155
Sales Tax						$0	$0	$45	$0	$0	$45
INEEL ORG Labor/Subcontractor Overheads						$1,085	$0	$455	$0	$0	$1,539
Subtotal Estimate											$4,739
Escalation						$857	$0	$359	$0	$0	$1,216
Contingency						$1,721	$0	$721	$0	$0	$2,442
---Total 9115.3.2 PLUMBING - BOILER HOUSE				60		$5,917	$0	$2,480	$0	$0	$8,397
--- 9115.3.3 PIPING - BOILER HOUSE											
	PIPE	U.C. per Ea		200	CN-PIPE	7516	2000	50000	0	0	59516
Boilers			2.00	400	$37.58	$15,032	$4,000	$100,000	$0	$0	$119,032

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
— 9115.3.3 PIPING - BOILER HOUSE											
	PIPE	U.C. per LOT		750	CN-PIPE	28185	0	40000	0	0	68185
STEAM & SUPPORT PIPING			1.00	750	$37.58	$28,185	$0	$40,000	$0	$0	$68,185
	INSUL	U.C. per LOT		175	CN-ASBE	6461	0	8920	0	0	15381
PIPE INSULATION			1.00	175	$36.92	$6,461	$0	$8,920	$0	$0	$15,381
Subtotal						$49,678	$4,000	$148,920	$0	$0	$202,598
Sales Tax						$0	$0	$7,446	$0	$0	$7,446
INEEL ORG Labor/Subcontractor Overheads						$23,498	$1,924	$74,640	$0	$0	$100,063
Subtotal Estimate											$310,107
Escalation						$18,777	$1,520	$59,276	$0	$0	$79,573
Contingency						$37,701	$3,052	$119,016	$0	$0	$159,769
---Total 9115.3.3 PIPING - BOILER HOUSE				1,325		$129,654	$10,496	$409,298	$0	$0	$549,449
— 9115.3.4 FIRE PROTECTION - BOILER HOUSE											
	FP	U.C. per SF				0	0	0	4	0	4
FIRE SPRINKLER SYSTEM - BOILER BUILDING			3,120.00	0		$0	$0	$0	$12,480	$0	$12,480
Subtotal						$0	$0	$0	$12,480	$0	$12,480
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$5,233	$0	$5,233
Subtotal Estimate											$17,713
Escalation						$0	$0	$0	$4,545	$0	$4,545
Contingency						$0	$0	$0	$9,126	$0	$9,126
---Total 9115.3.4 FIRE PROTECTION - BOILER HOUSE				0		$0	$0	$0	$31,384	$0	$31,384
— 9115.4.1 HVAC - STORAGE FACILITY											
	HVAC	U.C. per Lot		1100	CN-SHEE	39028	0	20000	0	0	59028
(*)Sheet Metal Ductwork			1.00	1,100	$35.48	$39,028	$0	$20,000	$0	$0	$59,028
Memo: The Interim Storage Facility is approximately 140' x 146' x 36' high.											
	HVAC	U.C. per Lot		500	CN-SHEE	17740	3000	100000	0	0	120740
HVAC Equipment			1.00	500	$35.48	$17,740	$3,000	$100,000	$0	$0	$120,740
	HVAC	U.C. per Lot		300	CN-SHEE	10644	0	150000	0	0	160644
HEPA Filters			1.00	300	$35.48	$10,644	$0	$150,000	$0	$0	$160,644
	HVAC	U.C. per Lot		100	CN-SHEE	3548	0	9000	0	0	12548
Diffusers, Grilles, Dampers, Registers			1.00	100	$35.48	$3,548	$0	$9,000	$0	$0	$12,548
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	2500	0	0	9596
Misc. Sheet Metal			1.00	200	$35.48	$7,096	$0	$2,500	$0	$0	$9,596

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9115.4.1 HVAC - STORAGE FACILITY											
	HVAC	U.C. per Lot		200	CN-SHEE	7096	0	0	0	0	7096
Test & Balance			1.00	200	$35.48	$7,096	$0	$0	$0	$0	$7,096
Subtotal						$85,152	$3,000	$281,500	$0	$0	$369,652
Sales Tax						$0	$0	$14,075	$0	$0	$14,075
INEEL ORG Labor/Subcontractor Overheads						$38,860	$1,369	$134,887	$0	$0	$175,116
Subtotal Estimate											$558,843
Escalation						$31,821	$1,121	$110,457	$0	$0	$143,399
Contingency						$63,892	$2,251	$221,777	$0	$0	$287,919
---Total 9115.4.1 HVAC - STORAGE FACILITY				**2,400**		**$219,725**	**$7,741**	**$762,696**	**$0**	**$0**	**$990,162**
--- 9115.4.2 PIPING / PLUMBING - STORAGE FACILITY											
	PIPE	U.C. per LOT				0	0	0	60000	0	60000
MISC. PIPING - ALLOW			1.00	0		$0	$0	$0	$60,000	$0	$60,000
Subtotal						$0	$0	$0	$60,000	$0	$60,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$28,862	$0	$28,862
Subtotal Estimate											$88,862
Escalation						$0	$0	$0	$22,802	$0	$22,802
Contingency						$0	$0	$0	$45,782	$0	$45,782
---Total 9115.4.2 PIPING / PLUMBING - STORAGE FACILITY				**0**		**$0**	**$0**	**$0**	**$157,447**	**$0**	**$157,447**
--- 9115.4.3 FIRE PROTECTION - STORAGE FACILITY											
	FP	U.C. per SF				0	0	0	4	0	4
FIRE PROTECTION			20,440.00	0		$0	$0	$0	$81,760	$0	$81,760
Subtotal						$0	$0	$0	$81,760	$0	$81,760
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$34,284	$0	$34,284
Subtotal Estimate											$116,044
Escalation						$0	$0	$0	$29,777	$0	$29,777
Contingency						$0	$0	$0	$59,787	$0	$59,787
---Total 9115.4.3 FIRE PROTECTION - STORAGE FACILITY				**0**		**$0**	**$0**	**$0**	**$205,608**	**$0**	**$205,608**
--- 9116.1.1 ELECTRICAL DEMO - CALCINER CELL											
	ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell			1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
	ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.1.1 ELECTRICAL DEMO - CALCINER CELL											
	ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%			1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
	ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work			1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
	ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work			1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
	ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost			1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal						$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax						$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads						$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate											$222,380
Escalation						$56,068	$0	$994	$0	$0	$57,063
Contingency						$140,032	$0	$2,483	$0	$0	$142,516
--Total 9116.1.1 ELECTRICAL DEMO - CALCINER CELL				4,512		$414,606	$0	$7,352	$0	$0	$421,958
--- 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL											
	ELEC	U.C. per Lot		850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell			1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
	ELEC	U.C. per Lot		100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"			1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%			1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
	ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work			1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
	ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work			1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL									
ELEC	U.C. per Lot		CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost	1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal				$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax				$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads				$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate									$222,380
Escalation				$56,068	$0	$994	$0	$0	$57,063
Contingency				$140,032	$0	$2,483	$0	$0	$142,516
---Total 9116.1.3 ELECTRICAL DEMO - OFF GAS CELL		4,512		$414,606	$0	$7,352	$0	$0	$421,958
--- 9116.1.4 ELECTRICAL DEMO - BLEND & HOLD CELL									
ELEC	U.C. per Lot	850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell	1.00	850	$34.12	$29,002	$0	$0.	$0	$0	$29,002
ELEC	U.C. per Lot	100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"	1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
ELEC	U.C. per Lot	1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%	1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
ELEC	U.C. per Lot	712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work	1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
ELEC	U.C. per Lot	950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work	1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
ELEC	U.C. per Lot		CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost	1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal				$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax				$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads				$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate									$222,380
Escalation				$56,068	$0	$994	$0	$0	$57,063
Contingency				$140,032	$0	$2,483	$0	$0	$142,516
---Total 9116.1.4 ELECTRICAL DEMO - BLEND & HOLD CELL		4,512		$414,606	$0	$7,352	$0	$0	$421,958
--- 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE									
ELEC	U.C. per Lot	850	CN-ELEC	29002	0	0	0	0	29002
Electrical Demo - Calciner Cell	1.00	850	$34.12	$29,002	$0	$0	$0	$0	$29,002
ELEC	U.C. per Lot	100	CN-ELEC	3412	0	0	0	0	3412
Cut Up Conduit For "Hot Boxing"	1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE											
	ELEC	U.C. per Lot		1900	CN-ELEC	64828	0	0	0	0	64828
Labor Adjustment For Working In "Hot" Area - 200%			1.00	1,900	$34.12	$64,828	$0	$0	$0	$0	$64,828
	ELEC	U.C. per Lot		712	CN-ELEC	24293.44	0	0	0	0	24293.44
Burn-Out Allowance - 25% Of Hot Work			1.00	712	$34.12	$24,293	$0	$0	$0	$0	$24,293
	ELEC	U.C. per Lot		950	CN-ELEC	32414	0	0	0	0	32414
Mock-Up Training - 100% Of Unadjusted Work			1.00	950	$34.12	$32,414	$0	$0	$0	$0	$32,414
	ELEC	U.C. per Lot			CN-ELEC	0	0	2600	0	0	2600
Small Tools & Consumables - 8% Of Labor Cost			1.00	0		$0	$0	$2,600	$0	$0	$2,600
Subtotal						$153,949	$0	$2,600	$0	$0	$156,549
Sales Tax						$0	$0	$130	$0	$0	$130
INEEL ORG Labor/Subcontractor Overheads						$64,556	$0	$1,145	$0	$0	$65,700
Subtotal Estimate											$222,380
Escalation						$56,068	$0	$994	$0	$0	$57,063
Contingency						$140,032	$0	$2,483	$0	$0	$142,516
---Total 9116.1.5 ELECTRICAL DEMO - VALVE CUBICLE				4,512		$414,606	$0	$7,352	$0	$0	$421,958
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF											
	ELEC	U.C. per Ea		72	CN-ELEC	2456.64	2500	150000	0	0	154956.64
2000 amp, 480/277 double ended 3R walk-in switchgear			1.00	72	$34.12	$2,457	$2,500	$150,000	$0	$0	$154,957
	ELEC	U.C. per Ea		24	CN-ELEC	818.88	2500	50000	0	0	53318.88
1500 kVA 13.8-480/277 transformers			2.00	48	$34.12	$1,638	$5,000	$100,000	$0	$0	$106,638
	ELEC	U.C. per Ls		24	CN-ELEC	818.88	0	7500	0	0	8318.88
2000 amp armor clad busway			1.00	24	$34.12	$819	$0	$7,500	$0	$0	$8,319
	ELEC	U.C. per Ea		16	CN-ELEC	545.92	0	10000	0	0	10545.92
1200 amp 480 volt normal power panels			2.00	32	$34.12	$1,092	$0	$20,000	$0	$0	$21,092
	ELEC	U.C. per Ea		12	CN-ELEC	409.44	0	5000	0	0	5409.44
480 volt power panels			2.00	24	$34.12	$819	$0	$10,000	$0	$0	$10,819

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF											
	ELEC	U.C. per Ls				0	0	0	0	35000	35000
Vault and equipment pads for main gear and transformers			1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal						$6,824	$7,500	$287,500	$0	$35,000	$336,824
Sales Tax						$0	$0	$14,375	$0	$0	$14,375
INEEL ORG Labor/Subcontractor Overheads						$2,862	$3,145	$126,585	$0	$0	$132,592
Subtotal Estimate											$483,791
Escalation						$2,485	$2,732	$109,943	$0	$8,981	$124,141
Contingency						$6,207	$6,822	$274,586	$0	$22,430	$310,045
---Total 9116.2.1 SWITCHGEAR AND TRANSFORMERS - NWCF				200		$18,378	$20,198	$812,989	$0	$66,411	$917,976
--- 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF											
	ELEC	U.C. per Lf				0	0	0	0	125	125
15kV electrical duct bank, 2 runs of 200 lf.			400.00	0		$0	$0	$0	$0	$50,000	$50,000
	ELEC	U.C. per Ls				0	0	0	0	25000	25000
600 volt feeders			1.00	0		$0	$0	$0	$0	$25,000	$25,000
	ELEC	U.C. per Ls				0	0	0	0	50000	50000
Branch power and lighting circuits			1.00	0		$0	$0	$0	$0	[illegible]	$50,000
Subtotal						$0	$0	$0	$0	$125,000	$125,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$125,000
Escalation						$0	$0	$0	$0	$32,075	$32,075
Contingency						$0	$0	$0	$0	$80,108	$80,108
---Total 9116.2.2 RACEWAYS, CONDUCTORS, AND GROUNDING - NWCF				0		$0	$0	$0	$0	$237,183	$237,183
--- 9116.2.3 MISC. COSTS - NWCF											
	ELEC	U.C. per Ls		120	CN-ELEC	4094.4	0	0	0	0	4094.4
Testing of systems and equipment			1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Ls		120	CN-ELEC	4094.4	0	0	0	0	4094.4
Material handling			1.00	120	$34.12	$4,094	$0	$0	$0	$0	$4,094
	ELEC	U.C. per Lot				0	0	0	40000	0	40000
Voice Paging / Evac.			1.00	0		$0	$0	$0	$40,000	$0	$40,000

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor		QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.2.3 MISC. COSTS - NWCF											
	ELEC	U.C. per Lot				0	0	0	40000	0	40000
Wiring Devices & Enclosures			1.00	0		$0	$0	$0	$40,000	$0	$40,000
Subtotal						$8,189	$0	$0	$80,000	$0	$88,189
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$3,434	$0	$0	$33,546	$0	$36,980
Subtotal Estimate											$125,169
Escalation						$2,982	$0	$0	$29,136	$0	$32,118
Contingency						$7,449	$0	$0	$72,768	$0	$80,217
---Total 9116.2.3 MISC. COSTS - NWCF				240		$22,054	$0	$0	$215,450	$0	$237,504
--- 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD											
	ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	1700	0	0	1972.96
480-208/120 75 kVA transformers			2.00	16	$34.12	$546	$0	$3,400	$0	$0	$3,946
	ELEC	U.C. per Ea		8	CN-ELEC	272.96	0	2500	0	0	2772.96
208/120 panels, lighting & misc. power loads			2.00	16	$34.12	$546	$0	$5,000	$0	$0	$5,546
Subtotal						$1,092	$0	$8,400	$0	$0	$9,492
Sales Tax						$0	$0	$420	$0	$0	$420
INEEL ORG Labor/Subcontractor Overheads						$458	$0	$3,698	$0	$0	$4,156
Subtotal Estimate											$14,068
Escalation						$398	$0	$3,212	$0	$0	$3,610
Contingency						$993	$0	$8,023	$0	$0	$9,016
---Total 9116.3.1 SWITCHGEAR AND TRANSFORMERS - TFD				32		$2,940	$0	$23,753	$0	$0	$26,694
--- 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD											
	ELEC	U.C. per Ls				0	0	0	0	35000	35000
Branch power and lighting circuits			1.00	0		$0	$0	$0	$0	$35,000	$35,000
Subtotal						$0	$0	$0	$0	$35,000	$35,000
Sales Tax						$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads						$0	$0	$0	$0	$0	$0
Subtotal Estimate											$35,000
Escalation						$0	$0	$0	$0	$8,981	$8,981
Contingency						$0	$0	$0	$0	$22,430	$22,430
---Total 9116.3.2 RACEWAYS, CONDUCTORS, AND GROUNDING - TFD				0		$0	$0	$0	$0	$66,411	$66,411
--- 9116.3.3 MISC. COSTS - TFD											
	ELEC	U.C. per Ls		90	CN-ELEC	3070.8	0	0	0	0	3070.8
Testing of systems and equipment			1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX in NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.3.3 MISC. COSTS - TFD										
	ELEC	U.C. per Ls	90	CN-ELEC	3070.8	0	0	0	0	3070.8
Material handling		1.00	90	$34.12	$3,071	$0	$0	$0	$0	$3,071
	ELEC	U.C. per Sf			0	0	0	4	0	4
Voice Paging / Evac.		13,700.00	0		$0	$0	$0	$54,800	$0	$54,800
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		13,700.00	0		$0	$0	$0	$27,400	$0	$27,400
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		13,700.00	0		$0	$0	$0	$13,700	$0	$13,700
Subtotal					$6,142	$0	$0	$109,600	$0	$115,742
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$2,575	$0	$0	$45,959	$0	$48,534
Subtotal Estimate										$164,276
Escalation					$2,237	$0	$0	$39,916	$0	$42,153
Contingency					$5,586	$0	$0	$99,692	$0	$105,279
---Total 9116.3.3 MISC. COSTS - TFD			180		$16,540	$0	$0	$295,167	$0	$311,707
--- 9116.3.4 LIGHTING - TFD										
	ELEC	U.C. per Sf			0	0	0	0	3.9	3.9
Lighting		13,700.00	0		$0	$0	$0	$0	$53,430	$53,430
Subtotal					$0	$0	$0	$0	$53,430	$53,430
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$53,430
Escalation					$0	$0	$0	$0	$13,710	$13,710
Contingency					$0	$0	$0	$0	$34,241	$34,241
---Total 9116.3.4 LIGHTING - TFD			0		$0	$0	$0	$0	$101,382	$101,382
--- 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
	ELEC	U.C. per Ls			0	0	0	0	12000	12000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$12,000	$12,000

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE										
Subtotal					$0	$0	$0	$0	$12,000	$12,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$12,000
Escalation					$0	$0	$0	$0	$3,079	$3,079
Contingency					$0	$0	$0	$0	$7,690	$7,690
---Total 9116.4.2 RACEWAYS, CONDUCTORS, AND GROUNDING - BOILER HOUSE			0		$0	$0	$0	$0	$22,770	$22,770
--- 9116.4.3 MISC. COSTS - BOILER HOUSE										
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Testing of systems and equipment		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Ls	40	CN-ELEC	1364.8	0	0	0	0	1364.8
Material handling		1.00	40	$34.12	$1,365	$0	$0	$0	$0	$1,365
	ELEC	U.C. per Sf			0	0	0	3	0	3
Voice Paging / Evac.		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		3,120.00	0		$0	$0	$0	$6,240	$0	$6,240
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		3,120.00	0		$0	$0	$0	$3,120	$0	$3,120
Subtotal					$2,730	$0	$0	$21,840	$0	$24,570
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$1,145	$0	$0	$9,158	$0	$10,303
Subtotal Estimate										$34,872
Escalation					$994	$0	$0	$7,954	$0	$8,948
Contingency					$2,483	$0	$0	$19,866	$0	$22,349
---Total 9116.4.3 MISC. COSTS - BOILER HOUSE			80		$7,351	$0	$0	$58,818	$0	$66,169
--- 9116.4.4 LIGHTING - BOILER HOUSE										
	ELEC	U.C. per Sf			0	0	0	3	0	3
Lighting		3,120.00	0		$0	$0	$0	$9,360	$0	$9,360

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9116.4.4 LIGHTING - BOILER HOUSE										
Subtotal					$0	$0	$0	$9,360	$0	$9,360
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$3,925	$0	$3,925
Subtotal Estimate										$13,285
Escalation					$0	$0	$0	$3,409	$0	$3,409
Contingency					$0	$0	$0	$8,514	$0	$8,514
---Total 9116.4.4 LIGHTING - BOILER HOUSE			0		$0	$0	$0	$25,208	$0	$25,208
--- SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE										
	ELEC	U.C. per LOT	480	CN-ELEC	16377.6	0	100000	0	0	116377.6
SWITCHGEAR AND TRANSFORMERS		1.00	480	$34.12	$16,378	$0	$100,000	$0	$0	$116,378
Subtotal					$16,378	$0	$100,000	$0	$0	$116,378
Sales Tax					$0	$0	$5,000	$0	$0	$5,000
INEEL ORG Labor/Subcontractor Overheads					$6,868	$0	$44,030	$0	$0	$50,897
Subtotal Estimate										$172,275
Escalation					$5,965	$0	$38,241	$0	$0	$44,206
Contingency					$14,897	$0	$95,508	$0	$0	$110,405
---Total SWITCHGEAR AND TRANSFORMERS - INTERIM STORAGE			480		$44,107	$0	$282,779	$0	$0	$326,886
--- RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE										
	ELEC	U.C. per Ls			0	0	0	0	21000	21000
Branch power and lighting circuits		1.00	0		$0	$0	$0	$0	$21,000	$21,000
Subtotal					$0	$0	$0	$0	$21,000	$21,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$21,000
Escalation					$0	$0	$0	$0	$5,389	$5,389
Contingency					$0	$0	$0	$0	$13,458	$13,458
---Total RACEWAYS, CONDUCTORS, AND GROUNDING - INTERIM STORAGE			0		$0	$0	$0	$0	$39,847	$39,847
--- MISC. COSTS - INTERIM STORAGE										
	ELEC	U.C. per Ls	100	CN-ELEC	3412	0	0	0	0	3412
Testing of systems and equipment		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Ls	100	CN-ELEC	3412	0	0	0	0	3412
Material handling		1.00	100	$34.12	$3,412	$0	$0	$0	$0	$3,412
	ELEC	U.C. per Sf			0	0	0	4	0	4
Voice Paging / Evac.		20,440.00	0		$0	$0	$0	$81,760	$0	$81,760

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number:*2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- MISC. COSTS - INTERIM STORAGE										
	ELEC	U.C. per Sf			0	0	0	2	0	2
Lightning Protection		20,440.00	0		$0	$0	$0	$40,880	$0	$40,880
	ELEC	U.C. per Sf			0	0	0	1	0	1
Grounding Grid		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
	ELEC	U.C. per Sf			0	0	0	1	0	1
Wiring Devices & Enclosures		20,440.00	0		$0	$0	$0	$20,440	$0	$20,440
Subtotal					$6,824	$0	$0	$163,520	$0	$170,344
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$2,862	$0	$0	$68,569	$0	$71,430
Subtotal Estimate										$241,774
Escalation					$2,485	$0	$0	$59,554	$0	$62,039
Contingency					$6,207	$0	$0	$148,738	$0	$154,945
---Total MISC. COSTS - INTERIM STORAGE			200		$18,378	$0	$0	$440,381	$0	$458,759
--- 9116.5 LIGHTING - INTERIM STORAGE										
	ELEC	U.C. per Sf			0	0	0	3.5	0	3.5
Lighting		20,440.00	0		$0	$0	$0	$71,540	$0	$71,540
Subtotal					$0	$0	$0	$71,540	$0	$71,540
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$29,999	$0	$29,999
Subtotal Estimate										$101,539
Escalation					$0	$0	$0	$26,055	$0	$26,055
Contingency					$0	$0	$0	$65,073	$0	$65,073
---Total 9116.5 LIGHTING - INTERIM STORAGE			0		$0	$0	$0	$192,667	$0	$192,667
--- 9116.6 ELECTRICAL - TRANSFER TUNNEL										
	ELEC	U.C. per SF		CN-ELEC	0	0	0	2.75	0	2.75
LIGHTING		1,500.00	0		$0	$0	$0	$4,125	$0	$4,125
	ELEC	U.C. per SF	0.03	CN-ELEC	1.024	0	2	0	0	3.024
VOICE PAGING / EVAC.		1,500.00	45	$34.12	$1,535	$0	$3,000	$0	$0	$4,535
Subtotal					$1,535	$0	$3,000	$4,125	$0	$8,660
Sales Tax					$0	$0	$150	$0	$0	$150
INEEL ORG Labor/Subcontractor Overheads					$644	$0	$1,321	$1,730	$0	$3,694
Subtotal Estimate										$12,505
Escalation					$559	$0	$1,147	$1,502	$0	$3,209
Contingency					$1,397	$0	$2,865	$3,752	$0	$8,014
---Total 9116.6 ELECTRICAL - TRANSFER TUNNEL			45		$4,135	$0	$8,483	$11,109	$0	$23,728

Project Name: **CONSTRUCTION DETAIL ITEM REPORT**
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL Org/Subcontractor	QTY		Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- 9301.1 CONSTRUCTION SUPPORT										
BWI	U.C. per Lot				174800	0	0	0	0	174800
Construction Support - .1% Of TCC		1.00	0		$174,800	$0	$0	$0	$0	$174,800
7620	U.C. per Wk		160	U60	3945.6	0	0	0	0	3945.6
Radiological Control Technicians - 4 FTE - 2 Years		104.00	16,640	$24.66	$410,342	$0	$0	$0	$0	$410,342
7610	U.C. per Hr		0.1	Z03	5.232	0	0	0	0	5.232
Radiation Control - Management Support - 10% OF RCT Total		16,640.00	1,664	$52.32	$87,060	$0	$0	$0	$0	$87,060
Subtotal					$672,203	$0	$0	$0	$0	$672,203
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$442,689	$0	$0	$0	$0	$442,689
Subtotal Estimate										$1,114,891
Escalation					$286,081	$0	$0	$0	$0	$286,081
Contingency					$1,162,807	$0	$0	$0	$0	$1,162,807
---Total 9301.1 CONSTRUCTION SUPPORT			**18,304**		**$2,563,780**	**$0**	**$0**	**$0**	**$0**	**$2,563,780**
--- 9301.2 CONSTRUCTION QUALITY CONTROL										
BWI	U.C. per Lot				174800	0	0	0	0	174800
Construction Quality Control - .1% Of TCC		1.00	0		$174,800	$0	$0	$0	$0	$174,800
Subtotal					$174,800	$0	$0	$0	$0	$174,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$174,800
Escalation					$44,854	$0	$0	$0	$0	$44,854
Contingency					$182,313	$0	$0	$0	$0	$182,313
---Total 9301.2 CONSTRUCTION QUALITY CONTROL			**0**		**$401,966**	**$0**	**$0**	**$0**	**$0**	**$401,966**
--- 9301.3 CONSTRUCTION DOCUMENTATION										
BWI	U.C. per Lot				873800	0	0	0	0	873800
PM Construction Document Control - .5% Of TCC		1.00	0		$873,800	$0	$0	$0	$0	$873,800
Subtotal					$873,800	$0	$0	$0	$0	$873,800
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$873,800
Escalation					$224,217	$0	$0	$0	$0	$224,217
Contingency					$911,354	$0	$0	$0	$0	$911,354
---Total 9301.3 CONSTRUCTION DOCUMENTATION			**0**		**$2,009,371**	**$0**	**$0**	**$0**	**$0**	**$2,009,371**

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3100 TESTING AND TURNOVER PLANNING										
	BWI	U.C. per Lot			349500	0	0	0	0	349500
Testing & Turnover Planning - .2% Of TCC		1.00	0		$349,500	$0	$0	$0	$0	$349,500
Subtotal					$349,500	$0	$0	$0	$0	$349,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$349,500
Escalation					$129,035	$0	$0	$0	$0	$129,035
Contingency					$488,106	$0	$0	$0	$0	$488,106
---Total OPC3100 TESTING AND TURNOVER PLANNING			0		$966,642	$0	$0	$0	$0	$966,642
--- OPC3200 S. O. TESTING										
	BWI	U.C. per Lot			8737700	0	0	0	0	8737700
SO Testing - 5% Of TCC		1.00	0		$8,737,700	$0	$0	$0	$0	$8,737,700
Subtotal					$8,737,700	$0	$0	$0	$0	$8,737,700
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$8,737,700
Escalation					$3,225,959	$0	$0	$0	$0	$3,225,959
Contingency					$12,202,932	$0	$0	$0	$0	$12,202,932
---Total OPC3200 S. O. TESTING			0		$24,166,591	$0	$0	$0	$0	$24,166,591
--- OPC3300 ORR SUPPORT										
	BWI	U.C. per Lot			384500	0	0	0	0	384500
ORR Support - .22% Of TCC		1.00	0		$384,500	$0	$0	$0	$0	$384,500
Subtotal					$384,500	$0	$0	$0	$0	$384,500
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$384,500
Escalation					$141,957	$0	$0	$0	$0	$141,957
Contingency					$536,987	$0	$0	$0	$0	$536,987
---Total OPC3300 ORR SUPPORT			0		$1,063,444	$0	$0	$0	$0	$1,063,444
--- OPC3400 FACILITY ACCEPTANCE REVIEW										
	BWI	U.C. per Lot			262100	0	0	0	0	262100
Facility Acceptance Review - .15% Of TCC		1.00	0		$262,100	$0	$0	$0	$0	$262,100

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3400 FACILITY ACCEPTANCE REVIEW										
Subtotal					$262,100	$0	$0	$0	$0	$262,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$262,100
Escalation					$96,767	$0	$0	$0	$0	$96,767
Contingency					$366,045	$0	$0	$0	$0	$366,045
---Total OPC3400 FACILITY ACCEPTANCE REVIEW			0		$724,912	$0	$0	$0	$0	$724,912
--- OPC3500 RADIOLOGICAL CONTROL SUPPORT										
	BWI	U.C. per Lot			192200	0	0	0	0	192200
Radiological Control Support - .11% Of TCC		1.00	0		$192,200	$0	$0	$0	$0	$192,200
Subtotal					$192,200	$0	$0	$0	$0	$192,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$192,200
Escalation					$70,960	$0	$0	$0	$0	$70,960
Contingency					$268,423	$0	$0	$0	$0	$268,423
---Total OPC3500 RADIOLOGICAL CONTROL SUPPORT			0		$531,584	$0	$0	$0	$0	$531,584
--- OPC3600 OPERATOR TRAINING										
	BWI	U.C. per Lot			3495100	0	0	0	0	3495100
Operator Training - 2% Of TCC		1.00	0		$3,495,100	$0	$0	$0	$0	$3,495,100
Subtotal					$3,495,100	$0	$0	$0	$0	$3,495,100
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$3,495,100
Escalation					$1,290,391	$0	$0	$0	$0	$1,290,391
Contingency					$4,881,201	$0	$0	$0	$0	$4,881,201
---Total OPC3600 OPERATOR TRAINING			0		$9,666,692	$0	$0	$0	$0	$9,666,692
--- OPC3700 OPERATING PROCEDURES										
	BWI	U.C. per Lot			768900	0	0	0	0	768900
Operating Procedures - .44% Of TCC		1.00	0		$768,900	$0	$0	$0	$0	$768,900

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
--- OPC3700 OPERATING PROCEDURES										
Subtotal					$768,900	$0	$0	$0	$0	$768,900
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$768,900
Escalation					$283,878	$0	$0	$0	$0	$283,878
Contingency					$1,073,833	$0	$0	$0	$0	$1,073,833
---Total OPC3700 OPERATING PROCEDURES			0		$2,126,611	$0	$0	$0	$0	$2,126,611
--- OPC3800 START-UP COORDINATION	BWI	U.C. per Lot			227200	0	0	0	0	227200
Startup Coordination - .13% Of TCC		1.00	0		$227,200	$0	$0	$0	$0	$227,200
Subtotal					$227,200	$0	$0	$0	$0	$227,200
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$227,200
Escalation					$83,882	$0	$0	$0	$0	$83,882
Contingency					$317,304	$0	$0	$0	$0	$317,304
---Total OPC3800 START-UP COORDINATION			0		$628,386	$0	$0	$0	$0	$628,386
--- OPC3900 SPARES	BWI	U.C. per Lot			1000000	0	0	0	0	1000000
Spares		1.00	0		$1,000,000	$0	$0	$0	$0	$1,000,000
Subtotal					$1,000,000	$0	$0	$0	$0	$1,000,000
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,000,000
Escalation					$369,200	$0	$0	$0	$0	$369,200
Contingency					$1,396,584	$0	$0	$0	$0	$1,396,584
---Total OPC3900 SPARES			0		$2,765,784	$0	$0	$0	$0	$2,765,784
--- GAPIF Non-Org G&A and PIF										
PF	NOGAPIF	U.C. per $			0	0	0	0	1	1
Procurement Fee %		1,744,349.00	0		$0	$0	$0	$0	$1,744,349	$1,744,349

Project Name:
UNEX Feasibility Study - Option D - Modified UNEX In NWCF
Project Location: *INTEC*
Estimate Number: *2570 - Option D*

CONSTRUCTION DETAIL ITEM REPORT

Client: *V. J. Balls*
Prepared By: *Rowley / Mitchell / Marler*
Estimate Type: *Planning*

LEVEL	Org/Subcontractor	QTY	Hrs	Crew/Rate	Labor	Const Eqp	Matl	S/C	Other	TOTAL
—	GAPIF Non-Org G&A and PIF									
Subtotal					$0	$0	$0	$0	$1,744,349	$1,744,349
Sales Tax					$0	$0	$0	$0	$0	$0
INEEL ORG Labor/Subcontractor Overheads					$0	$0	$0	$0	$0	$0
Subtotal Estimate										$1,744,349
Escalation					$0	$0	$0	$0	$0	$0
Contingency					$0	$0	$0	$0	$1,203,601	$1,203,601
—Total GAPIF Non-Org G&A and PIF			0		$0	$0	$0	$0	$2,947,950	$2,947,950
Subtotal MODIFIED UNEX IN NWCF - OPTION D					$**,***,***	$325,062	$90,236,009	$56,026,409	$2,025,779	$**,***,***
Sales Tax					$0	$0	$4,511,800	$0	$0	$4,511,800
INEEL ORG Labor/Subcontractor Overheads					$7,834,160	$125,003	$35,423,335	$4,969,900	$0	$48,352,397
Subtotal Estimate										$**,***,***
Escalation					$34,228,074	$115,487	$33,401,916	$9,891,188	$72,215	$77,708,880
Contingency					$99,549,211	$339,112	$62,777,746	$21,232,193	$1,383,960	$**,***,***
Total MODIFIED UNEX IN NWCF - OPTION D			512,008		$286,517,756	$904,663	$226,350,807	$92,119,690	$3,481,954	$609,374,869

MODIFIED UNEX PROCESS IN NWCF

@RISK Sensitivity Report

OPTION D

Sensitivity Ranking
Step-Wise Regression

Rank	Name	Cell	Regression	Weight	Amount	Level Markup
- PROJECT DEVELOPMENT / Contingency at F3, for Simulation 1						
1	EQUIPMENT	B22	0.5562	0.1751	$32,599,255	67%
2	SPECIALTIES	B21	0.5178	0.1630	$30,349,215	30%
3	PROJECT ACCEPTANCE/CLOSEOUT	B27	0.3728	0.1174	$21,848,153	102%
4	CONSTRUCTION MANAGEMENT	B7	0.2428	0.0764	$14,232,241	59%
5	PROJECT MANAGEMENT	B11	0.2140	0.0674	$12,545,556	43%
6	TECHNICAL DEVELOPMENT	B4	0.2002	0.0630	$11,735,849	101%
7	DECON SOLUTION PROCESSING	B6	0.1850	0.0582	$10,843,000	23%
8	GENERAL CONDITIONS	B14	0.1783	0.0561	$10,449,062	43%
9	TITLE II DESIGN	B9	0.1262	0.0397	$7,398,289	32%
10	MECHANICAL	B24	0.1069	0.0337	$6,266,707	41%
11	PROJECT EXECUTION	B5	0.0933	0.0294	$5,470,571	44%
12	TITLE I DESIGN	B8	0.0880	0.0277	$5,158,920	43%
13	QUALITY ASSURANCE	B10	0.0600	0.0189	$3,517,296	31%
14	CONSTRUCTION MISCELLANEOUS	B26	0.0391	0.0123	$2,291,167	83%
15	PROJECT DEVELOPMENT	B3	0.0329	0.0104	$1,927,218	33%
16	ELECTRICAL	B25	0.0272	0.0086	$1,596,147	51%
17	METALS	B17	0.0265	0.0084	$1,555,340	26%
18	CONCRETE	B16	0.0226	0.0071	$1,322,996	26%
19	Non-Org G&A and PIF	B28	0.0207	0.0065	$1,212,461	69%
20	CONVEYING SYSTEMS	B23	0.0184	0.0058	$1,078,556	9%
21	CONSTRUCTION AE SUPPORT	B12	0.0158	0.0050	$928,745	28%
22	SITEWORK	B15	0.0131	0.0041	$769,940	67%
23	THERMAL & MOISTURE PROTECTION	B18	0.0072	0.0023	$420,115	26%
24	FINISHES	B20	0.0053	0.0017	$310,463	26%
25	GOVERNMENT FURNISHED EQUIPMENT	B13	0.0044	0.0014	$258,164	130%
26	DOORS & WINDOWS	B19	0.0016	0.0005	$92,832	26%

3.1764

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MODIFIED UNEX PROCESS IN A GREEN FIELD FACILITY

@RISK Output Details Report

Output Statistics

Outputs	Contingency
Simulation#	1
Statistics / Cell	F3
Minimum	22228686
Maximum	275439040
Mean	122245592.1
Standard Deviation	35668522.23
Variance	1.27224E+15
Skewness	0.212454223
Kurtosis	3.094088199
NumErrs	0
Mode	131912237.2
5%	$64,187,656
10%	$76,683,504
15%	$84,461,929
20%	$91,314,248
25%	$97,757,688
30%	$103,280,224
35%	$108,056,576
40%	$112,237,552
45%	$116,950,719
50%	$122,338,736
55%	$126,955,816
60%	$130,884,624
65%	$134,862,574
70%	$139,252,207
75%	$144,914,000
80%	$151,282,641
85%	$158,849,875
90%	$167,473,973
95%	$183,359,656

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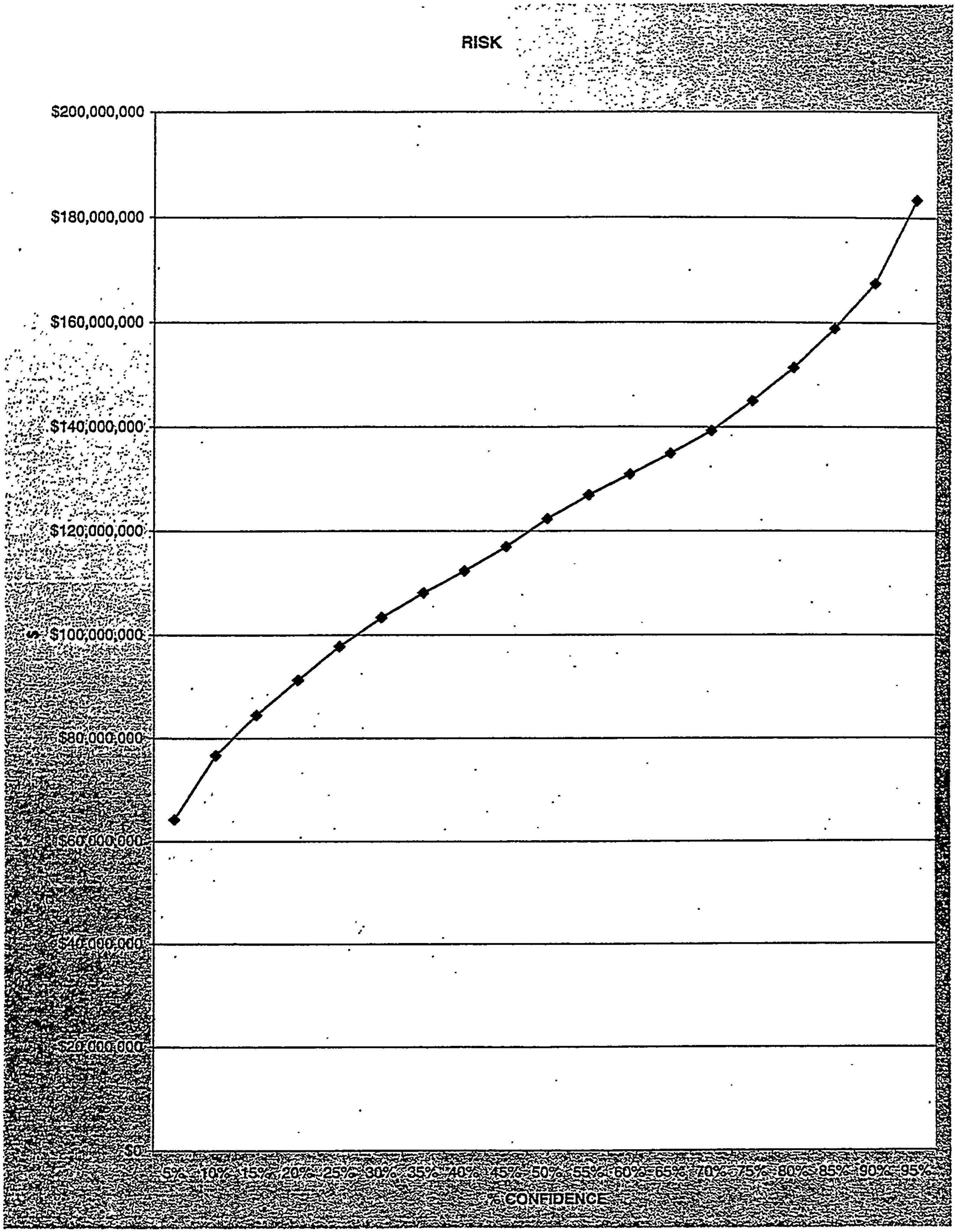
MODIFIED UNEX PROCESS IN A GREEN FIELD FACILITY



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Appendix F

Process Equipment Vendor Literature

ARGONNE NATIONAL LABORATORY - WEST
P.O. Box 2528, Idaho Falls, Idaho 83403-2528 Telephone: (208) 533-7627

March 16, 2000

Sylvester J. Losinski
BBWI
MS 3625
PO Box 1625
Idaho Falls, ID 83415

SUBJECT: **UNIX Process Cross Flow Filteration Equipment**

Dear : Mr. Losinski

Per your request please find attached the information concerning the "SpinTek" ST-II-25 cross flow filteration system.

The SpinTek vendor has stated that a stand alone system which utilizes the SpinTek technology is capable of meeting the following conditions:

- Particle removal efficiency of 95% with an inlet stream containing 3 gm/liter solids.
- A permeate flow rate of 200 g.p.h. when supplied with a feed inlet rate of 600 g.p.h. and solids concentration of up to 50% by weight.
- Filtration rate to be based upon 250 gallons of permeate per ft^2 of filter media per day. Each filter disk contains 1 ft^2 of media per 11" - ⌀ disk.

The SpinTek system would consist of two parallel flow filtration devices with 10 disks each, a supply pump capable of providing the required 600 g.p.h. flow rate of filter inlet feed, all electrical control and I&C equipment necessary for proper operation, and a tubular steel stand capable of supporting all mechanical and electrical components. The overall "foot print" size would be approximately 3' wide x 5' long x 5' high. Expected cost would run between $75K - $100K.

Also attached is information regarding an alternate filtration system manufactured by New Logic International Inc. which employs the cross flow filtration scheme. A review of the literature explains the difference between the SpinTek and V-Sep modes of operation and tends to indicate the V-Sep filtration system would have a higher maintenance demand due to its method of achieving the cross flow filtration shearing action. Consequently, I have not contacted the New Logic to discuss our application.

Sincerely,

Scott McBride

Scott D. McBride

SDM/rlo

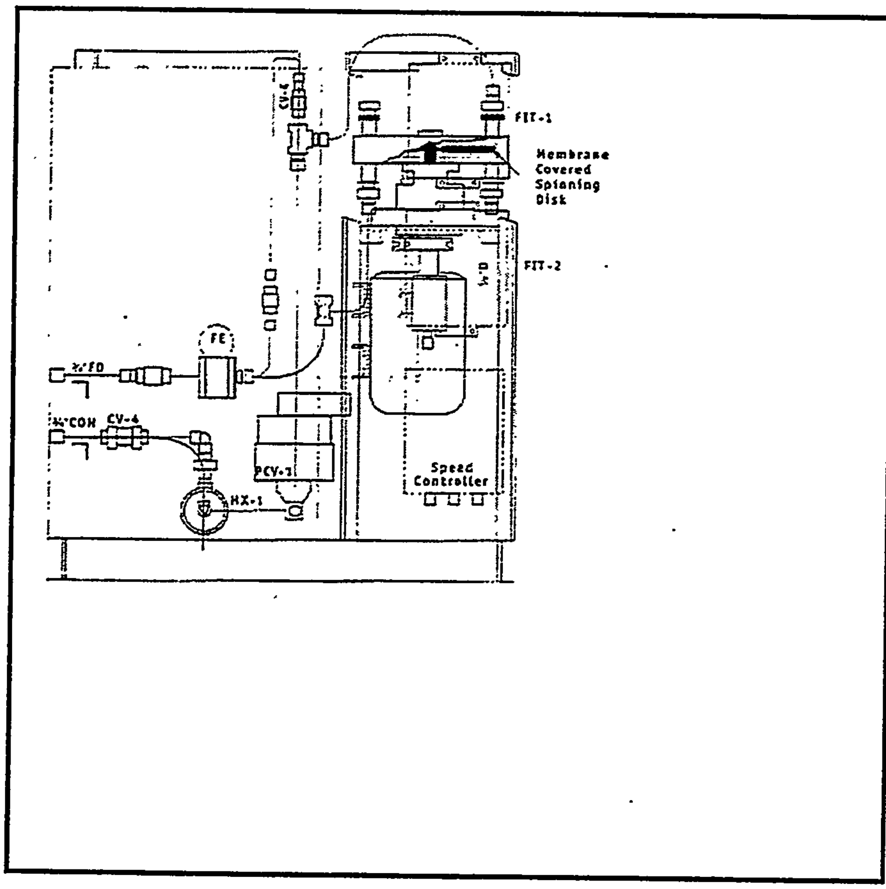
Attachments as stated

cc: w/o Attachments
T. J. Battisti
S. D. Herrmann
SDM File

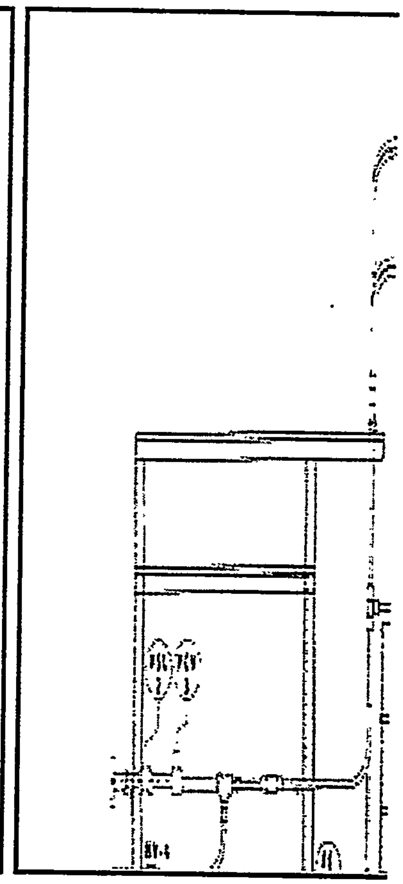
SpinTek™
Centrifugal Membrane Filtration

SpinTek™ ST-IIL and ST-II-25

Centrifugal Membrane System for Ultra and Microfiltration



ST-II-L



ST-II-25

SpinTek™ ST-II L

General
The SpinTek™ ST-II L is a compact cross flow membrane system that utilizes the unique SpinTek process of centrifugal action and shear force to prevent membrane fouling common to conventional systems. The ST-II L has wide open channels, uninhibited by mesh type turbulence promoters, allowing the system to process a wide variety of viscous solutions containing moderate to high solids.
The membrane can be easily removed from the system for inspection after testing or operation. The ST II-L membrane surface can be fully inspected unlike most other membrane systems.

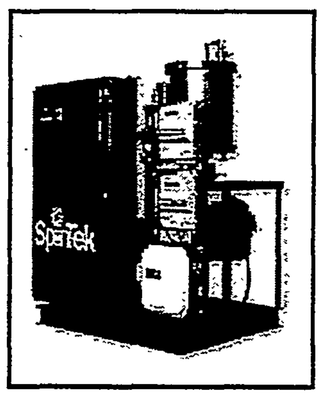
Membranes
The ST-II L can use a wide variety of ceramic or stainless steel membranes. Typical ceramic membranes include titania (Ti02), alumina (Al203), zirconia (ZrO2), or combinations of the three. Membrane pore sizes are available from 0.07 micron Up to 3 microns. Stainless steel membranes are available in pore sizes from 1 to 10 micron. SpinTek can install custom or prototype membranes on SpinTek ST-II disks.

SpinTek™ ST-II-25

General
The SpinTek™ ST-II-25 is a compact cross flow membrane system that utilizes the unique SpinTek process of centrifugal action and shear force to prevent membrane fouling common to conventional systems. The ST-II-25 has wide open channels, uninhibited by mesh type turbulence promoters, allowing the system to process a wide variety of viscous solutions containing moderate to high solids.
The membrane can be easily removed from the system for inspection after testing or operation. The ST-II-25 membrane surface can be fully inspected unlike most other membrane systems.

Membranes
The ST-II-25 can use a wide variety of ceramic or stainless steel membranes. Typical ceramic membranes include titania (Ti02), alumina (Al203), zirconia (ZrO2), or combinations of the three. Membrane pore sizes are available from 0.07 micron Up to 3 microns. Stainless steel membranes are available in pore sizes from 1 to 10 micron. SpinTek can install custom or prototype membranes on SpinTek ST-II disks.

ST-II-L



ST-II-25

Electronic Commerce

View our line items products complete with specifications and send us a RFQ online

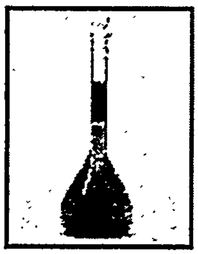
Literature by Fax

Receive our Product Specifications by Fax!

SpinTek™
Centrifugal Membrane Filtration

How To Keep Your Fluid Processing Budget From Going To Waste

INTRODUCTION



Finally, you can get reliable membrane filtration for even your toughest applications. The new SpinTek ST-II high shear rotary membrane filtration system is specifically designed for those applications previously considered unsuitable for membrane filtration. The unique centrifugal action of the SpinTek ST-II rotary membrane disk can form a slurry or concentrated sludge from a wide variety of feed solutions including kaolin, latex, calcium carbonate, yeast, radioactive precipitates and oily wastewater.

Here is how it works. Membranes are bonded to two sides of a disk, multiple disks are mounted on a hollow shaft that rotates the membranes disks at velocities up to 60 ft/sec, and stationary turbulent promoters are mounted near the rotary membranes to create high shear and turbulence. This high shear keeps the membrane surface clean to maximize filtrate throughput while allowing high concentration of solids to build in the concentrate.

STABLE PERFORMANCE

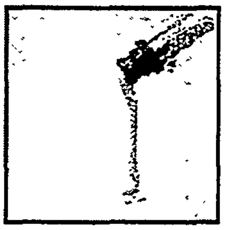
Membranes like to foul and when they do, down time occurs and usually chemical cleaning is required. Down time, chemical cost and chemical cleaning waste is a detriment to any system. The high shear of the ST-II reduces dramatically the need for cleaning. In a difficult radioactive waste concentration project, the ST-II ran for months at a time before cleaning was needed.

The stainless steel construction of the system combined with high tech ceramic membranes makes SpinTek's Systems ideal for operation in hostile environments, including high temperature, pH, radioactive waste, chemical and solvent solutions.

PUTTING THE POWER WHERE IT IS NEEDED

Energy is a major factor in calculating membrane system operating costs. SpinTek puts the power where it is needed and that is right at the membrane surface. Energy is directly applied to the turning membrane disk so no power is lost through high flow rate pumps or other process inefficiencies.

HIGH SOLIDS



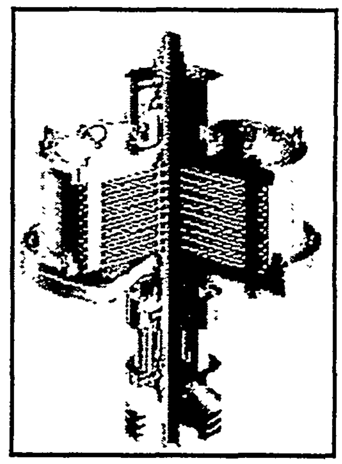
If you have ever tried to pump a high solids stream through a static membrane system to develop high shear, you know it is a costly proposition and at some point becomes impossible. This is where the new SpinTek ST-II takes over. The high shear rotating disks start working where other systems leave off. SpinTek ST-II can concentrate latex and kaolin clays up to 50%, calcium carbonate and oily sludges to 60%.

The new SpinTek ST-II is not only a filtration system but can be used as a dewatering device as well, rivaling some centrifuges. As an immediate concentration process prior to evaporators and spray dryers, SpinTek ST-II improves production substantially. The ST-II can increase kaolin clay spray dryer feed from 35% to 45% contributing directly to increased throughput with lower operating costs.

Most importantly, there is no need for costly filter aids or flocculating chemicals-eliminating secondary waste generation.

MEMBRANES

Because of its unique flat disk design, our rotating disks can be configured with many different types of microporous and ultrafiltration membranes constructed of either polymeric, metallic or ceramic materials. The heart of any membrane filtration system is, of course, its membrane. And several polymeric membranes such as PVDF, polysulfone, and polyether sulfone are available.



Also, ceramic membranes are now available using the latest nanopowder technique from a variety of materials including titanium dioxide (TiO_2), zirconia (ZrO_2), alumina ($Al2O_3$) and silica (SiO_2). These are available in ultra and micro filtration pore sizes.

NOT FOR EVERYONE

The new Spin Tek ST-II is not for every application. This system is designed for those tough applications where normal static membrane filtration works poorly or not at all. High solids, high viscosity or the need to fractionate is where the ST-II works best. The spinning disk system is the enabling technology on those tough jobs-that is why we have a complete line of static membrane filtration equipment including tubulars, hollow fibers and spiral wound elements. Such flexibility allows us to provide you with the best overall integrated solution for your application at the lowest possible operating and membrane replacement costs.

SpinTek™ has proven that integrated rotary and static membrane systems work well. Some examples are:

- styrene butadiene latex concentrates: a static system concentrates the solids from 1% to 20%-

the ST-II then takes the concentrate to 50% solids;

- metal coolants concentration to 10% with a static system and then to 60% oil with the ST-II; and
- radioactive waste concentration to 2% with a static system and then to 30% with ST-II.

FRACTIONATION

Fractionation of suspended solids with membrane filtration can be difficult. Under normal filtration conditions a boundary layer is formed on the membrane surface which begins to act as the filter barrier. Our high rotational speed creates turbulence which minimizes the formation of a secondary boundary layer. Such layers often become a filtration barrier in static membrane systems when trying to fractionate components. So for once, you can let the pore size of the membrane determine your system's true filtration rating. A membrane rated at 0.2 microns will actually act that way in a SpinTek System-with sharp pore size cutoffs.

SUMMARY

SpinTek™ Systems provides a complete line of membrane systems including rotary disks, tubulars, hollow fibers and spiral wound systems for chemical, nuclear, oil-water and wastewater separations. SpinTek also offers solvent extraction filters for applications in mining: hydrometallurgy and metals recovery, as well as innovative screen coalescers for industrial applications. If you have an application please call our Sales Department for information on our pilot rental systems or in-house testing capabilities. Do not let your processing budget go to waste-call SpinTek!

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Centrifugal Membrane Filtration

SpinTek™ Introduces New High Shear Rotary Cross Flow System for Micro and Ultrafiltration

A next generation rotary membrane system is now available from SpinTek™ Systems for filtration and fractionation of high fouling and viscous feed solutions. The patented rotary membrane device provides a high shear force to prevent membrane fouling with a wide variety of feed solutions containing moderate to high solids levels. The ST-II is available in small laboratory sized models to full production sized models for the food, beverage, and chemical industries. Successful operation has been performed in 90%+ recovery of protein from cheese whey, submicron filtration of lube oil, non-settleable solids concentration above 6,400 cP and fine chemical dewatering to above 40% solids. Systems are available with flow rates from 1 lph to over 50 gpm with operating pressure to 150 psig. The ST-II can use polymeric, ceramic and metallic membranes in various pore sizes and can also be configured to utilize any commercially available flat sheet membrane.

Description of Technology
SpinTek™ has developed a new generation high speed rotating membrane filtration system for laboratory and industrial applications. The new SpinTek ST-II utilizes membrane disks that are rotated at variable speeds up to 20m/s to achieve an antifouling force enabling membranes to solve problems not possible before with conventional membrane systems.

The new ST-II offers high and stable membrane flux allowing long term operation between cleaning, the ability to concentrate material up to 6,400 cP, and also to very effectively fractionate closely sized material. The ST-II is capable of this operation due to its unique design of spinning the membrane configured disks near a stationary element. This concept provides a very high relative velocity and shear between the membrane and the feed water effectively minimizing membrane fouling. This translates to high filtrate flow rates.

The energy to control fouling is transferred directly to the membrane surface where it is most effective. The ST-II does not require large and expensive recirculation pumps to attempt to minimize fouling as with conventional static membrane systems. The ST-II is capable of effectively controlling the boundary layer which causes fouling and reduction of permeation flow-- power is transferred directly to the membrane surface for highest efficiency.

The ST-II has a unique rotating membrane disk design that eliminates the need for artificial turbulent promoters that can plug with solids and lower system performance. The ST-II can be operated as a microfilter, ultrafilter or nanofilter.

Brief Background of Company
The Management of SpinTek has collectively over thirty years experience with membrane filtration systems and over ten years' experience with rotating membrane systems. The Company holds numerous worldwide patents on the SpinTek technology as well as other filtration patents for solvent extraction of copper.

Effect Caused by Rotating Disks
Two major effects are created by the dynamic spinning action of the new SpinTek ST-II system. The

high shear allows for concentration and dewatering of solids to in some cases above 40%. It also keeps the membrane surface clean so that permeation of material below the cut off size of the membrane can occur.

This is especially useful in such applications as bacterial filtration of food or chemical solutions and protein separation from fermentation broths.

Specific examples of ST-II successes are vanilla extract bacterial filtration without color loss, latex recovery up to 50%, hydrated aluminum concentration to 40%, yeast concentration above 35%, biodigester sludge concentration and blood plasma fractionation.

Field Tests
Laboratory sized pilot units are available with 0.5 sqft of membrane area and larger pilots up to 25 sqft are available. Both types of field test units can be configured with a wide range of polymeric membranes including TFC, PVDF, polysulfone and others plus a selected supply of ceramic membranes. Most membranes are available in pore sizes ranging from 200 NMWC up to 3 microns. Virtually any type of custom membrane developed by materials researchers can also be configured into the ST-II laboratory pilot.

Field test data for many applications are available from SpinTek. Pilot units are available in both standard and explosion proof ratings.

Laboratory and Production Uses
Small lab size units are available as well as production sized units with up to 150 square feet of membrane surface. The systems are capable of processing small volumes up to 50 gpm of permeate flow rate. All stainless steel construction, explosion proof and sanitary versions are available. Piping, instrumentation and controls can be configured to meet any plant specifications and requirements.

Advantages Over Conventional Membrane Systems
The rotation of the membranes allow for the energy to be applied directly to the membrane surface where it is needed to reduce fouling and the boundary layer. Efficiency is not lost by utilizing large, high pressure pumps to recirculate mass amounts of feed solution through the system to reduce fouling. It is typical for traditional cross flow membrane filters to recirculate over 98% of the feed stream, whereby the SpinTek ST-II requires less than 50% recirculation which is used for mixing. The ST-II, due to the high rotor speed, is capable of controlling the boundary layer to effectively cause fractionation. Membrane filtration is now possible for fractionation of similarly sized particles. An example is defatting of cheese whey. Conventional static membrane systems build up a layer of solids and fat on the membrane surface which impedes the passage of protein through the membrane by up to 65%. The ST-II prevents this material build up on the membrane and allows passage of over 95% of the pure protein at the same time withholding 90%+ of the fat.

Membrane systems have been plagued in the past with severe membrane fouling, concentration limitations, low fluxes and device plugging. The ST-II can operate without prefilters.

Types of Membranes

- Polymeric membranes--hydrophilic and hydrophobic, low protein binding, solvent resistive
- Ceramic membranes
- Metallic membranes
- Pore sizes are available from 200 NMWC up to 3 microns

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SpinTek ST-II-25: Centrifugal Membrane System for Ultra- and Microfiltration

› Controls and Instrumentation

The SpinTek ST-II-25 is fully instrumented and automated for production use or pilot testing. The ST-II-25 controller is simple to operate with a NEMA 4 rated panel, lights, and switches. Explosion proof ratings are also available.

Standard control system includes full PLC control with an operator interface terminal for setpoint entry. Instruments include a variable frequency drive with power output, a feed pressure transmitter with PID pressure control, temperature transmitter and heat exchanger for full temperature control. Alarms are provided for customer specifications. The ST-II-25 rotor motor has a variable speed from 0 to 1200 rpm. Special instrumentation can be provided upon request.

› Construction

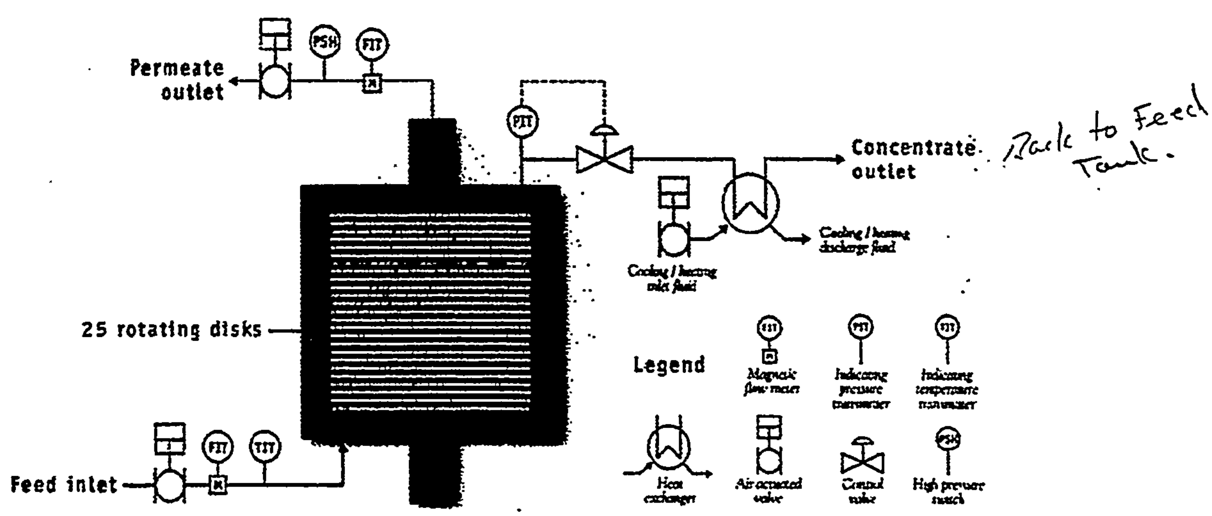
The ST-II-25 is built to process an extensive range of feed solutions. To meet the stringent requirements of industrial filtration, all wetted parts of the ST-II-25 are manufactured of 304 SS standard. 316 SS, PTFE and Viton are optional. Special systems can be manufactured with alternate alloys and elastomers.

All components of the system are rated for operation at 100 psig that allows for the use of microporous and ultrafiltration membranes.

ST-II-25 Flow data, power requirements and dimensions

Qty	Total Area ft² [m²]	Feed	Concentrate	Permeate	Hp [kW]	L x W x H inches [cm]	lbs [kg]
25	25.0 [2.3]	1 1/2"	1 1/2"	1"	25 [18.75]	48 x 64 x 84 [122 x 163 x 213]	1500 [680]

ST-II-25 Process and instrument diagram



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SpinTek ST-II *L*: Centrifugal Membrane System for Ultra- and Microfiltration

Centrifugal and high shear action

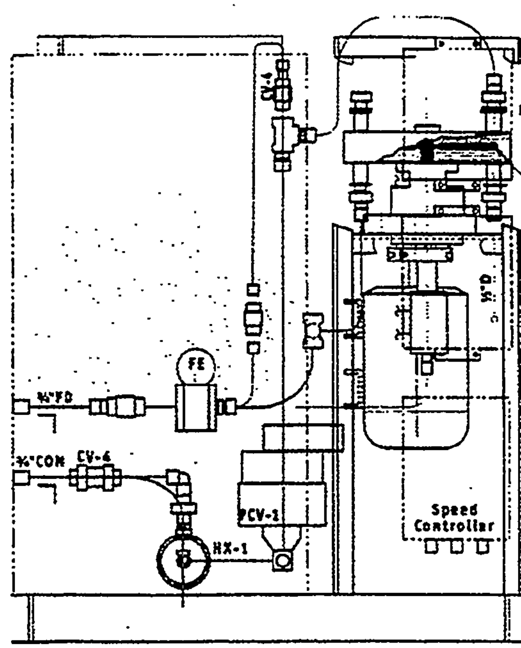
Single or 3 disk models available

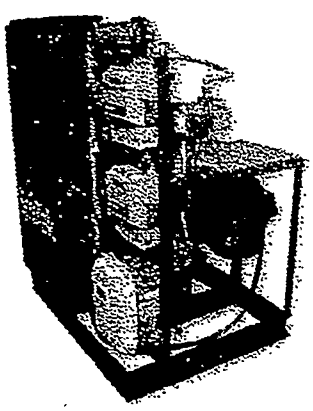
Variety of pore sizes available

Ideal as pilot system or small production system

Explosion proof optional

316 stainless steel construction





>General

The SpinTek™ ST-II *L* is a compact cross flow membrane system that utilizes the unique SpinTek process of centrifugal action and shear force to prevent membrane fouling common to conventional systems. The ST-II *L* has wide open channels, uninhibited by mesh type turbulence promoters, allowing the system to process a wide variety of viscous solutions containing moderate to high solids.

The membrane can be easily removed from the system for inspection after testing or operation. The ST-II *L* membrane surface can be fully inspected unlike most other membrane systems.

>Membranes

The ST-II *L* can use a wide variety of ceramic or stainless steel membranes. Typical ceramic membranes include titania (TiO_2), alumina (Al_2O_3), zirconia (ZrO_2), or combinations of the three. Membrane pore sizes are available from 0.07 micron up to 3 microns. Stainless steel membranes are available in pore sizes from 1 to 10 micron. SpinTek can install custom or prototype membranes on SpinTek ST-II disks.

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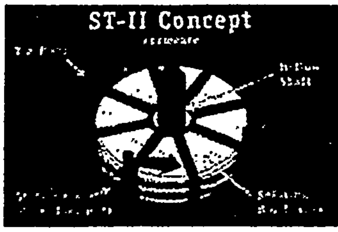


SpinTek ST-II *L*: Centrifugal Membrane System for Ultra- and Microfiltration

› Controls and Instrumentation

The SpinTek ST-II *L* is fully instrumented and automated for production use or pilot testing. The ST-II *L* controller is simple to operate with a NEMA 4 rated panel, lights, and switches. Explosion proof ratings are also available.

Standard control system includes full PLC control with an operator interface terminal for setpoint entry. Instruments include a variable frequency drive with power output, a feed pressure transmitter with PID pressure control, temperature transmitter and heat exchanger for full temperature control. Alarms are provided for customer specifications. The ST-II *L* rotor motor has a variable speed from 0 to 1200 rpm. Special instrumentation can be provided upon request.

› Construction

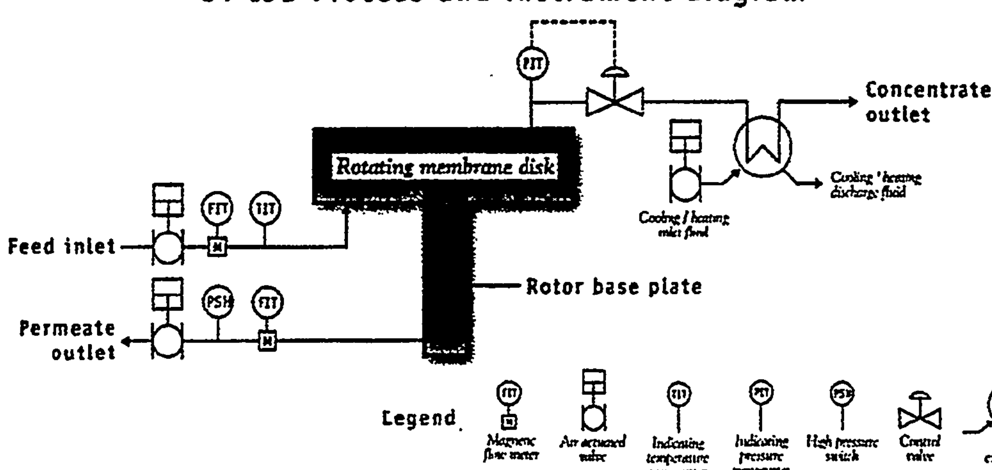
The ST-II *L* is built to process an extensive range of feed solutions. To meet the stringent requirements of industrial filtration, all wetted parts of the ST-II *L* are manufactured of 304 SS standard. 316 SS, PTFE and Viton are optional. Special systems can be manufactured with alternate alloys and elastomers.

All components of the system are rated for operation at 100 psig that allows for the use of microporous and ultrafiltration membranes.

ST-II *L* Flow data, power requirements and dimensions

Model Number	Membrane Module		Connections Swagelok™ Female Tube Fittings			Rotor Motor	Skid	Weight
Model	Qty	Total Area ft² [m²]	Feed	Concentrate	Permeate	Hp [kW]	L x W x H inches [cm]	lbs [kg]
ST-II-1	1	1.0 [0.09]	3/4"	3/4"	1/2"	2.0 [1.5]	34 x 42 x 48 [86 x 107 x 122]	1000 [450]
ST-II-3	3	3.0 [0.28]	3/4"	3/4"	1/2"	3.0 [2.25]	34 x 42 x 48 [86 x 107 x 122]	1200 [544]

ST-II *L* Process and instrument diagram



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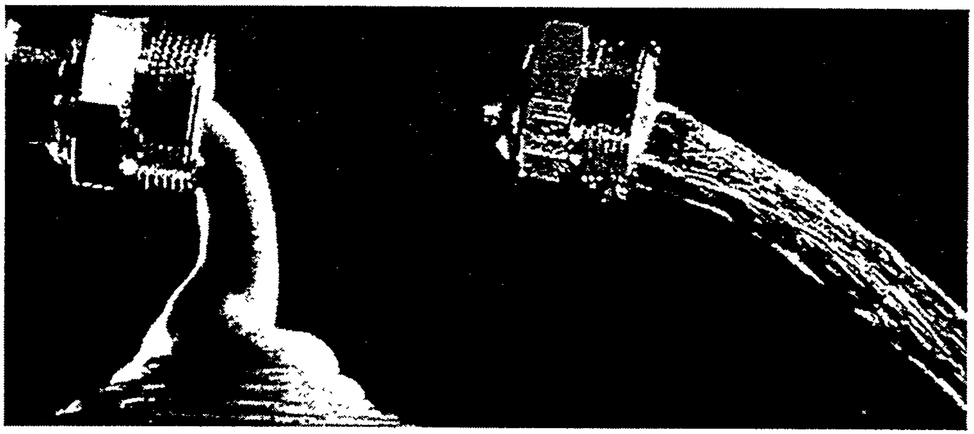
INTRODUCTION TO V✧SEP

. . . A New Standard In Rapid Separations ·



New Logic International presents VSEP (Vibratory Shear Enhanced Processing), a patented non-fouling membrane filtration system. At last, membranes can deliver on the promise of sustained and precise separation of product and waste streams.

The application of intense shear waves at the membrane surface has solved the age-old problem of membrane fouling.

VSEP's shearing action actually sweeps away foulants from the membrane surfaces, allowing high solids concentrations and very high filtration rates.

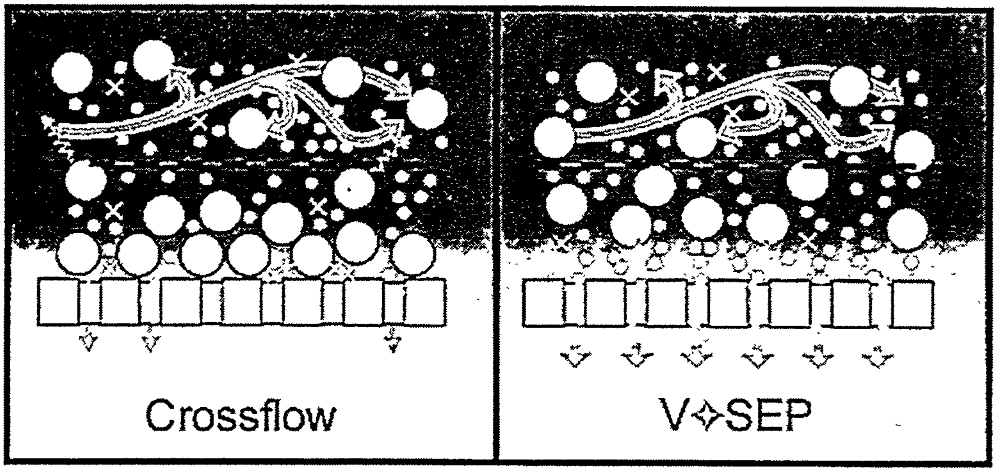
VSEP is a less expensive alternative to conventional separation systems such as centrifuges, bioreactors, sedimentation, flocculation and other less efficient filtration systems.

VSEP systems are being used in a diverse array of applications by major corporations throughout the world. New applications are continually being added as corporate researchers discover new and exciting uses for this innovative separation technology.

VSEP offers high flux rates, high concentration limits, low operating costs and total dependability in separations ranging from low molecular weights through 30 microns. These unique features, offered for the first time in a membrane system, have allowed VSEP to become a new standard in rapid separations.

TECHNOLOGY REVIEW

High Shear Sets V✧SEP Apart



Membrane-based separations of liquids from solids have enjoyed increasing popularity over the last 20 years. This increased interest has been driven by several unique advantages offered by membranes over competing separation techniques such as flocculation with vacuum filtration, centrifugation, and ion exchange. Those advantages include:

Perfect separation and crystal clear permeate.

Controlled size exclusion through selection of pore sizes extending from microns to molecular dimensions.

Excellent materials compatibility due to a wide variety of available membranes. Membrane separations are, however, still largely confined to the processing of high value, low volume streams due to the relatively high capital cost and low throughput capacity of these systems.

In addition, membrane separations suffer from fouling (a long term loss in throughput capacity due to membrane degradation), and they cannot concentrate feed slurries to high solids concentrations due to the rheological requirement that the feed material remain watery in consistency.

Large industrial separations involving millions of gallons per day such as mineral clay slurries, paper pulp, and waste water still require multi-step processing. Typically, chemical flocculation is used to consolidate small particulate solids, followed by vacuum filtration, sedimentation, feeding to spray dryers or filter presses, and other standard deterring techniques.

To broaden the use of membrane separations into mainstream chemical processing, five things are needed:

- High filtration rates
- Fouling resistance
- Solids levels suitable for feeding a spray dryer or filter press
- Low Cost
- Inherent reliability

Inherent reliability

V✧SEP Broadens Membrane Use. . .

Historically, membrane systems designers have struggled to reduce fouling by using tangential flow or cross flow filtration. In this method, membrane elements are placed in a plate-and-frame, tubular, or spiral-wound cartridge assembly, through which the substance to be filtered (the feed stream), is pumped at a high velocity to create shear forces.

In cross flow designs, it is not economic to create shear forces measuring more than 10-15 thousand inverse seconds. This limits the use of cross flow to low-viscosity (watery) fluids, further restricting the use of conventional membrane separations systems.

New Logic has developed an alternative method for producing intense shear waves on the face of a membrane leaf element. The technique is called Vibratory Shear Enhanced Processing (VSEP).

In a VSEP system, the feed slurry remains nearly stationary, moving in a leisurely, meandering flow between parallel membrane leaf elements. The leaf elements move in a vigorous vibratory motion in a direction tangent to the faces of the membranes. The shear waves produced by the membrane's vibration cause solids and foulants to be repelled and allow liquid to flow to the membrane pores unhindered.

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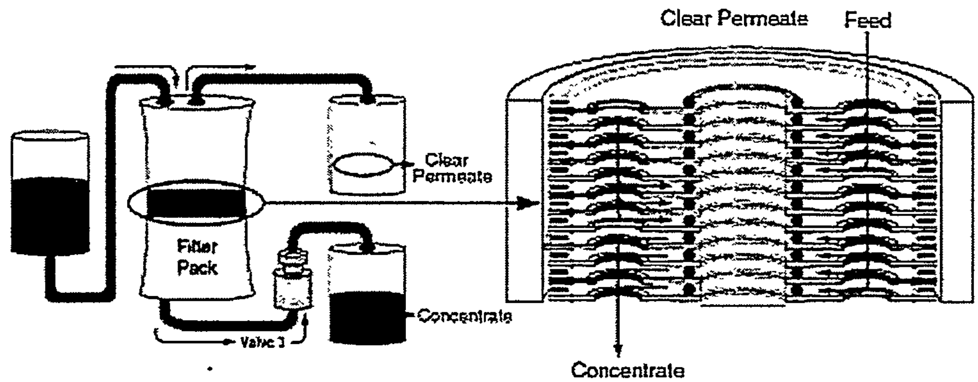
OPERATION REVIEW

V◇SEP Uses High Shear to Prevent Fouling



In an industrial VSEP machine, the leaf elements are arrayed as parallel discs separated by gaskets. The disc stack resembles records on a record changer and is spun in a torsional oscillation. This motion is analogous to the motion of the agitator of a washing machine but occurs at a speed faster than that which can be perceived by the human eye. The oscillation produces a shear rate at the membrane surface of about 150,000 inverse seconds. This rate is ten times greater than the rate obtained using conventional crossflow systems.

In crossflow systems, as little as 10% of the energy required to run the system is converted to shear. In contrast, VSEP enables nearly 99% of the total energy to be converted to shear. The shear is created at the membrane surface where it is most useful in preventing fouling.

Because VSEP does not depend on the shearing forces of the feed flow, the slurry can become extremely viscous and still be successfully dewatered.

The final product is essentially extruded between the vibrating disc elements and out of the machine.

By greatly reducing fouling, the very high shearing produced by VSEP has been shown to prevent diminished filtration rates in a large number of applications. VSEP's resistance to fouling is greatest when the membrane micro-structure is a non-depth type of filtration media (analogous to a screen or colander). Membranes containing cylindrical pores are ideal for use with VSEP.

Non-stick membrane surfaces of polypropylene and teflon also resist fouling when used in VSEP machines, especially when the tightest possible pore size is selected.

Because shear originates at the membrane surface and not in the process fluid, a VSEP machine can be operated successfully in a single pass.

In single pass operation the feed material enters the disc pack, experiences shear forces and is dewatered progressively as it cascades from disc to disc. The final product, once it reaches the desired end point concentration, exits the stack.

The disc pack holdup volume is less than 50 gallons. Therefore, product recovery in batch processes can be extremely high. Waste after draining the stack is less than 2-3 gallons of material.

System Operation

At startup the VSEP system is fed with a slurry and valve one (see the diagram above) is closed. Permeate is produced and suspended solids in the feed are collected inside the VSEP filter pack.

After a programmed time interval, valve one is opened to release the accumulated concentrated solids. The valve is then closed to allow the concentration of additional feed material. This cycle repeats indefinitely.

Membrane selection is the single most important parameter that affects the quality of the separation. Other important parameters that affect system performance are pressure, temperature, vibration amplitude, and residence time. All of these elements are optimized during testing and entered into the programmable logic controller (PLC) which controls the automation of the system.

The operating pressure is created by the feed pump. VSEP machines can routinely operate at pressures as high as 500 psi. Machines have been modified to operate at higher pressures as well. While higher pressures often produce increased permeate flow rates, they also use more energy. Therefore, an operating pressure is used that optimizes the balance between flow rates and energy consumption.

In most cases, the filtration rate can be further improved by increasing the operating temperature. The temperature limit on a standard VSEP system is 175 °F. Higher temperature constructions are available.

The vibration amplitude and corresponding shear rate can be varied and directly affect filtration rates. Shearing is produced by the torsional oscillation of the disc stack. Typically the stack oscillates with an amplitude of 1 inch peak to peak displacement at the rim of the stack. The oscillation frequency is approximately 60 Hz. This produces a maximum shear intensity of about 150,000 inverse seconds.

Feed residence time is set by the frequency of the opening and closing of the exit valve (valve one). The solids level in the feed increases as the feed material remains in the machine.

Large particles, greater than about 200 microns in size should be removed by screening, sedimentation, or other methods before the material is fed to a VSEP unit. Larger particles may cause abrasion damage to the membrane's surface.

Under normal operating conditions, a VSEP system requires the same amount of operator attention as a pump. Like a pump, a VSEP system performs the instant power is applied.

The VSEP system provides a separation that is entirely physical. No chemical addition or other operator intervention is required.

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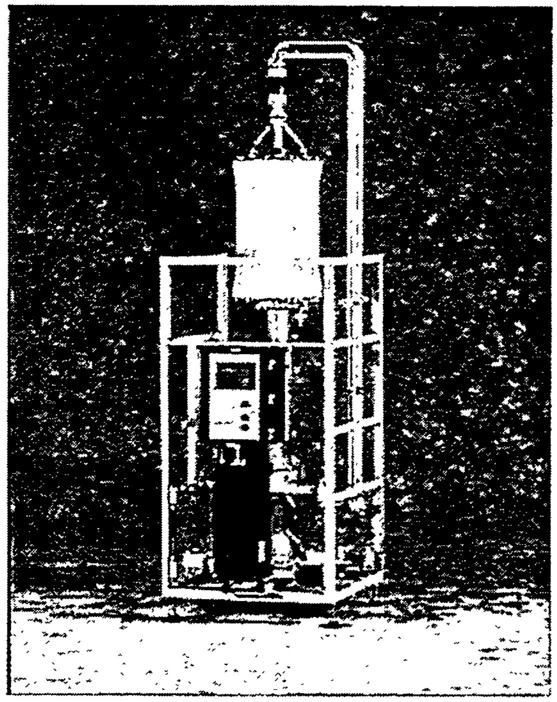
SYSTEM REVIEW

System Components



The VSEP filtration system consists of 5 major components: the frame, the drive system, plumbing, the filter pack and the control system.

Frame: A 2" tubular steel construction is used with an epoxy powder coat to assure resistance to chemicals and weather.

Drive system: This patented system includes a 10-20 horse power motor which drives an eccentric weight and seismic mass which in turn translates the energy through the torsion spring into the filter pack.

Plumbing: Teflon (FEP), polypropylene and stainless steel are used throughout to assure maximum compatibility with most solvents, caustics and acids.

Filter pack: VSEP machines are normally constructed of either polypropylene or kynar. Membranes offered include polypropylene, teflon, polysulfone, polycarbonate, stainless steel, nylon, acrylic, and many others.

Membranes containing a wide range of pore sizes are available. At one extreme, reverse osmosis membranes reject everything but water molecules. Ultrafiltration membranes can reject molecules of sizes ranging from 100 M.W. to 1 million M.W.) while microfiltration membranes are available with pore sizes ranging from 0.1 micron to 10 microns. At the other extreme, woven screens are available from 1 micron pore size to standard mesh sizes.

The standard modular size of a VSEP machine is 100 to 1,000 square feet composed of discs with a 19 inch active diameter. Each disc element is manufactured and quality assured by New Logic.

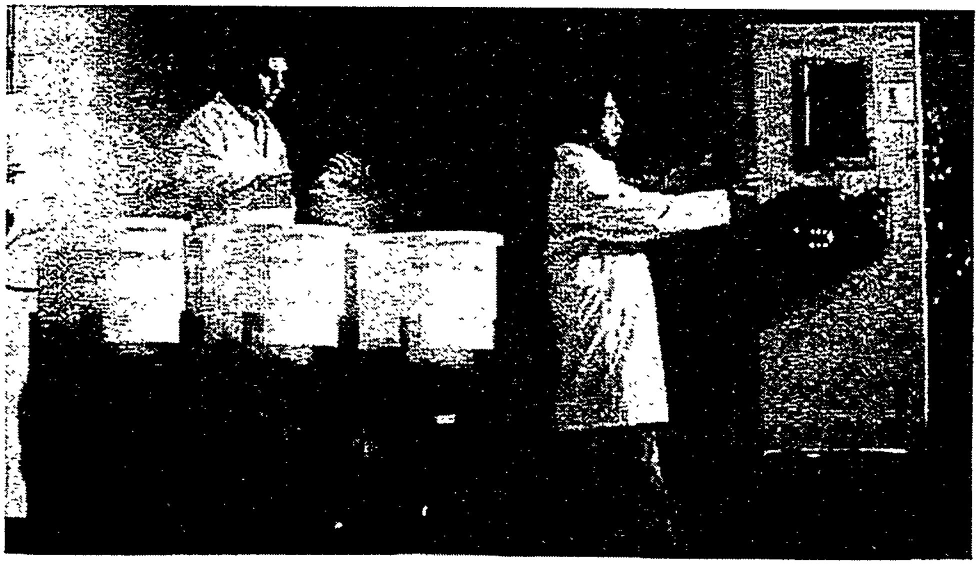
Control system: VSEP systems are normally supplied complete with Allen Bradley SLC 500 series Programmable Logic Controllers. All components are fully contained in a NEMA 4 rated enclosure.

Various levels of control sophistication are available depending on the complexity of the application. For polishing or low solids applications simple controls having minimal outputs and inputs are provided.

For high solids applications controls with more features are used. The VSEP controller typically sets solids levels by actuating the exit valve based on operating parameters such as motor current or temperature.

Other control options available include automatic clean in place, automatic flush, automatic shut down, full alarm features with digital diagnostic displays, remote diagnostics and monitoring, and many others. New Logic engineers have spent diagnostics and monitoring, and many others. New Logic engineers have spent years perfecting VSEP controls to maximize reliability and to minimize operator intervention

Implementation

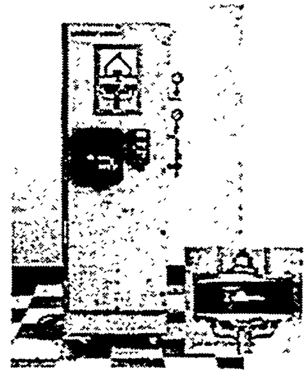


New Logic has run thousands of test samples, therefore it is very probable that data already exist on a sample similar to yours. In any case New Logic can test your material to determine general performance parameters and feasibility. Upon completion of testing in Emeryville, California, a comprehensive report outlining all pertinent data collected is delivered to you along with collected samples of permeate and concentrate.

For further studies to determine optimal shear intensity, pressures, and membrane choice, we recommend that you rent a Series L system. The Series L contains 0.5 square feet of membrane area and allows for easy membrane changing and pressure and shear level adjustment.

Series L is a laboratory-scale machine that holds a single piece of sheet stock membrane. Membrane can be supplied by New Logic or provided by you and hand-cut with a pair of scissors. Because the Series L simulates the environment of a single disc inside a full scale series i system, scale-up calculations can be made.

The Series L runs on 230 volt 3 phase 50/60 hz and consumes about 1 KVA. The feed pump can be supplied by New Logic, or user-supplied. The Series L comes in a caster-mounted cabinet 2 foot square by 7 feet tall and weighs about 500 pounds. For further validation, visit New Logic's modern wet test facility and run your material on a full-scale pilot plant where you can simulate all of the characteristics of a full-scale Series i system.



Series i system modules contain up to 1000 square feet of membrane area.For larger applications the Series i can easily operate in parallel with other Series i machines which share a single control system.

All of the data and information collected during testing is used to customize a Series i to your specific requirements. Controls, motor sizing, membranes and materials of construction will all be specifically selected to assure an optimized system that will give many years of trouble-free service.

To schedule testing or Series L rental, contact a New Logic sales engineer.

EIGHT REASONS V◇SEP OUTPERFORMS

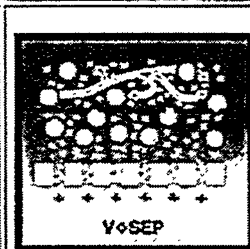
Changing The Way Engineers Think About Separations

1. High Filtration Rates:

In the separation of most products, VSEP rates average ten times higher than competing membrane technologies such as cross flow filtration. In addition to high rates, there is no product loss as there is in a centrifuge, and unlike rotary drum filters and filter presses, no flocculant addition is required.

2. Fouling Resistance:

VSEP systems use a patented vibratory shear process to keep the membrane surface clean. Most conventional filtration systems rely on less efficient shear forces far removed from the membrane surface to attempt to reduce fouling effects. Processes such as dewatering, counter current washing and size classification all benefit from VSEP's shearing action.



3. High Solids:

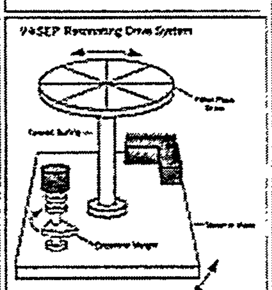
Systems which rely on the feed flow to create shear become increasingly inefficient as the feed stream concentrates. They stop operating as the stream becomes viscous. Because VSEP relies on a vibrating membrane surface to create shear it is able to achieve very high concentrations while retaining fouling resistance. The only solids limit is the ability to discharge the material.

4. High Efficiency:

In the VSEP system, shear waves are focused on the membrane surface allowing for a 99% conversion of energy to shear. In typical crossflow systems where only 10% of the energy is actually converted to shear, most of the energy is spent overcoming pressure drops associated with flow turnarounds and screens.

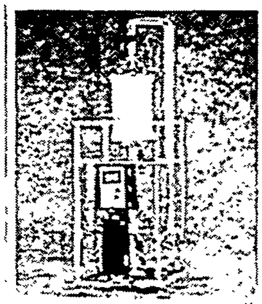
5. Engineered Dependability:

A VSEP system has only two moving parts; the torsion spring (which is tested to assure infinite life), and the bearings (which are automatically lubricated). Membrane integrity is guaranteed through a patented redundant membrane system (RMS). If a membrane element failure occurs it is immediately and automatically repaired.



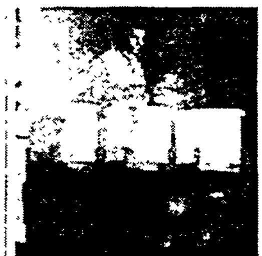
6. Compact Design:

A VSEP system occupying only 16 square feet of floor space supports up to 1000 square feet of membrane area and does the work of a system occupying 10 to 50 times that space. The system is also modular and will allow for easy expansion.



7. Convenient Testing:

New Logic offers a modular approach to system testing. Start with a comprehensive sample test and report provided by New Logic. Then rent a compact Series L laboratory scale system for in house data collection. For further validation, visit New Logic's modern wet test facility and run your material on a full scale pilot plant where you can simulate all of the characteristics of a full scale Series i system.



8. Low Cost:

VSEP uses less energy due to the high efficiencies of the system and uses less membrane area and processing time due to the high rates of the system. VSEP also offers reduced membrane replacement and cleaning maintenance due to the elimination of fouling, less floor space due to the compact design, and less maintenance due to the minimization of moving parts. All this adds up to a low cost separation system.

NEW LOGIC
INTERNATIONAL, INC.

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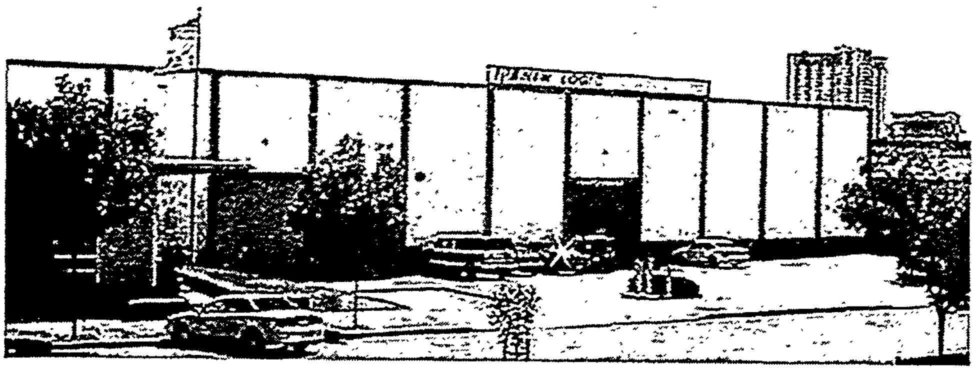
Company Profile



New Logic International is a privately held Corporation founded in 1984. Located in a 100,000 square foot facility in Emeryville, California, New Logic manufactures next generation filtration systems utilizing a patented technology known as VSEP (Vibratory Shear Enhanced Processing).

Our customer base includes a large cross section of the Fortune 500, and covers a wide range of industries including chemical, pulp and paper, mining, paints and pigments, municiple water and waste, oil production/ processing. As New Logic continues to increase the capabilities of VSEP, new applications and customers are continually being added.

New Logic International, 1295 Sixty-Seventh Street, Emeryville, CA 94608

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INEEL
Idaho National Engineering & Environmental Laboratory

INTEROFFICE MEMORANDUM

Date: April 4, 2000

To: Syl Losinski

From: Jila Banaee

Subject: Mercury Amalgamation

Enclosed is the information about mercury amalgamation by two commercial vendors, the ADA Technologies and Nuclear Fuel services, as requested. The information includes a description of the type of equipment used and the demonstration results for stabilization of elemental mercury.

Thanks.

Jila

News

ADA Technologies Names New Vice President of Technology Programs

ENGLEWOOD, Colo., March 23, 1999

– Marty Mastroianni has been named vice president of technology programs at ADA Technologies, Inc., where he will manage the technical staff and provide direction and assistance in business development, President Judy Armstrong announced. *The full story*

ADA Technologies Continues Development of Mercury Control Technologies

ENGLEWOOD, Colo., March 23, 1999

– Three mercury control technologies in various stages of development at ADA Technologies, Inc. hold promise for a number of commercial and government applications, according to the person in charge of business development for mercury technologies. *The full story*

Top of page

ADA Technologies
*Tom Broderick msg 303-792-5615
• Greg Glatzmaier greg.glatzmaier@adatech.com

Rick Woods @ INTEC
. he is involved with ADA

Oak Ridge
John Leckey msg

leckeyjh@y12.doe.gov
423-576-5605

The full story . . .

ADA Technologies Continues Development of Mercury Control Technologies

ENGLEWOOD, Colo., March 23, 1999

Three mercury control technologies in various stages of development at ADA Technologies, Inc. hold promise for a number of commercial and government applications, according to the person in charge of business development for mercury technologies.

Brian Sperry, ADA's mercury business development manager, said the company has developed expertise in all areas of mercury control, including in air emissions, water and solid waste. In fact, he believes the "suite of capabilities" that has been created at ADA make it the preeminent mercury treatment technology company in the country today.

One technology developed by ADA uses a regenerable sorbent to remove vapor-phase mercury from gaseous waste streams generated when certain types of wastes are thermally treated or when coal is burned to generate power. The sorbent is undergoing field testing at a Department of Energy (DOE) plasma arc centrifugal treatment facility in Butte, Montana, and at a coal research and test facility in Pittsburgh, Pennsylvania.

"This technology can help operators of hazardous waste incinerators meet new regulations that are anticipated in the next couple of years that will require less mercury in their off gases, and it also could be of use to coal-fired power plants if clean air regulations take effect as anticipated," Sperry said.

A second mercury control technology has shown good results in field demonstrations at the Y-12 plant at Oak Ridge, Tennessee, where a unit has been removing soluble mercury in creek water to very low concentrations for more than 15 months. Potential customers for the sorbent-based technology include DOE facilities and any industry that has mercury in its wastewater, according to Sperry. ADA also has developed a method of removing mercury from the wastewater leaving dental offices that could be used by medical and other commercial laboratories.

To address another problem facing DOE, ADA has developed a process for stabilizing radioactively contaminated liquid mercury generated in past weapons production activities. The process, which combines a proven mercury stabilization method with a scaleable, economically viable mixing technology, stabilizes the mercury so that it can be disposed of in landfills for non-hazardous, low-level radioactive waste.

"ADA plans to team with waste treatment companies for stabilizing DOE mercury-containing waste using this method," Sperry said, adding that the technology appears to have a large potential market at DOE facilities.

Mercury Technologies

ADA Technologies, Inc. has a broad range of mercury measurement and control capabilities, and can help solve a variety of mercury contamination problems facing the government and private industry.

ADA, through its primarily government-funded research and development program, has developed a sorbent-based technology for removing mercury from air emissions and aqueous liquids, including wastewater. The company also has expertise in the stabilization of radioactively contaminated liquid mercury.

ADA currently offers technology solutions for mercury offgas and flue gas treatment, mercury capture and recovery from wastewater and mercury stabilization/amalgamation.

Mercury Offgas/Flue Gas Treatment

ADA has developed a technology that uses a regenerable sorbent to remove vapor-phase mercury from gaseous waste streams generated when certain types of wastes are thermally treated or when coal is burned to generate power. The technology can help operators of hazardous waste incinerators meet new regulations that will require less mercury in their off gases, and it also could be of use to coal-fired power plants to dramatically reduce their mercury emissions.

Applications:
- Coal-fired power plants
- Medical incinerators
- Municipal solid waste incinerators
- Mixed waste incinerators
- Lead and zinc smelters
- Cement manufacturing operations
- Chlor-alkali plants

Features:
- Continuous emissions monitor for mercury measurement
- Vaporizer for mercury injection
- Bench-scale testing apparatus
- Regenerable mercury removal process for field applications

Results:
- Removal to less than 1 mg/m^3 in high mercury environment (85,000 mg/m^3)
- Effective in high SO_2, NO_2, H_2O, CO and CO_2 environments

Benefits:
- Captures vapor-phase mercury on regenerable sorbent
- Assures regulatory compliance (meets Environmental Protection Agency's proposed MACT control standards)
- Generates minimal secondary waste

Mercury Stabilization/Amalgamation

To address a problem facing the U.S. Department of Energy (DOE), ADA Technologies, Inc. has developed a technology for stabilizing radioactively contaminated liquid mercury generated in past weapons production activities. The process combines a proven mercury stabilization method with a scaleable, economically viable mixing technology. In this process, radioactive waste mercury is mixed with sulfur and other materials in a commercially available pug mill, producing cinnabar – a stable mercury sulfide product that can be disposed of as non-hazardous, low-level radioactive waste. The process also is applicable to soil and sludges.

Applications:
- Environmental remediation at DOE facilities
- Nuclear medicine

Features:
- Converts waste mercury to a stable, non-leachable form suitable for disposal
- Treats mercury regardless of form or speciation
- Satisfies Environmental Protection Agency's (EPA) definition of an amalgam

Results:

- Produces waste that passes the Toxicity Characteristic Leaching Procedure (0.20 mg/L)
- Produces waste that is no longer considered hazardous
- Minimizes mercury air emissions
- Produces a waste that is non-volatile

Benefits:

- Uses scaleable commercial equipment
- Cost effective
- Reliable
- Assures regulatory compliance
- Safe and easy operation

Mercury Capture and Recovery/Wastewater

ADA Technologies, Inc. has developed an effective method for removing mercury from water or aqueous products and recovering the mercury. The proprietary technology uses a sorbent to remove the mercury from the wastewater and recover it in a form suitable for further distillation and ultimate recycle. The company's capabilities range from removal of mercury from contaminated wastewater at former Department of Energy weapons-making operations to removal of waste amalgam from water leaving dental offices.

Applications:

- Dental and medical clinics
- Mining
- Chlor-alkali plants
- Industrial wastewater
- Groundwater

Features:

- Cleans contaminated wastewater to improve local water quality
- Captures soluble mercury on a regenerable sorbent

Results:

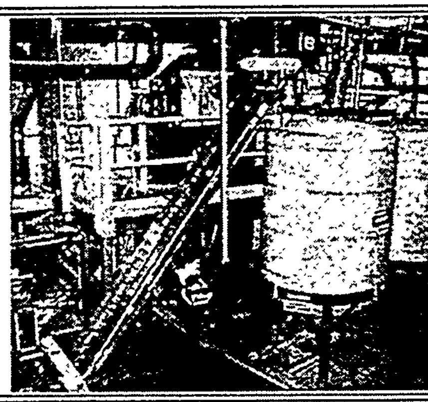
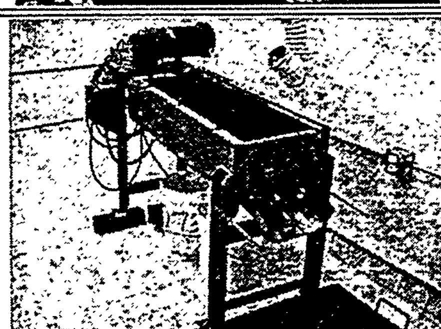
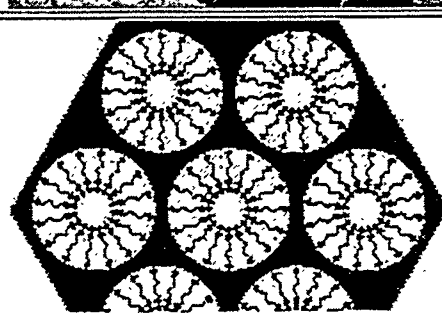
- Reduced soluble mercury from 1,000 parts per trillion (ppt) to <12 ppt in tests at the Y-12 plant at Oak Ridge, Tennessee
- Reduced soluble mercury in testing at dental clinics

Benefits:

- Provides effective, low-cost method of removing even very low concentrations of mercury from waste streams
- Generates minimal secondary waste
- Simple process that allows sorbent bed to be thermally regenerated and reused

Mercury Contamination

PHOTOGRAPHS

Mercury Contamination Photographs	Description
	Picture of General Electric's Mercury Extraction Process.
	Picture of NFS's DeHg process used to stabilize mercury contaminated wastes.
	Picture of ADA's process to treat elemental mercury (modified pug mill).
	Self-Assembled Monolayer Mesoporous Silica (SAMMS) material provides a highly effective and selective means for scavenging

Publications

1998 1997 1996 1995

Publications -- *1998*

98001 "Stabilization of Radioactively Contaminated Elemental Mercury Wastes" Roberts, Stewart and Broderick. ADA Technologies, Inc. Litz. Colorado Minerals Research Institute. Brown and Faucette. Advanced Integrated Management Services, Inc. Presented at Waste Management '98. Tucson, AZ. March 1-5, 1998.

98002 "Monitoring HC1 and $C1_2$ in Flue Gas Using a Real-Time Analyzer" Schlager, Sappey, Hill and Sagan. ADA Technologies, Inc. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98003 "Removal of Mercury from Contaminated Groundwater to Part Per Trillion Levels" Stewart and Roberts. ADA Technologies, Inc. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98004 "Monitoring Beryllium During Site Cleanup and Closure Using a Real-Time Analyzer" Schlager, Sappey and French: ADA Technologies, Inc. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98005 "Removing and Recovering Mercury from Off-Gases of Thermal Treatment Processes" Roberts, Broderick and Stewart. ADA Technologies, Inc. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98006 "Determination of Dry Carbon-Based Sorbent Injection for Mercury Control in Utility ESP and Baghouses" Broderick and Haythornthwaite. ADA Technologies, Inc. Bell, Selegue and Zuber. TDA Research, Inc. Perry. Flue Gas Cleanup Chemistry, Department of Energy, FETC. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98007 "COHPAC as an Air Pollution Control Option at Hudson Unit 2: A Case Study" Waugh. Public Service Electric & Gas Company. Haythornthwaite. ADA Technologies, Inc. Chang. EPRI. Bustard. ADA Environmental Solutions, LLC. Presented at the Air & Waste Management Association's 91st Annual Meeting & Exhibition. San Diego, CA. June 14-18, 1998.

98008 "Evaluation of Carbon Injection for Mercury Control at Coal-Fired Power Plants" Haythornthwaite, Smith and Ruhl. ADA Technologies, Inc. Fox. New Century Energies. Hunt. Utility Engineering. Chang. EPRI. Brown. FETC Contracting Officer Representative. Presented at the DOE Advanced Coal-Based Power & Environmental Systems '98 Conference. Morgantown, WV. July 21-23, 1998.

Publications -- *1997*

97017 "Mercury and Acid Gas Control in Utility baghouses through Sorbent Injection – Pilot-Scale Demonstration" Waugh, Jensen, Lapatnick, Gibbons. Public Service Electric and Gas Company (Newark, New Jersey). Haythornthwaite, Sjostrom, Ruhl, Slye. ADA Technologies, Inc.

97016 "Recovery of Mercury from Contaminated Primary and Secondary Wastes" Stewart, Roberts. ADA Technologies, Inc Presented at the Industry Partnerships to Deploy Environmental Technology Meeting. Morgantown, WV. October 21-23, 1997.

97015 "Mercury Control in Utility ESPs and Baghouses through Dry Carbon-Based Sorbent Injection Pilot-Scale Demonstration" Waugh, Jensen, Lapatnick, Gibbons. Public Service Electric and Gas Company (Newark, NJ). Sjostrom, Ruhl, Slye. ADA Technologies, Inc. Chang. Electric Power Research Institute. Presented at the EPRI-DOE-EPA Combined Utility Air Pollutant Control Symposium. Washington, DC. August 25-29, 1997.

97014 "Sodium Sorbents for SO_2 Trim in High-Ratio Baghouses" Sjostrom, Butz. ADA Technologies, Inc. Bustard. ADA Environmental Solutions, LLC. Chang. Electric Power Research Institute. Presented at the EPRI-DOE-EPA Combined Utility Air Pollutant Control Symposium. Washington, DC. August 25-29, 1997.

97013 "Experience with Combustion Tuning and Fuel System Modifications to Inexpensively Reduce NO_x Emissions from Eleven Coal-Fired Tangential Boilers" Mazzi. Levelton Engineering. Haythornthwaite. ADA Technologies, Inc. Presented at the EPRI-DOE-EPA Combined Utility Air Pollutant Control Symposium. Washington, DC. August 25-29,

STABILIZATION OF RADIOACTIVELY CONTAMINATED ELEMENTAL MERCURY WASTES

Daryl Roberts, Robin Stewart, Tom Broderick
ADA Technologies, Englewood, CO 80112
John Litz
Colorado Minerals Research Institute, Golden, CO 80403
Cliff Brown, Andrea Faucette
Advanced Integrated Management Services, Inc., Arvada, CO 80002

ABSTRACT

ADA Technologies and its subcontractors, Colorado Minerals Research Institute (CMRI) and Advanced Integrated Management Services, Inc. (AIMSI), have demonstrated the amalgamation of both "ordinary" elemental mercury and radioactively contaminated elemental mercury in batch sizes up to 75 pounds (2.5 liquid liters) using sulfur in a conventional pug mill mixer. The process satisfies the Environmental Protection Agency's definition of amalgamation as given in 40 CFR 268.42, Table 1. After developing the technology with ordinary mercury, we have demonstrated the technology by conducting treatibility studies on wastes provided by the Los Alamos National Laboratory. To date, three separate batches of LANL waste have been processed, a total of 185 pounds. The extent of conversion of mercury to HgS was over 99.92% for each batch, and each batch passed the Toxic Characterization Leach Procedure (TCLP) test for leachable mercury.

This paper describes demonstration results of a novel process for stabilizing radioactively-contaminated elemental mercury with sulfur. The process combines a proven mercury stabilization method with a scaleable, economically viable mixing technology. Waste mercury is mixed with sulfur in a commercially available pug mill, producing a stable mercury sulfide product. The pug mill is uniquely suited to the process since residence time can be controlled to ensure complete reaction. Also, contamination control requirements for dealing with mixed waste can readily be implemented for the process. The paper describes the treatment of radioactively-contaminated mercury wastes from three U.S. Department of Energy (DOE) sites. One of the major test objectives described in the paper is a determination of whether leachable mercury in the product is below the 0.20 mg/l treatment standard based on the Toxicity Characteristic Leaching Procedure (TCLP). Another major test objective is a determination of whether the mercury vapor pressure above the product is below 50 $\mu g/m^3$. This concentration is the OSHA eight-hour worker exposure limit for mercury. When the product's vapor pressure for mercury is below 50 $\mu g/m^3$, then the workers themselves are exposed to even less concentration of mercury, helping to ensure their safety.

The process described in this paper is readily scaleable to easily match the treatment needs at individual DOE sites. The product passes TCLP treatment standards and meets

vapor pressure requirements described in the "Technology Deficiency Requirements Document" published by the Mixed Waste Focus Area. It also satisfies the Environmental Protection Agency's definition of an amalgam as given in 40 CFR 268.42, Table 1, satisfying disposal requirements as defined in RCRA. The paper includes an overview of the DOE radioactively-contaminated mercury problem, a process description, experimental results, a life cycle cost analysis, and recommendations for implementing the process for routine waste treatment operations.

INTRODUCTION

Mercury and mercury-contaminated wastes are some of the more pervasive and troublesome wastes in the inventory of DOE legacy waste materials. Most of the larger DOE sites have radioactively-contaminated liquid, elemental mercury in their mixed waste inventories. Complex-wide, there are approximately 16.5 m^3 (500,000 pounds) of elemental mercury in the legacy waste and about 0.2 m^3 (5,700 pounds) per year generated at the Savannah River Site (Petersell, 1998).

The Environmental Protection Agency (EPA) specifies amalgamation as the treatment method for radioactively contaminated elemental mercury. Although the chemistry of amalgamation is settled, the practical engineering of a sizable amalgamation process is not settled (e.g., Gorin, et al., 1984; Tyson, 1992). A process that will serve the DOE need must process at least approximately two to three liters of mercury (50 to 100 pounds) per batch since even at this scale, treating the entire DOE inventory would require approximately 5,000 batches (one batch per day for over ten years, seven days per week).

Before funding work in this area, DOE's Mixed Waste Focus Area established a Technology Deficiency Requirement Document (TDRD) with the following criteria for a successful mercury amalgamation process:

1) the process must meet EPA's definition of an amalgam given in 40 CFR 268.42, Table 1;
2) the waste form must pass EPA's 0.2 mg/L treatment standard based on TCLP so as to allow the waste form to be disposed in a subtitle D landfill;
3) the mercury vapor concentration above the waste form must be less than 50 $\mu g/m^3$;
4) the process must be readily scalable; and
5) the process must be economically viable.

ADA Technologies, Inc., and its subcontractors, Colorado Minerals Research Institute (CMRI) and Advanced Integrated Management Services, Inc. (AIMSI) have demonstrated the amalgamation of both "ordinary" elemental mercury and radioactively-contaminated elemental mercury in batch sizes up to 75 pounds (2.5 liquid liters) using sulfur in a conventional pug mill mixer. After developing the technology with ordinary mercury, we have demonstrated the technology by conducting treatibility studies on wastes provided by the Los Alamos National Laboratory. To date, three separate batches of LANL waste have been processed, a total of 185 pounds. The extent of conversion of mercury to HgS was over 99.92% for each batch, and each batch passed the Toxic Characterization Leach Procedure (TCLP) test for leachable mercury. We are confident that the process meets the first two, and the only regulatory, requirements set by the MWFA.

Because we have used conventional mixing equipment to accomplish the amalgamation, the process is both scaleable and economical (requirements number 4 and 5). We have yet to perform the mercury vapor pressure tests, but we expect that our process will meet this requirement also.

The following sections describe the process, testing with ordinary elemental mercury, the treatibility tests with the LANL waste, and an approximate economic evaluation of the process.

DESCRIPTION OF PROCESS

We mix the liquid mercury with sulfur in a conventional mixer known as a pug mill. Pug mill mixers are commonly used in metallurgical and chemical operations where intense mixing of pasty material is required. Tens of thousands of such systems are utilized industrially today. Examples of common pug mills are the Rietz thermal screw, the Holoflite dryer, and the Bethlehem Porcupine Processor. The Holoflite dryer has been used to make sulfur polymer cement in tests at DOE's Idaho National Laboratory (Darnell, et al., 1992). Others have been used to stabilize RCRA wastes (e.g., Barth, 1990; Trezek, 1992). Manufacturers of pug mills for chemical stabilization of contaminated soils and sludges include Portec Chemical Processing Products (Yankton, SD), Pugmill Systems, Inc. (Columbia, TN), and Excel Machinery Company (Amarillo, TX). A brief description of these types of mixers and their relationship to other industrial mixers can be found in Kirk-Othmer's encyclopedia (Faulkner and Rimmer, 1995).

We used a small, dual shaft mixer that accommodates approximately 2 ft^3 of material (Figures 1 and 2). This mill is three feet long and has a one-foot square cross section. Its blades are 5.5" long. A liner was placed in the pug mill to reduce the dead volume beneath the blades. The typical rotation speed of the pug mill blades is 50 RPM. This size of pug mill accommodates the desired full-scale processing rate of 100 lb in an eight-hour shift with no difficulty.

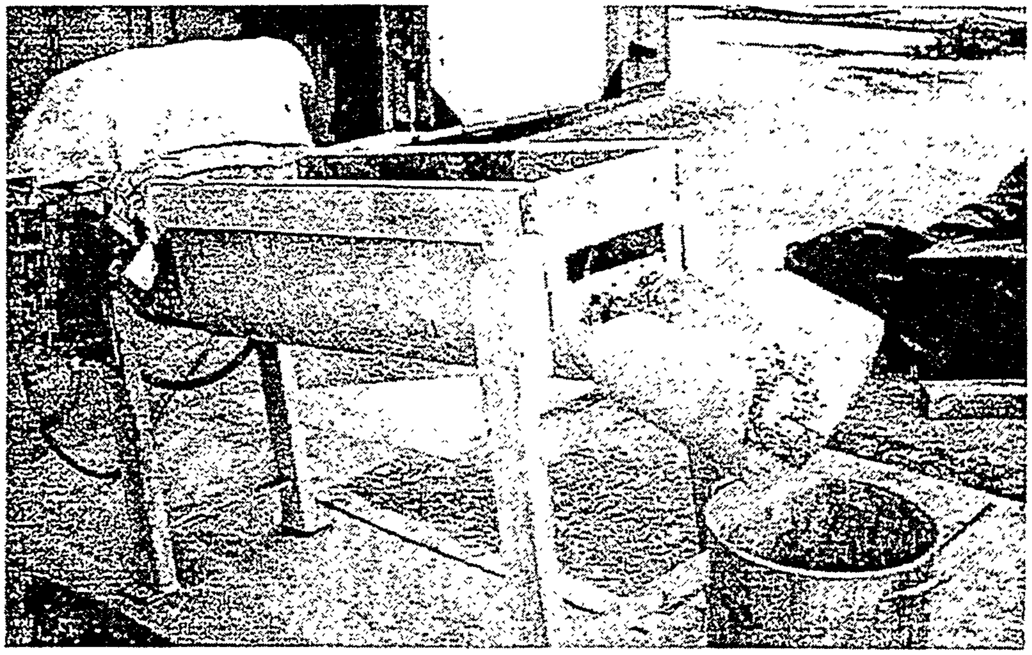


Figure 1 – Side View of Pug Mill

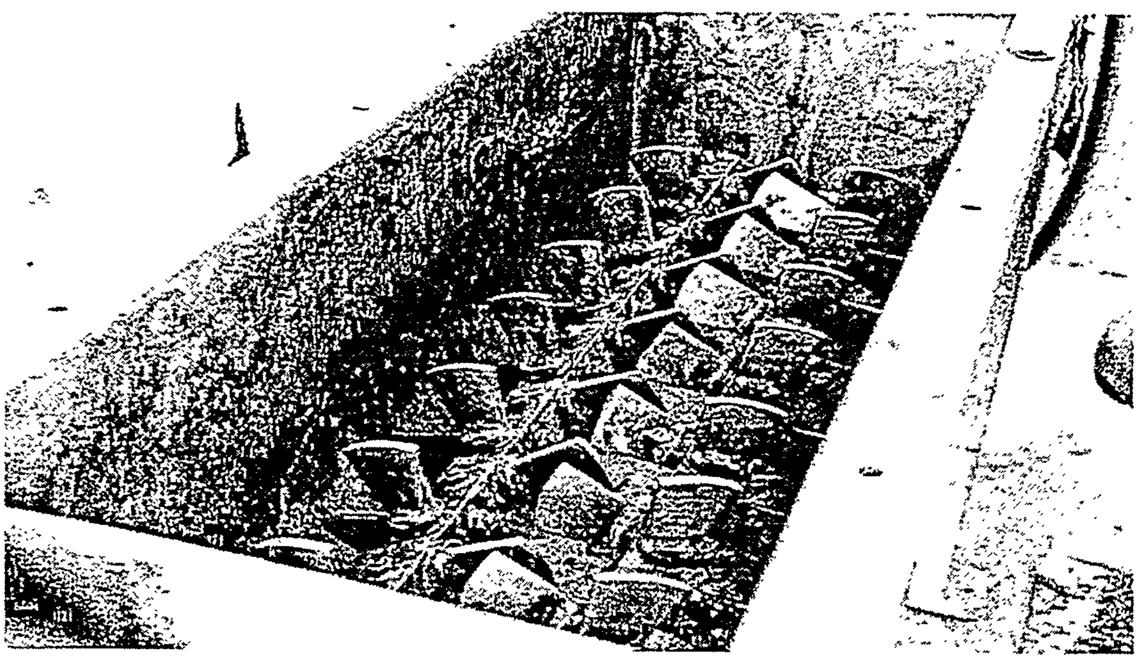


Figure 2 – Top View of Blades of Pug Mill

The basic process involves adding sulfur to the pug mill first, then pouring in the mercury. The mixing and reaction are followed by monitoring the mixture temperature and periodically taking samples for analysis. Mixing is concluded when the reaction exotherm subsides and the free elemental mercury analysis indicates that over 99.9% of the mercury has reacted. The details of the process are the subject of a patent application.

SURROGATE WASTE TEST RESULTS

The reactions of mercury with a variety of amalgamating agents are exothermic and, in principle, should proceed at room temperature. In practice, the mixing of the mercury with the amalgamating agent is the principle difficulty to overcome. Nearly 100% extent of reaction can be achieved when small quantities of mercury, approximately 10 cm^3 or less, are reacted in the laboratory with conventional shakers or manual stirring. However, with the quantities of liquid, elemental mercury waste in the DOE complex, batch sizes of approximately two to three liters will be the required to allow the DOE inventory to be processed in a reasonable time.

Therefore, our goal in working with "surrogate waste" (that is, ordinary elemental mercury) was to learn to conduct the mixing of two to three liters of mercury with sulfur in conventional mixing equipment. Working with a conventional mixer was an important part of our process development strategy so that we would be confident in our ability to scale-up the process.

Through a variety of testing in the laboratory, we found an inability to react mercury with sulfur beyond about 50% extent of conversion. We then added a sulfur-containing liquid to the mixture and were able to achieve up to 98.8% extent of reaction of the mercury.

In working with the pug mill and 30 pounds of mercury, we were able to achieve 99.9% extent of conversion of the mercury, but the TCLP results were in the range of 1.2 mg/L to 2.6 mg/L, well above the statuatory limit of 0.2 mg/L. Only when we further added sand to the mixture were we able to achieve more than 99.9% extent of reaction, and then the TCLP results were consistently below 0.1 mg/L. During this work with the pug mill, we found physical forms of sulfur that worked and did not work, quantities of sulfur-containing liquid that worked and did not work, and quantities of sand that worked and did not work. The resulting formulation and processing conditions form the basis of our patent application.

The key results, however, of the "ordinary" mercury tests are that we achieve above 99.9% extent of reaction of the mercury with the sulfur, and we achieve a leachable mercury concentration below the TCLP limit of 0.2 mg/L.

TEST RESULTS WITH RADIOACTIVELY CONTAMINATED MERCURY

We received 242 pounds (110 kg) of contaminated, waste mercury from Los Alamos National Lab. The shipment came from Los Alamos in a 40-gallon carbon steel drum.

Inside the drum were five two-liter steel flasks, each of which were roughly full with mercury. The radioactivity level of the mercury was quite low, and in fact no radioactivity was detected with a standard gamma scan.

To date we have treated 185 pounds of this waste in three separate batches weighing 50 pounds, 62 pounds, and 73 pounds. At the end of each treatment, we determined the mass concentration of the unreacted mercury. The extents of reaction (1 minus the free mercury, expressed as a percentage) in these batches were 99.963%, 99.951%, and 99.922%, respectively. The TCLP testing with each batch showed less than 0.1 mg/L of leachable mercury.

We have one 57-pound batch remaining of the Los Alamos waste in the treatibility study. We have also received a 55-pound batch of waste mercury from the Fernald site. The last Los Alamos batch and the Fernald batch will finish our treatibility study.

ECONOMIC EVALUATION OF PROCESS

Capital equipment costs and operational costs for a full-scale facility were evaluated as part of this study to determine the treatment cost for the process. The basis for this evaluation was a facility designed to treat 50 gallons of waste mercury per year with a life cycle of 10 years. The throughput of the waste facility was based on a projected annual production rate of mercury waste. Waste transportation and disposal costs were not included in the present value life cycle cost for this facility.

Mixing equipment for a full-scale operation would be large enough to process the waste mercury in 40 kilogram batches compared to the 25 kilogram batch size used in the surrogate tests. Larger batch size would be required in order to process 50 gallons of mercury per year with a limited staff. Other equipment would be needed to support the operation which would include safety equipment, such as radiation and mercury monitors, eyewash/shower station, and scales to weigh process materials and drums with treated waste. Laboratory equipment would also be required to perform analytical procedures during the waste processing operation.

The costs associated with the installation of the process equipment, and process materials such as piping and ductwork, electrical, insulation, process structural, and instrumentation were not directly costed but estimated using a method presented by Perry. The method uses average percentages for direct and indirect construction costs based on data from over 200 chemical process capital projects. On average, the process equipment and process materials costs were found to be 33% and 16% of the total installed facility cost, respectively. Labor for process equipment and materials installation is about 13% of installed costs.

Annual maintenance costs were also estimated using recommendations by Perry, which suggests that the maintenance cost be based on a fixed percentage of the captial equipment costs. Capital equipment include the process equipment and process materials. In general, maintenance should be a minimum of 4 percent per year of the capital equipment cost for chemical processing equipment. Maintenance costs would include the material, installation, and overhead costs.

Labor costs were estimated based on a three person staff. The staff would be required to perform the operational, analytical, and clerical functions associated with the process. Direct labor, materials and supplies, subcontracted analytical costs, as well as the indirect costs were included in the operating costs for this process. Materials and supplies were determined on a per batch basis, which assumed the facility would treat 25 waste streams per year, each consisting of two gallons of mercury, there would be a total of 112 batches per year. The annual analytical costs were determined based on the number of waste streams. These cost included characterization tests of the wastes to document that the waste passed TCLP for mercury and cost of swipe tests to certify cleanliness of the process equipment.

Operating costs for the process were escalated at a rate of 3.5% per year over the life of the project. The present value of each year's operating costs were totalled and added to the construction costs of the facility for the overall present value of life cycle costs. Treatment cost for the stabilization process was estimated to be $5,500 per gallon of waste mercury, or $110 per kilogram of mercury.

CONCLUSIONS

REFERENCES

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ACKNOWLEDGEMENTS

The tests of the radioactively-contaminated mercury were funded by Lockheed Martin Energy Systems under subcontract 1GX-05496. The test of the surrogate mercury wastes were funded by ADA Technologies.

The authors wish to acknowledge the active participation of the Mercury Working Group headed by Mr. Tom Conley of the Oak Ridge National Lab in pushing hard to develop technologies that will treat real wastes in the DOE Complex. We also wish to thank Mr. Chris Duy at the Los Alamos National Lab and Mr. Al Schmidt at the Fernald site for their diligent assistance in coordinating the transfer of the radioactively-contaminated mercury to CMRI for the treatibility studies.

WHITE PAPER

THE NFS MERCURY MIXED WASTE TREATMENT PROGRAM

Nuclear Fuel Services, Inc. (NFS) provides treatment technology for converting mercury mixed wastes typically found at Federal facilities to non-hazardous waste forms that fully achieve disposal criteria. NFS has permitted and operated a mercury mixed waste treatment facility at its Erwin, TN site that recently achieved a significant milestone - conversion of production-generated mercury mixed waste to a non-hazardous waste form!

To supplement current expertise, NFS is developing new and improved technologies for mercury mixed waste treatment. In support of these development programs, NFS operates fully licensed treatability, development, and radio-analytical laboratories in Erwin, Tennessee. NFS performs both bench and pilot scale testing of new treatment technologies. The NFS laboratories operate under the treatability exemption limit of 10,000 kg for hazardous materials, a limit which has recently been accepted by the State of Tennessee.

The following describes NFS applied technologies for treating mercury mixed wastes to produce non-hazardous, disposable waste forms.

Mercury Stabilization

NFS constructed, permitted, and operated a treatment system based on proprietary technology to convert mercury-contaminated solid waste materials containing low levels of mercury to non-hazardous waste forms. Using this system, NFS recently *converted 1800 ft^3 of mercury mixed waste trash and debris contained in 249 drums to 900 ft^3 of non-hazardous waste form contained in 125 drums.* The final waste form produced by the NFS system was a solid material that achieved the 0.2 mg/L Toxicity Characteristic Leach Procedure (TCLP) limit for mercury. This system includes operations for material pre-processing, ventilation, process monitoring, and is fully supported by professionals versed in health/safety, licensing, and permitting issues. Furthermore, this system was designed to accept feed materials that contain enriched uranium.

This system will be used to process other Federal and commercial mixed wastes. The NFS mercury mixed waste treatment process is briefly described in the VISITT III database provided by the Environmental Protection Agency (EPA).

NFS has also validated technology for treating *aqueous and organic-bearing mercury solutions contaminated with trace levels of tritium.* The waste stream tested was from the Martin Marietta Specialty Components (MMSC), Inc., Pinellas Plant, in Largo, Florida. The mercury treatment process selected for this study was demonstrated to be effective for the mercury-bearing solutions. Both the aqueous and organic phases of the treatability samples were treated to produce test filtrates containing 0.02 mg/L mercury and solid residues having TCLP leachate mercury concentrations averaging 0.003 mg/L. This result is nearly *three orders of magnitude less than the RCRA treatment standard of 0.2 mg/L mercury* in a TCLP leachate. An additional advantage of the process is that it produced a solid, free-standing waste form with good handling and storage characteristics.

<u>Mercury Amalgamation</u>

NFS has developed proprietary technology to stabilize materials containing a high concentration of mercury to produce final waste forms that are non-hazardous. As part of a technology validation effort, NFS successfully completed two technology validation studies on two different waste streams.

NFS completed a validation study on elemental mercury contaminated with low levels of tritium. The waste stream tested was from the Martin Marietta Specialty Components (MMSC), Inc., Pinellas Plant, in Largo, Florida. This study successfully demonstrated the effectiveness of the amalgamation treatment process to immobilize elemental mercury to meet the treatment standard for D009 wastes. The amalgam produced in proving tests using two kilograms of elemental mercury had TCLP leachate mercury concentrations averaging 0.06 mg/L.

NFS can demonstrate the amalgamation process on liquid mercury wastes using a proprietary mixing and blending method. A scaleup process can be implemented for this application.

Fernald Mercury Treatment Validation Studies

NFS continues to validate its mercury treatment technology on a variety of mercury bearing wastes from FERMCO, including elemental mercury, batteries, contaminated debris, asbestos, water, salts, light bulbs, spill cleanup fluid. This work is in progress as of February, 1996.

Mercury Separation and Removal

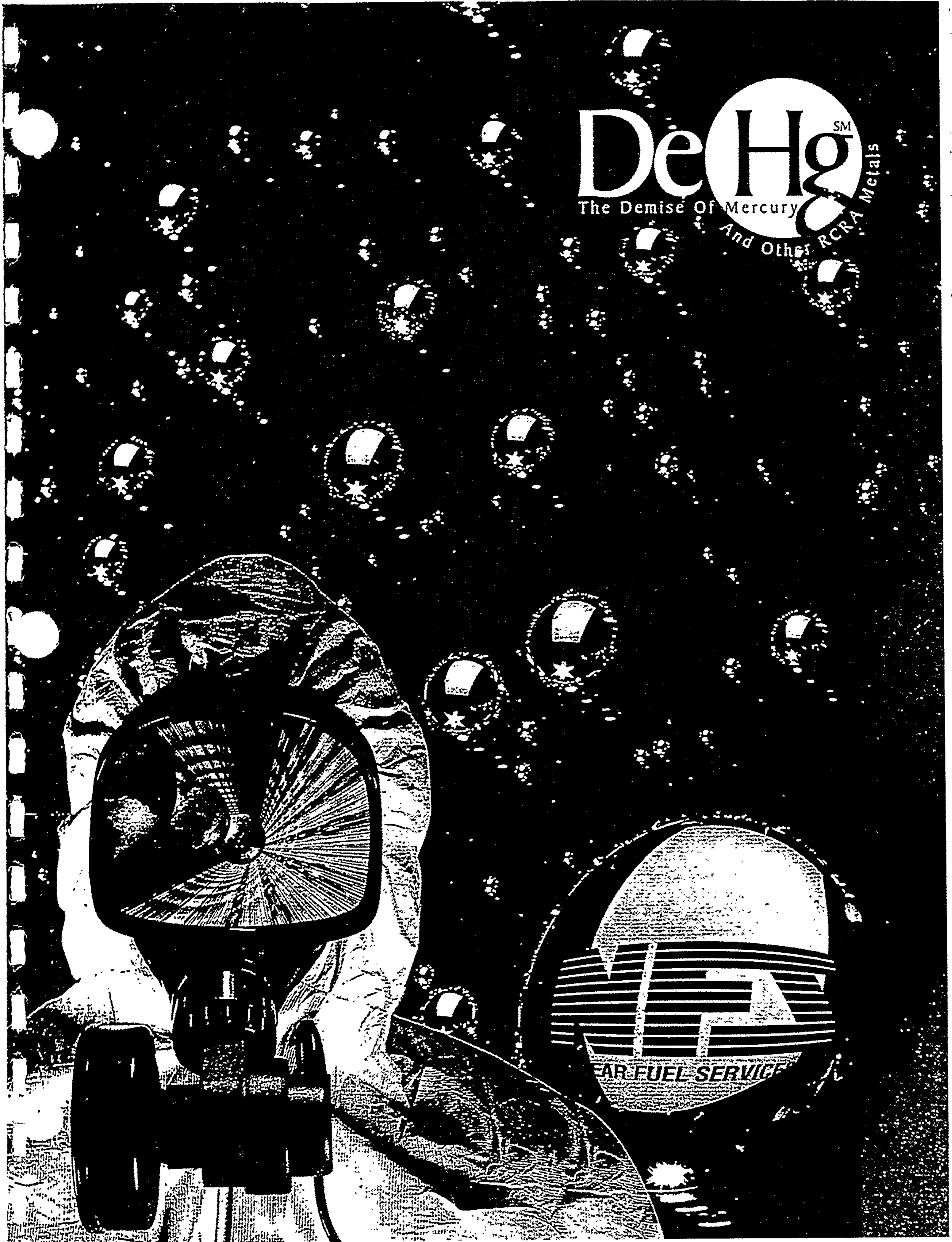
To broaden our program applicability, NFS has initiated development of a low-temperature (<80°C) process which **extracts and concentrates mercury into a small volume for disposal or reuse, converts the resulting sludge or soil matrix to a stabilized non-RCRA waste form, and recovers chemical reagent for reuse.** NFS believes that this process offers advantages compared to current treatment schemes which do not provide for a final non-RCRA waste form. This process also has applicability to extracting mercury from high level waste prior to vitrification.

High Efficiency, Regenerable Mercury Filter

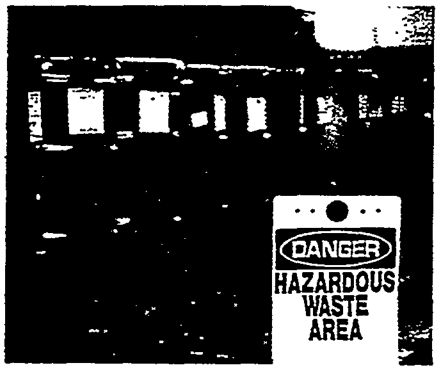
NFS, as part of our Mercury Abatement Program, is evaluating new adsorbents for efficiently capturing flue gas mercury evolved from nuclear systems. These adsorbents appear to offer nearly maintenance-free operations and can be regenerated several times, greatly reducing the volume of residual waste due to filter discard. The substrate also appears to have a high efficiency under elevated temperature conditions.

Publications

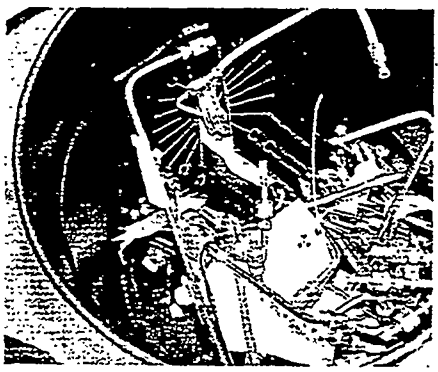
NFS technology is proprietary, therefore technical publications and conference presentations have not been pursued. NFS-ARS technical personnel have presented a poster paper on mercury amalgamation and stabilization studies at the Waste Management 94 Conference in Tucson, Arizona.


DeHg SM
The Demise Of Mercury
And Other RCRA Metals
EAR FUEL SERVICE

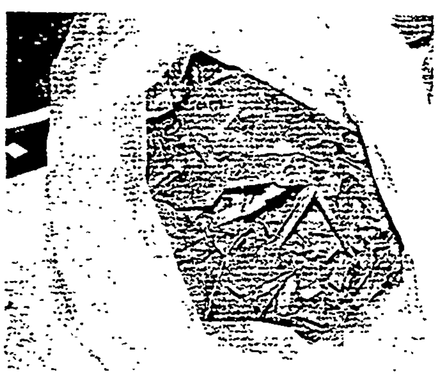
Effective RCRA Metals Remed



RCRA metals are a serious environmental concern to government and industry.



Mercury-contaminated equipment before treatment



Mercury-contaminated equipment after treatment

Treated elemental mercury

The remediation of mixed and other wastes containing hazardous metals is one of the most challenging problems in government and industry today. Until recently, remediation of wastes containing mercury, cadmium, lead and arsenic metals was limited to principally high-temperature desorption, a costly and equipment-intensive method. Today, a pioneer of the nuclear industry offers an effective, ambient-temperature solution to a host of RCRA-regulated metals.

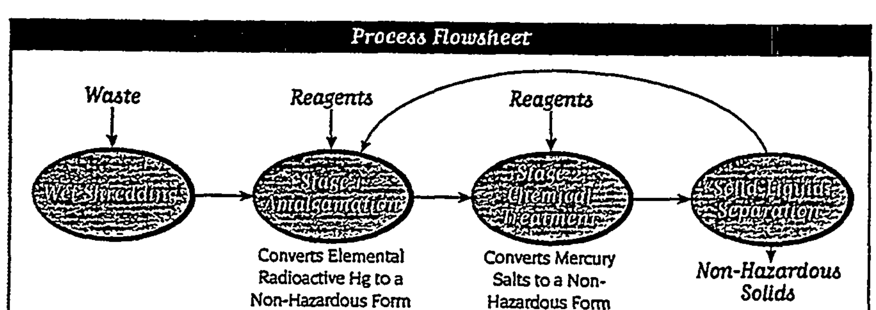
A TRUE SOLUTION... FROM A TRUE PIONEER

Nuclear Fuel Services, Inc. (NFS) was a pioneer in the development and manufacture of specialty nuclear fuels for the U.S. Navy, Department of Energy and commercial power reactors business. Today, NFS remains as America's sole source of fuel for the U.S. Navy's nuclear fleet and as the source for innovative technologies in environmental remediation. The DeHg℠ (pronounced de-merc) process was originally intended for the conversion of mercury-contaminated laboratory wastes which also contained highly enriched uranium. This proprietary technology has proven to be effective in permanently resolving a myriad of mercury-contaminated wastes in various forms. The process can render many RCRA-regulated metals non-hazardous.

SAFE, EFFECTIVE... THE RIGHT CHOICE FOR RCRA METALS

The DeHg℠ process begins with the sorting and shredding of waste materials. The shredding increases the surface area of the waste to maximize contact with proprietary reagent chemicals. Shredded waste is slurried with water then mixed with reagents to immobilize the RCRA metal.

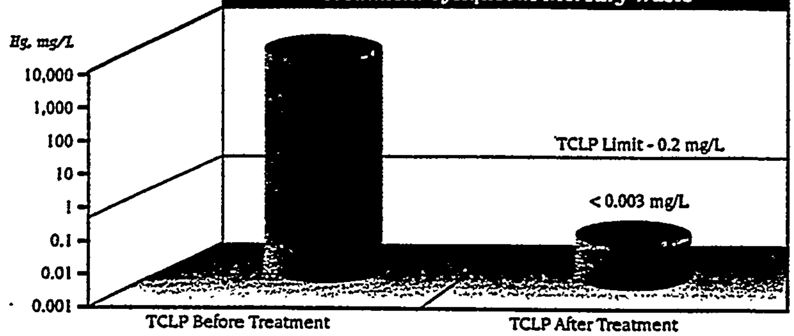
The slurry is later dewatered and packaged for shipment to a licensed landfill for disposal. TCLP concentrations for leachate metals, such as mercury, are typically < 0.05 mg/L, which is safely below the RCRA treatment standard of 0.2 mg/L. The filtrate from this process, which can be recycled, also achieves wastewater discharge criteria.



tion...Without Thermal Processing

DeHg℠ also works well for complex forms of mercury as well as organic-bearing mercury wastes. DeHg℠ treatment on actual organic-bearing mercury waste has produced filtrate typically <0.02 mg/L metals and solid residues with a TCLP concentration of < 0.003 mg/L.

Treatment of Aqueous Mercury Waste



The process has been successfully applied to dry active wastes, metallic wastes, sludges, soils, pumps, switches, thermometers, elemental mercury and other waste matrices with varying initial concentrations of mercury from elemental to a few ppm. The process runs at ambient temperature, is relatively easy to operate and generates no mercury vapors.

PROVEN...TIME AND TIME AGAIN

The value of the innovative DeHg℠ process is especially clear in the remediation of mixed wastes containing both radioactive and hazardous metals. An example is in the use of the process in remediating nearly 2,000 cubic feet of mixed wastes stored in 249 drums. The wastes included: mercury-contaminated laboratory trash, solidified mercuric thiocyanate, elemental mercury, insulation and miscellaneous trash, all of which also contained small quantities of uranium.

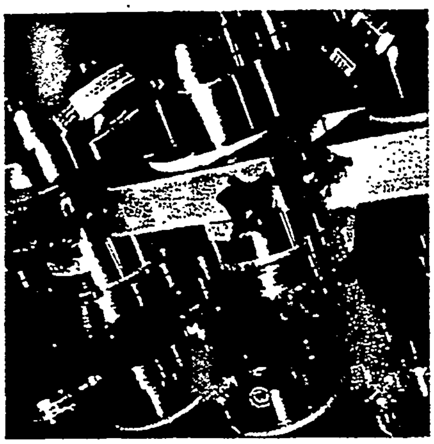
Due to the wide range of waste forms, sorting was conducted prior to shredding, slurrying and treatment. The DeHg℠ process reduced the number of hazardous mixed waste drums from the original 249 to 122, a 50% volume reduction. The process offered a final package which was one-half the original volume and was no longer classified as hazardous waste...providing substantial cost savings for future handling and burial. Additionally, the 249 drums originally classified as mixed waste were completely eliminated.

Description of Wastes Treated by DeHg℠

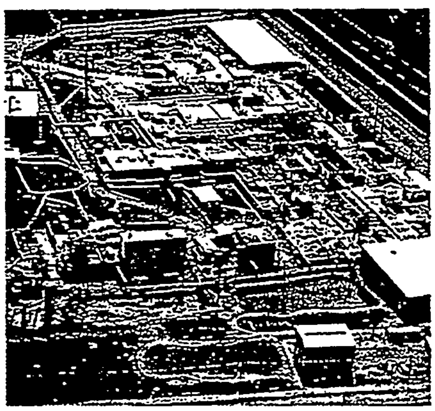
Waste Description	Hg Chemical Form	TCLP Initial mg/L	TCLP Final mg/L
Liquid Mercury	Elemental	60	0.06
Aqueous Mercury	Ionic	3000	<0.01
Thiocyanate Waste	Complexed	1	<0.02
Hoses	Elemental	N/A	<0.01
Trap Water/Oil	Elemental	N/A	<0.01
Trap Sludge	Elemental	N/A	<0.01
Sink Traps	Elemental	N/A	<0.20
Plastic	Elemental	N/A	<0.02
Spill Cleanup Solids	Elemental	N/A	<0.04
Insulation	Elemental	N/A	<0.02
Spent Carbon Filters	Elemental	N/A	<0.01
Fluorescent Tubes	Elemental	0.3	<0.04
Scrap Salts	Elemental, Ionic	2	<0.02
Floor Tile	Elemental	N/A	<0.04
Soil	Elemental	0.9	<0.01
Metal Tubing	Elemental	N/A	<0.10
Oil	Organic, Elemental	0.9	<0.04
Mercury Switches	Elemental	N/A	<0.04
Broken Thermometers	Elemental	N/A	<0.03
Misc. Treatment Waste	Elemental, Ionic	0.2-0.3	<0.05

NFS Mercury MxW Treatment Projects using DeHg℠

• **LMSC Pinellas**	Hg(l) w/H-3	1993
• **LMSC Pinellas**	Hg(aq), w/Organic	1994
• **Thermal Desorp.**	Hg(l), Hg Salts in Condensate	1994
• **FERMCO**	Hg(l), Debris w/Elem., Hg Salts	1995
• **NFS**	Debris, Hg Thiocyanate w/U	1995
• **LMUS/USEC**	Hg(l), Debris w/Elem., Hg Salts	1996



TCLP Rotary Extractors are part of the analytical equipment utilized by NFS to ensure compliance of regulatory standards.



NFS maintains and operates a fully licensed and permitted facility in Erwin, TN.

DeHg℠...
THE POSSIBILITIES ARE ENDLESS

The remediation of mercury is just one of the many permanent solutions which the DeHg℠ process offers. The process can stabilize and render non-hazardous a myriad of RCRA-regulated metals, including, but not limited to, lead, silver and cadmium.

NFS scientists can perform treatability studies of your waste to determine the applicability of the DeHg℠ process.

FLEXIBLE TREATMENT OPTIONS

Whether you prefer that your RCRA metals be treated and shipped from your site, or shipped to our licensed and permitted TSD facility in Tennessee, the response to your waste challenge will be met with a fast and flexible response. NFS maintains a qualified and experienced staff of professionals to serve you with a safe, cost-effective solution which will permanently resolve your RCRA metals challenge.

FOR A FREE RCRA METALS CONSULTATION, CONTACT:

Mr. Stephen M. Schutt, Nuclear Fuel Services, Inc.
3945 Holcomb Bridge Road, Suite 202, Norcross, GA 30092
Tele: (770) 447-6956 • Fax: (770) 662-8415
Web: http://www.atnfs.com

Mr. David Wise, Nuclear Fuel Services, Inc.
1205 Banner Hill Road, Erwin, TN 37650
Tele: (423) 743-1795 • Fax: (423) 743-0140
Web: http://www.atnfs.com

NUCLEAR FUEL SERVICES, INC.

1205 Banner Hill Road • Erwin, TN 37650
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Nuclear Fuel Services, Inc.
1205 Banner Hill Road
Erwin, TN 37650

(423) 743-9141

March 17, 1997

Ms. Kathleen M. Gatens
Lockheed Idaho Technologies Company
P. O. Box 1625
Idaho Falls, ID 83415-3521

Reference: 1. Solicitation CBD 063, Treat and/or Dispose Of Mercury Contaminated Water
2. Solicitation CBD 064, Transportation of Mercury Contaminated Water

Dear Ms. Gatens:

Nuclear Fuel Services, Inc., (NFS), would like to express its interest in the referenced Solicitations. NFS operates a RCRA permitted treatment facility for D009 (mercury wastes) at its Erwin, Tennessee, facility. The facility is also licensed by the State of Tennessee and the Nuclear Regulatory Commission for a wide range of radiological materials. Our facility also incorporates a State of Tennessee permitted Wastewater Treatment Facility. Additionally, NFS operates two (2) NRC licensed tank trucks which have been previously used to safely transport a wide variety of radiologically contaminated solutions.

NFS has successfully performed mercury treatment and treatability work for many Lockheed Martin Companies, including LMSC Inc. (Pinellas) and LMUS Inc. at both Portsmouth, Ohio, and Paducah, Kentucky. We were also recently awarded a technology demonstration contract by LMER Inc. and the Mixed Waste Focus Area for our DeHg^{sm} process for elemental mercury amalgamation. I am enclosing materials to demonstrate our capabilities in this area:

1. Information Package on NFS Mercury Capabilities,
2. State of Tennessee Radiological License,
3. Nuclear Regulatory Commission Category I License, and
4. Letter from State of Tennessee modifying NFS RCRA Part B Permit for D009 (Mercury Mixed Wastes).

NFS looks forward to assisting you with the transportation and treatment of this waste. Please call me at 1-423-743-1795 with any questions you may have.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

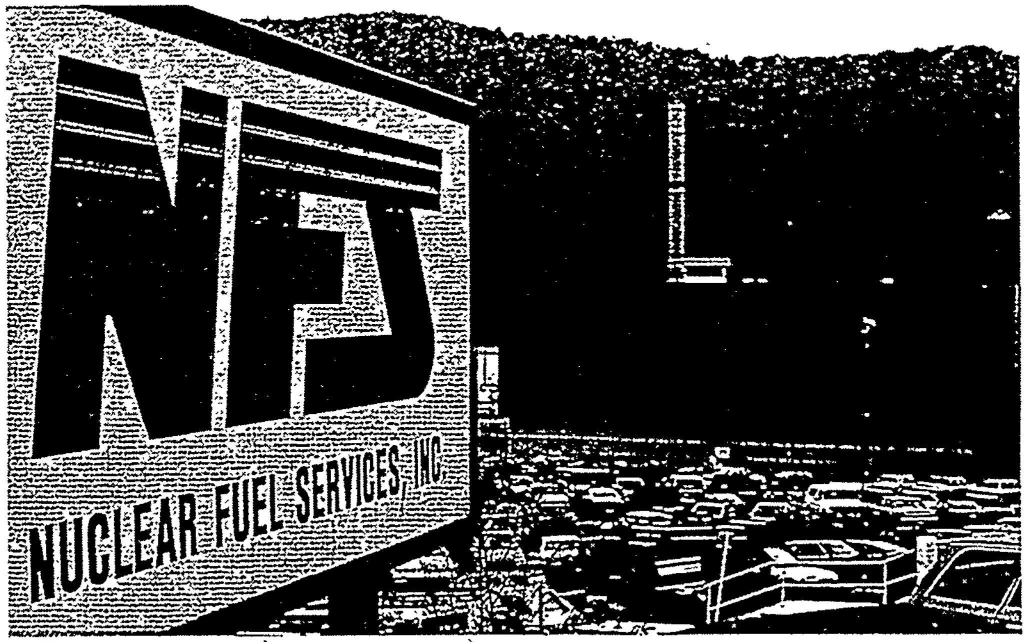
David Wise

R. David Wise
Director - Business Development

Enclosure

NFS INNOVATION in action
NUCLEAR FUEL SERVICES, INC.
Volume 5, Winter 1997

NFS at work on landmark HEU recovery project for DOE



The project marks the restart of NFS' fuel-processing operations.

NRC approves start-up of NFS' HEU processing

The commercial recovery and processing of DOE-owned weapons-grade highly enriched uranium (HEU) is now under way. NFS, a subcontractor on the project, is converting the highly enriched material into a stable oxide at NFS' Erwin, Tennessee, facility.

The effort involves the removal and conversion of several thousand liters of highly enriched uranyl nitrate (HEUN) solution once used in critical experiments. By removing the HEUN from its site, the DOE will reduce the costs of facility maintenance and HEUN surveillance activities.

The HEUN material entered NFS' highly enriched fuel recovery facility (HEURF) on January 24 following a thorough review of safety and operational readiness by NFS and officials from the Nuclear Regulatory Commission.

In its history, NFS has processed a variety of HEU materials.

The recovery and conversion project has been under way since the multi-million dollar project was awarded to NFS in April 1995. Prior and subsequent to the contact signing, NFS personnel helped to develop the engineering design package, work plan and procedures, nuclear materials safety limits, and other support work necessary for full project activation. In December 1995, refurbishment of NFS' HEURF began to allow input of the HEUN. In addition to equipment installation, the refurbishment effort included preparation of design documents describing the work and quality assurance (QA) oversight of the procurement and installation work.

The conversion of material into a stable oxide is scheduled to be complete by mid-1997.

Proprietary HEU downblending technology receives U.S. patent

Innovative process a key resource to DOE remediation effort

The last day of 1996 marked an important milestone that will offer cost savings to the Department of Energy for years to come. December 31, 1996, marked the issuance of a U. S. Patent for NFS' proprietary high-enriched uranium (HEU) downblending process.

NFS has been a proponent of downblending as the solution for many of the DOE's current challenges. By converting stockpiles of HEU material into low-enriched uranium (LEU) materials for

continued on page 2 see Patent

INSIDE INNOVATION...

Patent, continued from page 1

peaceful purposes, the high cost of safeguarding and storing HEU can be lifted from the responsibility of the DOE.

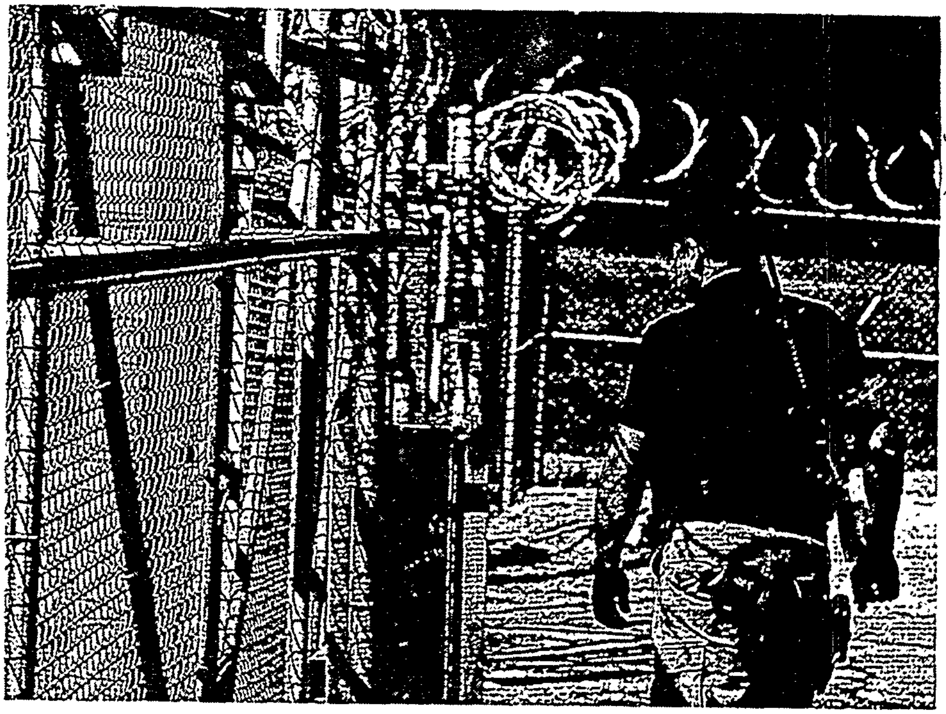
The patent involves "the conversion or downblending of feed material to a blend product which contains fissionable components in such dilute conditions that self-sustaining fission reactions cannot occur." The technology offers a fail-safe system for the downblending of material (e.g., HEU, plutonium) which is not dependent on the functioning of electronic controls or structural devices.

The technology is the cornerstone of NFS' efforts to offer the process to the DOE. More than 200,000 kilograms of HEU are currently the responsibility of the DOE. By downblending the HEU, a more stable and more useful LEU product can be offered as feed stock for commercial power reactor fuel.

As early as 1991, NFS and its partner AlliedSignal approached both U.S. and Russian government officials regarding the process. The U.S. Enrichment Corporation (USEC) later signed an agreement with the Russian government to purchase HEU and downblend the material in the U.S. The USEC would be the contracting agency for both U.S. and Russian HEU material downblending domestically.

NFS submitted the patent application in January 1995. The company will maintain exclusive rights to the technology for the next 18 years. NFS is currently utilizing the technology on several DOE projects.

HEU scrap aluminum project work to begin



NFS maintains an NRC Category 1 license for processing of HEU at its Erwin, Tennessee, facility.

Recycle project to generate purified material

Preparations are under way to initiate processing of 400 kilograms for highly enriched uranium-aluminum scrap at Nuclear Fuel Services' Erwin, Tennessee, facility. The project will provide the Department of Energy (DOE) with oxide for feed stock material for low-enriched downblending or other department needs. NFS was the successful bidder on the contract offered by the DOE's Central Scrap Management Office (CSMO) in Oak Ridge.

"NFS is one of only two commercial facilities in the nation authorized by the DOE for this type of project by the CSMO," said Norm Brandon, NFS Director of HEU Programs. "NFS has been awarded a one-year contract by the CSMO for similar upcoming projects with four one-year renewal options."

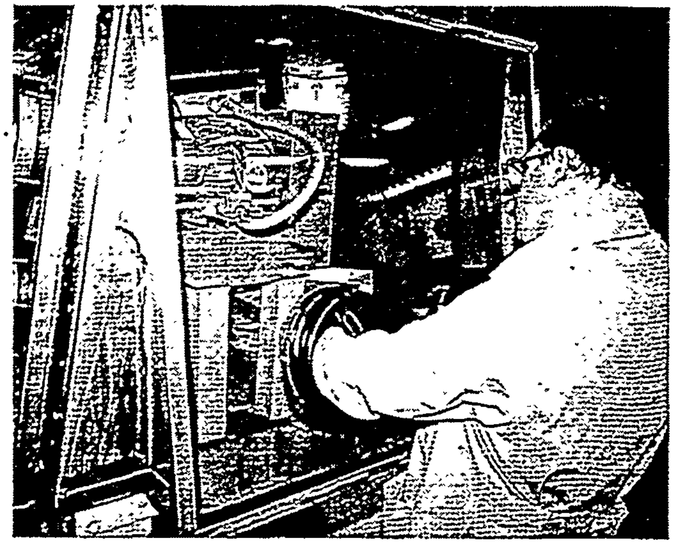
The scrap, primarily uranium-aluminum metal shavings and floor sweepings from fabrication activities at the DOE's Savannah River Plant, will undergo solvent extraction processing at NFS. The process will convert the material to an oxide, which will be returned to Oak Ridge for eventual sale or downblending of up to 2,000 kilograms of low-enriched materials for use in commercial nuclear reactors.

Processing is expected to begin during the first quarter of 1997 and requires about two months to complete.

Historic project involves USEC barter of HEU to NFS

Cylinder heel material to be recycled and sold as LEU

> *"...the government reduced the cost of processing–plus it will remove the cylinders as a safety, security and environmental concern."*
>
> Norm Brandon
> NFS Director of
> HEU Programs



The current USEC agreement is two-phased and runs through 1998.

"To my knowledge, it's the first working example of the concept NFS has championed since the end of the Cold War," is how NFS Director of HEU Programs Norm Brandon sums up a new contract with Lockheed Martin Utility Services.

The agreement saw the transfer of title of HEU cylinder heels (the hold up UF_6 material remaining in the cylinders) to NFS to help offset the costs of recovering and processing the material to LEU. Lockheed Martin Utility Services (LMUS) is the prime contractor for the U.S. Energy Corporation (USEC), an entity formed by the DOE to oversee domestic and Russian HEU management and processing.

NFS and Project Plows partner AlliedSignal were the first to offer the concept of private industry purchase or barter of HEU material for downblending to LEU material for commercial reactor fuel. Project Plows foresaw the purchase of 500 metric tons of Russian HEU material from warheads and eventual sale on the world market as commercial reactor fuel. The USEC is now involved in projects similar to Plows with the Russian Federation.

"NFS sees the conversion of HEU material into a form ideal for commercial reactor fuel manufacturing as the best way to resolve the world's stockpile of nuclear arms," explained Brandon. "By bartering the title to the HEU to NFS, the government reduced the cost of processing - plus it will remove the cylinders as a safety, security and environmental concern."

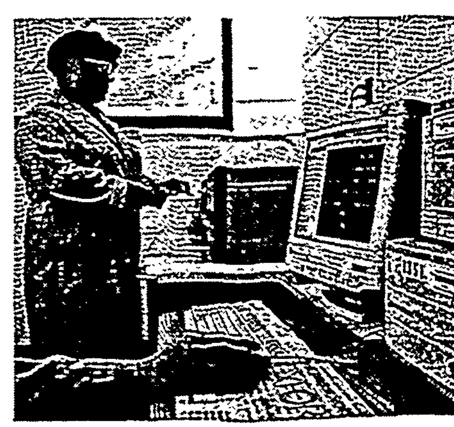
The new contract between LMUS and NFS is a two-phased agreement running through 1998. Phase one involves HEU material inside 414 Model 5A and 5B UF_6 cylinders. NFS will remove approximately 82 kilograms of residual HEU material inside the cylinders. The HEU will undergo NFS' solvent extraction process and will be blended with NFS' own stock of depleted uranium to produce about 1,600 kilograms of LEU. NFS has sold the LEU to another commercial client for use in the manufacture of commercial nuclear reactor fuel.

The second phase of the contract, to begin in 1998, will involve 526 cylinders and is expected to yield 82 kilograms of HEU for downblending into over 2,000 kilograms of LEU. The UF_6 cylinders from both phases of the contract will be cleaned, packaged and shipped to a low-level radioactive burial site for disposal.

NFS to provide blend stock to USEC

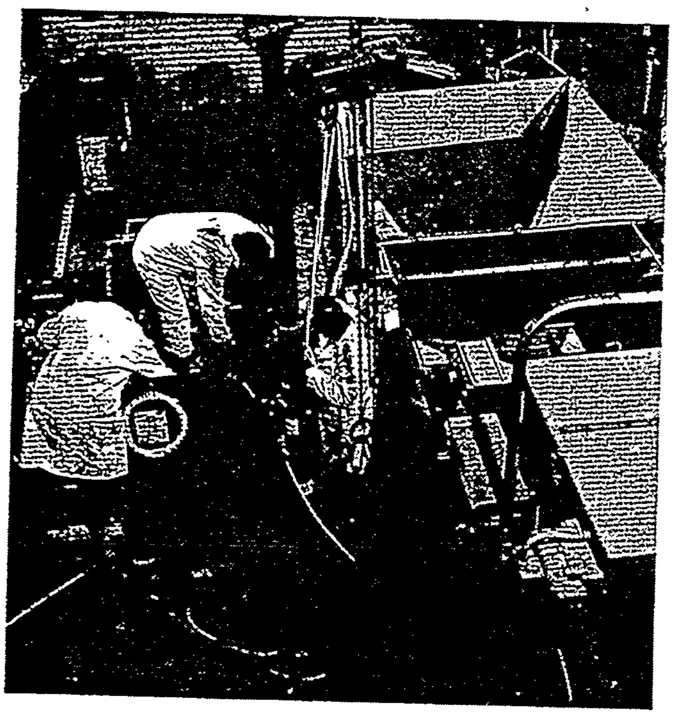
NFS has been contracted by the U.S. Energy Corporation's Portsmouth, Ohio facility to provide 42 drums of liquid blend stock urnyl nitrate. The material will be used by USEC in its own efforts toward downblending government HEU material into LEU.

The blend stock will be produced in NFS' Erwin, Tennessee, facility with delivery of the blend stock expected during second quarter 1997.

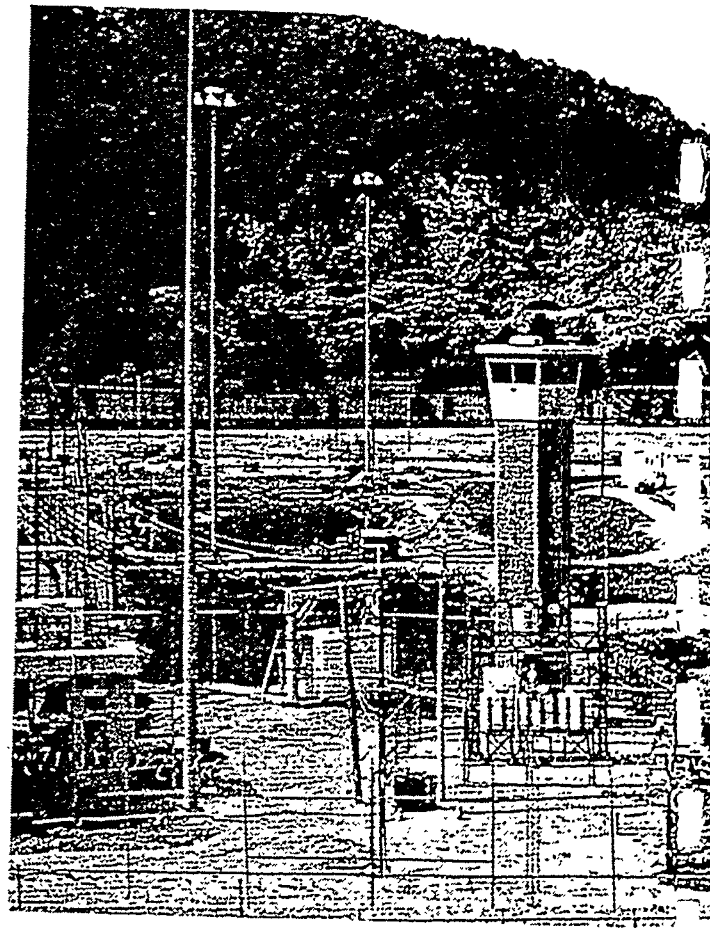


Quality control is maintained with the help of NFS' own laboratory personnel.

This unusual-looking dredge was utilized in initial characterization and in preparing sludge to be moved to the facility in the background.



The facility can process approximately 80 55-gallon drums of material per day.



The NFS Sludge Dewate... g F

Sludge process facility to l e

Truly, innovation in action

One of the most unique waste treatment facilities in the U.S. is now available to commercial and government clients. The facility employs technology for processing sludges contaminated with special nuclear material (SNM), other radionuclides, and mixed and hazardous metals.

The facility was constructed in 1993 by Nuclear Fuel Services at its Erwin, Tennessee, plant to process sludges from its own settling ponds. After processing and stabilizing more than 90,000 cubic feet of metals-contaminated material dredged from the ponds, the facility's capacity is now being permitted to receive other client materials, or may also be moved to client facilities for on-site treatment and processing.

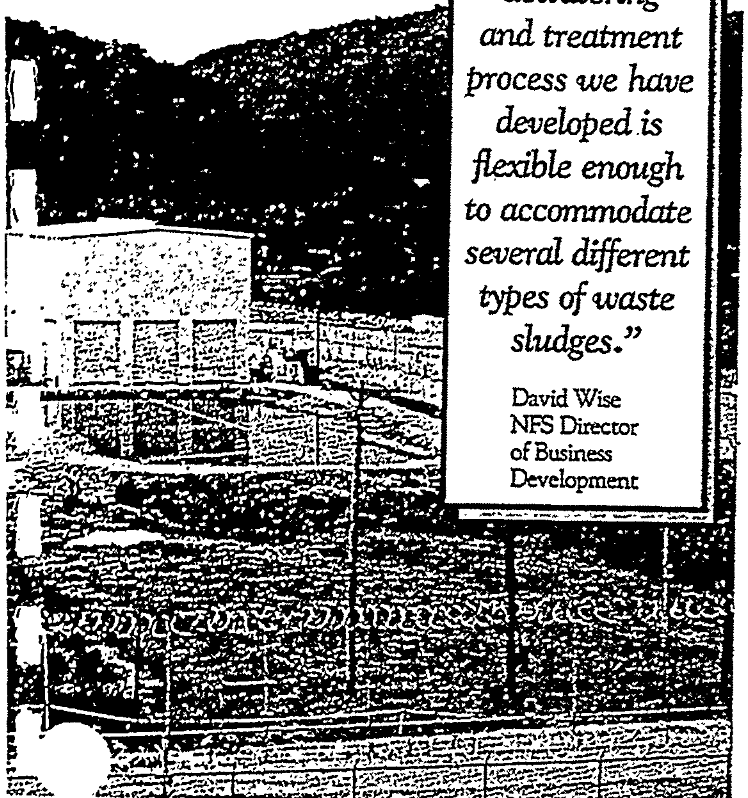
The NFS sludges were contaminated with thorium, all isotopes of uranium and other radioactive materials deposited in the ponds during the early 1960s. Transferred to the facility and surveyed by a non-destructive assay system to ensure criticality safety, the sludge was pumped through a knock-out tank to separate out rocks, twigs and other debris.

"Any sludges containing radionuclides and RCRA metal-contaminated mixed-waste sludges are ideally suited for this facility," explained David Wise, NFS' Director of Business Development. "Our employees have the materials-handling experience and technical expertise to process almost any kind of metals-bearing sludge. NFS has worked closely with interested clients to incorporate their radionuclides and hazardous constituents into our Part B permit application."

Mixed wastes (those containing radioactivity and Resource Conservation and Recovery Act metals, such as mercury, cadmium and nickel) can be treated at this point with NFS' own proprietary process (DeHg™). The treatment renders the RCRA metals non-hazardous allowing disposal in a regulated facility. Light organics and other

"The sludge dewatering and treatment process we have developed is flexible enough to accommodate several different types of waste sludges."

David Wise
NFS Director
of Business
Development



ed a key role in remediating the company's settling ponds as seen in this 1994 photo.

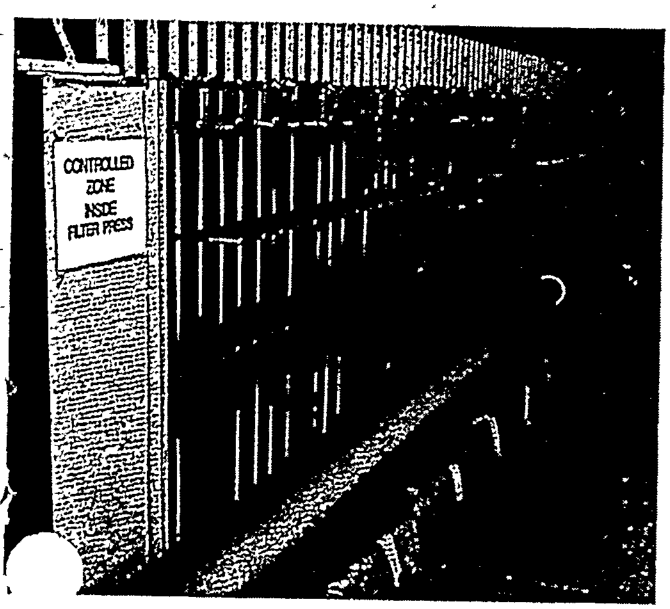
contaminants can also be treated within the process.

With batches of 100 cubic feet each, the facility can process approximately 80 55-gallon drums of material per day. The filter press removes excess liquids and yields a 70% solids press cake. Material control and accountability standards are followed throughout the process. An electronic tracking system is used to ensure safety and disposal criteria are met for each drum package for final shipment to a disposal site.

"The treatment and sludge dewatering process we have perfected is flexible enough to accommodate several

An innovative automated waste tracking system utilized bar coding to identify wastes ready for shipment and disposal.

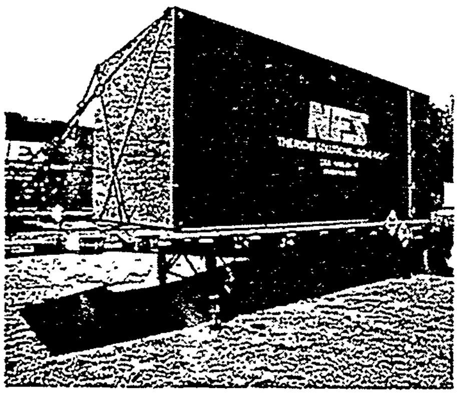
ilable for mixed-waste sludge processing



The filter press enabled batches of 100 cubic feet to be processed.

different types of waste sludges," Wise explained. "We have received interest from several DOE facilities in regard to moving the process to their site for treatment of pond and process sludges."

For more information regarding sludge dewatering services, contact David Wise at NFS (423) 743-1751 or via e-mail at our web site (www.atnfs.com).



Three Super Tigers are available for rent or lease.

Super Tiger leasing draws interest from customers involved in D&D projects

NFS continues to draw interest from customers about its most recent addition to its D&D toolbox–Super Tigers. NFS owns three Model 6400 Type B (Super Tiger) Protective Overpacks. The Super Tigers have proven their rugged durability by transporting plutonium-contaminated wastes from two recent projects and continue to be a valuable asset for any D&D project involving transuranics. The Super Tigers are NRC-approved for shipment of fissile quantity materials of "hard waste" containing up to 200 grams of plutonium.

In addition to the Super Tigers, NFS can also provide reusable corrugated steel H-2 inner containers and two InstaPak™ Foam Insert Machines. Each Super Tiger has the loading capacity for 16 55-gallon drums or 24 40-gallon drums.

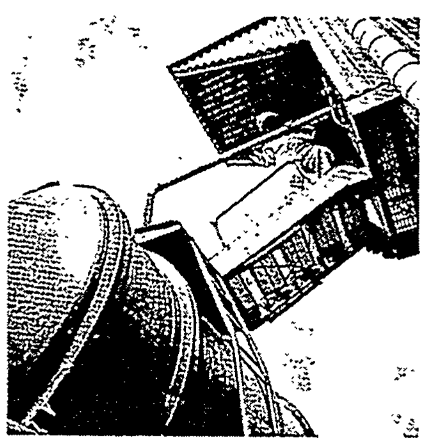
The Super Tigers stand ready to support NFS D&D clients or are available for lease. NFS can provide handling and training for facilities opting to prepare their own shipments utilizing these unique transport overpacks. For more information regarding NFS' D&D Services or leasing arrangements, call NFS today at (423) 743-1751.

NFS continues environmental remediation involving uranium-contaminated CaF_2

NFS has proven expertise in resolving CaF_2 waste issues.

NFS awarded $1.3 million in contracts

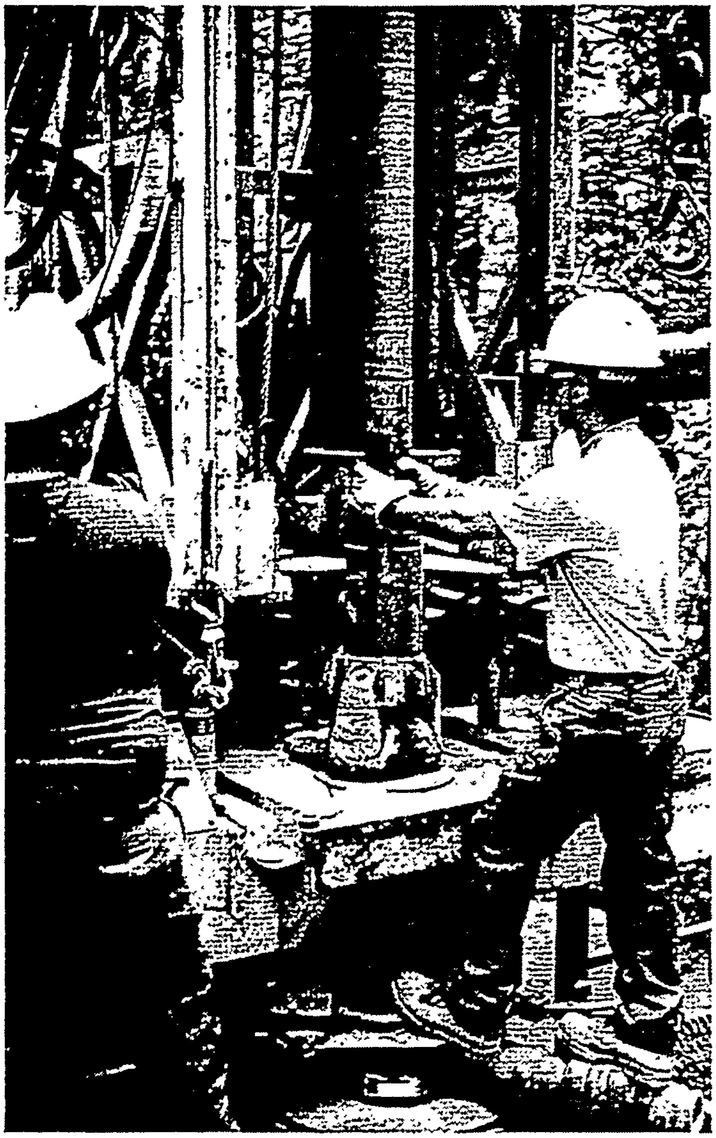
NFS has been awarded a follow-up contract to continue environmental remediation at a Fortune 50 corporation's manufacturing facility in the Southeast. The $1.3 million contract will ensure that efforts to remediate low-level radioactive wastes will remain a priority through the year. NFS is the prime contractor in the project. Initially contracted to remove uranium contaminated CaF_2 from in-ground disposal pits and to relocate the material for stable storage, NFS will now focus on surface impoundments elsewhere at the client's facility. Additionally, NFS developed and now markets a proprietary process ($DeCaF_2$™) to separate heavy metals (such as uranium or rare earth metals) from CaF_2. The process enables CaF_2 material to be sold as a bulk commodity or disposed of in a commercial landfill. The process has been successfully applied on a myriad of waste matrices for other clients, including sludges containing: tantalum, niobium and scandium. For more information regarding environment remediation involving CaF_2, contact Stephen M. Schutt at NFS' Norcross, Georgia, office at (770) 447-6956.



NFS has proven that its process can separate uranium from CaF_2. Some clients may choose to sell the purified CaF_2 as a bulk material.

Innovative work continues at university's radioactive landfill

Video camera verifies key information through boreholes



Workers operate a drill derrick to prepare a borehole.

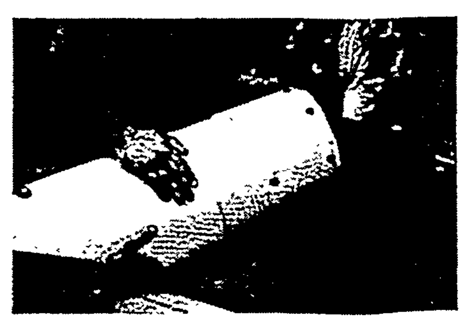
A casing is prepared for lowering into a borehole.

NFS recently completed a new well installation program, including aquifer testing and borehole geophysics systems to support the remedial investigation for a Southern university's radioactive waste landfill.

According to NFS' Project Manager Richard Raione, well installation in bedrock can be tricky since the locations and orientation of water-bearing fractures can be difficult to locate correctly and precisely. Incorrect placement of a well screen essentially voids the primary objective for a monitoring well and results in project delays and excess expenditures.

Unique to this activity was the successful utilization of a down hole video camera which ensured that the well screen intervals were correctly placed and were of the proper length. By lowering the video camera into the boreholes while the wells are being pumped, the video and accompanying audio comments produced by the site geologist accurately preserve a record of vital information for regulators. Significant information recorded by the camera included: where water-bearing fractures were located and fracture-specific water yields, a visual record of where bedrock is located, the nature of the bedrock/overburden interface, vertical changes in rock types and weathering, fracture patterns, caves and total well yields. The video camera also provided an educational and training benefit.

NFS has been the environmental contractor for the university for several years. NFS has also completed characterization and remedial activities at radioactive landfills for three other major universities. For more information regarding radiologically contaminated biological waste landfill remediation, contact NFS at (423) 743-1751.



A casing was used to protect video equipment during monitoring activities.

Lockheed Martin Utility Services awards NFS arsenic mixed-waste treatability work

NFS has been awarded a contract to perform treatability studies on United States Enrichment Corporation (USEC) arsenic mixed wastes. NFS began receiving the materials in February and will conduct the work over the next three months.

The material to be evaluated for treatment is especially challenging due to the concentrated form of the arsenic contained in the waste stream.

The work will be performed by NFS' Advanced Recovery Systems (ARS) Group. ARS has developed an approach to render the waste non-hazardous. This scope of work will add another RCRA metal to NFS' inorganic chemical treatment technology, DeHg™. NFS has successfully treated cadmium and mercury-contaminated mixed waste and continues to be recognized as an industry leader in cost-effective solutions to DOE's mixed waste dilemma.

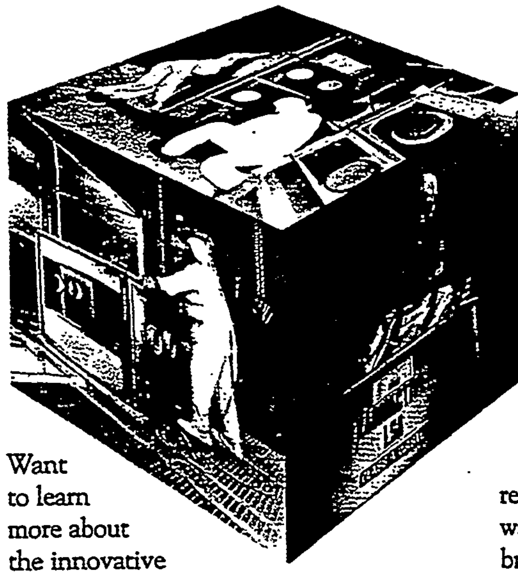
The Internet

From Turkey, England and Canada they come. That is the beauty of the world's new information source–the Internet. In just the first few months, the response to NFS' web site has been exciting.

The NFS web site allows visitors to explore the innovative technologies and case histories of how NFS has resolved some of the toughest radwaste challenges. The site also offers web surfers the opportunity to test their knowledge of nuclear trivia. By answering five trivia questions correctly, they become finalists in a monthly drawing for a USS Tennessee submarine T-shirt.

Next time you're surfing, stop by and visit NFS, at www.atnfs.com.

New materials available regarding NFS technologies



Want to learn more about the innovative technologies offered by NFS to resolve your waste challenge? NFS has just released new materials which help explain the company's approach and use of technologies in both D&D and RCRA metals treatment.

A new videotape reviewing two decontamination and decommissioning projects (one at Argonne National Laboratory and the other at NFS) has just been completed. An accompanying 4-page brochure is also available.

The company's DeHg™ process for resolving RCRA metals and mixed wastes is outlined in another new brochure. All materials are now available for those interested in utilizing NFS technologies for their own waste challenge. Simply mark the technology you are interested in below on the order form, or leave a message at http://www.tony@cenergy.com.

NUCLEAR FUEL SERVICES, INC. **INNOVATION** *in action*

- ☐ Yes, please continue to send me the new NFS Innovation in action newsletter.
- ☐ Please have an NFS representative contact me with more information regarding:
  - ☐ Environmental Remediation
  - ☐ Decontamination & Decommissioning
  - ☐ NFS Plant Site Opportunities
  - ☐ Treatability Studies

Name ______________________

Company ______________________

Address ______________________

____

City ______________________

State/Zip ______________________

Phone ______________________

FAX ______________________

Return to:
NFS Business Development Dept.
1205 Banner Hill Road
Erwin, TN 37650
Or call: 423-743-1751 FAX 423-743-0140 E-mail: http://www.tony@cenergy.com

McBride, Scott

From: Jack D Law/JDLAW/CC01/INEEL/US [JDLAW@inel.gov]
Sent: Monday, April 10, 2000 13:42
To: scott.mcbride@anlw.anl.gov
Cc: leonard@cmt.anl.gov; Ronald S Herbst/HERBRS/CC01/INEEL/US; Terry A Todd/TTODD/CC01/INEEL/US
Subject: UNEX contactors

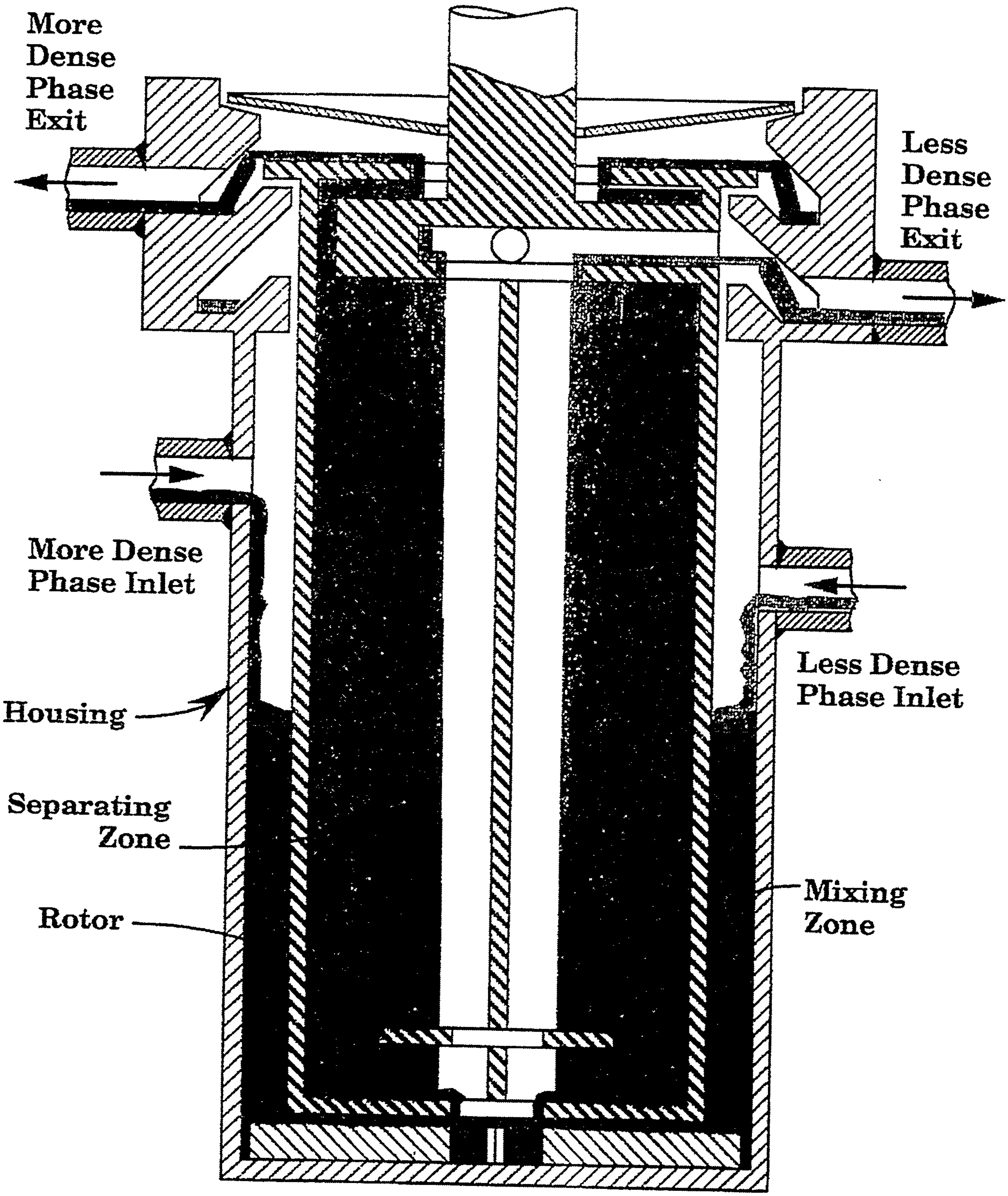
Scott,

The following calculations were performed to support the UNEX and modified UNEX process feasibility study. For 24 stages of 11.0 cm diameter centrifugal contactors, 64.1 square feet of cell space is required. This is based upon arranging the contactors in a three foot wide row, 21.4 feet long. Cell space requirements were determined using the Generic TRUEX Model which was developed by ANL-E. I have forwarded this email on to Ralph Leonard at ANL-E so hopefully he can give us an idea of the cost for 24 stages of 11.0 cm contactors. Let me know if you need any further information.

Jack Law

Additional
Vendor
Info.

Operating ANL Centrifugal Contactor



Paper Number: 72

Title: CONTINUOUS LIQUID-LIQUID EXTRACTION VIA AN IMPROVED CENTRIFUGAL CONTACTOR

by: David Meikrantz, Director of Technology

Scott B. Meikrantz, Applications Chemist

Mitch St. George, Regional Manager

CINC

Prepared for presentation at the AIChE Spring National Meeting,
March 8-12, 1998 Symposium on Extraction in Practice

SUMMARY

An improved annular centrifugal contactor design is being commercially employed in numerous liquid-liquid extraction applications. It is mechanically driven by a directly coupled motor at relatively low rotor speeds. The combination of interchangeable heavy phase weirs and variab rotor drive makes this centrifuge applicable to a wide range of processes. Single stage efficiencies of 90% or higher are typical for chemical systems with rapid kinetics. Mixing and disengaging times range from 10 to 30 seconds each, dependent on the feed rate to the unit and the unit size. Efficient two phase mixing is achieved in the annulus between the spinning rotor and fixed housing. For versatility, a low mix sleeve can also be used to process shear sensitive liquids, often encountered in washing applications.

Annular centrifugal contactors with rotor diameters of 5 to 51 centimeters which range in throughput from 2 to 750 liters per minute are now readily available. The criteria used to select the proper size and operating parameters needed will be discussed. In addition, convenient methods of using this technology to convert batch to continuous processing will be given. Advantages in yield improvement and waste minimization will be discussed, and process equipment footprint will be given. Finally, some field examples which describe the versatility of this liquid-liquid centrifugal contactor will be presented.

INTRODUCTION

General Centrifuge

Clarification of process streams has been one of the niches in the process arena carved by liquid-liquid centrifuges, especially whenever emulsions or liquids close in density have been involved *(Davies et. al., 1972).* Difficulties that often arise in separation of immiscible liquids include: poor or slow phase separation, emulsion or rag layer formation, and poor process control in batch systems. Centrifuges accelerate separation processes by enhancing the specific gravity differences. Liquid-liquid dispersions requiring hours to separate at 1G will proceed much faster at 100 to 1000 G, with greatly improved efficiency and outflow quality. The efficiency of the physical separation of two phases can be several percent higher using centrifuges versus decanting from tanks.

Contactors as Extractors and Washers

Liquid-liquid centrifuges are valuable separation devices because of their small size and the rapid, yet efficient operation. However, they become even more valuable when employed as liquid-liquid contactors. The ability of a centrifuge to thoroughly mix two phases in the annular zone prior to separation in the rotor broadens its scope. Good mixing is very important to ensure optimal mass transfer and to minimize solvent or water usage. Chemical processes requiring extraction and washing (or neutralization) as well as separation can be performed in one step utilizing liquid-liquid centrifugal contactors. Better process control, low retained fluid volume during processing, and reduced plant space usage are realized when using these devices in place of traditional tanks, mixer settlers, and extraction columns.

ANNULAR CENTRIFUGAL CONTACTORS

History

Annular centrifugal contactor design and development has been pursued by various Departmen of Energy labs for more than 30 years. It has been employed in solvent extraction processes fo metals valuable to the nuclear industry. Commercialization of this technology began in 1990 when a patent was granted for continuous separation of hydrocarbons from water *(Meikrantz, 1990).* In the past four years the centrifuge design has been further improved and scaled up to flow rates of several hundred gallons per minute *(Meikrantz et. al., 1997).* In addition, a low mixing sleeve which enhances the washing and separation of shear sensitive liquids has been developed *(Meikrantz et. al., 1996).*

The annular centrifugal contactor possesses many unique design features that distinguish it from other centrifuges on the market today. It has an upright design in which the vertical rotor pumps, thereby feeding itself. A self-pumping rotor maintains separation equilibrium during intermittent feeding because a constant liquid volume is maintained in the rotor. Liquid-liquid separators that require direct feeding to the rotor are not as capable of handling processes where interruptions in flow often occur.

Another advantage of a self-pumping rotor is the method by which a process stream is fed to th centrifuge. Because the liquid need only be fed to the annulus, any low pressure pump or feed supply can be used. Other types of liquid-liquid contactors require high pressure to feed liquid the rotor. This poses a significant barrier to potential users processing liquids with specific gravity values of 0.8 or less. The only pumps capable of generating these high pressures are regenerative turbine pumps which are expensive, noisy, and high maintenance.

COMMERCIAL ANNULAR CENTRIFUGAL CONTACTOR

Principle of Operation

The annular centrifugal contactor operates as both separator and contactor which makes it a valuable tool in numerous types of processes. It's unique design provides mixing and separation in a single, compact unit. Figure 1. shows a cutaway view of the centrifuge housing and rotor and details the significant design features including the liquid flowpath.

Cutaway View

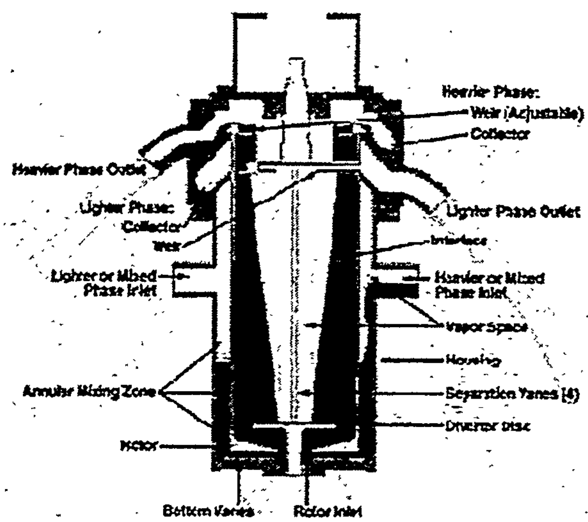


Figure 1

Two immiscible liquids of different densities are fed to the separate inlets and are rapidly mixed in the annular space between the spinning rotor and stationary housing. Please note that the areas above the liquid levels are vapor space. The mixed phases are directed toward the center of the rotor bottom by radial vanes in the housing base. As the liquids enter the central opening of the rotor, they are accelerated toward the wall. This self pumping rotor is divided in four vertical chambers which are dynamically balanced by the pumped liquids. The mixed phases are rapidly accelerated to rotor speed once trapped in a quadrant, and separation begins as the liquids are displaced upward by continued pumping. The separating zone extends from the diverter disk to the lighter phase weir, which provides a transit time for the liquid-liquid interface to form and sharpen. The interface should be positioned half way between the lighter phase weir and the heavier phase underflow at the top of the separating zone. This is done by selecting the proper heavy phase weir ring and then adjusting the rotor speed to fine tune position if necessary. Optimum performance is thus achieved despite changes in flow rate or liquid ratios because the interface position can shift a significant distance without loss of separation efficiency. Because the interface is free to adjust in position, it is important to keep the liquid discharges unrestricted in terms of liquid and vapor flow and pressure. Equilibration of pressure between the centrifuge housing, discharge pipes, and receiver tanks ensures troub free operation over a wide range of process conditions.

Low Mix Option

In process situations where only a two phase separation is being performed or shear sensitive fluids are employed, excess mixing in the annulus needs to be minimized. To accomplish this, a low mixing sleeve can be used, which is a cylinder slightly larger than the rotor. It is permanently attached to the bottom of the housing. By shrouding the rotor, liquids entering the annulus do not come in contact with a high shear surface, but instead enter a primarily static environment. The radial vanes in the bottom of the housing are still present so that the liquid flow path to the rotor is unchanged. Liquid-liquid shear is minimized yet the pumping action of the rotor is not adversely affected. Mixing of the two phases occurs as the liquids are accelerated to rotor speed and pumped. This action is vigorous enough to provide an efficient washing step in many shear sensitive processes.

Take Apart Rotor/CGMP Design

Many process streams include small amounts of solids and particulates that build up on the internal surfaces of the rotor even though filtration is used. Eventually these solids will impair the separation efficiency of the centrifuge. Many pharmaceutical and chemical industrial applications require thorough cleaning between batches to ensure product purity. Cleaning of the annular centrifugal contactor can be accomplished in two ways. The two liters per minute laboratory scale model has a rotor which can be completely disassembled for cleaning and inspection of the internals. The rotor can be removed from the housing by the operator with simple tools. Removal of the vane package and heavy phase weir exposes all internal surfaces for cleaning. The frequency of cleaning is dependent on the percentage of particulates in the process stream. These features are also available on the next larger model which processess up to 20 liters per minute. Both units utilize a rotor suspended from the upper bearing housing to enhance disassembly and simplify the design. Good manufacturing practice requirements for these centrifuges are readily addressed by the use of castings to eliminate welds or crevices and by the ability to inspect all wetted areas.

Clean in Place Rotor

Large, high volume annular centrifugal contactors require a rotor bottom tail shaft to adjust stability. These rotors are suspended between an upper and lower bearing and, coupled with the size and weight, makes frequent disassembly for cleaning impractical. Therefore clean-in-place (CIP) rotor (Figure 2) has been developed.

Clean-In-Place Rotor

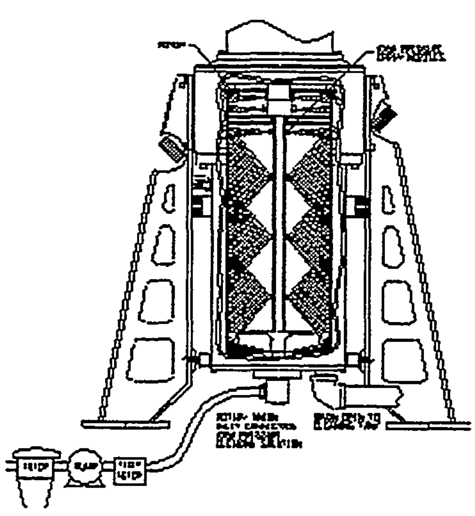


Figure 2

A hollow through-shaft is employed which starts below the bottom plate of the housing and extends into the upper rotor assembly. It is equipped with a series of high pressure spray nozzles for each quadrant. These nozzles provide complete coverage of the internal wall of the rotor, the aqueous underflow, and the upper rotor assembly. A rotary union that is permanently attached to the tail shaft provides the inlet for the desired cleaning solution and allows the cleaning process to be fully automated. The process steps for cleaning are quite simple. Product feed to the centrifuge is halted and the rotor is stopped, which drains the holdup volume into the annulus. Next, draining the process liquid from the centrifuge exposes all the internal rotor surfaces to the cleaning solution spray. Cleaning solution is then pumped to the centrifuge via the rotary union until the unit is clean. After sufficient cleaning, the process is reversed and the centrifuge is put back in service. The total operation is performed in minutes requiring no disassembly of the unit or connection and disconnection of supply lines. When multiple units are set up in parallel to handle a continuous process, sequential cleaning can be used to avoid flow interruptions. The extra centrifuge is the off-line unit and the cleaning process simply shifts from one to the next while the remaining units continue operation.

Processing Principles

The annular centrifugal contactors are low rpm, moderate gravity enhancing (100-1000 G) machines, and can therefore be powered by a direct drive, variable speed motor. The effectiveness of a centrifugal separation can be easily described as proportional to the produc of the force exerted in multiples of gravity (G) and the residence time in seconds or G-seconds Achieving a particular G-seconds value in a liquid-liquid centrifuge can be obtained in two ways increasing the multiples of gravity or increasing the residence time. Creating higher G force values for a specific rotor diameter is a function of rpm only, which is limited by direct drive motor capabilities.

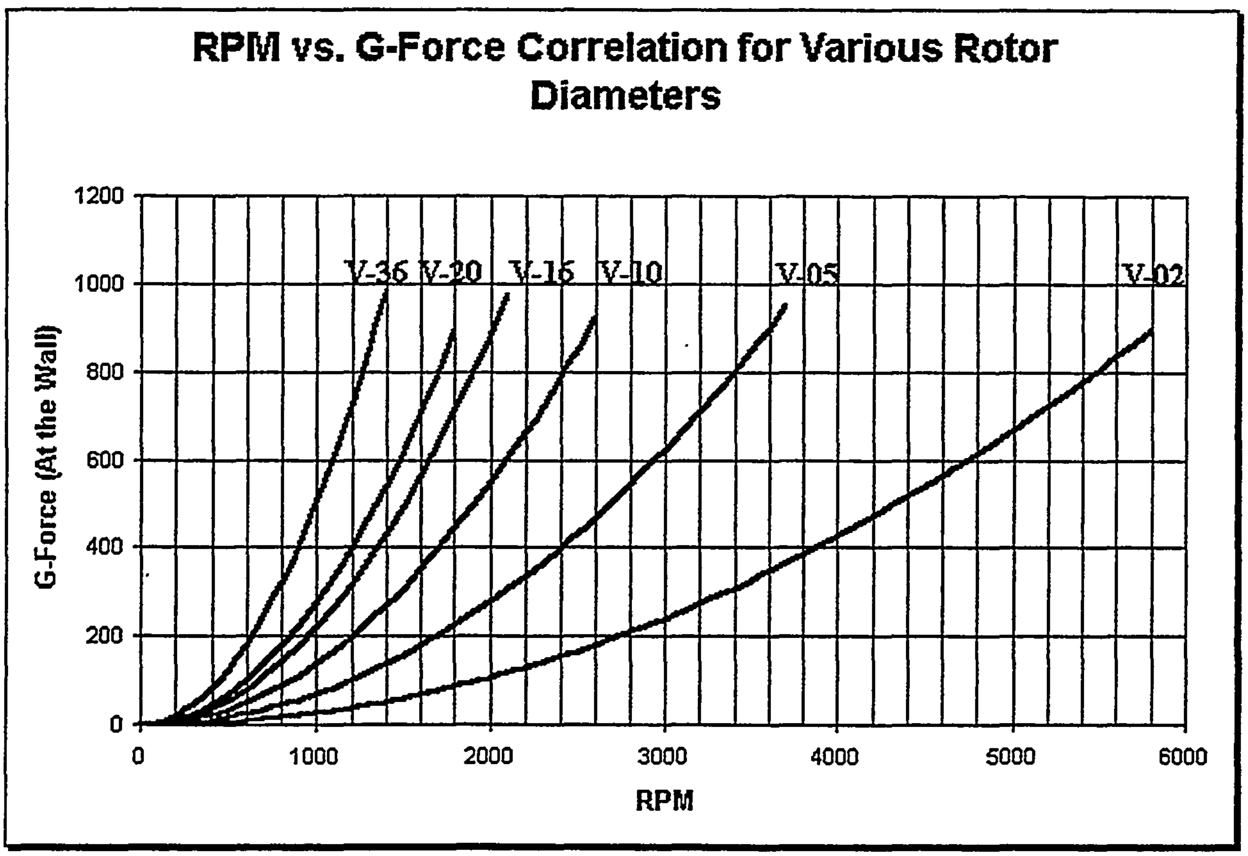


Figure 3

Figure 3 shows a plot of RPM versus G-force for various rotor diameters. Normally 4000 to 12,000 G-seconds of force is adequate to efficiently separate two immiscible liquids in most processes. For separations where the specific gravity differences are slight, G-seconds as high as 50,000 can be obtained by merely slowing the feed rate to the contactor or by upgrading to the next larger size unit. Figure 4 is a plot showing the residence time versus flowrate for a 12. cm. diameter rotor. As a general rule, the residence time increases proportionately with rotor diameter. Therefore, a 25.4 cm. diameter rotor will provide twice the residence time of a 12.7 cm. diameter rotor at maximum operating flow.

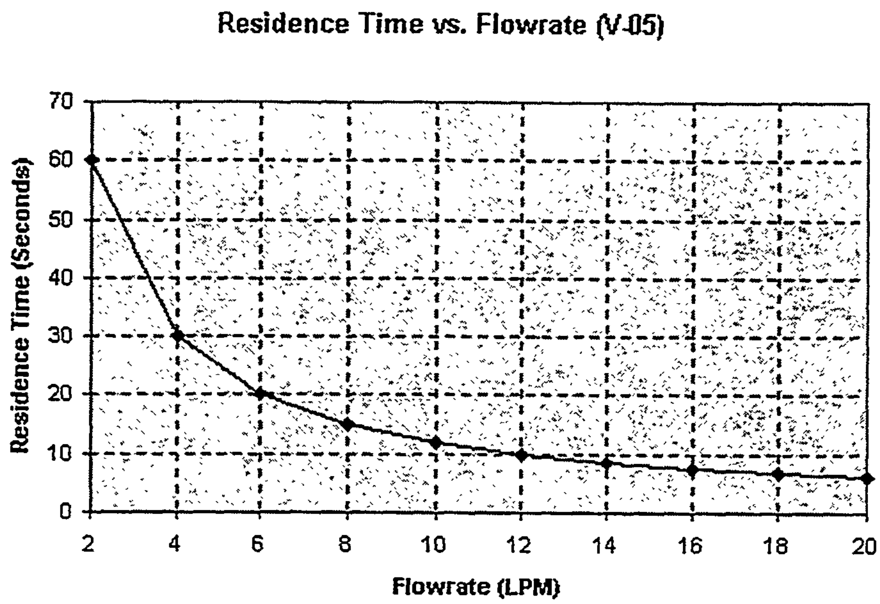


Figure 4

Extraction processes are based upon selective distribution. Transfer of a specie between phases must make allowance for intimate contacting and separation of the phases *(Olive 1966)*. For extraction and washing purposes the ability of the contactor to efficiently mix two phases is vital. It is also important that over-mixing does not occur to avoid emulsification which results in poor separation. Several variables for mixing control are available to the operator of the annular centrifugal contactor. Varying of the rotor speed changes the linear speed of the rotor surface thus effecting the mixing shear.

Rotor Linear Mixing Rate

Diameter.(centimeters)	*m/sec.*
5.0	7.01
12.7	11.6
25.4	16.5
40.6	20.1
50.8	21.6

Table 1

Table 1 shows a comparison of the linear mixing rates at 200 G for the various rotor sizes. Flow rate to the contactor also plays a role in the degree of mixing. A high flow rate results in a high annulus level providing more mixing between the phases and the spinning rotor. These variables can be used to process shear sensitive fluids while addressing cases where high energy mixing is required for optimum mass transfer. The kinetics of certain extraction systems may also dictate that more annular (mixing) residence time is necessary for maximum efficiency. Additional stages may be required to meet these requirements.

Conversely a low flow rate does not generate a high annulus level because the liquid is drawn into the rotor almost immediately. Such a situation does not afford much mixing due to minimum annulus residence time and rotor contact. This reduced mixing parameter can also be better attained through the use of the low mixing sleeve. With the surface of the rotor shrouded, the liquids are no longer subjected to the linear mixing shear, and the only annular mixing is due contact from fluid flow into the annulus. As mentioned previously, some mixing of the two phases occurs as the liquids are accelerated to rotor speed. In washing procedures where kinetics are not an issue, this phase contact is often sufficient. This approach should be taken when employing shear sensitive fluids for washing or extraction. The ability to vary the separating and mixing parameters makes the annular centrifugal contactor more versatile than many of its counterparts.

Sometimes chemical processes require more than just the separation of two liquids of a process stream. The annular contactor has two inlet ports for introduction of solvents and washing solutions, making it an excellent device for extraction applications. Efficient two phase mixing is achieved in the annulus between the spinning rotor and the fixed housing. Mixing and disengaging times range from 10 to 30 seconds each, depending on the feed rate to the unit and unit size. Single stage efficiencies of 90% or higher are typical for solvent extraction systems with rapid kinetics. The advantages of using centrifugal contactors versus columns or mixer-settlers for extraction, washing, and neutralization are numerous. Reagent volume required for a specific process are much less than comparably scaled reactions performed tanks or other vessels. Rapid mixing and separation can enhance product recovery and quality. This is especially true in processes where product degradation occurs under separation conditions due to prolonged contact with either pH extreme solutions or reagents that continue to react with the product. Achieved separations are better than when normal decant methods are used; and this saves product, time, and minimizes waste.

Multistage processing

Continuous separation, washing, and extraction processes often require many steps or stages to achieve desired product quality or required extraction efficiencies. Centrifugal contactors can be readily interconnected to allow multistage processes (Figure 5). This is a three stage counter current washing process in which an organic solvent contaminated with 10,000 ppm salts washed with fresh water. We assume 90% efficiency at each stage.

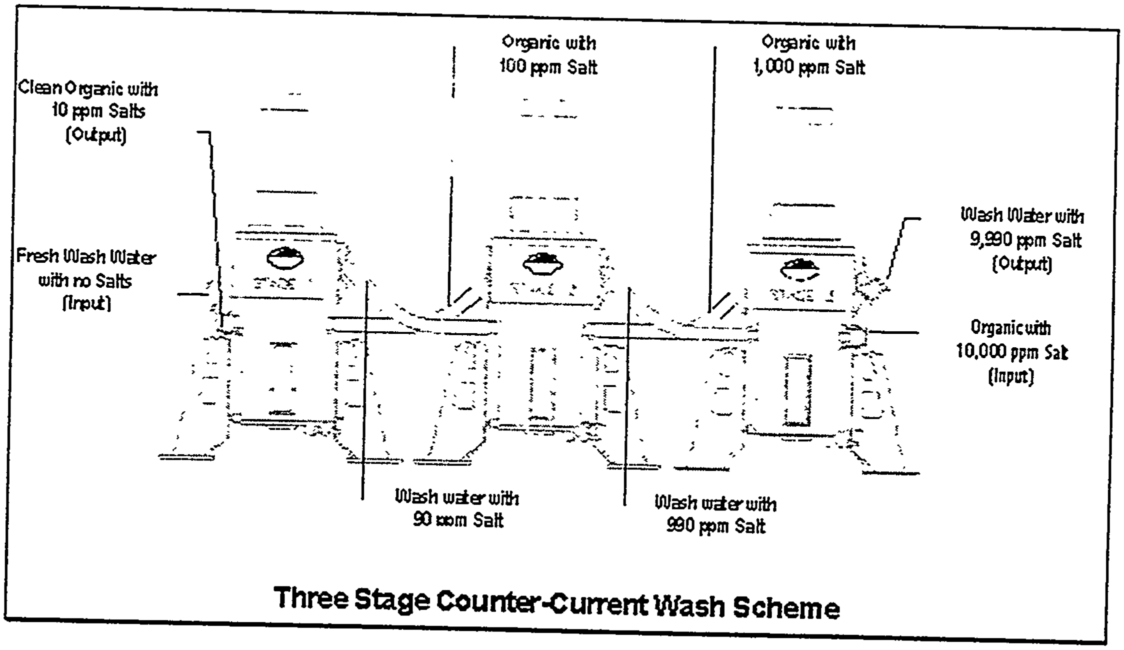


Figure 5

Because the discharge ports are at a higher elevation than the inlets, pumps are not required for feed from stage to stage. For example, a multistage counter-current wash process would only require two feed pumps, one for each liquid phase. In this case, the barren wash water in stage 1 contacts the cleanest organic in order to remove the remaining small amount of salts, acting as a polishing step. In stage 3, semi-loaded wash water contacts the pregnant organic feed thereby maximizing the efficiency of the wash. Receiver tanks collect the washed organic product and the salted waste water exiting from stages 1 and 3, respectively. This feature eliminates numerous pumps, tanks, and level controls. Such a system occupies only a fraction of the operating floor space of a corresponding batch process.

Multi Stage Process

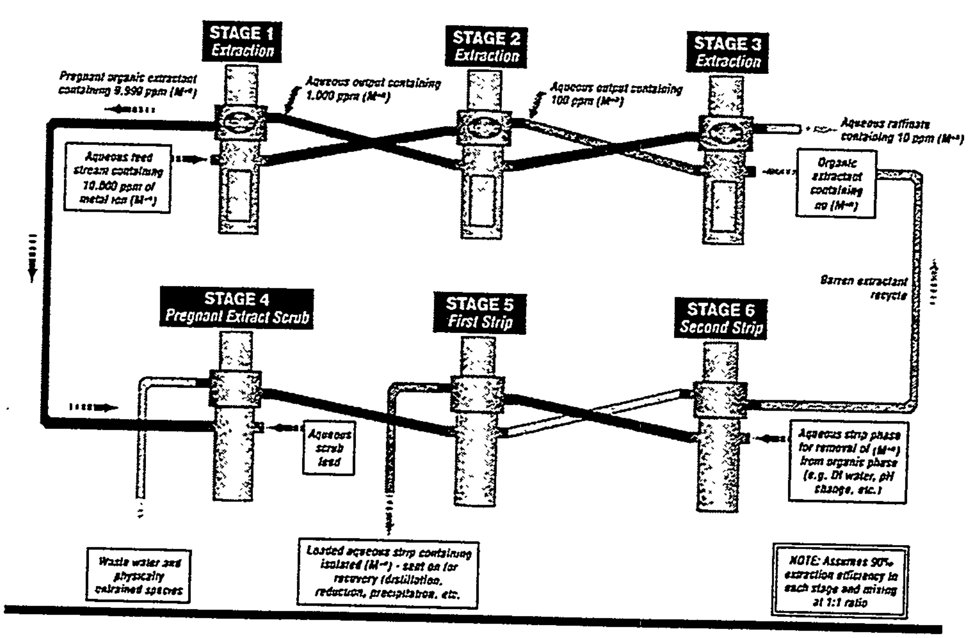


Figure 6

A further example of a multistage process is given in Figure 6. In this case, six inter-connected stages provide a continuous metal extraction, scrub, and strip process. No intermediate pumps or tanks are required for the continuous phase as it traverses the complete separation. A 90% efficiency is assumed and a 1:1 aqueous to organic ratio is used to quantify the interstage met concentrations in the 3 stage extraction part of this process. Counter current flow in both the extraction and strip stages is employed to gain maximum efficiency while minimizing reagent usage.

FIELD APPLICATIONS

Although employed by the Department of Energy for decades, this technology has only recently become commercially available. Therefore, a broad base of industry experience is lacking at this time. However, as more than 65 annular centrifugal contactors have been sold during the past two years, more data and experience is forthcoming. Numerous studies, especially with the laboratory scaled unit, are in progress in such industries as mining, metals recovery and purification, and chemical and pharmaceutical production. Conversion of separation, washing and extraction processes from batch to continuous is rapidly gaining importance due to highly efficiency goals and increased waste management costs.

A good example of a commercial installation took place in April, 1997 at Great Lakes Chemic at El Dorado, Arkansas. An annular centrifuge contactor was installed as the first step converting a batch process to a continuous operation following the reaction sequence. replaces a 4,000 gallon decant tank by efficiently separating the brominated polymer produ from the aqueous waste at the rate of 45 liters per minute. The increase in efficiency thus gaine has been measured as a 3% improvement in product recovery, which represents 136,00 kilograms of brominated polymer worth $400,000 per year.

The contactor has been operating continuously without problems while being fed in batch mod from the multiple production reactors. In addition, off normal, emulsified product batches whic previously were processed off-line are no longer a concern. The enhanced separation power the annular centrifugal contactor operating at 300 times gravity processes all product rapidly an efficiently.

A second Hastelloy C-276 contactor has been purchased for the next process step, hydrochlor washing of the polymer phase. When installed, this unit will remove unreacted amine from th product and will enhance the recycling of this starting material. Coupling the second unit to th first will be simple and will make the process even more cost effective to operat

CONCLUSIONS

Annular centrifugal contactor designs of this type are a significant improvement over tradition methods of liquid-liquid processing. Increased productivity from continuous or simultaneou multiple step processes as well as improved finished product quality from better process contr is realized. Rapid and efficient separation prevents significant product loss at the liquid-liqu interface and from unwanted reactions resulting from prolonged contact times. Multistag separations and extractions utilizing annular centrifugal contactors not only minimize water an liquid reagent usage but also occupy a minimum of floor space compared to the alternative Low maintenance due to moderate operating speeds and ease of cleaning means downtime reduced thereby maintaining process efficiency.

ACKNOWLEDGEMENTS

The authors wish to thank Larry Macaluso, Bill Flim, Mary Manning, and Deana Ward for the contributions and assistance in the preparation of this manuscript.

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Large, high volume annular centrifugal contactors require a rotor bottom tail shaft to a stability. These rotors are suspended between an upper and lower bearing and, coupled w the size and weight, makes frequent disassembly for cleaning impractical. Therefore clean-in-place (CIP) rotor (Figure 2) has been developed.

Clean-In-Place Rotor

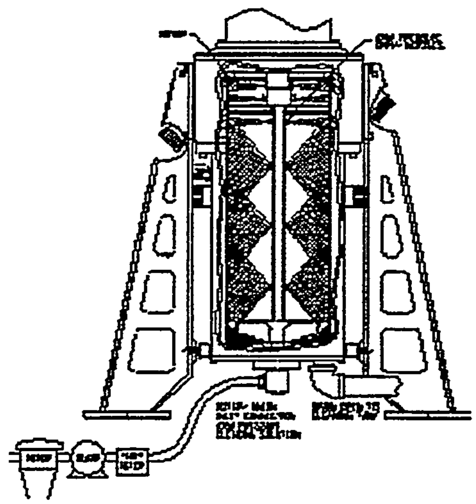


Figure 2

A hollow through-shaft is employed which starts below the bottom plate of the housing and extends into the upper rotor assembly. It is equipped with a series of high pressure spray nozzles for each quadrant. These nozzles provide complete coverage of the internal wall of th rotor, the aqueous underflow, and the upper rotor assembly. A rotary union that is permanentl attached to the tail shaft provides the inlet for the desired cleaning solution and allows the cleaning process to be fully automated. The process steps for cleaning are quite simple. Product feed to the centrifuge is halted and the rotor is stopped, which drains the holdup volun into the annulus. Next, draining the process liquid from the centrifuge exposes all the internal rotor surfaces to the cleaning solution spray. Cleaning solution is then pumped to the centrifu via the rotary union until the unit is clean. After sufficient cleaning, the process is reversed an the centrifuge is put back in service. The total operation is performed in minutes requiring no disassembly of the unit or connection and disconnection of supply lines. When multiple units are set up in parallel to handle a continuous process, sequential cleaning can be used to avoi flow interruptions. The extra centrifuge is the off-line unit and the cleaning process simply shif from one to the next while the remaining units continue operation.

Processing Principles

The annular centrifugal contactors are low rpm, moderate gravity enhancing (100-1000 G) machines, and can therefore be powered by a direct drive, variable speed motor. The effectiveness of a centrifugal separation can be easily described as proportional to the produ of the force exerted in multiples of gravity (G) and the residence time in seconds or G-second Achieving a particular G-seconds value in a liquid-liquid centrifuge can be obtained in two way increasing the multiples of gravity or increasing the residence time. Creating higher G force

Products

Liquid-Liquid Centrifugal Separators

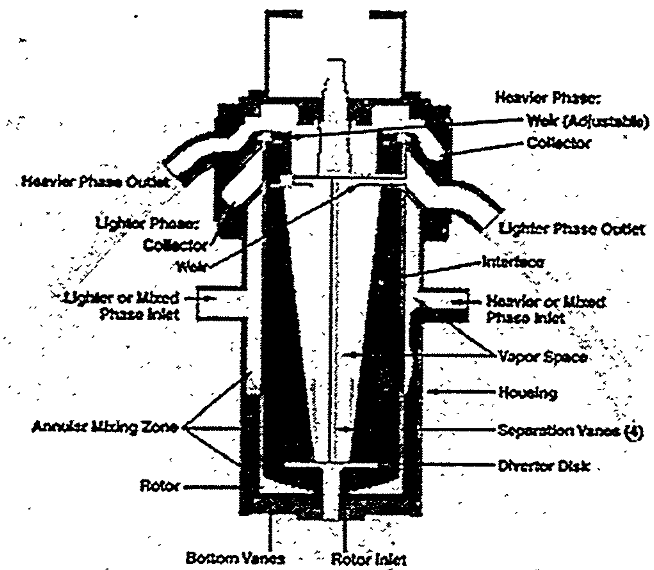
The basis for the CINC centrifugal separator is a *process so* **unique** t
our **unique** underflow and weir design, originally developed by the U.
our systems are capable of separating a variety of liquids with ease a
unique features include:

- Efficient, effective separation/extraction utilizing only 200-1000
- Low mixing option for shear sensitive fluids
- The ability to accommodate continuous changes in input ratios
- Automatically handle variable flow rates and flow interruptions
- Handle input temperatures from freezing to boiling
- Process flow rates as low as 2 liters per minute (1/2 gallons per liters per minute (200 gallons per minute)
- Clean in Place (CIP) rotor system for high reliability and low ma
- Rugged Stainless Steel Construction
- Simple direct drive with sealed bearings and only one moving p. maintenance

How it Works

Principle or Operation

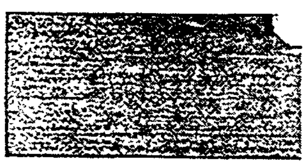
The CINC Liqui
Centrifugal Sep
utilizes the forc
generated by rc
an object about
central axis. By
spinning two flu
different densiti
a rotating conta
rotor the heavie
forced to the wa
inside of the rot
the lighter fluid
toward the cent
rotor.



In the figure the
fluid is shown ir
the lighter phas
yellow and the I
phase fluid in b
can be seen the
fluids enter alre
mixed (separati
process) or
independently
(extraction process) through one or both inlets. The fluids mix in the annulu
between the rotor and the inside of the housing in the mixing zone. The flui
then fed through an inlet or hole at the bottom of the rotor. A diverter plate c
used to direct the fluid to the inside of the rotor sleeve (shown in gray).

As additional fluid is introduced to the rotor the fluid within the rotor is force
upward to the rotor underflows and weirs. The light phase fluid having a low
density flows toward the center of the rotor (shown in yellow) where it exits
over the lighter phase weir through the lighter phase outlets. The heavy pha
continues up the rotor (shown in blue) through the underflows, then exits ov
heavy phase weir. Each fluid is collected in its own collector ring and then l
the separator through the heavy and light phase outlets.

SPECIFICATIONS	Model V-2	Model V-5	Model V-10
Rotor Size	2"	5"	10"
Throughput	0 - .5 GPM 2 LPM	1 - 6 GPM 4 - 22 LPM	10 - 30 GPM 35 - 110 LPM
Footprint (Separator Only)	9" X 9"	1' X 1'	2' X 2'
Height (Includes Motor)	17"	3'	5'
Fittings (NPT Male) Input/Output	3/8" / 3/8"	1" / 1"	2" / 2"
Standard Power	Electric	Electric	Electric
Power Requirements	1/6 HP	2 HP	7.5 HP
	220 VAC	220 or 440 VAC	220 or 440 VAC
	Single-Phase	Single- or Three-Phase	Single- or Three-Pha
Weight - Approx. (In Stainless Steel)	25 lbs 11.4 kg	150 lbs 70 kg	750 lbs 340 kg



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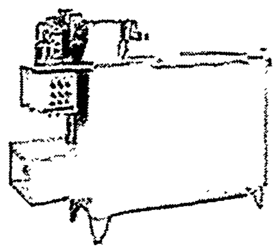
SAMSCO

Samsco Evaporators

Evaporator Design / Solids and Oil Removal

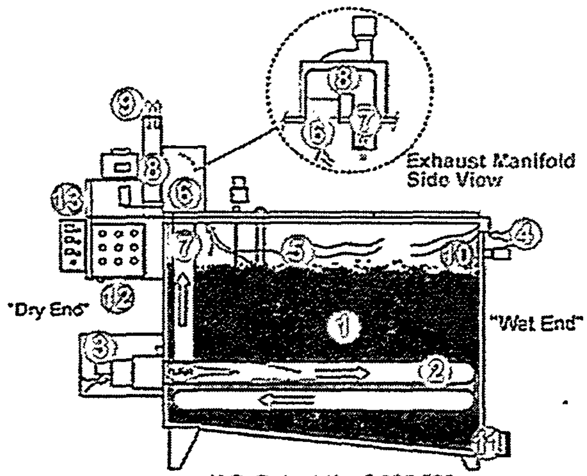
Equipment Design / Solids & Oil Removal
Heat Exchanger System
Air Handling & Mist Elimination System
Operational and Safety features
Optional Add-Ons and Systems
Contact Us
Home



Samsco's evaporator design philosophy is to keep the system "elegantly simple" for the user, based upon Samsco's application experience and strong engineering expertise. Samsco's engineering practices are based upon real-world evaporator experiences, and they demonstrate practicality and depth of thought.

Samsco's philosophy has achieved time-proven evaporator performance, safety, simplicity of use, and minimal maintenance in its evaporation technology.

Principles of Operation



U.S. Patent No. 5,032,525
Samsco Water Evaporator

To view a full size schematic and text explanation in Adobe Acrobat

To download Adobe Acrobat Reader

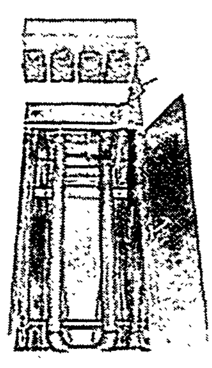
- Solution is fed to the tank **(1)** in either a batch or continuous mode (automatic fill)
- Solution is heated in the tank to boiling (212°F) by a serpentine gas-fired heat exchanger **(2)**
- Blower **(8)** draws ambient air through both the burner **(3)** and a specially sized opening in the tank **(4)**
- Air is drawn across the surface **(5)** of the heated liquid, sweeping away

water vapor as it breaks the surface

- This moisture-saturated air and the flue gases leave the tank via separate passageways. The moisture saturated air passes through a coalescer-style mist eliminator, which removes oil mist and droplets, allowing only the steam to pass through. The steam **(6)** and the flue gases **(7)** are joined together at the blower entrance
- The two air streams, environmentally safe, are mixed in the blower **(8)** and are released up the stack **(9)**
- Free oils and oils whose emulsions have been thermally broken float to the surface. They are then removed, either automatically or by simply pushing a button. These oils exit via an overflow trough **(10)** into an external waste receptacle
- Precipitated solids settle to a sloping trough and are easily removed via a convenient clean-out port **(11)**
- A full-function Control Panel **(12)** and System Process Control (SPC) **(13)** indicate and manage all operating and safety conditions

Evaporator General Tank Design
Equipment is compact and commands only small footprint on the factory floor

Tank's "Dry End" (electronics & burner) and its "Wet End" (oil & residue removal) are placed at opposite ends of the tank (practical, convenient and safe).



Convenient Solids and Oil Removal
Equipment design provides accessibility to tank interior and convenient sludge/solid removal.

- Serpentine heat-exchanger - with **open center area** - allows easy access to sloped bottom
  No bulky immersed horizontal box, obstructing access to tank's bottom
- Tank's bottom slopes to a convenient
  4" Cleanout Port
- Large hinged lids give roomy access to tank interior/bottom (½ to ¾ of tank interior)

Simple oil decanting is handled via an oil overflow trough.

- Proper height for 55 gallon drum or holding tank
- Simple switch activation automatically shuts off burner and decants oil
- Automatic oil removal is available

MICROPUMP, INC. • A unit of IDEX
1402 NE 136th Avenue
Vancouver, WA 98684-0818
Phone: (360) 253-2008
Fax: (360) 253-8294
e-mail: info@micropump.com

MICROPUMP

FACSIMILE TRANSMISSION

To:	Scott	From	Mindi Walker
Fax:	208-533-7471	Phone ext.	229
Co:	ARGONNE	Pages:	11
Phone:		Date:	May 24, 2000
Re:	Technical Specs on 114,5500, 10K	CC:	

Scott,

Here is the technical information you requested on our Models 114, 5500 and 10K. I included the 3 gear widths on the 5500, because I wasn't sure which one you needed. There is a formula on the "high performance viscosity" curves to figure out hp.

Hopefully these will help determine your motor needs.

Please call us if you need further assistance!

Thank you,

Mindi

Mindi Walker
Customer Service Manager

MICROPUMP IDEX

Technical Data

Series 114

Order Code

Base Code | Gear Set | Drive Mount | Options

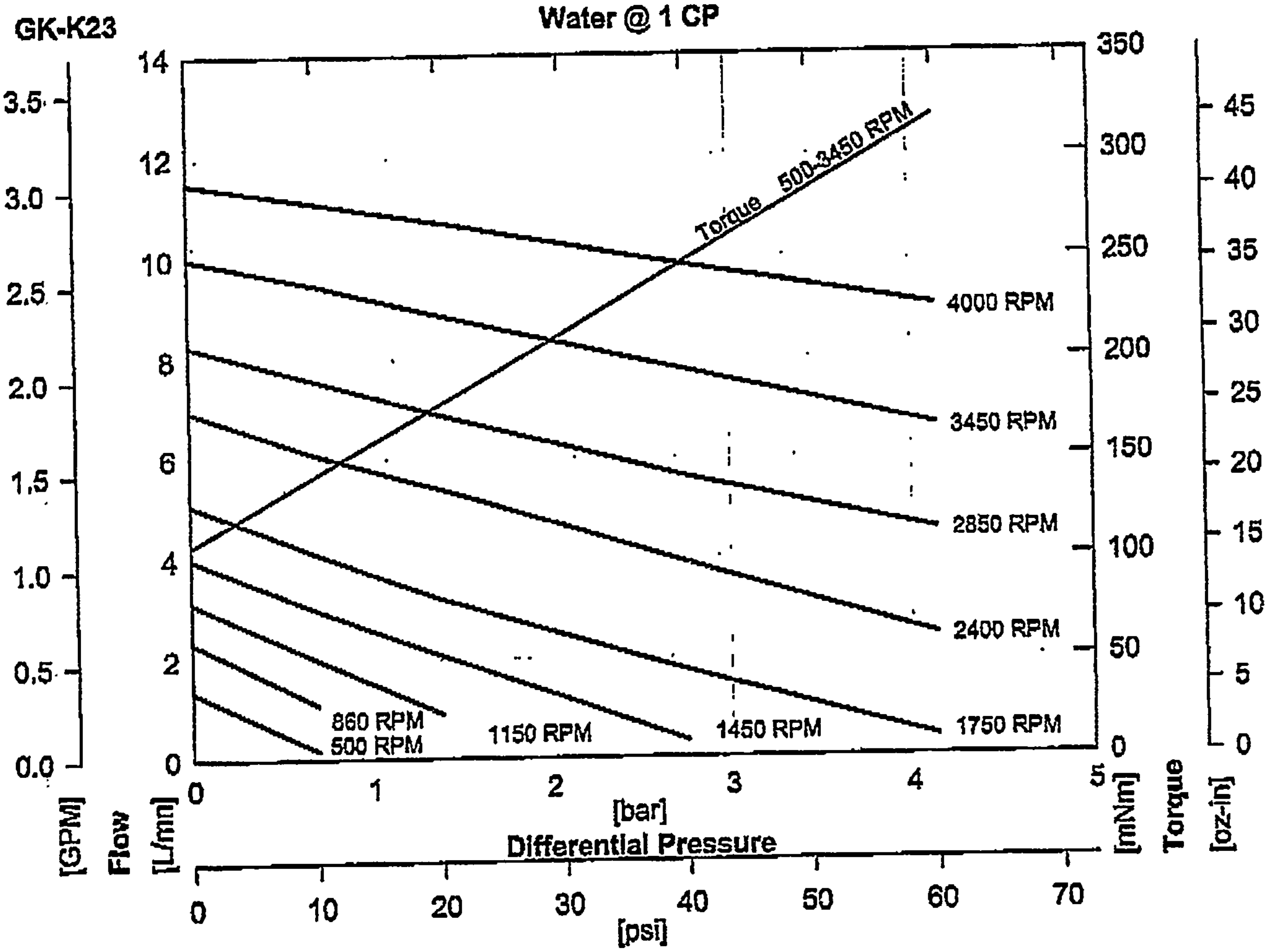
G	K	-	K23					
1	2	3	4	5	6	7	8	

Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP16
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance



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info@micropump.com www.micropump.com

Order Code

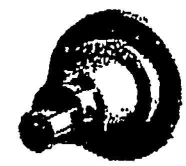
Base Code — Gear Set — Drive Mount — Options

G	K	-	K23					
1	2	3	4	5	6	7	8	

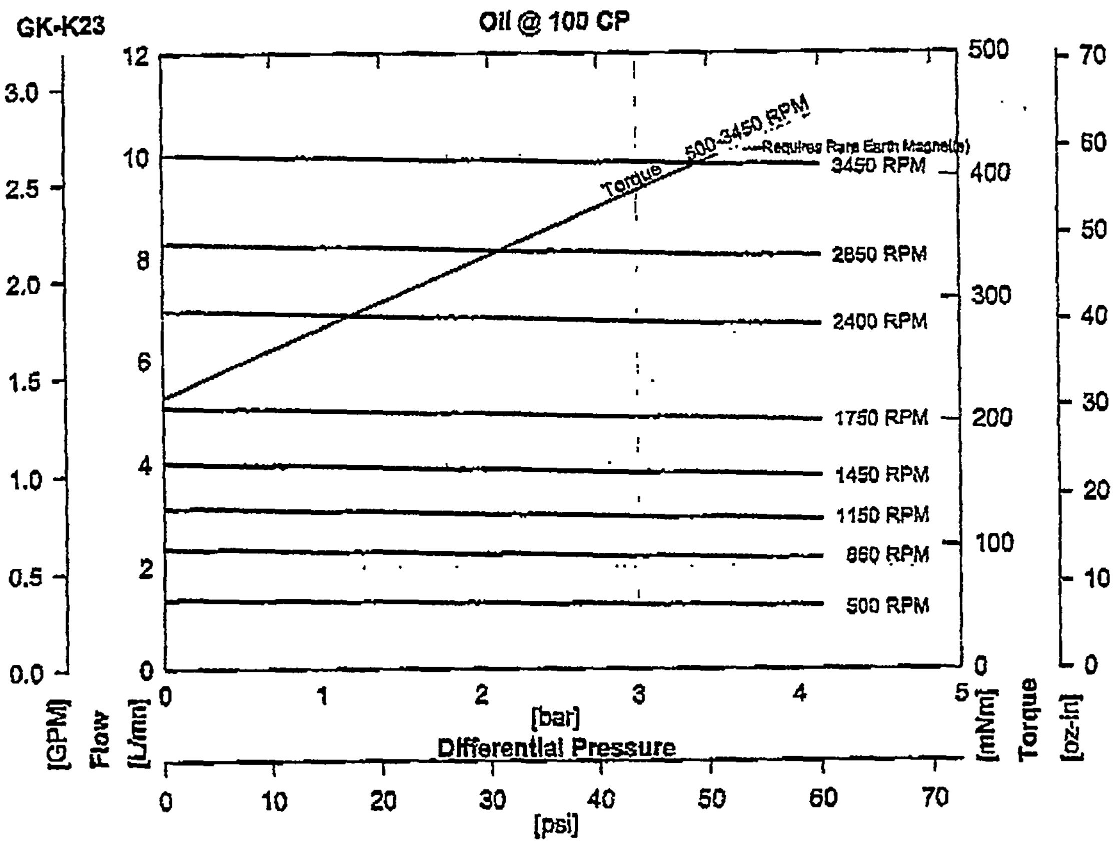
Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP16
Sleeve Bushings
O-Ring Seals (Qty 3)



Performance-High Viscosity



$$\text{Watts} = \frac{\text{Torque [mNm]} \times \text{Speed [RPM]}}{9555}$$

$$\text{HP} = \frac{\text{Torque [oz-in]} \times \text{Speed [RPM]}}{1.008 \times 10^{6}}$$

To calculate torque, multiply correction factor by torque from viscosity curve above.

Torque Correction Factors: For Higher Viscosity Liquids

	Viscosity [cp]	1	100	1500
	Max Speed [RPM]	3450	3450	860
[Bar]	[psi]			
0.3	5	0.5	1	1.6
1.4	20	0.6	1	1.5
2.8	40	0.7	1	1.4
4.1	60	0.7	1	1.3

Magnet Decouple Torque

Driven Magnet	Driving Hub	Torque [mNm]	Torque [oz.in]
Ferrite	Ferrite	417	59

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Technical Data

Series 5500

MICROPUMP IDEX

Order Code

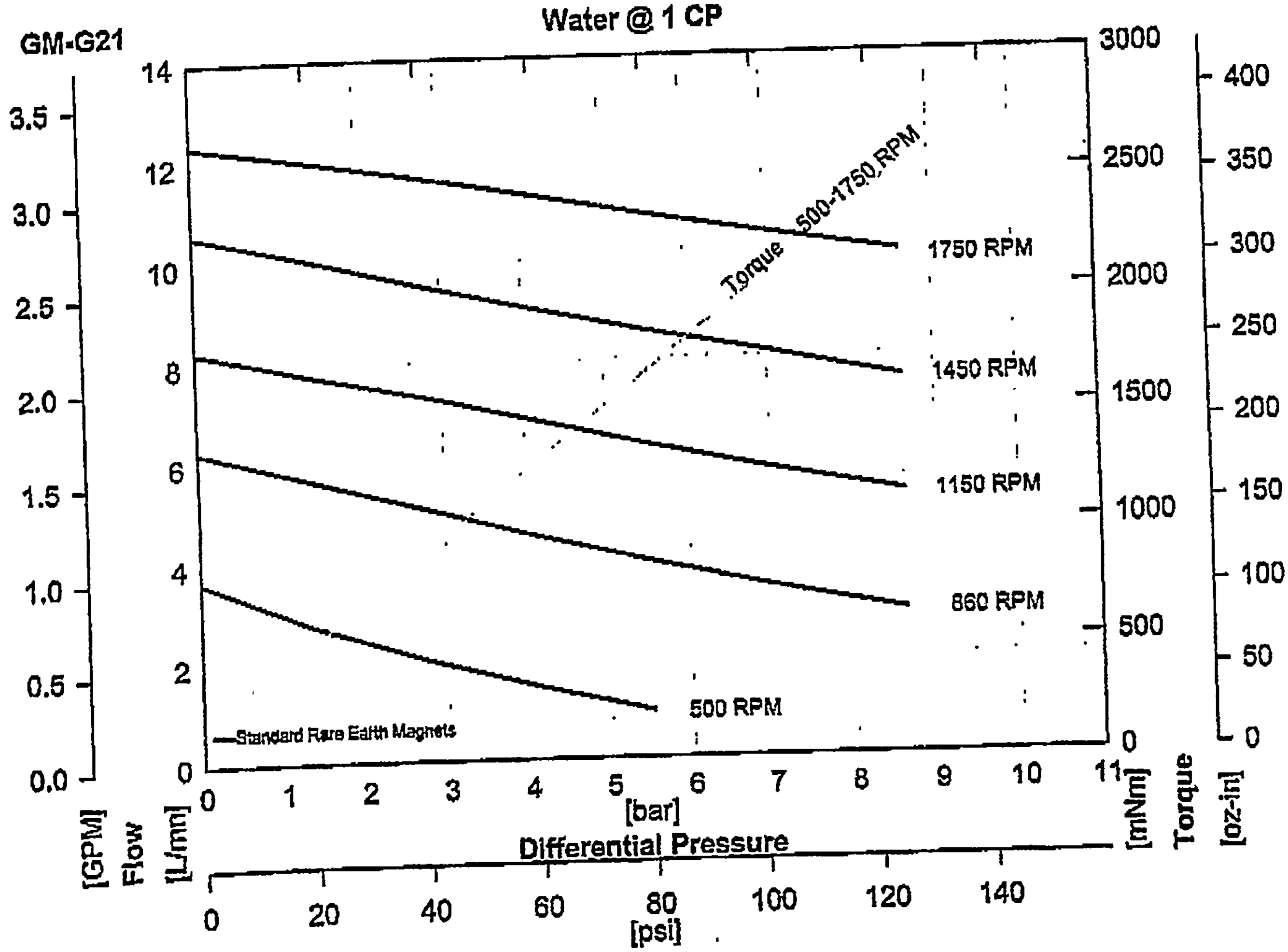
Base Code			Gear Set				Drive Mount	Options
G	M	-	G21					
1	2	3	4	5	6	7	8	

1–3: Model; 5–7: Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance



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MICROPUMP IDEX

Technical Data

Series 5500

Order Code

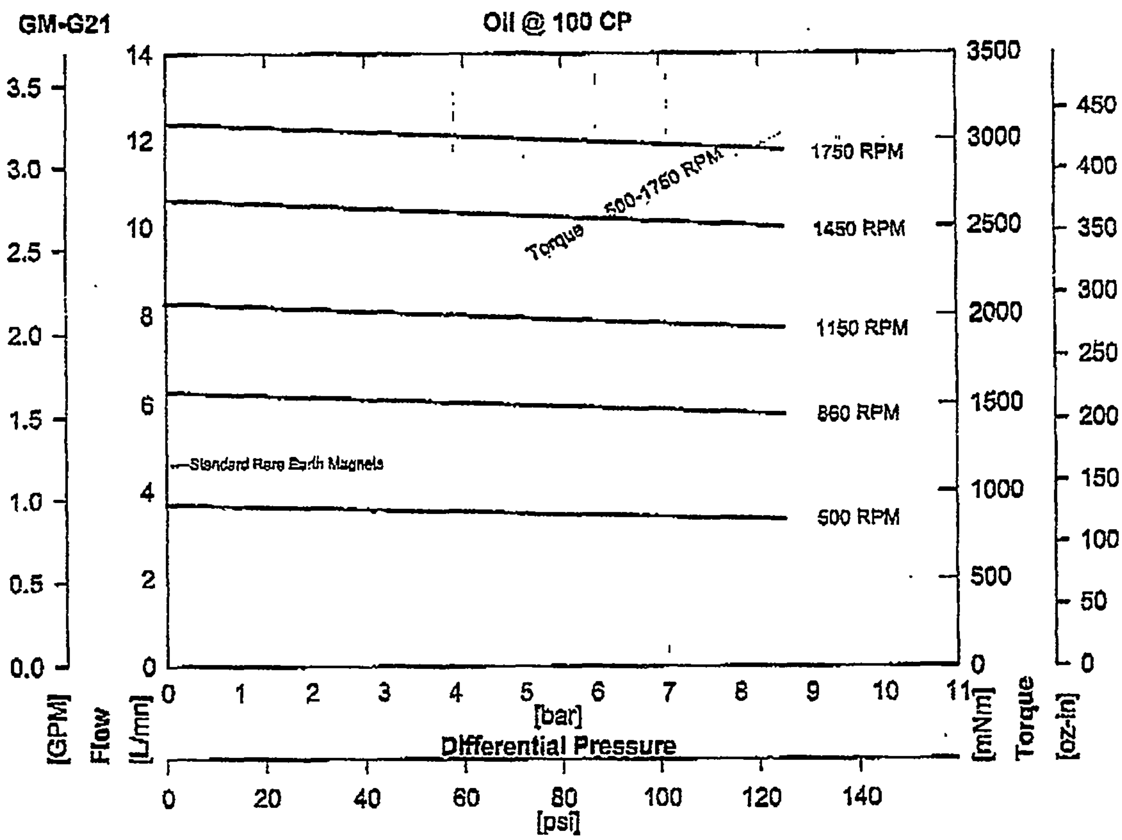
Base Code			Gear Set			Drive Mount	Options
G	M	-	G21				
1	2	3	4	5	6	7	8

Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance-High Viscosity



Watts = Torque [mNm] x Speed [RPM] / 9555

HP = Torque [oz-in] x Speed [RPM] / 1.008 x 10^6

To calculate torque, multiply correction factor by torque from viscosity curve above.

Torque Correction Factors: For Higher Viscosity Liquids

	Viscosity [cp]	1	100	2500
	Max Speed [RPM]	1750	1750	1750
[Bar]	[psi]			
0.3	5	0.1	1	3.8
1.4	20	0.4	1	3.2
2.8	40	0.5	1	2.6
4.1	60	0.7	1	2.3
5.5	80	0.8	1	2.3
6.9	100	0.8	1	

Magnet Decouple Torque

Driven Magnet	Driving Hub	Torque [mNm]	Torque [oz.in]
SmCo	SmCo	5650	800

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MICROPUMP IDEX

Technical Data

Series 5500

Order Code

Base Code

G	M	-	G23				
1	2	3	4	5	6	7	8

Gear Set (4); Drive Mount (8); Options

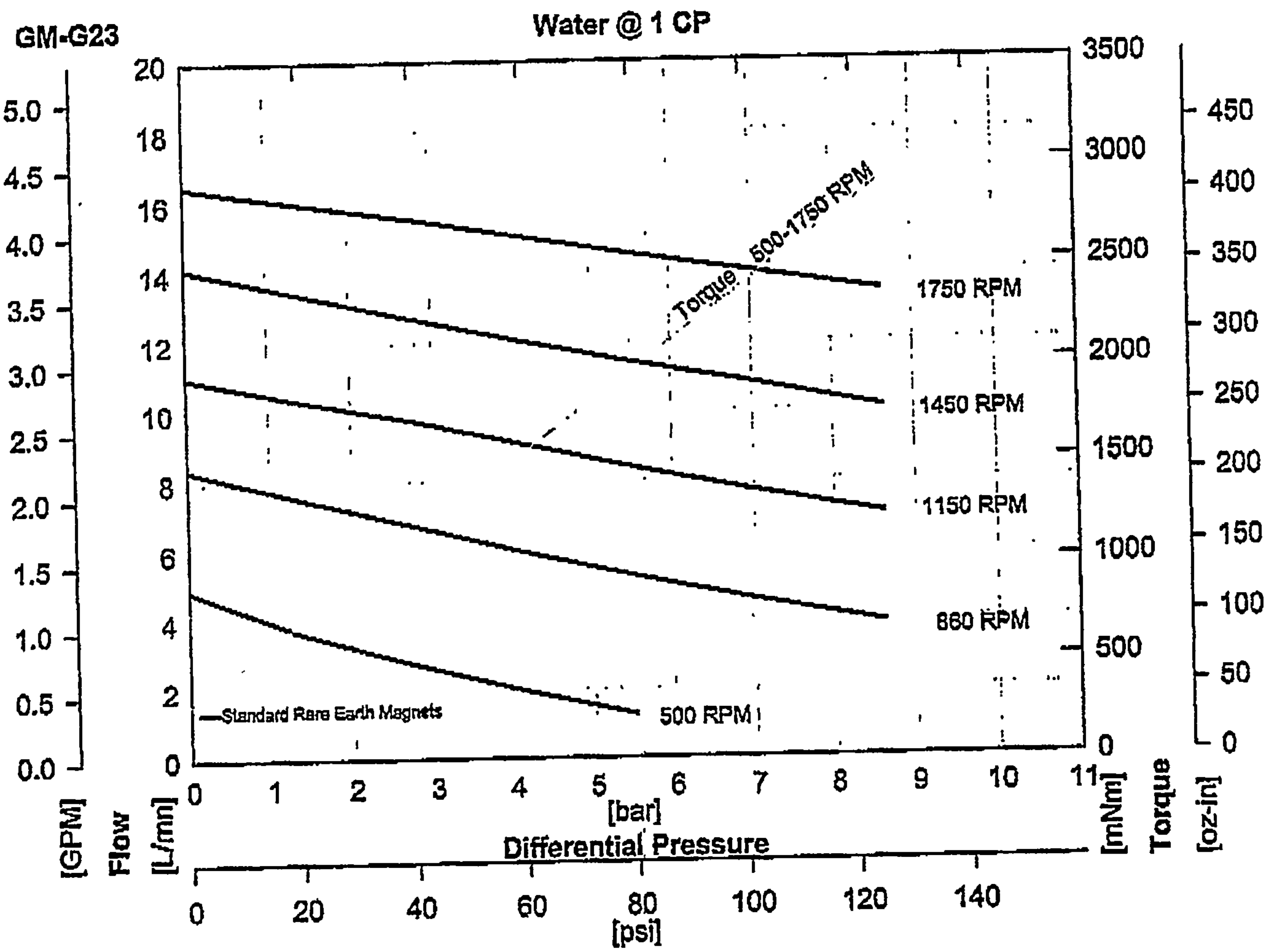
1–3: Model; 5–7: Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction

Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance



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Order Code

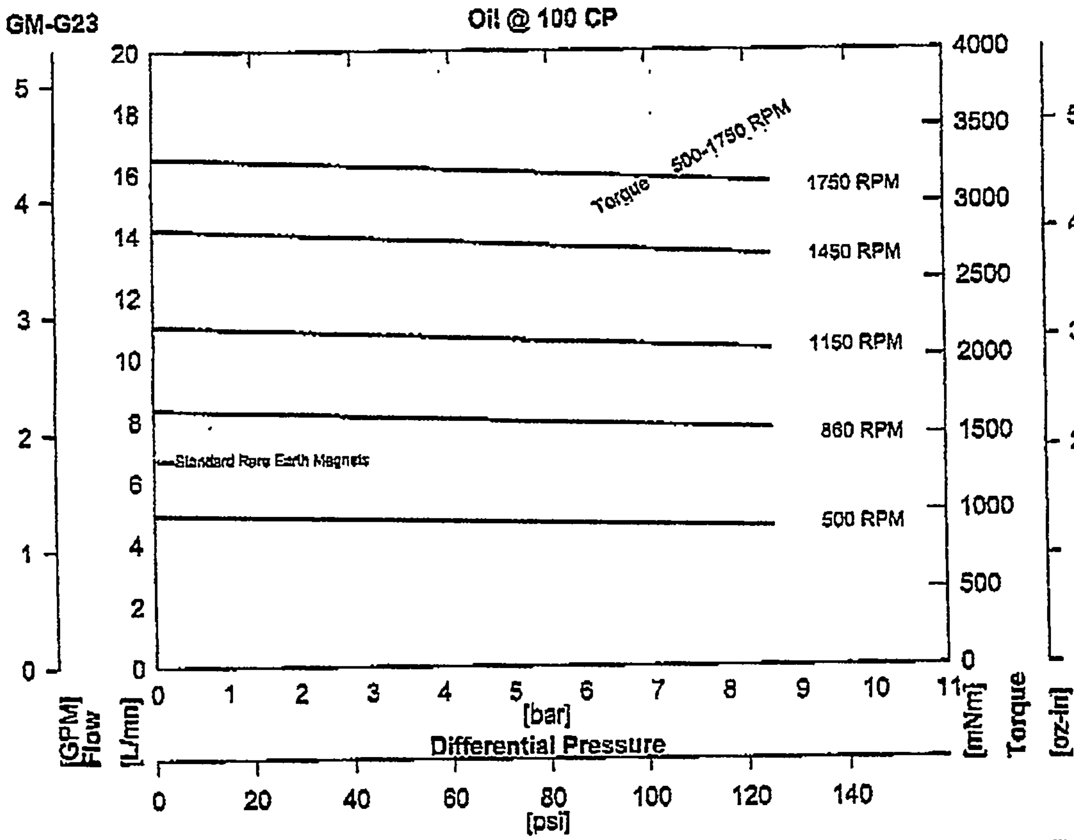
Base Code			Gear Set				Drive Mount	Options
G	M	-	G23					
1	2	3	4	5	6	7	8	

Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance-High Viscosity



Watts = Torque [mNm] x Speed [RPM] / 9555

HP = Torque [oz-in] x Speed [RPM] / 1.008 x 10^6

To calculate torque, multiply correction factor by torque from viscosity curve above.

Torque Correction Factors: For Higher Viscosity Liquids

	Viscosity [cp]	1	100	2500
	Max Speed [RPM]	1750	1750	1750
[Bar]	[psi]			
0.3	5	0.2	1	3.4
1.4	20	0.4	1	2.9
2.8	40	0.6	1	2.5
4.1	60	0.7	1	2.2
5.5	80	0.8	1	
6.9	100	0.8	1	

Magnet Decouple Torque

Driven Magnet	Driving Hub	Torque [mNm]	Torque [oz.in]
SmCo	SmCo	5650	800

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Order Code

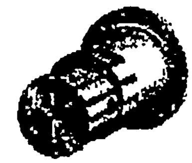
Base Code | Gear Set | Drive Mount | Options

G	M	-	G25				
1	2	3	4	5	6	7	8

1–3: Model; 5–7: Wetted Materials

O/C: Pump
S/K: Service Kit

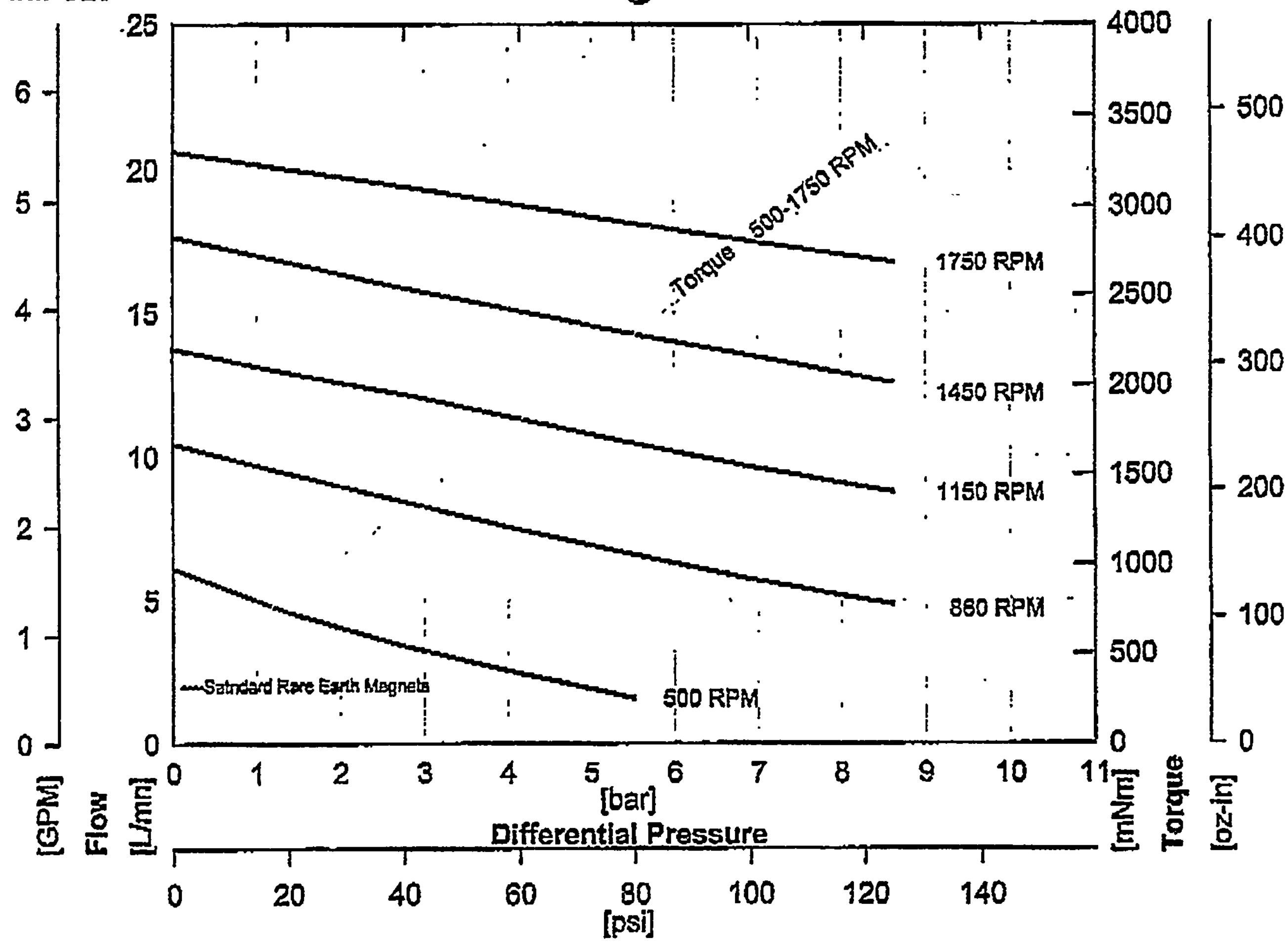
Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)



Performance

GM-G25

Water @ 1 CP



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MAY.24.2000 11:33AM MICROPUMP INC - SALE NO.525 P.8/11

MICROPUMP IDEX

Technical Data

Series 5500

Order Code

Base Code — Gear Set — Drive Mount — Options

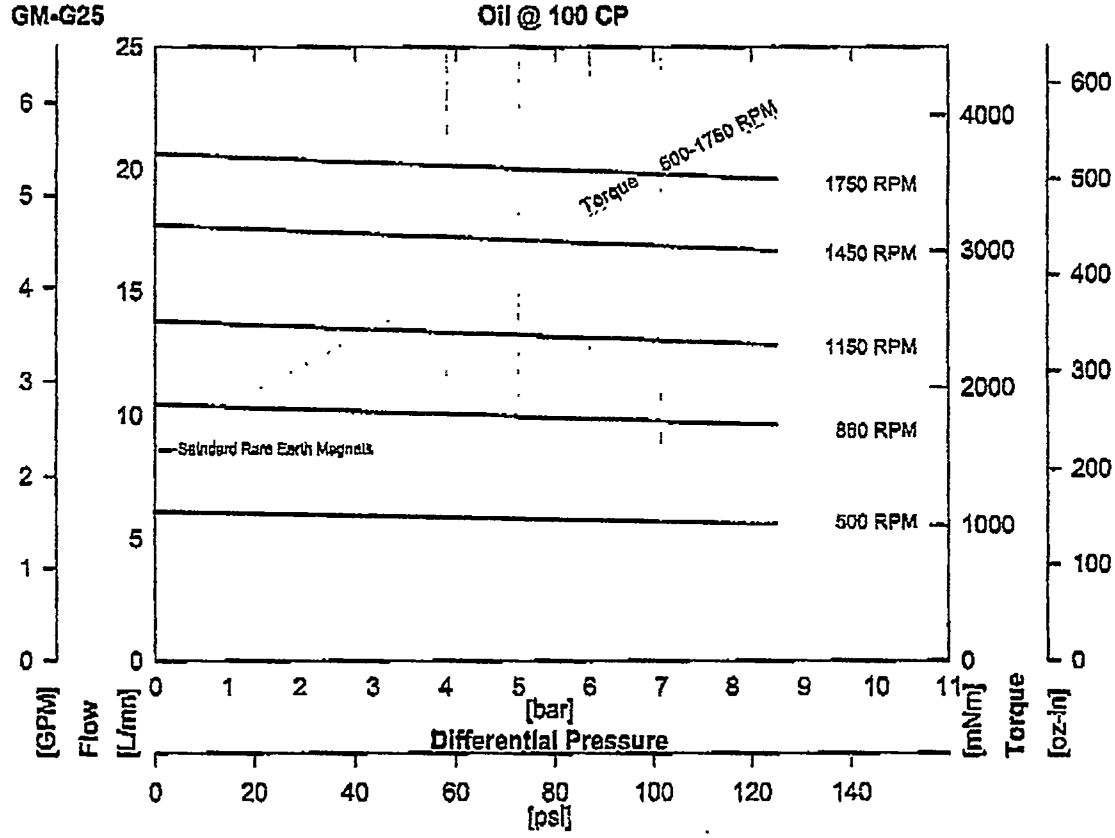
G	M	•	G25					
1	2	3	4	5	6	7	8	

Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Two Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance-High Viscosity



Watts = Torque [mNm] x Speed [RPM] / 9555

HP = Torque [oz-in] x Speed [RPM] / 1.008 x 10^6

To calculate torque, multiply correction factor by torque from viscosity curve above.

Torque Correction Factors: For Higher Viscosity Liquids				
	Viscosity [cp]	1	100	2500
	Max Speed [RPM]	1750	1750	1750
[Bar]	[psi]			
0.3	5	0.2	1	3.0
1.4	20	0.4	1	2.6
2.8	40	0.6	1	2.2
4.1	60	0.7	1	
5.5	80	0.8	1	
6.9	100	0.8	1	

Magnet Decouple Torque			
Driven Magnet	Driving Hub	Torque [mNm]	Torque [oz.in]
SmCo	SmCo	5650	800

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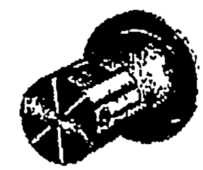
Order Code

Base Code			Gear Set			Drive Mount		Options
G	N	-	G35					
1	2	3	4	5	6	7	8	

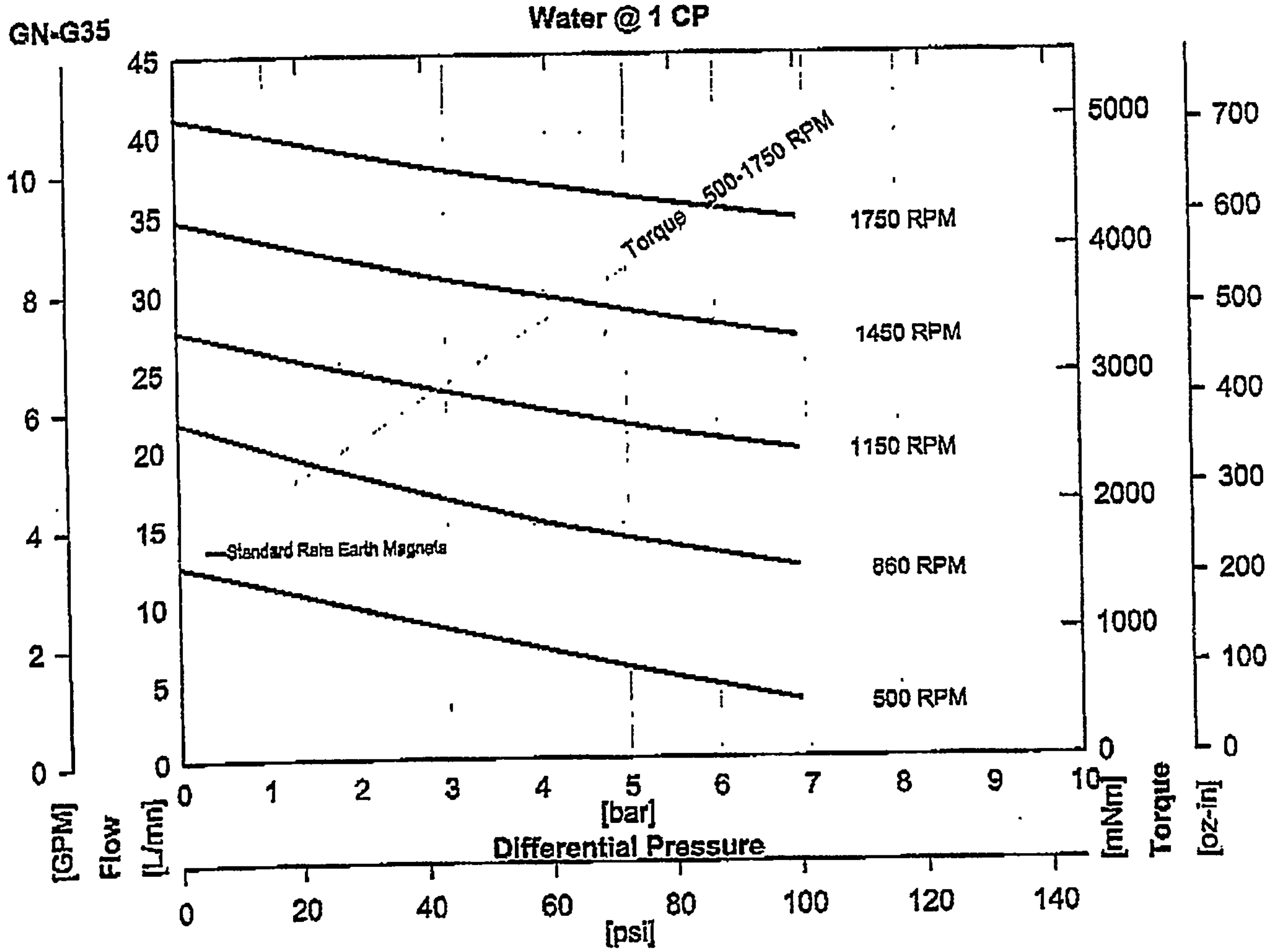
Model — Wetted Materials

O/C: Pump
S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Three Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)



Performance



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Technical Data

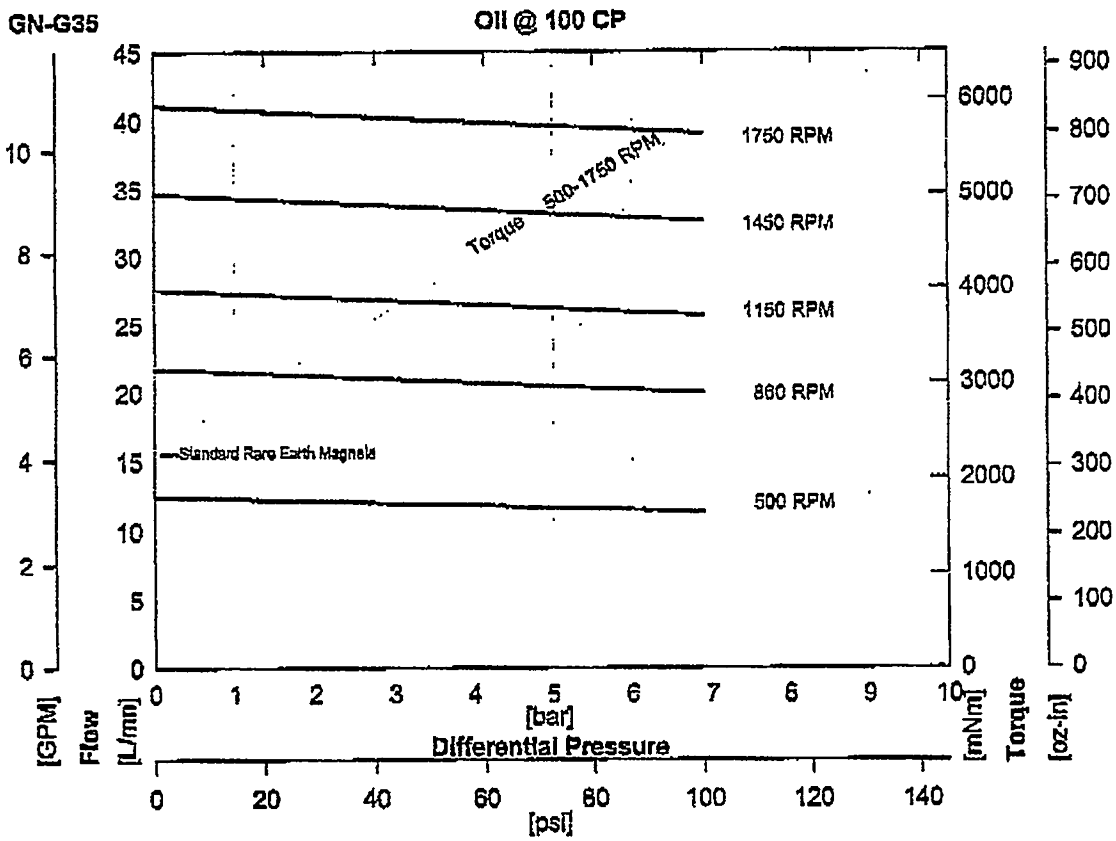
Series 10K

MICROPUMP IDEX

Order Code								
Base Code			Gear Set			Drive Mount		Options
G	N	-	G35					
1	2	3	4	5	6	7	8	
Model			Wetted Materials					O/C: Pump S/K: Service Kit

Pump Construction
Magnetic Drive Gear Pump
Cavity Style
Three Helical, Shafted Gears/DP10
Sleeve Bushings
O-Ring Seals (Qty 3)

Performance-High Viscosity



Watts=Torque [mNm] x Speed [RPM] / 9555

HP=Torque [oz-in] x Speed [RPM] / 1.008 x 10^6

To calculate torque, multiply correction factor by torque from viscosity curve above.

Torque Correction Factors: For Higher Viscosity Liquids

	Viscosity [cp]	1	100	2500
	Max Speed [RPM]	1750	1750	200
[Bar]	[psi]			
0.3	5	0.7	1	1.6
1.4	20	0.7	1	1.6
2.8	40	0.8	1	1.6
4.1	60	0.8	1	
5.5	80	0.8	1	
6.9	100	0.8	1	

Magnet Decouple Torque

Driven Magnet	Driving Hub	Torque [mNm]	Torque [oz.in]
SmCo	SmCo	5650	800

ACTUAL PERFORMANCE MAY VARY - Specifications are subject to change without notice. When multiple specs are noted, the most conservative value applies.

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UK: Micropump, Ltd., A Subsidiary of Micropump, Inc. • Phone +44 (1480) 356900 • Fax +44 (1480) 356920
info@micropump.com www.micropump.com

TELEFAX

To:	Steve Herrmann Argonne National Laboratories	From:	Jamie Horton	LCI Corporation, Process Division PO Box 16348, Charlotte, NC 28297-8804 Switchboard: 704-394-8341 Direct phone: 704-398-7880 Telefax: 704-392-8507
		Date:	June 6, 2000	
		# Pages:	1 of 2	
Fax #:	(208)533-7996	Message #:		
Ref:	Your inquiry dated June 2, 2000			

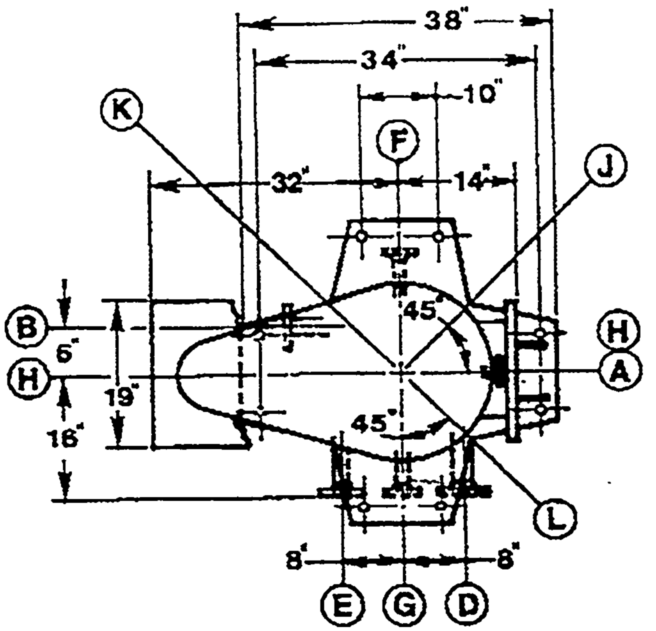
Attached is a drawing of a 2 sq. m. dryer which might fit your application. This dryer has no botttom cone and the outlet diameter is 16". The overall height is 10'10".

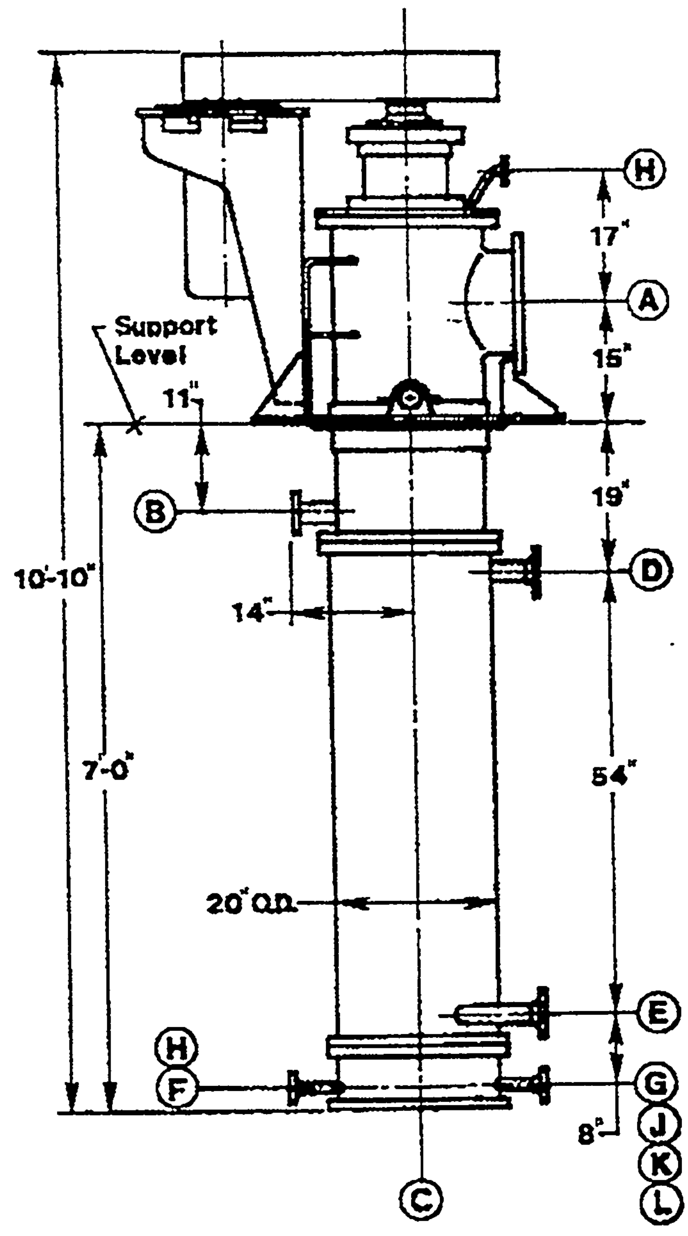
If I can be or further assistance please call me.

Regards/ Jamie Horton

VERTICAL DRYER

CP-0200





Nozzle Schedule

A — Vapor Outlet — 12"
B — Product Inlet — 1½"
C — Product Outlet — 16"
D — Heating Conn. — 2"
E — Heating Conn. — 2"
F — Heating Conn. — 1"
G — Heating Conn. — 1"
H — Flush Inlet — 1"
J — Sealing Gas Inlet — 3/8"
K — Cooling Conn. — 3/8"
L — Cooling Conn. — 3/8"

Notes:

1. Heating Surface — 21.6 Sq. Ft.
2. Pressure Rating:
   Process Area F. V. To Atm.
   Thermal Section Jacket
   D & S Steam — 150 Psig
3. Weights:
   Unit Empty (inc. rotor) — 2,650 lbs.
   Unit Flooded — 3,550 lbs.
   Rotor & Top Cover — 550 lbs.
4. Clearance For Rotor Removal
   From Support Level — 13'-2"
5. See Top View For Nozzle Orientation.

Dimensions & Notations Are Approximate And Are Not To Be Used For Construction

LCI TELEFAX

To:	Steve Herrmann	From:	Jamie Horton	LCI Corporation, Process Division
	Argonne National Laboratories	Date:	June 5, 2000	PO Box 16348, Charlotte, NC 28297-8804
		# Pages:	1 of 1	Switchboard: 704-394-8341
Fax #:	(208)533-7996	Message #:		Direct phone: 704-398-7880
Ref:	Your inquiry dated June 2, 2000			Telefax: 704-392-8507

Thank you for your inquiry dated June 2, 1000. As you may know we have supplied a thin film dryer to the Hanford facility for handling low level radwaste. Their distillate rate requirement was very close to yours but the salt was ammonium sulfate. As we just discussed on the telephone we have no experience handling guanidine. The design evaporation rate for the Hanford system was 305 lb/hr and the design feed rate was 480 lb/hr. The cost was approximately $1,000,000.

The dimensions of this system were 13' x 13' x 30'H. The lower half of this system was contained in a shielded cell.

In order to thoroughly evaluate your application we will need a quart sample to evaluate in glassware in our laboratory. If this test is positive we would suggest a pilot test in a 3 sq. ft. dryer in our test center.

The cost for the preliminary evaluation is $500. A pilot test would likely cost from $10,000 to $15,000 and last 3 to 5 days. If you would like to proceed toward testing let me know and I will email you a product questionnaire.

If I can be or further assistance please call me.

Regards/ Jamie Horton

Argonne National Laboratory - West
P.O. Box 2528
Idaho Falls, ID 83403-2528

Telecopy Number (208) 533-7996

Verification Number (208) 533- 7859
Sender's Extension

Date: June 2, 2000

To: Bill Glover

Fax No: 704-392-8507

Phone No: 704-398-7878

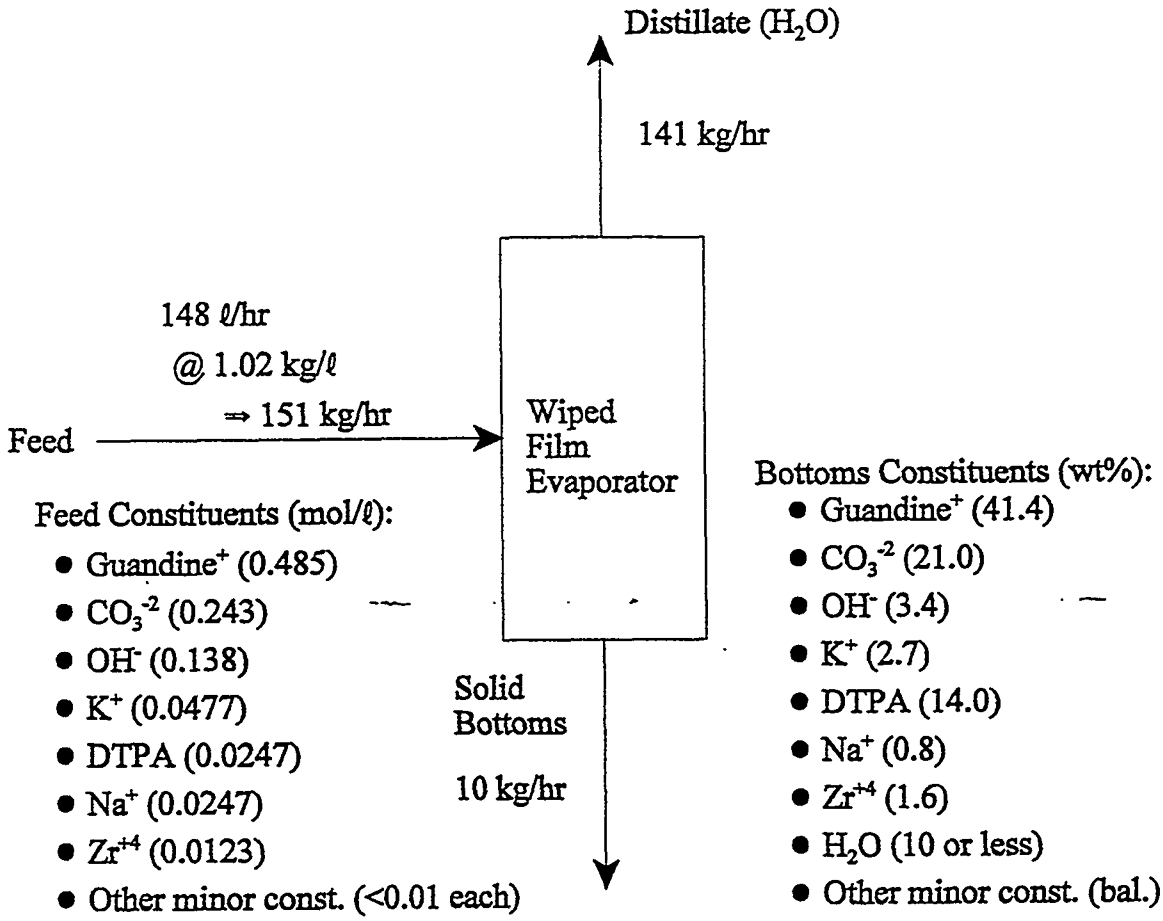
From: Steve Herrmann

Message:

Bill,

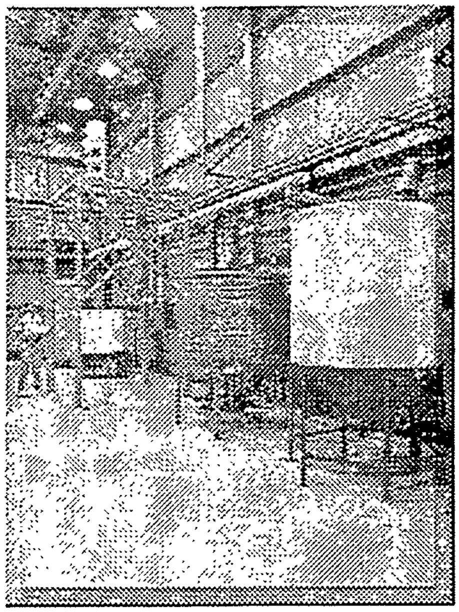
Per our conversation I've attached a simple schematic of our estimated flow rates and compositions. It is possible that some portion of the hydroxide in these streams could actually be nitrates. Please provide a budgetary cost estimate and rough spacing dimensions for a wiped-film evaporator to accommodate such flow streams. The end product should be a powder with no free-standing liquid. The attached specifies a maximum 10% moisture content in the bottoms. This equipment would be used in a hot cell to treat a high-level radioactive waste stream. Thus, it would be desirable to keep space and maintenance to a minimum. Thank you for your assistance.

Pages: 1
(Excluding the Cover Page)


Distillate (H_2O)
141 kg/hr
148 ℓ/hr
@ 1.02 kg/ℓ
⇒ 151 kg/hr
Feed
Wiped Film Evaporator
Feed Constituents (mol/ℓ):
• Guandine$^+$ (0.485)
• CO_3^{-2} (0.243)
• OH^- (0.138)
• K^+ (0.0477)
• DTPA (0.0247)
• Na^+ (0.0247)
• Zr^{+4} (0.0123)
• Other minor const. (<0.01 each)
Solid Bottoms
10 kg/hr
Bottoms Constituents (wt%):
• Guandine$^+$ (41.4)
• CO_3^{-2} (21.0)
• OH^- (3.4)
• K^+ (2.7)
• DTPA (14.0)
• Na^+ (0.8)
• Zr^{+4} (1.6)
• H_2O (10 or less)
• Other minor const. (bal.)

Utilization of Agitated Thin Film Evaporators (ATFEs) for Concentration of Transuranic Sodium Nitrate Based Sludges

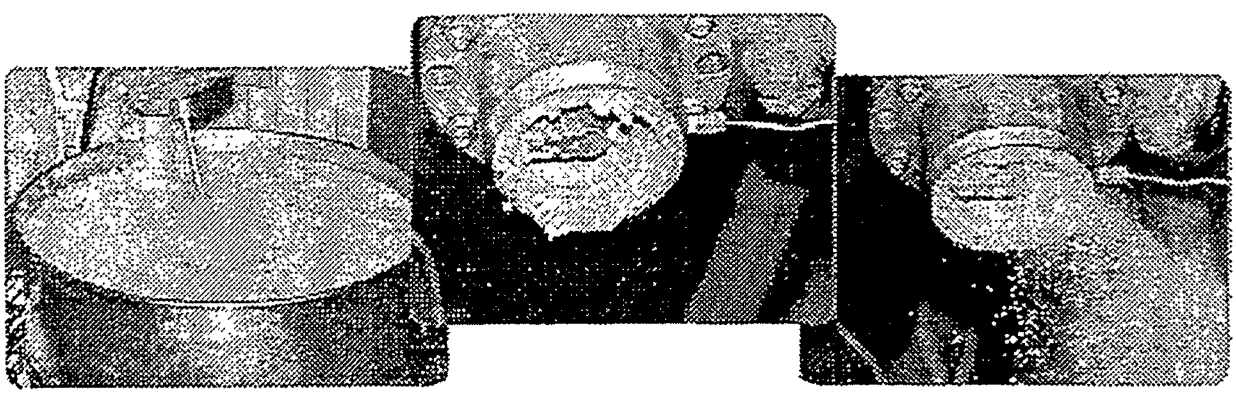
J. F Walker, Jr.



ATFE with Support Equipment

Vertical Agitated Thin Film Evaporators (ATFE) contain a rotor designed to produce and agitate a thin film between the rotor and the heated wall of the evaporator. The agitation of the film on the heated surface promotes heat transfer and maintains precipitated or crystallized solids in a manageable suspensioin without fouling the heat transfer surface. This capability makes ATFEs particularly suited for volume reduction of radioactive wastes that contain suspended solids. The use of an ATFE for concentration of remote handled transuranic waste was evaluated at Oak Ridge National Laboratory. The tests were conducted with surrogates that contained no radionuclides. The results of the tests indicated that a variety of products could be produced with the ATFE. It was possible to vary the consistency from a highly concentrated liquid to a completely dry powder. Volume reductions ranged from ~20 to 68% and decontamination factors in the range of 10,000 to 100,000 were achieved.

Feed to and Products from Agitated Thin Film Evaporator



Surrogate Feed **Product Slurry** **Transition: Slurry to Powder**

Product Powder   Product Melt   Product Melt

Preliminary Comparison with Savannah River Plant Model

Table 1. Input Parameters from Tests Using a Cherry-Burrell Vertical Agitated Thin-Film Evaporator

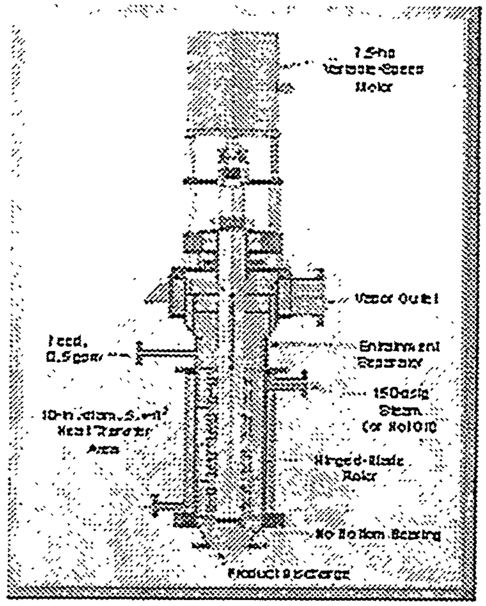
Input	Parameter Description
1	Vertical
1	Purex
0.17–0.28	Feed Rate (gpm)
22–26	Feed Temperature (°C)
150.0	Product Temperature (°C)
1.0	Temperature Increment (°C)
120.0	Steam Pressure (psig)
4.0	Inside Diameter (in.)
0.0	Cladding Thickness (in.)
0.1	Wall Thickness (in.)
1.7	Heat Transfer Area (ft^2)
0.0	Cladding Conductivity (Btu/h·ft·°F)
9.4	Wall Conductivity (Btu/h·ft·°F)
1798.0	Rotor Speed (rpm)
25.0	Rotor Wall Clearance (mils)
0.0	Concentration, Na_2SO_4 (g-mol/L)
0.0	Concentration, $CaCO_3$ (g-mol/L)
3.5	Concentration, $NaNO_3$ (g-mol/L)
0.0	Concentration, NaOH (g-mol/L)
0.0	Concentration, $NaAlO_2$ (g-mol/L)

Table 2. Comparison of Process Parameters from Vertical Agitated Thin-Film Evaporator with the Modified SRP Model

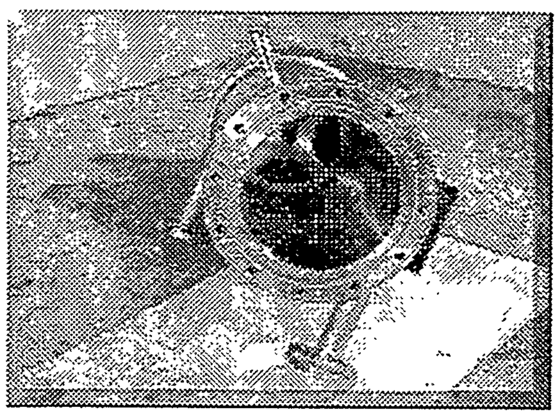
Run	Parameter	Measured	Model	Difference (%)
1	Initial Boiling Point (°C)	102	106	3.9
	Mass Flow Rate, Feed (lb/h)	157.5	164.1	4.2
	Mass Flow Rate, Bottoms (lb/h)	75	69.8	-6.9
	Mass Flow Rate, Overhead (lb/h)	82.5	94.3	14.3
	Total Solids in Product (%)	63	56	-11.1
	Overall Heat Transfer Coefficient (Btu/h·ft^2·°F)	503	483	-3.9
2	Initial Boiling Point (°C)	102	106	3.9
	Mass Flow Rate, Feed (lb/h)	136.9	142.8	4.3
	Mass Flow Rate, Bottoms (lb/h)	50.6	49.7	-1.8
	Mass Flow Rate, Overhead (lb/h)	86.25	93.2	8.1
	Total Solids in Product (%)	83	67	-19.3
	Overall Heat Transfer Coefficient (Btu/h·ft^2·°F)	497	455	-8.5
3	Initial Boiling Point (°C)	102	106	3.9
	Mass Flow Rate, Feed (lb/h)	120	125.1	4.3
	Mass Flow Rate, Bottoms (lb/h)	46.5	35.6	-23.4
	Mass Flow Rate, Overhead (lb/h)	73.5	89.5	21.8
	Total Solids in Product (%)	38	22.5	-63
	Overall Heat Transfer Coefficient (Btu/h·ft^2·°F)	489	415	-15.1
4	Initial Boiling Point (°C)	102	106	3.9
	Mass Flow Rate, Feed (lb/h)	101.3	105.5	4.1
	Mass Flow Rate, Bottoms (lb/h)	42.2	25.2	-40.3
	Mass Flow Rate, Overhead (lb/h)	59.1	80.3	35.9
	Total Solids in Product (%)	97	98	1.0
	Overall Heat Transfer Coefficient (Btu/h·ft^2·°F)	385	465	20.8

Link: Savannah River

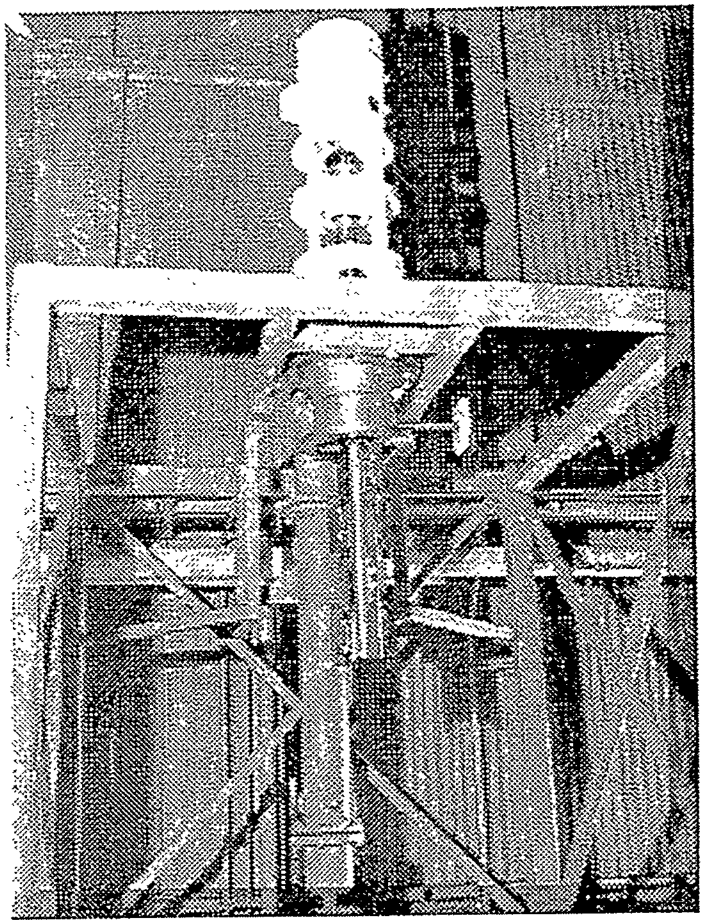
Waste Handling and Packaging Plant Agitated Thin-Film Evaporation



Wiped-Film Evaporator Test Unit
(Votator Turba-Film Processor *Cherry-Burrell* ANCO/Votator Division)



ATFE Outer Shell



ATFE Internals

Contact: J. F. Walker, Jr.
phone: (423) 241-4858
fax: (423) 241-3817
email: *wffa ornl.gov*

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To feature your Chemical Technology group or project, contact J. Jernigan

Rising Film Evaporator / Falling Film Evaporator

Click here for the inquiry form

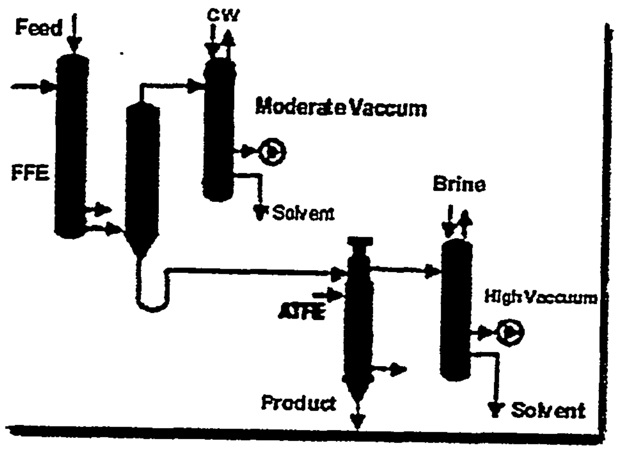
The Rising Film Evaporator or Falling Film Evaporators are used for pre-concentration wherever possible. These conventional evaporators help in reducing the size of Thin Film Evaporators and Dryers.

Optimum Solutions :

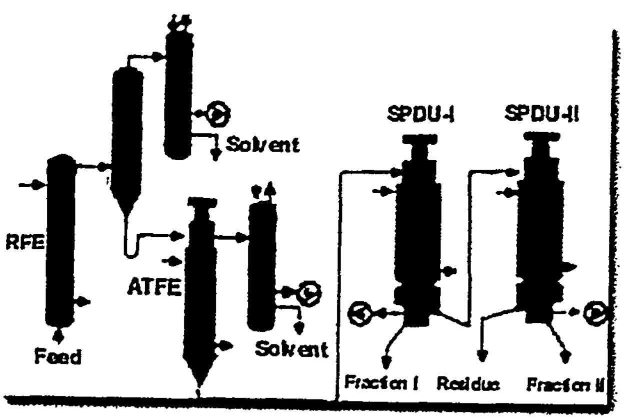
With our broad range of equipment, we offer the most optimum solutions to your process problems minimizing the initial investment and lowering the operating cost. Here are some examples :

Pesticide : Preconcentration and Final Stripping

For clean feed streams and heat sensitive products, most of the solvent in recovered in falling film evaporator (FFE) and the final stripping of solvent and impurities is achieved in an agitated thin film evaporator (ATFE). FFE operates under moderate vacuum and the heat load is shifted to chilled water (CW) lowering the operating cost.



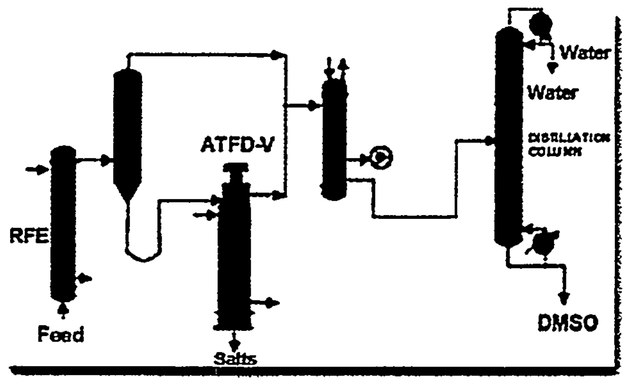
Bulk Drug: Solvent Recovery, Degassing and High Vacuum Distillation



Solvent is recovered at moderate vacuum in a rising film evaporator (RFE),and then an agitated thin film evaporator (ATFE) is used to further strip it.The first short path distillation unit (SPDU-I) achieves degassing while the final distillation is achieved in a second short path distillation unit (SPDU-II) at a very high vacuum. As each fraction is removed at an appropriate vacuum the load on high vacuum system is less and the equipment sizes are reduced.

DMSO Recovery from salts:

For contaminated feed streams, the rising film evaporator (RFE) preconcentrates the feed to saturation point and then an agitated thin film dryer (ATFD-V) achieves the desired dryness of salt.We recommend the use of RFE to reduce the agitated thin film dryer size.



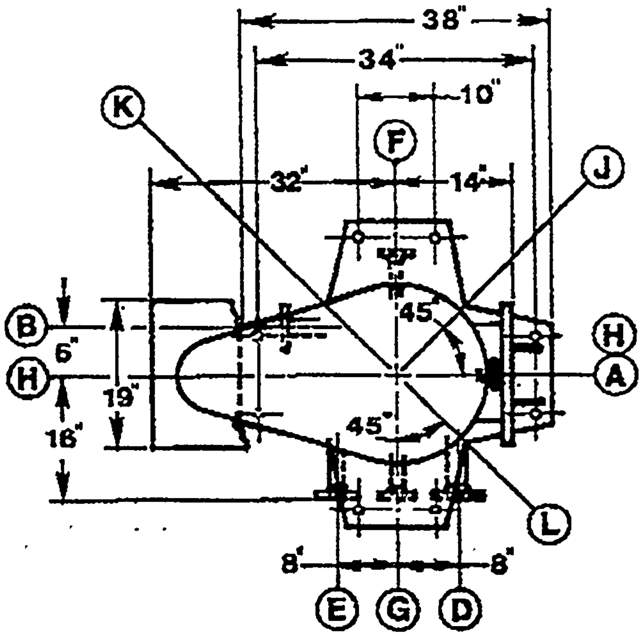
Click here for the inquiry form

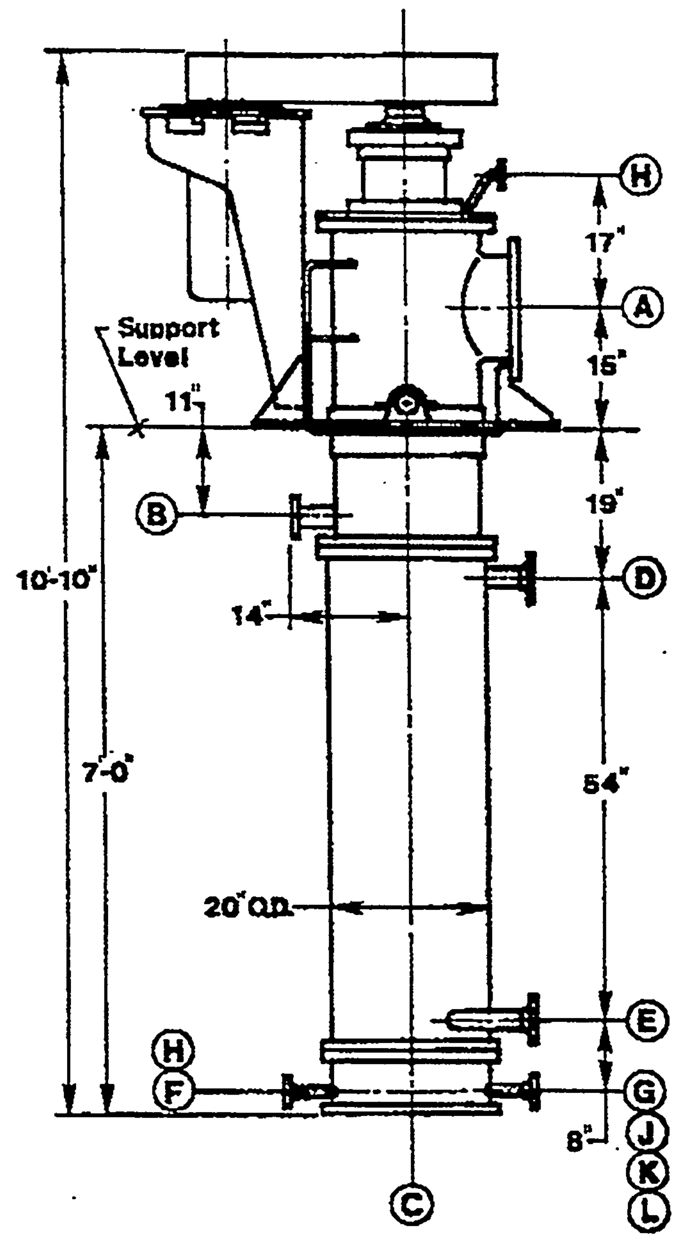
Top

LCI

VERTICAL DRYER

CP-0200





Nozzle Schedule

A — Vapor Outlet — 12"
B — Product Inlet — 1½"
C — Product Outlet — 16"
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G — Heating Conn. — 1"
H — Flush Inlet — 1"
J — Sealing Gas Inlet — ⅜"
K — Cooling Conn. — ⅜"
L — Cooling Conn. — ⅜"

Notes:

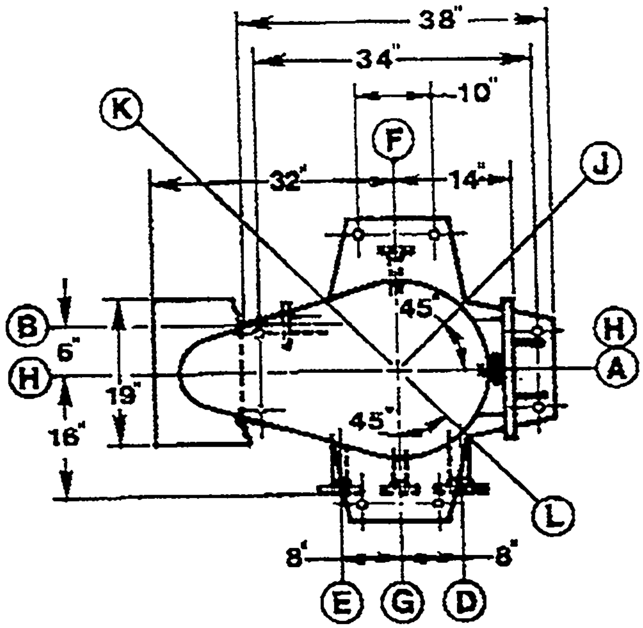
1. Heating Surface — 21.6Sq. Ft.
2. Pressure Rating:
   Process Area F. V. To Atm.
   Thermal Section Jacket
   D & S Steam — 150 Psig
3. Weights:
   Unit Empty (inc. rotor) — 2,650 lbs.
   Unit Flooded — 3,550 lbs.
   Rotor & Top Cover — 550 lbs.
4. Clearance For Rotor Removal
   From Support Level — 13'-2"
5. See Top View For Nozzle Orientation.

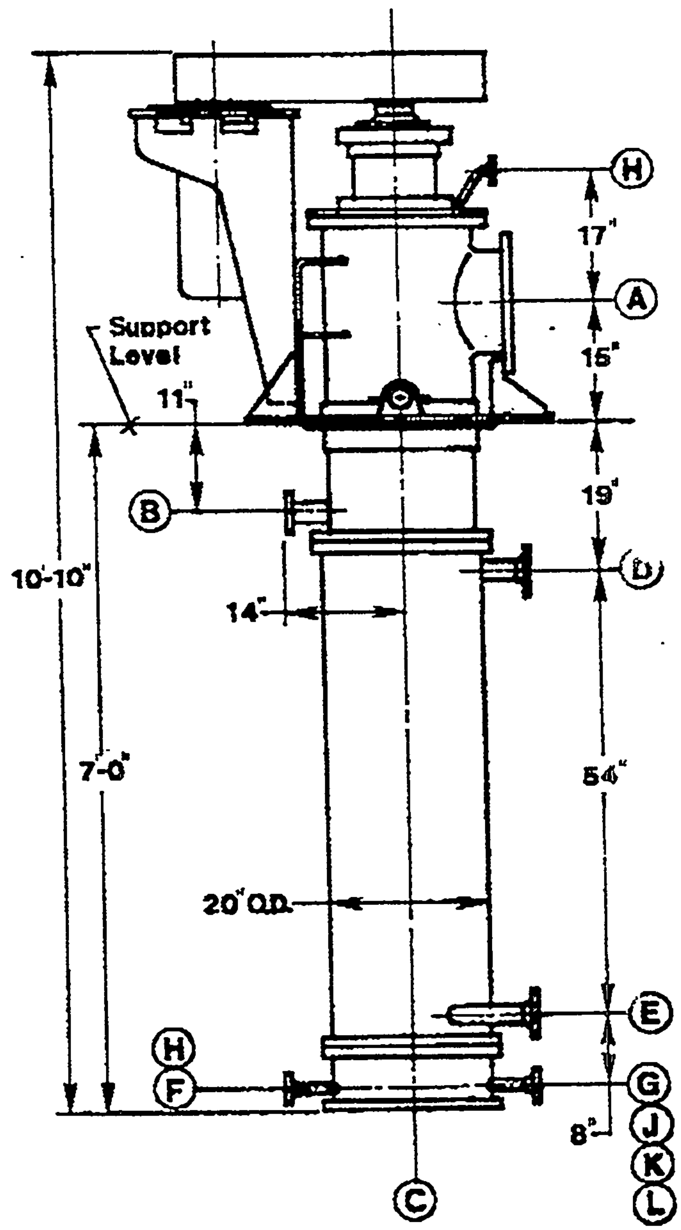
Dimensions & Notations Are Approximate And Are Not To Be Used For Construction

ICI

VERTICAL DRYER

CP-0200





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Appendix G

Environmental Regulations and Waste Acceptance Criteria Evaluation

Environmental Regulations and Acceptance Criteria of Candidate Repositories for the Treatment and Disposal of UNEX and Modified UNEX Wastes

1. BACKGROUND

The Idaho Settlement Agreement,[1] together with the non-compliant SBW storage tanks conditions require that the HLW and SBW be processed into acceptable waste products that can be permanently disposed of. The HLW and SBW are considered mixed wastes[a] because they contain both radioactive and Resource Conservation and Recovery Act (RCRA) constituents.

To meet the commitments and the environmental requirements, DOE has been conducting several studies to identify a reasonable set of alternatives for management of the HLW and the SBW. As part of these studies, a Universal Extraction process (UNEX) and a Modified UNEX process have been considered for treatment of the liquid SBW plus any newly generated liquid waste (NGLW) produced before January 2003. It is assumed that the calciner at the New Waste Calcination Facility (NWCF) will not be operational.

This study identifies and presents existing regulatory requirements and other environmental issues for the treatment of the wastes of the UNEX and Modified UNEX processes. It also provides a survey of the waste acceptance criteria (WAC) of the potential candidate repositories for the final waste products resulting from these processes.

2. ENVIRONMENTAL REGULATIONS AND AGREEMENTS

The target wastes contain both RCRA hazardous contaminants and radionuclides. Therefore, the management of the wastes must be in compliance with the requirements of EPA RCRA Subtitle C for the hazardous wastes and of the Atomic Energy Act (AEA)-based requirements for the radioactive materials. The State of Idaho adopted the Federal RCRA regulations pursuant to the Idaho Hazardous Waste Management Act of 1983, and it has the authority to implement them in Idaho. The regulations are incorporated by reference as provided in the Federal requirements under 40 CFR into the Idaho "Rules and Standards for Hazardous Wastes," under administrative code known as Idaho Administrative Procedures Act (IDAPA) 16.01.05.

The AEA requirements are implemented and administered by DOE. The principal DOE requirement is compliance with DOE Order 435.1 on "Radioactive Waste Management,"[2] and by implication, compliance with DOE Order 460.1A on "Packaging and Transportation Safety," and DOE Order 460.2 on "Departmental Materials Transportation and Packaging Management," These, in turn, imply compliance with applicable U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulations. The wastes are also subject to all other applicable federal, state, and local laws and regulations.

The waste management activities and their schedules must also comply with the terms and conditions of the Idaho Settlement Agreement and of the Consent Orders,[3] and other INEEL specific

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[a] Although these wastes are all considered mixed wastes, they are inadvertently referred to as HLW, SBW, and as NGLW in this report.

requirements. Also, the wastes must be managed in a way that meets the enforceable requirements and intent of the INEEL Site Treatment Plan developed in accordance with the Federal Facilities Compliance Act (FFCA).[b]

The UNEX and Modified UNEX treatment options under consideration will result in waste forms that must meet the applicable regulatory requirements and that satisfy the WAC of the repositories identified as most suitable for them.

3. WASTE OVERVIEW

Two types of waste are to be treated and converted into products that can be permanently disposed of. These include SBW and NGLW. The SBW and NGLW are considered mixed wastes. These are wastes that contain both radioactive and RCRA hazardous constituents. The wastes must be treated to meet the RCRA land disposal restriction (LDR) standards or alternative methods approved by EPA for land disposal. They must also meet the criteria of the respective repositories they are destined to be sent to.

The SBW feed carry a number of RCRA characteristic and listed components, as defined in 40 Code of Federal Regulations (CFR) Part 261, Subparts C and D. Because the waste is listed, the treated waste products would be listed and carry the same listed waste as those assigned to the SBW as a result of the RCRA "derived-from rule" (40 CFR 261.3 (c)(2)(i),(d). Without delisting, the treated waste products would continue to be regulated under RCRA even after LDR requirements are met, unless excluded from the RCRA Subtitle C regulations. "Delisting" is currently the only EPA approved mechanism for obtaining such an exclusion. The delisting requirements and other EPA proposed exclusion methods are discussed in Section 6. In this study, it is assumed that the wastes will be delisted. All of the wastes resulting from the UNEX or Modified UNEX process will be considered delisted prior to final interim storage and shipment to the disposal sites.

The waste processing activities would generate primary and secondary waste streams. The primary products are designated as high-activity waste (HAW) and low-activity waste (LAW). The HAW and LAW designation is based on the projected radionuclides and their concentrations in the wastes. The HAW will predominantly contain TRU nuclides that would meet the definition of TRU waste. The LAW will mainly contain cesium and strontium. The projected data indicate that the LAW meets the definition of LLW.

The treatment options considered under the UNEX or the Modified UNEX process would result in waste products that would be suitable for permanent disposal. The treatment options for the primary wastes will generate two distinct waste forms: grout and crystallite. The waste products of the UNEX process are CH-LLW grout (Class A) and RH-TRU crystallite, and of the Modified UNEX process are CH-TRU grout and RH-LLW crystallite (Class C). It is planned for the TRU waste to be disposed of at the Waste Isolation Pilot Plant (WIPP). The LLW will be shipped to a LLW disposal facility.

The secondary waste streams include the final process solvents remaining at the end of the treatment campaign, spent high efficiency particulate air (HEPA) filters, and personal protective equipment (PPE). All the secondary waste streams are considered listed mixed wastes and are subject to

[b] Section 3021 (b) of the FFCA requires each DOE site to have an approved Site Treatment Plan for development of treatment capacity and technologies, and with schedules and plans for treating mixed wastes in order to meet LDR requirements. These plans identify how DOE will provide the necessary mixed waste treatment capacity and schedules for bringing new treatment facilities in operation.

the RCRA LDR Subtitle C requirements prior to disposition. In addition, the wastes must meet the criteria of the respective repositories they are destined to be shipped to. Section 9 of this study provides a description of the treatment options being considered for the secondary wastes.

The SBW feed to the UNEX or the Modified UNEX process meets the definition of TRU waste based on the type of isotopes and their activities. The SBW does not meet the statutory definition of HLW in the Nuclear Waste Policy Act (NWPA) and the NRC regulatory definition in 10 CFR 60. However, although by NRC definition, the SBW is not a HLW, it has historically been stored and managed the same way as the HLW. This is because some of its physical and chemical properties are similar to those of the HLW. The SBW is a mixture of decontamination solutions, miscellaneous laboratory wastes, and second- and third-cycle extraction waste from the SNF reprocessing. It primarily originated from processes that were incidental to the SNF processing. It follows that the SBW is not a HLW. However, the SBW would need a WIR determination using the "Evaluation" process established in DOE Manual 435.1 to be managed as non-HLW. The NRC assistance/concurrence should be sought for making the determination for evaluating and managing the waste incidental to the SNF reprocessing. An effort is currently being underway by the INEEL HLW Program Office to prepare a plan for making a WIR determination for the SBW. This determination is primarily based on statutes, regulations, DOE criteria, sources of the SBW, and INTEC operational records. Solid heels that have settled out at the bottom of the SBW tanks are not part of the liquid SBW WIR determination.

Based on the DOE-HQ and NRC assessments, it appears that the SBW as it sits today in the Tank Farm may be considered HLW.[c] If a "WIR ruling" is not established for the SBW and/or the SBW is legally classified as HLW, the resultant waste fractions (LAW and HAW) would need to receive an evaluation and redefinition of waste classification to be managed in accordance with requirements for LLW and TRU waste, as appropriate. The concurrence of the applicable government authorities would need to be sought in this evaluation and waste reclassification.

For the purpose of this study, it is assumed that the WIR ruling will be established and the SBW will not be considered HLW. Consequently, the waste products to be derived from the SBW processing will be considered LLW and TRU waste.

4. EPA TREATMENT AND DISPOSAL REQUIREMENTS APPLICABLE TO THE WASTES

EPA under RCRA has established LDR treatment standards for hazardous in 40 CFR 268 when the waste is land disposed. RCRA and AEA-based requirements are generally consistent and compatible. However, the provisions in Section 1006(a) of the RCRA Statute allow the AEA to take precedence in the event the two acts are found to be inconsistent.[5]

The treatment standards for hazardous waste, as designated by their hazardous waste codes or hazardous waste numbers (HWNs),[d] and UHCs[e] are identified in 40 CFR 268.40 and 40 CFR 268.48,

[c] Communication with Clifford Olsen and Dennis Harrell on 5/15 and 5/18/2000.

[d] Hazardous waste codes and hazardous waste numbers are interchangeable terms.

[e] UHCs. Hazardous constituents present in the waste at the point of generation other than those that cause wastes to exhibit a characteristic are called underlying hazardous constituents (UHCs). These include any constituents listed in UTS Table 40 CFR 268.48, except for fluoride, vanadium, and zinc, which can be reasonably expected to be present at the point of hazardous waste generation in concentrations above the constituent-specific UTS treatment standards (40 CFR 268.2 (i)). Selenium and sulfides were recently added to the UTS table by Phase IV, Part 2 LDR Rule, however, these constituents are not considered UHCs.

respectively. The standards are expressed either as specified-technologies, or as waste concentration values that apply to leachate from the toxicity characteristic leaching procedure (TCLP). The standards are based on the performance of the best demonstrated available technology (BDAT) for each HWN. For wastes subject to a specified technology, the wastes may be land disposed after being treated using that specified technology or an alternative method approved by EPA.

The LDR applicability and treatment standards are determined based on RCRA hazardous chemical constituents, the sources of these constituents for listed wastes, and their concentrations in the waste at the point of generation.[6] The SBW represents the point of generation. It contains RCRA characteristic and listed components and UHCs. The HWNs currently assigned to the SBW are D002, D004-D0011, other D-codes, and listed F001, F002, F005 and U134.[7] Tables 1 and 2 provide a list of RCRA hazardous constituents identified in the Tank Farm, assigned HWNs, and their LDR treatment standards. The chemicals listed only for characteristic of ignitability (F or U) include acetone, cyclohexane, cylohexanone, ethyl acetate, methanol, methyl isobutyl ketone, and xylenes. These have not been assigned with any HWNs. This is because these chemicals, listed only for characteristic of ignitability, when mixed with water at the point of generation or with other wastes prior to being transferred to the Tank Farm for storage, lost the characteristic of ignitability.[7] Therefore, based on the provisions of 40 CFR 261.3(a)(2)(iii), the constituents with the listing (either F or U) would no longer carry such listing. These chemicals are still required to meet the LDR requirements although they no longer exhibit characteristic of ignitability [40 CFR 261.3(a)(2)(iii)].[f] Other constituents representing the four listed HWNs in Table 1 are also subject to the LDR standards in 40 CFR 268.40 if their concentrations are found above their respective standard limits by sampling and testing.

The list of UHCs shown in Table 2 is preliminary at this time and is subject to change. Further process waste evaluation at the point of generation, and sampling and analysis are needed to identify any additional UHCs, to evaluate the preliminary list of UHCs, and to determine the final UHCs list.

Because of the HWNs and UHCs assigned to the waste feed, so many treatment standards apply that it could be impractical or inappropriate to meet all these treatment standards. The EPA must have foreseen this type of problem because the LDR regulations offer an alternative approach. When is impractical or technically inappropriate to treat a waste to the LDR concentration level or by the specified technology, an alternative treatment can be used. Under 40 CFR 268.42(b), a waste generator can petition EPA for a "determination of equivalent treatment" (DET) or a variance (40 CFR 268.44) from the LDR regulations. It will be necessary to contact the EPA Region 10 office early in the design process to determine the correct approach to LDR compliance and to eliminate the possibility of generating new waste for which no disposal outlet exists.

The SBW contains TC metals assigned with D004-D011 HWNs. For waste residues generated from the treatment of TC metals, RCRA has addressed specific requirements. These residuals may contain UHCs above the UTS limits due to their concentrations in treatment residuals. For such wastes, only UHCs present at the original point of generation must be treated to meet the UTS standards. However, if the waste residue is itself characteristically hazardous (above TC limits) and therefore, demonstrates a newly generated waste, the residue must be treated to remove the characteristic and to meet the UTS for the UHCs.[8]

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[f] Example: Acetone is considered to have been used for its solvent properties at the point of generation. However, when mixed with water or other wastes prior to being transferred to the Tank Farm for storage, it lost the characteristic of ignitability. Thus, the mixture is not considered to be RCRA-listed, due to acetone being F listed, based only on the characteristic of ignitability. Likewise, pure, unused acetone would also lose the characteristic of ignitability, and not carry the U002 RCRA-listed code. Although neither the F003 nor U002 code would apply, acetone is still subject to the treatment standards under the LDR.

EPA has decided that the point of generation must be used to determine if a waste is subject to the LDR. Therefore, a complete waste characterization and/or process knowledge are required to determine all the "regulated constituents" at the point of generation to determine LDR compliance, and the required treatment standards that must be met and disposal restrictions.

Table 1. Tank Farm RCRA chemicals and assigned listed HWNs, and applicable LDR treatment standards.[7]

Hazardous Waste Numbers	Chemical Name	LDR Non-Wastewater Standard
F005	Benzene	10 mg/kg
F005	Carbon disulfide	4.8 mg/L TCLP
F001	Carbon tetrachloride	6.0 mg/kg
F002		
U134	Hydrogen fluoride	ADGAS fb NEUTR or NEUTR[a]
F005	Pyridine	16 mg/kg
F002	Tetrachloroethylene	6.0 mg/kg
F005	Toluene	10 mg/kg
F001	1,1,1-trichloroethane	6.0 mg/kg
F002		
F001	Trichloroethylene	6.0 mg/kg
F002		
N/A[b]	Acetone	160 mg/kg
N/A	Cyclohexane	CMBST[c]
N/A	Cyclohexanone	CMBST (alternate standard: 0.75 mg/L TCLP)
N/A	Ethyl acetate	33 mg/kg
N/A	Methanol	CMBST
N/A	Methyl isobutyl ketone	33 mg/kg
N/A	Xylenes	30 mg/kg

a. ADGAS fb NEUTR: Venting of compressed gases into an absorbing or reacting media, followed by, neutralization.

b. Not Applicable

c. CMBST – High temperature organic destruction technologies such as combustion

Table 2. Tank Farm characteristics and preliminary UHCs, assigned HWNs, and applicable LDR treatment standards.[9,10]

Hazardous Waste Numbers	Chemical Name	LDR Nonwastewater Standard
D002	Corrosivity (pH)	DEACT and meet UTS for UHC
D002- Mixed HLW		HLVIT for mixed HLW
N/A[a] (underlying D002)	Fluoride[b]	-----[c]
N/A (underlying D002)	Nickel	11 mg/L TCLP
D004	Arsenic	5.0 mg/L TCLP
D004-Mixed HLW		HLVIT[d]
D005	Barium	21 mg/L TCLP
D005-Mixed HLW		HLVIT
D006	Cadmium	0.11 mg/L TCLP
D006-Mixed HLW		HLVIT
D007	Chromium	0.60 mg/L TCLP
D007-Mixed HLW		HLVIT
D008	Lead	0.75 mg/L TCLP
D008-Mixed HLW		HLVIT
D009	Mercury[e]	IMERC; or RMERC[f]
	Mercury[g]	0.20 mg/L TCLP
	Mercury[h]	0.025 mg/L TCLP
D009-Mixed HLW		HLVIT
D010	Selenium[b]	5.7 mg/L TCLP
D010-Mixed HLW		HLVIT
D011	Silver	0.14 mg/L TCLP
D0011-Mixed HLW		HLVIT
N/A	Antimony	1.15 mg/L TCLP
N/A	Beryllium	1.22 mg/L TCLP
N/A	Vanadium[b]	1.6 mg/L TCLP
N/A	Thallium	0.20 mg/L TCLP
N/A	Zinc[b]	4.3 mg/L TCLP
D019	Carbon tetrachloride	6.0 mg/kg and meet UTS for UHC
D021	Chlorobenzene	6.0 mg/kg and meet UTS for UHC
D022	Chloroform	6.0 mg/kg and meet UTS for UHC
D026	Cresol-mixed sorbers	11.2 mg/kg and meet UTS for UHC
D028	1,2-dichloroethane	6.0 mg/kg and meet UTS for UHC
D032	Hexahlorobenzene	10 mg/kg and meet UTS for UHC

Table 2. (continued).

Hazardous Waste Numbers	Chemical Name	LDR Nonwastewater Standard
D034	Hexachloroethane	30 mg/kg and meet UTS for UHC
D035	Methy ethy ketone	36 mg/kg and meet UTS for UHC
D036	Nitobenzene	14 mg/kg and meet UTS for UHC
D038	Pyridine	16 mg/kg and meet UTS for UHC
D039	Tetrachloroethylene	6.0 mg/kg and meet UTS for UHC
D040	Trichloroethylene	6.0 mg/kg and meet UTS for UHC
N/A	Phenol	6.2 mg/kg
N/A	Ethyl benzene	10 mg/kg
N/A	Chloroform	6 mg/kg
N/A	Methylene chloride	30 mg/kg
N/A	Isobutyl alcohol	170 mg/kg
N/A	Naphthalene	5.6 mg/kg
N/A	*o*-Nitrophenol	13 mg/kg
	p-Nitrophenol	29 mg/kg

a. Not applicable – These are UHCs, except for those with superscript b.

b. Not an UHC in characteristic wastes.

c. No specific treatment standard finalized for this constituent.

d. HLVIT – Vitrification of mixed HLW.

e. High-mercury (≥ 260 mg/kg total mercury) that also contains organics. DOE has been conducting research to address treatment and stabilization alternatives for mercury-bearing mixed waste. This includes development of new technologies to stabilize waste with ≥ 260 PPM mercury and working with the EPA to develop waste test protocols that may replace the TCLP. DET will need to be sought from EPA for successfully demonstrated processes other than those currently specified by RCRA. The RCRA specified treatment for waste with ≥ 260 PPM mercury that also contains organics is incineration or retorting).

f. IMERC or RMERC – IMERC: Incineration of wastes containing mercury and organics; or RMERC: Retorting or roasting in a thermal processing unit.

g. Low-mercury (<260 mg/kg total mercury) and residues from RMERC.

h. Low mercury (<260 mg/kg total mercury) that are not residues from RMERC.

Mercury Removal routes and Regulatory Issues

There are regulatory concerns over the fate of heavy toxic metals, in particular mercury for partitioning in the UNEX process and its disposition. Some of the tanks with SBW feed to the UNEX process contain a relatively large amount of mercury. The regulatory issues and treatment options surrounding the mercury waste are discussed below.

As specified in 40 CFR 268.40, waste containing mercury have been divided into a single wastewater[g] subcategory and several nonwastewater subcategories with different treatment standards. There are two subcategories for nonwastewater mercury: high-mercury subcategory and low- mercury subcategory. For high-mercury subcategory (≥ 260 mg/kg total mercury) that also contain organics, he LDR treatment standard is IMERC or RMERC. For high-mercury subcategory (≥ 260 mg/kg total mercury) that are inorganic, including residues from retorting and incineration, the treatment standard is RMERC. For low-mercury subcategory that contains <260 mg/kg total mercury and that are residue from retorting only, the waste must be at or below 0.2 mg/l TCLP and meet the UTS treatment standards in 40 CFR 268.48 for UHCs before disposal. The low mercury (<260 mg/kg total mercury) that are not residues from RMERC (retorting) must be at or below 0.025 mg/l TCLP before disposal. For all wastewaters that exhibit the characteristic of toxicity for mercury, the waste must be at or below 0.15 mg/l TCLP and also it must meet the UTS limits in 40 CFR 268.48 for UHCs. The LDR treatment method for elemental mercury is amalgamation (AMLGM). Th amalgamated mercury can be land disposed if mercury is below the characteristic level (0.2 mg/l TCLP). It should be noted that any waste that contains ≥ 260 mg/kg total mercury, but otherwise appears to meet the definition wastewater is classified as nonwastewater.[11]

The SBW currently stored in the tank is considered a nonwastewater due to its high solids contents. The SBW feed to the UNEX process is expected to be filtered prior to further processing. The filtered SBW would meet the definition of RCRA wastewater. However, according to EPA, any wastewater that contains ≥ 260 mg/kg total mercury is classified as nonwastewater.[11] The LDR treatment standard for the waste with high-mercury organic subcategory is IMERC or RMERC and for high-mercury inorganic subcategory is RMERC. Due to nature and composition of the SBW, this waste is not amenable to either treatment option. For DOE mixed waste in high mercury subcategory, DOE has been conducting research to address treatment and stabilization alternatives. This includes development of new technologies to stabilize waste and working with the EPA to develop waste test protocols that may replace the TCLP. DET will need to be sought from EPA for successfully demonstrated processes other than those currently specified by EPA. If an equivalent treatment is approved, the alternative grouting treatment option can be used to stabilize the waste for disposal. It is assumed that the DET petition will approved by EPA for using grouting to dispose of the waste.

If mercury is not removed, a large percentage of mercury in the SBW feed will end up in the LLW grout. Due to concerns over the mercury leach from the grout, a mercury removal system was initially considered but later eliminated. It was originally suggested that an electrochemical reduction system (ECR) be used to capture mercury upstream of the grouting to keep the mercury concentration in the grout to a limit that would be acceptable for land disposal. The treatment standard includes: 1) precipitation of the mercury, 2) RMERC of precipitate, 3) AMLGM of the radioactively contaminated elemental mercury recovered by RMERC, 4) treatment of the residue from RMERC to < 0.2 mg/l TCLP,

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[g] Per 40 CFR 268.2(f), wastewaters are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS). Nonwastewaters are wastes that do not meet the criteria for wastewaters (40 CFR 268.2(d).

and 5) treatment of the wastewater left over after precipitation of the mercury to ≤ 0.15 mg/l TCLP and to the UTS standards prior to disposal.

Other alternative options proposed for the mercury removal included sorption with potassium copper hexacyanoferrate resin and the other known as Sachtleben-Lurgi process. In the first option, the waste would be a mercury-loaded resin which would need retorting per RCRA LDR requirements. In the Sachtleben-Lurgi process, the resulting waste form is a mercuric sulfide precipitate (a form of mercury amalgam) that may not require retorting. Since the RMERC treatment would result in a radioactively-contaminated elemental mercury waste that requires amalgamation, it would be desirable to bypass the retorting step (avoid volatizing mercury). If the waste is not retorted, an equivalency petition is needed for using the Sachtleben-Lurgi process to accomplish amalgamation and bypassing the retorting step.

The possible management schemes for the SBW treatment with and without mercury removal using ECR option are shown in Figure 1.

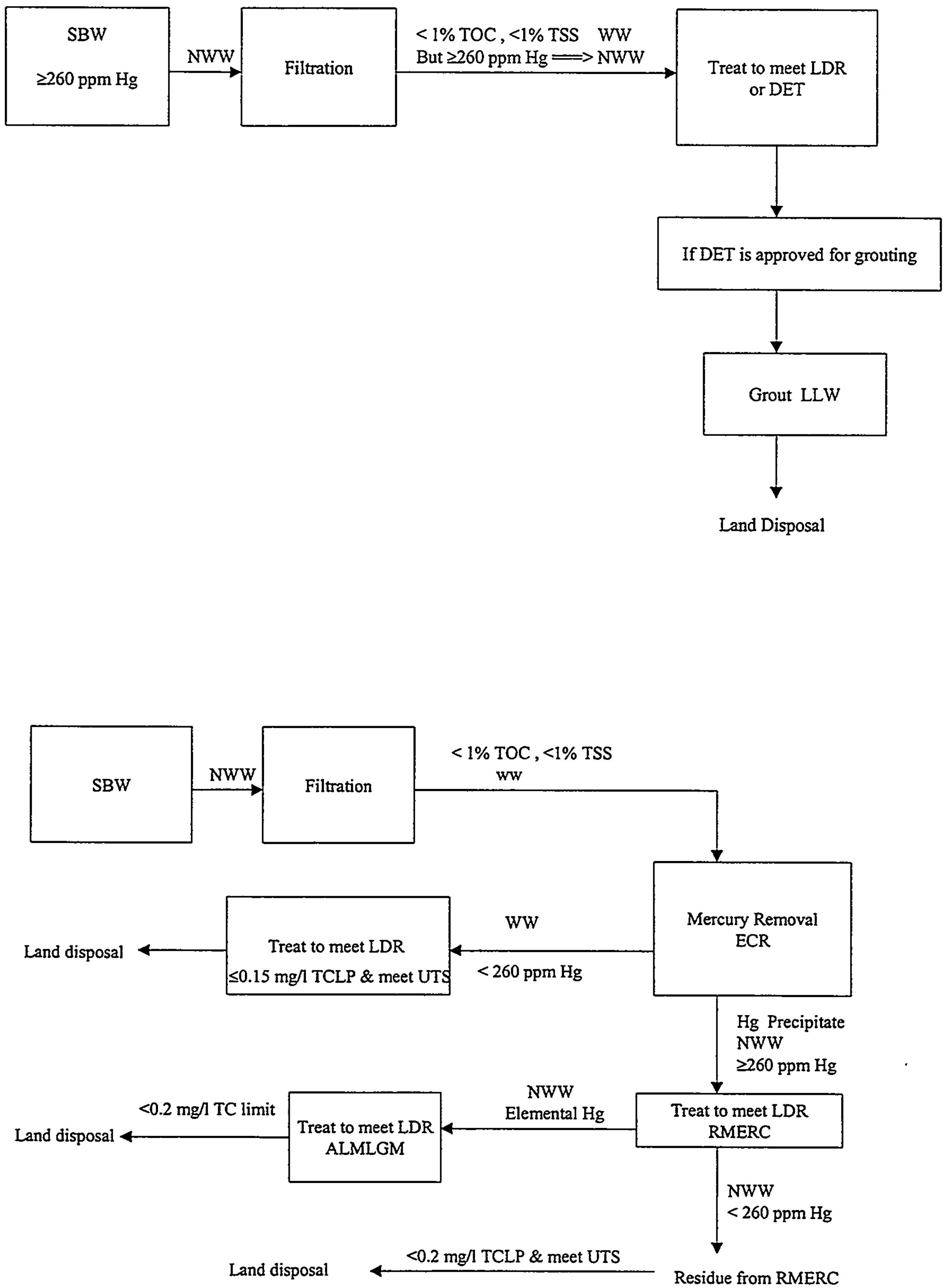

Figure 1. Management schemes for the SBW and mercury removal option.

5. SAMPLING REQUIREMENTS

Various types of verification sampling of the feed streams, additives, etc. and analytical data are required for monitoring the processes (eg., monitoring certain parameters such as temperature and pressure) and for the compliance purposes. 40 CFR 264.13 contain the requirements for performing general waste analysis.

For the compliance purposes to certify that waste is acceptable for disposal, the use of process qualification versus verification sampling is encouraged. For example, EPA requires either a Totals Analysis Test or the TCLP for waste extract from the final treatment product to be performed to determine the concentration of RCRA constituents for LDR compliance, and to demonstrate that the process qualification standards have been achieved. However, due to the radiological exposure risk considerations, it could be impractical to perform the required sampling and analysis using the conventional methods. Process qualification standards that reduce or eliminate radiological exposure risk should be established. Also, surrogate waste should be used to determine the operating and performance conditions and process qualification standards under which the required concentration levels for hazardous constituents would be achieved. This would demonstrate that wastes produced under these operating conditions would be considered to achieve the required performance and concentration levels.

6. MIXED WASTES EXCLUSION FROM RCRA REGULATIONS

Presently, some of the candidate disposal locations evaluated in this study are not RCRA-regulated hazardous waste Subtitle C facilities. Consequently, these facilities do not accept any RCRA-regulated or listed hazardous waste (i.e., mixed waste) for disposal. Others accept only certain LDR treated listed waste. The final products resulting from processing of the SBW must not be assigned with any RCRA HWNs unacceptable for disposal at these facilities. This section describes the avenues for allowing the disposal of the subject mixed wastes as non-hazardous wastes once they meet the RCRA LDR requirements. These avenues include EPA delisting, and the use of EPA proposed Hazardous Waste Identification Rule (HWIR) and the EPA proposed Mixed Waste Storage and Disposal Rule if the latter two are approved.

6.1 Delisting Approach

Delisting is a method by which a waste bearing a listed HWN can be excluded from the hazardous waste regulations under the RCRA Subtitle C program. To exclude, or delist, a listed waste, a delisting petition must be submitted to the authorized delisting agency. Then, the agency determines if the waste is eligible for delisting. There are three types of delisting or exclusion: a standard exclusion, a conditional exclusion, and an upfront exclusion. Procedures and guidance for petitioning to delist a listed waste can be found in 40CFR 260.20 and 260.22 and references 12 and 13. The intricate details about delisting and related requirements governing the process of requesting and awarding delisting petitions are provided in reference 14.

Currently, some of the potential target repositories under consideration in this study are not permitted to receive any RCRA-characteristic or listed hazardous waste for disposal. WIPP has received a license to dispose of radioactive waste with certain RCRA chemicals. Others such as the Nevada Test Site (NTS) accepts mixed LLW for disposal, however, it does not accept such waste from the off-site generators at the present time. Nevertheless, per DOE's record of decision (ROD) issued in February 2000, for mixed LLW disposal, the NTS and Hanford site will be used for off-site waste.[15] Presently, the Hanford site accepts certain LDR treated listed LLW.

Currently, the Envirocare of Utah mixed LLW facility is the only commercial facility permitted to dispose of DOE and commercial mixed LLW wastes from off-site generators. Any LLW bearing listed and characteristic HWNs must meet the applicable LDR standards prior to disposal at the mixed waste facilities. In such cases, delisting will not be required unless a particular listed HWN is not authorized for disposal.

Before shipment, delisting petitions for the target waste must be granted for both Idaho and the receiving state. If the target waste were transported through other states on its way to the receiving state, it would have to be accompanied by a manifest. Potentially, notification of transitory states may be performed before shipment as a courtesy.

Delisting can be granted by the individual states authorized to administer delisting and EPA regional offices. It could also be granted through EPA rulings between regions or on a national level.[h] Delisting on a national level would require at least a federal rulemaking and amendment to the definition of hazardous waste in 40 CFR 261.[h] State with authorized delisting programs (authorized to administer delisting) must also adopt the EPA rule making into their program for the delisting to be in effect. EPA rule making does not automatically allow waste to be disposed of as a non-hazardous waste in an authorized state.

In this study, it is assumed that the EPA delisting will be granted for the petitioned wastes to delist the RCRA listed hazardous waste codes. All of the wastes resulting from the UNEX or Modified UNEX option will be considered delisted prior to final interim storage for shipment to the disposal sites. An upfront exclusion could be an option for delisting the target wastes. This is a type of conditional exclusion that can be used for wastes and/or wastes from treatment that have not been generated, but will be generated in the future. The upfront exclusion is based on evaluation of the characteristics of the untreated waste, process description, and data from bench scale or pilot scale treatment system. The treated wastes will no longer be considered RCRA hazardous wastes if the petition is granted. Once the full-scale treatment process is on-line, verification testing would be required to demonstrate that the system is operating as described in the petition and that the treated wastes achieve the delisting levels described in the petition.

6.2 Hazardous Waste Identification Rule

EPA proposed the HWIR to amend the RCRA hazardous waste regulations.[16] This rule would allow mixed waste containing listed hazardous constituents below the HWIR exit levels to become eligible for self-implementing exemption from the RCRA Subtitle C regulations. Such wastes would be disposed as radioactive wastes only. Application of the self-implementing exemption would require notifying the state regulatory agency, complying with sampling and analysis requirements, and meeting administrative requirements. The self-implementing nature of the proposed HWIR proposal would enable some listed wastes to leave the RCRA regulatory management system without having to be formally "delisted." The proposed HWIR is scheduled to be finalized on April 30, 2001.

6.3 Mixed Waste Storage and Disposal Rule

EPA issued the proposed Mixed Waste Storage and Disposal Rule that aims to reduce dual regulations of mixed LLW, which is subject to RCRA and AEA. The proposal would exempt certain mixed LLW from RCRA storage, manifesting, and disposal requirements if specific conditions are

[h] Personal communication with David Bartus, EPA Region 10, on 04/14/99.

met.[17] The exemption does not apply to RCRA hazardous waste mixed with HLW or TRU waste. The conditions for exemption are to ensure the waste meet the applicable LDR requirements, to notify the disposal facility of the exempt status of the waste before shipment to the disposal facility, and to comply with the NRC transportation requirements 10 CFR 71. In addition to these, for RCRA-exempted mixed wastes, DOE facilities must comply with the DOT and 10 CFR 20 requirements to claim the exemption. The exempt waste must be disposed of at facilities licensed by NRC or Agreement State.

7. REQUIREMENTS FOR THE INTERIM STORAGE AND SBW PROCESSING FACILITIES

The design and operation of the interim storage facility that would be used for the final waste products do not require compliance with the RCRA requirements. This is based on the assumption that the delisting petitions for the target waste products would be granted prior to interim storage. However, since the SBW also contains characteristic constituents, the facilities used for processing the liquid SBW (prior to interim storage) must be designed, constructed, and operated in accordance with the RCRA requirements. These requirements are defined in 40 CFR 264 (IDAPA 16.01.05.008) and in 40 CFR 270 (IDAPA 16.01.05.012). 40 CFR 264 contains the minimum national standards for owners and operators of hazardous waste facilities, and 40 CFR 270 establishes the permit requirements.

The planning, design, and construction of the interim storage and SBW processing facilities must be performed in a manner that will satisfy all applicable DOE criteria, and State and local environmental, safety and health laws and regulations.

40 CFR 264 sets regulatory requirements such as quality assurance program, testing and maintenance of the equipment, air emission standards, groundwater protection standards, security, inspection, personnel training, contingency plan and emergency procedures, manifest system and record keeping, closure and post-closure, financial requirements, and use and management of containers. For example, for the new storage tanks, 40 CFR 264, Subpart J (Parts 264.192 through 264.200) contains the specific standards that apply to the design, installation, containment, response to leaks and spills, operation, inspection, air emissions, and closure of a new tank system. RCRA requires that new storage tanks or components be equipped with secondary containment in order to prevent the releases of any hazardous wastes to the environment. The secondary containment must be designed and operated in accordance with the standards in Part 264.193

Any existing hazardous waste facilities used for the future hazardous waste management activities can continue operations while meeting the requirements in 40 CFR 265 (16.01.05.009), "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities". This will allow the existing facilities to continue operations while meeting minimum operational requirements defined in 40 CFR 265. To be qualified for interim status, the existing facility must have been in operation or under construction on November 19, 1980 or have been in operation when the facility became subject to the RCRA requirements.

8. CRITERIA OF THE POTENTIAL CANDIDATE REPOSITORIES

Wastes resulting from the proposed processes are analyzed here in the context of their evaluation against the disposal facilities WAC. The UNEX and Modified UNEX process would generate wastes that would be classified as TRU waste and LLW from the radiological standpoint. Currently, WIPP is the only facility authorized to accept TRU and mixed TRU waste for disposal. Several facilities are considered as potential candidates for the disposal of the LLW. These include DOE and commercial sites. A detailed description of the criteria of these facilities is provided below.

8.1 Waste Isolation Pilot Plant

8.1.1 Waste Acceptance Criteria

8.1.1.1 Background

In October 1999, WIPP received a RCRA Permit from the State of New Mexico Environment Department (NMED) to receive CH-mixed TRU waste for disposal. The WIPP WAC document revised in November 1999 (Revision 7) to reflect the NMED permit requirements. The revised WAC identify criteria that must be met for the safe handling, transportation, and disposal of CH-TRU and CH-mixed TRU waste. The RH-TRU waste criteria are deleted in the revised WIPP WAC document because the WIPP is currently not permitted to dispose of RH-TRU. The RH-TRU criteria are being developed by the WIPP office and will be issued as a separate document.[i]

This study provides the criteria for both CH- and RH-TRU and mixed TRU waste. However, the RH criteria are based on the previous version (Rev. 5) of the WIPP-WAC document.[18] These criteria are preliminary at this time and are provided here as technical guidance to proceed with the waste acceptance issues.

In addition to the NMED Permit, the acceptance criteria for CH-TRU and CH-mixed TRU are derived from several sources. These include WIPP Safety Analysis Report (SAR), WIPP Safety Analysis Report for the Transuranic Package Transporter (TRUPACT-II) Shipping Package (TRUPACT-II SARP), the TRUPACT-II Certificate of Compliance (COC), the site compliance certification, and the land withdrawal Act (LWA) and its amendments (LWAA).

The WIPP SAR addresses handling operations for CH-TRU wastes and safety bases necessary to ensure the safety of the workers, the public, and the environment. The acceptable methods for payload compliance are specified in the TRUPACT-II SARP, Appendix 1.3.7 (TRUPACT-II Authorized Methods for Payload Control (TRAMPAC)). The SARP addresses the NRC safety requirements in 10 CFR 71, Subpart H for the TRUPACT-II. A site-specific TRAMPAC and a QA program must be prepared describing compliance methodology with payload requirements (TRUPACT-II COC) and the QA activities that apply to the use of NRC-approved packaging.

The site compliance certification is a documented declaration by each site to demonstrate that the waste has been characterized and meets the requirements for transportation to and disposal at WIPP.

The LWA specifies that waste destined for disposal at the WIPP meet the definition of TRU waste, not contain HLW or SNF, and be generated from atomic energy defense-related activities. The LWAA exempts WIPP from the LDR treatment standards for the RCRA chemicals acceptable at WIPP.

8.1.1.2 NMED Permit Requirements

The NMED Permit contains a Waste Analysis Plan (WAP) that defines the requirements for waste characterization activities that generators are required to implement for waste disposal. Based on the Permit, only CH-TRU wastes that have been characterized in accordance with the WAP (contained in the Attachment B of the Permit) are acceptable for disposal at WIPP. The characterization requirements are

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[i] According to Tawnya Goddard of the WIPP document control, the draft RH-TRU WIPP WAC document has not been issued yet (personal communication, August 22, 2000).

specified on a waste stream basis. A waste stream is defined as waste materials generated from a single process or from an activity that is similar in material, physical form, and hazardous constituents. In the Permit, all waste streams that can be accepted at WIPP are categorized into three Summary Category groups/codes based on the physical and chemical properties of the wastes: Homogenous Solids, Soil/Gravel, and Debris Waste (each of the three groups is described in the footnote, below).[j] Waste destined for disposal at WIPP must be assigned to one of these there categories for further characterization. Acceptable knowledge is used for the purpose of grouping waste. The INTEC mixed TRU waste that would be destined for disposal at WIPP can be grouped as a Homogeneous Solids category (Code: S-3000) based on its projected physical and chemical properties. The WAP specifies characterization methods for each of the three categories. The characterization methods include: 1) acceptable knowledge, which incorporates confirmation by headspace-gas sampling and analysis, 2) homogeneous waste sampling and analysis, and 3) radiography and visual examination. Generators are required to develop and implement a Quality Assurance Project Plan (QAPjP) that addresses the requirements specified in the WAP. The QAPjP must include the qualitative or quantitative criteria for making a hazardous waste determination. The QAPjP will require the approval of the WIPP CAO.

Under the LWAA, the WIPP is exempt from the LDR requirements. However, the WIPP WAC specify that only selected RCRA HWNs are acceptable for disposal (see Table 6). The LDR exemption applies only to the list of HWNs acceptable for disposal at WIPP. For TRU waste bearing other HWNs that are not in the WIPP WAC, a request must be submitted to the WIPP DOE Carlsbad Area Office (CAO) to modify the WIPP RCRA Permit to allow disposal of that waste at WIPP, thus bringing it within the envelope of waste to which the LDR exemption applies. Such waste will be prohibited for disposal at WIPP until the permit modification is approved by the NMED for these HWNs.

The RCRA chemicals that are expected to be present in the wastes resulting form the UNEX processes would exhibit characteristics of corrosivity (D002) and toxicity (toxic metals). The waste would also carry other RCRA listed HWNs. Based on the WIPP WAC, TRU waste exhibiting ignitable (D001), corrosive (D002), or reactive (D003) characteristic must be treated to remove the hazardous characteristic. From the RCRA HWNs currently assigned to the wastes, D002 (corrosive) and U134 (hydrogen fluoride – listed waste) are currently not accepted at the WIPP. The waste must be treated to remove the characteristic of corrosivity and be delisted for U134. A potential alternative to delisting could be obtaining permission from the WIPP management or addition of U134 to the WIPP RCRA Permit to dispose of U134.[19]

All the RCRA HWNs in the TRU waste, regardless of the WIPP waste acceptability status, must be reported to the WIPP prior to the waste shipment. The determination of hazardous contaminants shall be based on acceptable knowledge and/or sampling and analysis data indicating that the waste is hazardous

[j] S-3000 - Homogeneous Solids - Homogenous solids, or solid process residues, are defined as solid materials, excluding soil, that do not meet the NMED criteria for classification as debris (40 CFR 268.2[g] and [h])). Included in the series of solid process residues are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Summary Category Group based on the specific waste stream types and final waste form. This Summary Category Group is expected to contain toxic metals and spent solvents. This category includes wastes that are at least 50 percent by volume solid process residues.

S-4000 - Soils/Gravel - This Summary Category Group includes waste streams that are at least 50 percent by volume soil/gravel. This Summary Category Group is expected to contain toxic metals. Soils/gravel are further categorized by the amount of debris included in the matrix.

S-5000 - Debris Wastes - This Summary Category Group includes heterogeneous waste that is at least 50 percent by volume materials that meet the criteria specified in (40 CFR 268.2 (g)). Debris means solid material exceeding a 2.36 inch (in.) (60 millimeter) particle size that is intended for disposal and that is: a manufactured object, or plant or animal matter, or natural geologic material.

as defined in 40 CFR 261, subparts C and D. It is also required that an LDR notification be transmitted to the WIPP for each shipment of mixed waste. The notification must contain hazardous waste characterization records and records showing types and quantities of all hazardous constituents that require LDR treatments in accordance with 40 CFR 268.

The following contains the criteria for both CH- and RH- TRU and mixed TRU waste. The criteria are provided under the following categories: container requirements, nuclear properties, chemical properties, gas generation, and data package. These criteria are summarized in Tables 10 and 11. The TRU waste sites must certify all TRU waste packages to the criteria identified in the WIPP-WAC.

8.1.1.3 WIPP Criteria for CH-TRU Waste

8.1.1.3.1 Container Requirements

A TRU waste payload container must be one of the following and meet all applicable DOT requirements in 49 CFR 173.412:

- DOT Type A 55-gallon drums
- Pipe overpack in 55-gallon drums
- Standard Waste Boxes (SWBs)
- Ten Drum Overpack (TDOP)

These containers are authorized for shipment of CH-TRU waste in the TRUPACT-II. The maximum number of containers per TRUPACT-II and the authorized packaging configurations are provided in Table 3.

Only DOT Type A 55-gallon drums and TRUPACT-II SWBs shall be unloaded at the WIPP as payload containers. The Type A requirements for payload containers used for newly generated CH-TRU waste may be verified by procurement or fabrication documentation. Specification UN1A2 55-gallon drums are considered adequate to meet Type A requirements if the requirements of the TRUPACT-II SARP are also met.

Table 3. Maximum number of containers per TRUPACT-II and authorized configurations.

Max. #	Authorized Packaging Configurations
14	55-gallon drums
14	Pipe overpacks in 55-gallon drums
2	SWBs
2	SWBs, each containing one bin
2	SWBs, each containing four 55-gallon drums
1	TDOP, containing ten 55-gallon drums
1	TDOP, containing one SBW
1	TDOP, containing one bin within a SWB
1	TDOP, containing four 55-gallon drums within a SWB

8.1.1.3.1.1 *Container/Assembly Weight limits*

Individual container weights shall be limited to the weight capacities that meet the DOT Type A requirements. The weight limits that apply to CH-TRU waste payload containers, loaded TRUPACT-IIs, and TRUPACT-II shipments are specified in Table 4.

As all weight criteria must be met, different payload configurations are restricted by different requirements. For example, a payload assembly of fourteen 55-gallon drums may not weigh more than 7,265 lb even though the maximum weight of a single 55-gallon drum may be 1,000 lb. Although the maximum weight of the payload assembly must not exceed 7,265 lb, the weight available for the CH-TRU waste payload assembly will be less, depending on the as-built (i.e., empty) weight of the TRUPACT-II to be used (the average as-built weight of production TRUPACT-IIs is 12,705 pounds). The weight available for the CH-TRU waste payload assembly is obtained by subtracting the as-built weight of a TRUPACT-II from the maximum gross weight of 19,250 lb.

The maximum gross weight per TRUPACT-II is specified based on an approximate as-built weight of 13,050 lb and an average payload weight of 6,200 lb; this is usually the limiting weight for two TRUPACT-IIs per shipment. DOT's limit of 80,000 lb gross vehicle weight rating must also be met; this is the limiting weight for three TRUPACT-IIs per shipment.

Documented evidence shall exist that each CH-TRU waste payload container has been weighed, and that the weight of the payload container and container assembly meets the requirements. The weight of the payload container cannot exceed the weight for which the payload container has been certified in accordance with DOT Type A requirements.

Table 4. Container/Assembly Weight Criteria.

Components	Max. Weight (lb)
Individual Payload Container	
55-gallon steel drum (DOT Specification 17 C)	≤ 1000
55-gallon steel drum (DOT Specification 17 H)	≤ 1000
55-gallon steel drum (UN/1A2/X320/S)	≤ 700
55-gallon steel drum (UN/1A2/X325/S)	≤ 716
55-gallon steel drum (UN/1A2/X400/S)	≤ 882
55-gallon steel drum (UN/1A2/X320/S)	≤ 937
55-gallon steel drum (UN/1A2/X425/S)	≤ 948
55-gallon steel drum (UN/1A2/X430/S)	≤ 959
55 gallon drum overpacked in SWB	≤ 1450

SWB	≤ 4000
TDOV	≤ 6700
Pipe Overpack Payload Container	
Pipe overpack 6" diameter	≤ 328
Pipe overpack 12" diameter	≤ 547
Payload Container Assembly	
Payload container assembly of two SWBs	≤ 7265
TRUPAT-II	≤ 19250
Truck (tractor/trailer)	≤ 80000

8.1.1.3.1.2 Removable Surface Contamination

Removable surface contamination on CH-TRU waste payload containers or container assemblies to be disposed at the WIPP shall not be greater than 20 dpm/100 cm^2 for alpha-emitting radionuclides and 200 dpm/100 cm^2 for beta-gamma emitting radionuclides. Beta-gamma contamination may be ≤1000 dpm/100 cm^2 if it meets the requirements of the DOE RADCON Manual, Table 2-2. The fixing of surface contamination to meet the above criterion is not permitted.

The Sites/generators must measure the degree of removable surface contamination for each CH-TRU waste payload container or payload container assembly prior to its shipment. The sampling methods are described in 10 CFR 835. The results of these surveys must be documented.

8.1.1.3.1.3 Container Marking

Each CH-TRU waste payload container shall be labeled with a unique container identification number consisting of Site and container identification. The shipping category shall be labeled conspicuously on each payload container.

8.1.1.3.1.4 Dunnage

Dunnage must complete one of the configurations specified in Table 3 if too few payload containers are available that meet all payload container and transportation requirements. An empty, 55-gallon metal drum or an empty SWB may be used as dunnage as specified in Section 13.4 of Appendix 1.3.7 of the TRUPACT-II SARP. If an empty drum is used as dunnage to complete a seven-pack in a shipment to the WIPP, the drum shall be labeled "EMPTY" or "DUNNAGE" and have a container marking.

8.1.1.3.1.5 Filter Vents

All payload containers shall be vented. All CH-TRU waste payload containers, including overpacks, shall be vented with filters to control gas concentration and pressure. Filters must meet the specifications described in Appendix 1.3.5 of the TRUPACT-II SARP. The installation of filter vents shall be documented and verified by visual inspection.

8.1.1.3.1.6 Liquids

Liquid waste is not acceptable at the WIPP. CH-TRU waste shall contain as little residual liquid as is reasonably achievable through pouring, pumping, and/or aspirating. Internal containers (e.g., bottles, cans, etc.) shall contain less than 1 in. or 2.5 cm of liquid in the bottom of the container. In no case shall the total liquid volume (i.e., the sum of all internal or payload container volumes) exceed 2 L in a 55-gallon drum or 8 L in a SWB. The total volume of residual liquid in a payload container shall be less than 1 volume percent of the payload container.

Radiography or visual examination shall be used to determine the presence of liquids and to estimate the quantity of liquid in retrievably-stored waste. Radiography or visual records shall include a description of the location of any liquid detected (e.g., between the rigid liner and the 55-gallon poly bag liner or in a one-gallon poly bottle) and an estimate of its volume.

For newly generated waste, visual examination and documentation of container content at the time of waste packaging, or verification (random sampling) and documentation may be used to demonstrate compliance. Sites shall have policies and procedures in place that prohibit free liquids being placed in newly generated CH-TRU waste.

8.1.1.3.2 Nuclear Properties Requirements

8.1.1.3.2.1 Nuclear Criticality (Pu-239 FGE)

The fissile or fissionable radionuclide content, in terms of Pu-239 fissile-gram equivalent (FGE), of CH-TRU waste payload containers shall be no greater than 200 g per 55-gallon drum (including Pipe overpacks) or 325 g per SWB and per TDOP maximum. The Pu-239 FGE shall be calculated using the methods detailed in Appendix 1.3.7 of the TRUPACT-II SARP. Table 3-1 of Appendix 1.3.7 of the TRUPACT-II SARP contains Pu-239-FGE for a number of radionuclides. Table 5 below defines the maximum allowable quantity of fissile material, expressed as Pu-239 FGE, for CH-TRU waste in the TRUPACT-II.

Table 5. Nuclear criticality criteria.

Component	Pu-239 FGE (g)
55-gallon drum	≤ 200
SWB	≤ 325
TDOP	≤ 325
Pipe component overpacked in 55-gallon drum	≤ 200
TRUPACT-II	≤ 325
TRUPACT-II (14 Pipe overpacks)	≤ 2800

Records of calculations converting the specific activity of selected radionuclides to FGE using the methods detailed in Appendix 1.3.7 of the TRUPACT-II SARP shall be maintained.

8.1.1.3.2.2 Pu-239 Equivalent Activity

Untreated CH-TRU waste shall not exceed 80 plutonium equivalent curies (PE-Ci) of activity per 55-gallon drum, or 130 PE-Ci of activity per SWB, or 130 PE-Ci of activity per TDOP. Untreated CH-TRU waste in 55-gallon drums containing a pipe component may be up to 1800 PE-Ci, or 1100 PE-Ci of activity per 55-gallon drum if overpacked in a 85-gallon drum or TDOP. The PE-Ci limit for SWBs overpacked in a TDOP is up to 1100. 55-gallon drums containing solidified/vitrified CH-TRU waste shall not exceed 1800 PE-Ci of activity per drum.

8.1.1.3.2.3 Contact Dose Rate

CH-TRU waste payload containers shall have a maximum contact dose rate (beta + gamma + neutron) at any point at no greater than 200 mrem/hr. Neutron contributions to the total payload container dose rate shall be reported separately in the data package.

The external dose rate of individual CH-TRU waste payload containers is limited to 200 mrem/hr at contact. The external dose rate of the loaded TRUPACT-II to be transported is limited to 200 mrem/hr contact dose rate and 10 mrem/hr at 2-m distance. Shielding only is allowed for as low as reasonably achievable (ALARA) purposes.

Documented procedures shall be used to measure dose rates on each type of payload container. The instrumentation used must be properly calibrated using sources traceable to the National Institute of Science and Technology or other nationally recognized organization. The results of these measurements shall be documented for each CH-TRU waste payload container.

8.1.1.3.2.4 Thermal Power

Individual CH-TRU waste payload containers in which the average thermal power density exceeds 0.1 watt/ft^3 (3.5 watts/m^3) shall have the thermal power recorded in the data package. Based on the materials of construction, 40 watts is the thermal limit for total decay heat from all CH-TRU waste payload containers in a TRUPACT-II. Records of calculations converting the specific activity of selected radionuclides to decay heat using the methods detailed in Appendix 1.3.7 of the TRUPACT-II SARP shall be maintained. Table 3-1 of Appendix 1.3.7 of the TRUPACT-II SARP presents the decay heat for a number of radionuclides.

8.1.1.3.2.5 TRU Alpha-Activity Concentration

Documented evidence shall exist to show that the concentration of alpha-emitting TRU isotopes with half-lives greater than 20 years is more 100 nCi/g in the waste. The weight of added external shielding and the payload containers (including any rigid liners) shall be subtracted prior to performing the nCi/g calculation.

8.1.1.3.3 Chemical Properties Requirements

8.1.1.3.3.1 Pyrophoric Materials

Pyrophoric materials, other than radionuclides, shall be rendered safe by mixing them with chemically stable materials (i.e., concrete, glass) or shall be processed to remove their hazardous properties. Not more than 1 wt% of the CH-TRU waste payload in each payload container may be pyrophoric forms of radionuclides, and these shall be generally dispersed in the payload.

CH-TRU waste for shipment in TRUPACT-II shall contain less than 1 wt% of the payload container as pyrophoric radioactive materials as specified in Appendix 1.3.7 of the TRUPACT-II SARP. Nonradioactive pyrophorics shall be rendered nonreactive prior to placement in the CH-TRU waste payload container.

Documented procedures or evidence shall exist to show that the CH-TRU waste payload container contains no nonradionuclide pyrophorics and no significant quantities of radionuclide pyrophorics (i.e., <1% by weight) or other materials that could become pyrophoric compounds because of mixing. The 1% limitation on radionuclides is to allow any minor residues of uranium or plutonium that may remain in an unoxidized state in the payload.

CH-TRU wastes expected to contain any metallic radionuclides shall be treated (oxidized) to eliminate as much of the potential pyrophorics as possible, prior to placement in payload containers. A validated process (i.e., one that has been proven by test or analysis) that converts pyrophoric compounds to a nonpyrophoric form may be used to meet this requirement. This process may either change the chemical form of the pyrophoric material or mix and bind it within an inert matrix.

8.1.1.3.3.2 Mixed Waste

Hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes) are not acceptable for disposal at WIPP. Both TRU waste and mixed TRU wastes are acceptable for disposal at the WIPP. However, only TRU waste bearing RCRA HWNs shown in Table 6 is designated for disposal at the WIPP. Such waste is exempt from the LDR treatment standards. Wastes with HWNs not listed in Table 6 are not entitled to this exemption, and are consequently subject to the LDR treatment requirements. To be exempt from the LDR requirements, a request must be submitted to the CAO to modify the RCRA Permit to allow disposal of such wastes at WIPP.

Regardless of the LDR exemption, the RCRA hazardous components in the TRU waste must be determined and recorded. The determination shall be based on acceptable knowledge and/or sampling and analysis data that indicates that the waste is hazardous as defined in 40 CFR Part 261, Subparts C and D.

Table 6. List of RCRA hazardous waste codes acceptable at the WIPP.

F001	D008	D030
F002	D009	D032
F003	D010	D034
F004	D011	D035
F005	D018	D036
F006	D019	D037
F007	D021	D038
F009	D022	D039
D004	D026	D040
D005	D027	D043
D006	D028	P015
D007	D029	

All TRU mixed waste exhibiting corrosive, reactive, or ignitable characteristics shall be treated to remove the hazardous characteristic. Ignitable, corrosive, and reactive wastes are defined in 40 CFR 261.21, 261.22, and 261.23, respectively.

8.1.1.3.3.3 Chemical Compatibility

CH-TRU mixed waste shall contain no chemicals which would cause adverse reactions with other payload containers during handling or disposal. To comply with environmental requirements, waste must be evaluated to ensure that no adverse reactions could take place during transport, and that the chemical/material or any products of reaction are compatible with its container and packaging as well as other chemicals in the waste. Documentation must show compliance with chemical compatibility requirements.

8.1.1.3.3.4 Hazardous Constituents

For compliance with 40 CFR Part 268, the type and quantity of hazardous constituents on the target Analyte list (TAL), as defined in the QAPP, and tentatively identified compounds (TICs) must be reported. TICs are those not in the TAL that are detected via Gas Chromatography/Mass Spectrometry (GC/MS). Hazardous constituents included in the TAL and TICs must be recorded in the Site's data package and reported in the WIPP Waste Information System (WWIS) database.

8.1.1.3.3.5 Explosives, Corrosives, and Compressed Gases

The CH-TRU waste and TRUPACT-II payload shall contain no explosives, corrosives or compressed gases. 49 CFR 173.50 defines explosives; 40 CFR 261.22 defines corrosives; and 49 CFR 173.115 defines compressed gases. Explosive or corrosive chemical constituents are prohibited, and pressurized containers are not allowed in a TRUPACT-II payload.

Documented procedures, radiography, or visual examination shall be used to ensure that individual CH-TRU waste payload containers contain no pressurized vessels. For newly generated waste, documented procedures shall be used to exclude explosive or corrosive items, compounds, or combinations of materials that could form explosive or corrosive constituents within the payload container. If explosive materials are present, they must be treated or diluted such that a detonation is not possible. Corrosive materials, if present, must be treated to render them noncorrosive.

8.1.1.3.4 Gas Generation Requirements

8.1.1.3.4.1 Decay Heat

The decay heat must be less than the wattage limits shown in the TRUPACT-II SARP, Section 1.2.3.3.8 for the specified payload shipping category. If individual payload containers exceed the limit, these containers must be tested in accordance with Appendix 1.3.7 of the TRUPACT-II SARP, Attachment 2.0, "Gas Generation Test Plan to Qualify Test Category Waste for Shipment in the TRUPACT-II."

8.1.1.3.4.2 Flammable VOCs

The total concentration of potentially flammable VOCs is limited to 500 ppm in the headspace of a CH-TRU waste payload container. Documented procedures shall be used to ensure that the total concentration of potentially flammable VOCs is less than or equal to 500 ppm in the headspace of a CH-TRU waste payload container. Content codes that do not identify any of the flammable VOCs in the chemical lists do not have to implement additional controls to meet this requirement.

8.1.1.3.4.3 VOC Concentrations

Waste managed at the WIPP must not contain headspace-gas VOC concentrations resulting in emissions that are not protective of human health and the environment. The results of VOC headspace gas sampling for each TRU waste payload container must be reported using the WWIS. Reported VOC concentrations levels will then be evaluated by the WIPP management to ensure that VOC averages for each repository room do not exceed the limits defined in Table 7. A container reported to have higher VOC concentrations than the average limits may be approved for disposal by the WIPP contractor on a case-by-case basis.

Table 7. VOCs and their concentration limits.

Compound	Max. Headspace Concentration (PPM)
carbon tetrachloride	7,510
Chlorobenzene	17,600
Chloroform	6,325
1,2-dichloroethylene[a]	28,750
1,2-dichloroethane[a]	9,100
methylene chloride	100,000
1,1,2,2-tetrachloroethane	7,924
Tolulene	41,135
1,1,1-trichloroethane	100,000

a. These compounds are also restricted to 500 ppm total per payload container by the TRUPACT-II SARP.

8.1.1.3.4.4 Aspiration

Sites that add filters to unvented payload containers of CH-TRU waste shall aspirate the payload containers for a sufficient period of time prior to transport to ensure equilibration of any potentially flammable gases that may have accumulated in the closed containers. Options for determining aspiration time include determination based on the date of drum closure and headspace gas sampling at the time of venting or during aspiration.

Documented procedures shall be used to ensure that an unvented CH-TRU waste payload container has had a filter installed and been aspirated for a sufficient period of time to ensure equilibration of any potentially flammable gases prior to transport.

8.1.1.3.4.5 Shipping Category

All CH-TRU waste payload containers in a single TRUPACT-II shall belong to the same shipping category as defined in the TRUPACT-II SARP. Each payload container shall belong to one of the content codes defined in the CH-TRUCON. Documented procedures shall be used to ensure that all CH-TRU waste payload containers to be transported in a single TRUPACT-II belong to one of the content codes defined in the CH-TRUCON and to the same shipping category.

8.1.1.3.4.6 Confinement Layers in TRUPACT-II Containers

The requirements applicable to the layers of confinement in TRUPACT-II containers are defined in Section 8.0 of Appendix 1.3.7 of the TRUPACT-II SARP, as follows:

- Rigid 55-gallon drum liners, if present, shall be punctured or have a filter vent
- Maximum number of confinement layers for the waste shall be known and must comply with the CH-TRUCON

- Bags shall be closed by one of the following methods:
  - Twist-and-tape closure—the use of wire or plastic ties to aid twist and tape closure is allowable.
  - Fold-and tape closure—the use of wire or plastic ties to aid fold and tape closure is allowable.
  - Heat-seal closure with a vented bag—heat-sealed unvented bags are prohibited.

Documented procedures shall be used to ensure that the requirements specified in Section 8.0 of Appendix 1.3.7 of the TRUPACT-II SARP are met. The number of layers and bag closure shall be visually verified for newly generated waste; for stored waste, acceptable knowledge or sampling may be used.

8.1.1.3.5 Data Package Requirements

8.1.1.3.5.1 Acceptance Data

An auditable package of data, with a signed certification statement indicating that the CH-TRU waste meets the requirements of the current WAC, shall be maintained at the Site. Required WWIS data must be entered and approved by the WIPP prior to shipping waste to the WIPP.

8.1.1.3.5.2 RCRA Data

Sites shall prepare and transmit a "Waste Stream Profile Form" to the WIPP for each waste stream. Sites shall also prepare a "Uniform Hazardous Waste Manifest" in accordance with 40 CFR 262.23 and an "LDR Notification" in accordance with 40 CFR 268 for each shipment of CH-TRU mixed waste.

8.1.1.3.5.3 Shipping Data

Sites shall prepare a "TRUPACT-II Payload Container Transportation Certification Document," have procedures in place for certifying a TRUPACT-II payload, and shall prepare a "Bill of Lading" for CH-TRU waste shipments in accordance with 49 CFR Part 172, Subpart C; or a "Uniform Hazardous Waste Manifest" in accordance with 40 CFR 262.23.

Table 8. Summary of WIPP CH-TRU waste acceptance criteria.

Criteria	Limits
Container And Physical Properties	
Container Description	DOT Type A 55-gallon drums & Standard Waste Boxes (SWBs), and Ten-drum overpacks (TDOP)
Container Weight	≤ 1000 lb/55-gallon drum ≤ 4000 lb/SWB ≤ 6700 lb/TDOP ≤ Transuranic Package Transporter-II (TRUPACT-II) Weight (limits shown in Table 4)
Removable Surface Contamination	20 dpm/100 cm^2 Alpha 200 dpm/100 cm^2 Beta-Gamma
Container Marking	Bar Code Shipping Category
Dunnage	Empty 55-gallon drums or empty SWBs
Filter Vents	Payload containers vented using filters the WIPP RCRA Permit and TRUPAT-II SARP
Liquids	Free liquid < 1% volume of external container < 1 in. (2.5 cm) in the bottom of internal container
Nuclear Properties	
Radionuclide Composition	Assay measurements Quantification of Am-241, Pu-238, Pu-239, Pu-240, Pu-242, U-233, U-234, U-238, Sr-90, and Cs-137
Nuclear Critically Pu-239 FGE	≤ 200 g/55-gallon drum ≤ 325 g/SWB ≤ 325 g/TDOP < 325 g/TRUPAT-II ≤ 2,800 g/TRUPACT-II (14 55-gallon drums each containing one pipe component)
Pu-239 Equivalent Activity (PE-Ci)	Untreated Waste ≤ 80 PE-Ci/55-gallon drum ≤ 130 PE-Ci/SWB ≤ 130 PE-Ci/TDOP ≤ 1,100 PE-Ci/55-gallon drum overpacked in a 85-gallon drum, or SWB, or TDOP ≤ 1,100 PE-Ci/SWB in a TDOP ≤ 1,800 PE-Ci/55-gallon drum containing a pip component Solidified/Vitrified Waste ≤ 1800 PE-Ci/55-gallon drum
Radiation Dose Rate	≤ 200 mrem/hr @ the surface of the payload container and the TRUPACT-II ≤ 10 mrem/hr @ 2 m
Thermal Power	Report if > 0.1 watts/ft3 (3.5 watts/m^3) < 40 watts per TRUPACT-II
TRU Alpha Activity	> 100 nCi of alpha-emitting TRU isotopes per gram of waste

Table 8 (continued).

Criteria	Limits
Chemical Properties	
Pyrophoric Materials	< 1% radionuclide pyrophorics No nonradionuclide pyrophorics
Hazardous Waste	Characterization per QAPjP Limited to EPA HWNs listed in Table 6
Chemical Compatibility	No chemicals or materials that are incompatible
###Hazardous Constituents	Target analytes and TICs must be reported per QAPP
Explosives, Corrosives and Compressed Gases	No compressed gases No ignitable, reactive, or corrosive waste
Gas Generation	
Decay Heat[a]	≤ wattage limit for the authorized shipping category < 40 watts per TRUPACT-II
Flammable VOCs	≤ 500 ppm in any payload container's headspace
VOC Concentration	≤ the values shown below: Carbon Tetrachloride 7,510 Chlorobenzene 17,600 Chloroform 6,325 1,2-Dichloroethylene 28,750 1,2-Dichloroethane 9,100 Methylene Chloride 100,000 1,1,2,2-Tetrachloroethane 7,924 Toluene 41,135 1,1,1-Trichloroethane 100,000
Aspiration[a]	≥ Times shown in TRUPACT-II SARP
Shipping Category[a]	All payload containers in a TRUPACT-II shall belong to the same shipping category.
Test Category Waste	Hydrogen gas release ≤ rate specified in TRUPACT-II SARP, Appendix 1.3.7,
Data	
Characterization and Certification Data	Waste Stream Profile Form and accompanying characterization data Waste container data imported to the WIPP Waste Information System
Shipping Data	Payload Container/Assembly Transportation Certification Documents Bill of Lading (A Uniform Hazardous Waste Manifest may be substituted.) Uniform Hazardous Waste Manifest[b] LDR notification

8.1.1.4 WIPP Criteria for RH-TRU Waste

The RH-TRU acceptance criteria and compliance requirements are not finalized yet. Final requirements will not be available until the RH-TRU 72-B Cask SARP is approved by the NRC, the WIPP Safety Analysis Report (SAR) is updated, and C of C is issued. The RH-TRU 72-B Cask is intended to be used for transportation of RH-TRU waste canisters to the WIPP. The criteria and requirements provided here are to assist in preparing site-specific plans and detailed procedures as required by WIPP for certifying TRU waste for transport to and disposal at WIPP.

8.1.1.4.1 Container Requirements

8.1.1.4.1.1 Container Description

Canisters shall be noncombustible and as a minimum, meet the structural requirements and design conditions for Type A packaging as contained in 49 CFR 173.412. In addition, all RH-TRU canisters shall be certified in accordance with DOT Specification 7A, Type A, and shall meet the Type A packaging specification from the time of RH-TRU waste certification to disposal at the WIPP.

RH-TRU canisters shall be no larger than a nominal 0.66 m (26-in) diameter with a maximum length of 3.1 m (10 ft, 1 in), including the pintle, per Rockwell International Drawing RI-H-2-91273. For RH-TRU 72-B cask, the RH canister configured with the axial lifting pintle shall be used.

8.1.1.4.1.2 Canister Gross Weight

RH-TRU canisters shall weigh no more than 8,000 lb when loaded. For RH-TRU waste, the canister weight may be calculated based on the weight of the empty canister plus the weight of RH-TRU waste that will be placed in the canister. The weight of the canister cannot exceed the weight for which the canister has been certified in accordance with 49 CFR 173.463.

8.1.1.4.1.3 Removable Surface Contamination

Removable surface contamination on RH-TRU canisters to be disposed at the WIPP shall not be greater than 20 dpm/100 cm^2 for alpha-emitting radionuclides and 200 dpm/100 cm^2 for beta-gamma emitting radionuclides. Beta-gamma contamination may be $\leq$1000 dpm/100 cm^2 if it meets the requirements of the DOE RADCON Manual, Table 2-2. Fixing surface contamination to meet the above criterion is not permitted.

The site must measure the degree of removable surface contamination for each RH-TRU canister prior to its shipment. The sampling methods are described in DOE-EH-0256T, DOE RADCON Manual. The results of these surveys must be documented.

8.1.1.4.1.4 Container Marking

RH canisters shall be uniquely identified by means of an identification number consisting of a Site and package identification permanently attached to the canister in a conspicuous location using characters at least 2 inches high.

For RH-TRU 72-B Casks, there shall be an identification number consisting of 2-in. high characters, raised or indented into the surface by forging, die-stamping, or welding on the top closure and on the outside surface of the top crush ring. The identification number shall begin with the Site's two-letter identifier code and a four-digit sequential number (e.g., IN0001 or LA0003).

8.1.1.4.1.5 Dunnage

Dunnage may be used to fill voids inside the RH-TRU canister placed inside a RH-TRU 72-B Cask. Dunnage shall be reported as part of the waste volume.

8.1.1.4.1.6 Filter Vents

All canisters shall be vented with filters to control gas concentration and pressure. Filters must meet the specifications described in Appendix 1.3.5 of the SARP. The placement of filter vents shall be documented and verified by visual inspection.

8.1.1.4.1.7 Liquids

Liquid waste is not acceptable at the WIPP. RH-TRU waste shall contain as little residual liquid as is reasonably achievable through pouring, pumping, and/or aspirating. Internal containers (e.g., bottles, cans, etc.) should contain less than 1 in. or 2.5 cm of liquid in the bottom of the container. In no case shall the total liquid volume (i.e., sum of all internal or payload container volumes) exceed 6 L in a canister. The total volume of residual liquid in a canister placed inside a RH-TRU 72-B Cask shall be not greater than 1 volume percent of the canister.

Radiography (when feasible), visual examination, or acceptable knowledge shall be used to determine the presence and quantity of liquid. Inspection records shall include a description of the location of any liquid detected and an estimate of its volume. Sites shall have in place policies and procedures that prohibit free liquids being placed in newly generated RH-TRU waste.

8.1.1.4.2 Nuclear Properties Requirements

8.1.1.4.2.1 Nuclear Criticality (Pu-239 FGE)

The fissile or fissionable radionuclide content of RH-TRU canister shall not exceed 600 g total of Pu-239 FGE. The fissile or fissionable radionuclide content of RH-TRU waste in an RH-TRU 72-B Cask, including two times the measurement error, shall be less than 325 grams of Pu-239 FGE.

Assay data shall be presented to show that the FGE content complies with the limits for both a canister and a cask. For newly generated RH-TRU waste, documented procedures controlling the loading of contents into the canister's inner containers may be substituted for assay data.

8.1.1.4.2.2 Pu-239 Equivalent Activity

RH-TRU waste canisters shall not exceed 1,000 PE-Ci of activity. Documented analyses shall be available to show that each RH-TRU canister is within the limit.

8.1.1.4.2.3 Canister/Cask Contact Dose Rates

The RH-TRU canister limit is based on the total RH-TRU waste volume at the WIPP, not on the Site's number of RH-TRU canisters. No more than 5% of the RH canisters received at the WIPP are allowed to have dose rates >100 rem/hr. Prior approval by the WIPP is required before RH-TRU canisters having dose rates >100 rem/hr but ≤1000 rem/hr may be shipped to the WIPP. All RH-TRU canisters shall have a maximum contact dose rate at any point no greater than 1,000 rem/hr. Neutron contributions are limited to 270 mrem/hr. Neutron contributions of greater than 20 mrem/hr to the total canister dose rate shall be reported in the data package.

The external dose rate on the loaded RH-TRU 72-B Cask is limited to 200 mrem/hr at the surface of the cask and 10 mrem/hr at 2 m distance from the cask.

8.1.1.4.2.4 Thermal Power

The thermal power generated by RH-TRU waste materials in any RH-TRU canister shall not exceed 300 watts. The thermal power shall be recorded in the RH-TRU waste data package. Documented evidence shall be presented that each RH-TRU canister meets the indicated limits based on the radionuclide distribution and quantity of radioactive material present.

8.1.1.4.2.5 TRU Alpha Activity Concentration

For purposes of RH-TRU waste certification, the lower limit of >100 nCi/g of TRU radionuclides in the waste shall be interpreted as >100 nCi/g of waste matrix. The weight of internal containers (including any rigid liners) shall be subtracted prior to performing the nCi/g calculation. A propagated measurement error may be included in the calculation of the lower limit of activity concentration (e.g., measurement plus error >100 nCi/g). The maximum activity concentration for a RH-TRU canister shall not exceed 23 Ci/L. The concentration may be averaged over the canister.

Documented evidence shall exist to show that the TRU alpha activity concentration of any RH-TRU canister is greater than 100 nCi/g of waste matrix and that the activity of RH-TRU waste does not exceed 23 Ci/L.

8.1.1.4.3 Chemical Properties Requirements

8.1.1.4.3.1 Pyrophoric Materials

Pyrophoric materials, other than radionuclides, shall be rendered inert by mixing them with chemically stable materials (e.g., concrete, glass) or shall be processed to remove their hazardous properties. Not more than 1 wt% of the payload in each RH-TRU canister may be pyrophoric forms of radionuclides, and these shall be generally dispersed in the payload.

Documented procedures or evidence shall exist to show that the RH-TRU canister contains no nonradionuclide pyrophorics and no significant quantities of radionuclide pyrophorics (i.e., <1 wt%) or other materials that could become pyrophoric compounds because of mixing. The 1% limitation on radionuclides is to allow any minor residues of uranium or plutonium that may remain in an unoxidized state in the payload. RH-TRU wastes expected to contain metallic radionuclides are to be treated prior to placement in canisters (oxidized) to eliminate as much of the potential pyrophorics as possible. A validated process (i.e., one that has been proven by test or analysis) that converts pyrophoric compounds to a nonpyrophoric form may be used to meet this requirement. This process may either change the chemical form of the pyrophoric material or mix and bind it within an inert matrix.

8.1.1.4.3.2 Mixed Waste

The mixed waste requirements for RH-TRU wastes are the same as those described for CH-TRU wastes.

8.1.1.4.3.3 Chemical Compatibility

Like CH-TRU mixed waste, RH-TRU mixed waste shall contain no chemicals that would cause adverse reactions with the canisters during handling or disposal. Any chemical/material in the RH-TRU waste in excess of 1 wt% shall conform to the allowable chemicals in each "waste material type" as defined in the RH-TRUCON. Waste must be evaluated to ensure that no adverse reactions could take place during transport and that the chemical/material or any products of reaction are compatible with the RH-TRU 72-B Cask construction materials.

RH-TRU mixed waste must be compatible with its container and packaging materials as well as other waste. They must be listed in the RH-TRUCON and be limited to the chemical amounts shown in the RH-TRUCON Chemical List for the applicable Content Code.

8.1.1.4.3.4 Hazardous Constituents

The hazardous constituents requirements for the RH-TRU waste are the same as those described for the CH-TRU waste.

8.1.1.4.3.5 Explosives, Corrosives, and Compressed Gases

The requirements for the RH-TRU waste are the same as those described for the CH-TRU waste.

8.1.1.4.4 Gas Generation Requirements

8.1.1.4.4.1 Decay Heat

The decay heat limits for canisters in each shipping category are presented in the RH-TRU 72-B Cask SARP, Table 1.2-7. Calculations must be performed as specified in Section 10.0 of Appendix 1.3.7 of the RH-TRU 72-B Cask SARP. Documented evidence shall exist to show that the RH-TRU canister and payload assembly to be transported meet the decay heat limits specified.

8.1.1.4.4.2 Flammable VOCs

The total concentration of potentially flammable VOCs is limited to 500 ppm in the headspace of a RH-TRU canister in the RH-TRU 72-B Cask. Content Codes that do not identify any of the flammable VOCs in the chemical lists do not have to implement additional controls to meet this requirement.

Documented procedures shall be used to ensure that the total concentration of potentially flammable VOCs is less than or equal to 500 ppm in the headspace of a RH-TRU waste canister.

8.1.1.4.4.3 VOC Concentrations

The requirements are the same as those identified for the CH-TRU waste.

8.1.1.4.4.4 Aspiration, Shipping Category, Confinement Layers

8.1.1.4.5 Data Package Requirements

The data package requirements identified for the CH-TRU waste are applicable to the RH-TRU waste canisters and the RH-TRU 72-B Cask.

Table 9. Summary of WIPP preliminary RH-TRU waste acceptance criteria.

Criteria	Limits
Container and Physical Properties	
Container Description	DOT Type A RH canister
Canister gross Weight	≤ 8000 lb/loaded canister
Removable Surface Contamination	≤ 20 dpm/100 cm^2 Alpha ≤ 200 dpm/100 cm^2 Beta-Gamma
Container Marking	Canister ID
Dunnage	Limited to inside canister
Filter Vents	Canisters vented
Liquids	No Liquid waste < 6 Liters total residual liquid per canister < 2.5 cm (1 in.) in the bottom of any canister
Nuclear Properties	
Nuclear Critically Pu-239 FGE	< 325 g/cask < 600 g/canister (may get waiver)
Pu-239 PE-Ci	≤ 1000 PE-Ci/canister
Contact Dose Rate	≤ 1000 rem/hr per canister Preapproval required if > 1000 rem/hr per canister ≤ 200 mrem/hr per cask Neutron ≤ 270 mrem/hr per canister
Thermal Power	< 300 watts per canister
TRU Alpha Activity	> 100 nCi/g of waste matrix ≤ 23 Ci/Liter
Chemical Properties	
Pyrophoric Materials	< 1% Radionuclide pyrophorics No nonradionuclide pyrophorics
Mixed Waste Hazardous Constituents	Characterization per Quality Assurance Project Plan (QAPP) Limited to EPA HWNs listed in Table 6
Chemical Compatibility	All chemicals must be allowable per the remote-handled TRUPACT-II Authorized Methods for Payload Control (RH-TRAMPAC)
Hazardous Constituents	Target analytes and TICs must be reported per QAPP
Explosives, Corrosives and Compressed Gases	No compressed gases No ignitable, reactive or corrosive waste
Gas Generation	
Decay Heat[(a)]	≤ wattage listed in RH TRU-72-B Cask SARP, Table 1.2-7
Flammable VOCs	≤ 500 ppm in canister headspace
Criteria	Limits

Table 9. (continued).

Criteria	Limits	
VOC Concentration	≤ the values shown below:	
	Carbon Tetrachloride	7,510
	Chlorobenzene	17,600
	Chloroform	6,325
	1,2-Dichloroethylene	28,750
	1,2-Dichloroethane	9,100
	Methylene Chloride	100,000
	1,1,2,2-Tetrachloroethane	7,924
	Toluene	41,135
	1,1,1-Trichloroethane	100,000
Aspiration[a]	None currently identified	
Shipping Category[a]	None currently identified	
Confinement Layers[a]	None currently identified	
Data		
Acceptance Data	Auditable package of data with signed Certification Statement on file WWIS data transmitted	
RCRA Data	Waste Stream Profile Form Uniform Hazardous Waste Manifest[b] Land Disposal Restriction notification[b]	
Shipping Data	RH-TRU 72-B cask payload Container Transportation Certification Documents Bill of Lading[c]	

a. Applies to RH-TRU 72-B Cask payload control only.

b. Applies to mixed waste only.

c. Uniform Hazardous Waste Manifest may be substituted.

8.2 Low-Level Waste[k] Disposal sites

The proposed plan is to convert the LLW either into a grout or a crystalline form that can be ultimately disposed of. This section identifies and evaluates the DOE and commercial facilities that could potentially be used for disposal of the LLW. Also, it provides the criteria of these facilities for waste acceptance. The potential DOE sites are a new INEEL LLW disposal facility, the Hanford Site, and the NTS. The operating commercial sites include the Barnwell Waste Management Facility in South Carolina; US Ecology Richland Disposal Facility in Washington; and the Envirocare Facility in Utah. Another commercial site including Waste Control Specialist (WCS) in Texas is exploring the potential of obtaining a permit to expand its services to include the disposal of DOE LLW and mixed LLW. However, it is not clear if and when this permit will be issued. The candidate sites and their key WAC are described below.

8.2.1.1 Commercial LLW Disposal Facilities

8.2.1.1.1 Background

Per DOE Manual 435.1,[20] it is the policy of DOE to dispose of its LLW and mixed LLW at the site where these wastes are generated, if practical, or if onsite disposal is not available, at another DOE disposal facility. The Order and the Manual contain provisions for exemptions to this requirement. The exemptions allow DOE to use commercial (non-DOE) disposal facilities when these wastes cannot be disposed of at the site where they are generated and use of other DOE disposal sites is not practical.[20,21,22] DOE's current policy is to rely on its own facilities for the disposal of its wastes, and by exemption where necessary, make limited use of commercial facilities that have been licensed by the NRC or an Agreement State.[l,21,22]

Commercial LLW disposal facilities must be licensed by either NRC or Agreement States in accordance with health and safety requirements. The NRC or Agreement States licenses are issued to commercial LLW disposal facilities that are not controlled or owned by DOE. NRC LLW activities associated with the disposal of waste are subject to the requirements under the 1980 Low-Level Radioactive Waste Policy Act (LLRWPA) and its 1985 amendments (Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA)). NRC requirements place restrictions on the types of waste that can be disposed of. Under the federal laws (LLRWPA and LLRWPAA), states are responsible for the disposal of commercial LLW generated within the state's borders. The Acts recommend states to enter into regional "Compacts" in order to share waste disposal responsibilities. "Compact" is defined as an agreement entered into by two or more states pursuant to the LLRWPA. Since these laws were passed by congress, many states have formed Compact regions, with one or more of the member states selected to host regional disposal facilities. Others (Texas, Main, and Vermont) have planned to join pending congressional approval.

Under the LLRWPA, the Compact States are not responsible for providing disposal capacity for LLW: 1) generated by DOE, 2) Navy; 3) generated by any research, development, and testing or

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[k] Per NWPA, LLW means radioactive material that: "(A) is not spent nuclear fuel, high-level radioactive waste , transuranic waste , or byproduct material as defined in section 11 e.(2) of the Atomic Energy Act of 1954 (42 U.S.C. 2014(e)(2)); and(B) the Commission, consistent with existing law, classifies as low-level radioactive waste." The term "Commission" stands for Nuclear Regulatory Commission.

[l] An Agreement State has signed a formal agreement with the NRC under a provision of the AEA allowing the State to regulate certain radioactive materials within the State.

production of nuclear weapons; or 4) identified under the Formerly Utilized Sites Remedial action program. Commercial disposal facilities licensed by NRC or an Agreement State may accept waste from DOE and other federal or private sources. If the commercial facility is a Compact facility under the LLRWPA, it can refuse wastes from state(s) that is not a member of the Compact States. In addition, the Compact states may prohibit the facility from disposing of LLW for which the federal government is responsible. This includes LLW generated by DOE.

8.2.1.1.2 Barnwell Waste Management Facility

The Barnwell Waste Management Facility was one of the original "Compact" facilities under the Low-Level Radioactive Waste Policy Act (LLRWPA). One of the incentives established under this Act was that the Barnwell, a member of the "Southeast Compact" could close its facility to wastes from states that were not a member of the "Southeast Compact." Up to July 1, 1995, the Barnwell facility disposed of wastes from the "Southeast Compact" only. On July 1, 1995, South Carolina withdrew from the "Southeast Compact" and allowed Barnwell to accept LLW from other states outside the "Southeast Compact."[21,m] The Barnwell facility can dispose of LLW with higher levels of radioactivity than the Envirocare can. The Barnwell is currently not authorized to accept any mixed LLW for disposal. [21]

The Barnwell Facility WAC[23] require that waste shipments to its site be in compliance with the South Carolina Department of Health and Environmental Control (DHEC) Radioactive Materials License, and the DOE and NRC requirements. These requirements are summarized below.

Class A, B, and C LLW are accepted for disposal at the Barnwell Waste Management Facility. A mixture of radioactive waste and waste regulated under 40 CFR 261 and South Carolina Hazardous Waste Management Regulations is not accepted for disposal. Radioactive waste with hazardous components regulated under RCRA solely because it exhibited hazardous characteristics as defined in 40 CFR 261, Subpart C, but it has been treated in a manner that no longer exhibits RCRA characteristics, will be reviewed for acceptance on a case-by-case basis. A description of the treatment process and results of the analytical tests of the final waste shall be submitted to the Barnwell Facility for evaluation prior to shipment.

The Barnwell facility requires waste shipments to have supporting documentation certifying the wastes meet the Barnwell WAC. Shipments containing wastes with activities totaling 40,000 Ci or more must have prior to shipment approval for the Barnwell Licensing Department. Class C shipments requires additional documentation which must be received by the Barnwell Licensing Department to obtain approval from the South Carolina DHEC prior to departure. Waste greater than Class C limit is not acceptable for disposal without prior written approval from the DHEC.

For Class A, B, and C waste, the concentration of a radionuclide or radionuclide mixture may be averaged over the volume of the waste and, if used, the solidification agent or matrix if the waste form is a homogenous mixture. The concentration of radionuclides in filters/sealed sources encapsulated with a solidification agent or matrix shall be averaged over the volume of the filter/sealed source not the solidification agent. The volume of packaging, containers, liners, or overpacks shall not be included in this calculation, nor shall the volume of the waste mixture be artificially increased with the addition of non-dispersible solids or objects even if considered as waste. If expressed in units of nCi/g, concentration

[m] In early June 2000, the Atlantic Low-Level Radioactive Waste Compact was created to include South Carolina, New Jersey, and Connecticut. With the formation of the new Compact, the Barnwell, South. Carolina, LLW disposal site will gradually restrict access to its facility by out-of Compact generators. The sit will completely close to non-Compact waste generators in 2008 (reference: Radwaste Solutions, July/August 2000, page 9).

may be averaged over the weight of the waste and, if used, the solidification agent if homogenous, except in the case of encapsulation of filters which shall be over the weight of the filter. The weight of packaging, containers, liners, or overpacks shall not be included in this calculation, nor shall the weight of the waste mixture be artificially increased by the addition of heavy, non-dispersible solids or objects even if considered as waste.

In addition to the nuclides listed in Tables 12.a and 12.b, waste containing radium (Ra-226), a South Carolina State regulated radionuclide, is acceptable for disposal in specific cases authorized by the South Carolina DHEC. In all the cases, Ra-226 concentration limits must be $\leq$ 10 nCi/g (for Class A) and $\leq$ 100 nCi/g (for Class C). Unless authorized by the DHEC, radium containing waste acceptance is limited to: 1) radium contained in solid homogeneous waste forms in which the radium activity is incidental (incidental is defined as not more that one percent of the total activity), and the concentration of radium has not been technologically enhanced; or 2) radium contained in devices such as self-luminous dials; or 3) radium contained in biological research waste.

No liquid waste or solid waste containing liquids can be received at the Barnwell Site. All free liquids must be sorbed or stabilized, or otherwise removed from the waste. Liquid waste must be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid. The amount of liquid cannot exceed 1% of the volume of the waste or 0.5% of waste processed to a stable form. Liquid waste containing isotopes with half-lives greater than 5 years having a total specific activity of $\geq$ 1 Ci/m^3 require stabilization. Hazardous organic solutions, solidified or otherwise, are not acceptable for disposal at the Barnwell Site.

Solidified or dewatered radioactive waste shall have no detectable free-standing liquids in excess of 0.5% by waste volume of non-corrosive liquids per container. In lieu of these requirements, solidified or dewatered waste containing non-corrosive liquids in excess of 0.5% by waste volume, and less than 1% non-corrosive liquids by waste volume, may be received and disposed of in High Integrity Containers (HIC) approved by the DHEC. The HIC approved for use at the Barnwell facility are:

C of C Number	Manufacturer
DHEC-HIC-PL-001	Chem-Nuclear Systems
DHEC-HIC-FRP0003	Chem-Nuclear Systems
DHEC-HIC-PO-006	Chem-Nuclear Systems
DHEC-HIC-PL-002	Philadelphia Electric Company
DHEC-HIC-PL-017	Scientific Ecology Group, Inc. (SEG)
DHEC-HIC-PL-004	Allied Technology Group, Inc.
DHEC-HIC-PL-005	Allied Technology Group, Inc.
DHEC-HIC-PL-007	Allied Technology Group, Inc.
DHEC-HIC-PL-008	Allied Technology Group, Inc.
DHEC-HIC-PL-012	Allied Technology Group, Inc.
DHEC-HIC-ML-013	Allied Technology Group, Inc.
DHEC-HIC-PL-014	Allied Technology Group, Inc.
DHEC-HIC-ML-016	Allied Technology Group, Inc.
DHEC-HIC-ML-018	Allied Technology Group, Inc.

DHEC-HIC-PL-009	Vermont Yankee Nuclear Power Station
DHEC-HIC-PL-010	NUKEM Nuclear Technologies Corporation
DHEC-HIC-CL-015	Chichibu Cement Co., Ltd.
DHEC-HIC-PL-011	Adwin

The Barnwell facility WAC require the solidification agents to include one of the following media: Vinyl ester styrene, cement, Bitumen, vinyl chloride, Aqua set I-H (Class A waste only), MetalPlex III (Class A waste only), and Petroset H (Class A waste only). The solidification media and processes to be used to stabilize Class A, B, or C LLW must be evaluated in accordance with the NRC waste form technical position document[24] or other methods for which approval has been granted by the DHEC. The NRC technical position document provides guidance to generators for implementing the 10 CFR 61 waste stability requirements. This document contains test methods and results acceptable to NRC for demonstrating long-term (300-year) structural stability that is required by 10 CFR 61.56. The requirements are intended to ensure that the waste does not structurally degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. The section below under the heading "Acceptable Conditions for Disposal," contains additional discussion on the NRC 10 CFR 61 stability requirements. The NRC technical position document[24] focuses on cement stabilization of LLW and use of generic testing data (compressive strength and leach index) to demonstrate waste form stability, as follows:

- Solidified waste specimen should have compressive strength of at least 60 psi when tested in accordance with ASTM C 39. Compressive strength test should be performed in accordance with ASTM D1074. May solidification agent such as cement will be easily capable of meeting the 60 psi limit.

- Leach testing should be performed for a minimum of 90 days in accordance with the procedures in ANS 16.1. The leachability index, as calculated in accordance with ANS 16.1, should be greater than 6.0.

Containers of ion exchange resins or filter media (dewatered or solidified) are accepted for disposal if records of complete radiological analyses (quantitative and qualitative) are provided. The records must specify the specific activity of each radionuclide expressed in $\mu Ci/cm^3$ and TRU nuclides in nCi/g. Ion exchange resins and filter media containing isotopes with half-lives greater than 5 years having a specific activity of all these isotopes of 1 Ci/m or greater must be stabilized by solidification in accordance with the NRC requirements and the free standing liquid requirements described above. However, in lieu of solidification, the DHEC will authorize disposal of these waste forms meeting the free standing liquid requirements in approved HIC or other approved methods of stabilization.

Waste capable of generating, toxic gases, vapors, or fumes during transportation, handling, or disposal will not be accepted. Pyrophoric or flammable solid material contained in waste shall be made inert to prevent self-ignition during transport and disposal. No material that might react violently with water or moisture is accepted for disposal at the Barnwell Site.

Waste containing TRU radionuclides are acceptable for disposal, provided that the following conditions are met:

- The TRU concentrations are within the limits specified in Tables 12.a and 12.b. Waste not meeting the limits will require specific approval by the DHEC.

- Each TRU nuclides is identified on the waste manifest.
- The TRU nuclides are evenly distributed within a homogeneous waste form.
- The TRU content is incidental to the total activity. Incidental is defined as up to 1% of the total activity.[n]

All shipments received at the Barnwell Site shall be properly classified and marked in accordance with the DHEC. The waste Class A-U (unstable), Class A-S (stable), Class B or C must be durably and legibly marked on top of the disposal container. Stable waste is waste that is inherently stable (i.e., metal reactor components), has been rendered stable by placement in a HIC, or has been rendered stable with an approved solidification media. An approved solidification media is one for which specific approval has been granted by the DHEC. Any such processing must eliminate void spaces in containers to the extent practical. Unstable waste is all other waste that complies with all other license requirements except those listed for stable waste. Barnwell Facility requires all waste containers to be filled to no less tan 85% except for waste packaged in approved HIC or waste comprised of irradiated metal.

8.2.1.1.3 US Ecology Richland Disposal Facility

The US Ecology Richland Disposal Facility is a "Compact facility" which serves the "Northwest Compact" and the "Rocky Mountain Compact."[21] The "Northwest Compact" includes Washington, Oregon, Wyoming, Idaho, Montana, Utah, Alaska, and Hawaii; and the "Rocky Mountain Compact" consists of Nevada, Colorado, and New Mexico. Since the US Ecology at Richland is a Compact facility, the Compact States must approve the disposal of DOE waste at the facility.[21] Under the LLRWPA, the State of Washington and the others relevant Compact States can prohibit the disposal of the DOE waste at the US Ecology.[21]

The US Ecology Richland Disposal Facility WAC[25] require waste shipment and disposal requirements to be in accordance with the applicable federal, state, and local laws and regulations. These include Washington State Department of Health, Washington State Rules and Regulations for Radiation Protection, Washington Radioactive Materials License, Washington State Dangerous Waste Regulations, and DOT and NRC regulations. These requirements are briefly described below.

The US Ecology facility accepts Class A, B, and C LLW for disposal. Mixed waste is not accepted for disposal at the facility. The US Ecology defines mixed waste as:

"any radioactive material which is no longer of use or value, and contains waste that either (A) is listed as dangerous waste in the State of Washington's Dangerous Waste Regulations, (B) causes the waste to exhibit any of the dangerous waste characteristics identified in the State of Washington's Dangerous Waste Regulations, (C) fulfills any of the "dangerous waste criteria" identified in the State of Washington's Dangerous Waste Regulations, (D) listed as hazardous waste in Subpart D, 40 CFR Part 261, or (E) causes the waste to exhibit any of the hazardous waste characteristics identified in Subpart C, 40 CFR Part 261."

Waste capable of generating, toxic gases, vapors, or fumes during transportation, handling, or disposal will not be accepted at the US Ecology facility. No pyrophoric, hazardous, dangerous, or

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[n] Pu-241 is exempted from the 1% Incidental TRU waste activity criteria provided it is not the only TRU in the waste. However, it must be considered when classifying the waste. Wastes containing only TRU or Pu-241 are not acceptable for disposal unless specifically approved by the DHEC.

chemically explosive materials or materials which could react violently with water or moisture or when subject to agitation shall be accepted for disposal.

Untreated liquids are not allowed for disposal. Liquids shall be rendered non-corrosive ($4 \leq pH \leq 11$) prior to treatment. Acceptable treatments are solidification or stabilization. Liquids treated by solidification must be processed in accordance with a process control program using an approved solidification media. The resulting waste for must not contain detectable free-standing liquid. Liquids, ion exchange resins, or filter media treated by stabilization shall be processed in accordance with a process control program using an approved stabilization media. The resulting waste form shall contain no detectable free-standing liquid and shall meet the NRC stability requirements. Class A ion exchange and filter media containing radionuclides with half-lives greater than 5 years, the total concentration of which is 1 Ci/m^3 or greater, except Co-60 having a concentration of 50 Ci/m^3 or greater (subject to sum of fractions less than 1) shall be stabilized and contain no detectable free-standing liquid.

The US Ecology requires waste to be stabilized, when required, in accordance with the NRC stability requirements. As in the Barnwell facility, the US Ecology has also adopted the NRC requirements[24] for demonstrating compliance with 10 CFR 61. Only those stabilization media or HIC approved by Washington State Department of Health and listed in the State of Washington Radioactive Materials License may be used. The approved stabilization media include:

- Concrete – When used as encapsulation media around a small volume of radioactive material; e.g, sealed source centered in a 55-gal drum containing concrete, shall have a formulated compressive strength ≥ 2500 psi.
- Dow media (vinyl ester styrene)
- Veri solidification process
- Aztech
- Oxidized Bitumen
- Other stabilization media and processes that have been reviewed and approved by the NRC and by the Washington State Department of Health as meeting the waste form stability criteria.

Only the following approved HIC that have been used in accordance with the C of C may be used. Other HIC that have been specifically approved by the Washington State Department of Health can also be used.

C of C Number	Manufacturer
WN-HIC-01	Pacific Nuclear
WN-HIC-02	Nuclear Packaging
WN-HIC-03	Chichibu Cement Co., Ltd.
WN-HIC-04	Chichibu Cement Co., Ltd.
WN-HIC-05	Nuclear Packaging
WN-HIC-06	Nuclear Packaging

WN-HIC-07	Nuclear Packaging
WN-HIC-08	Nuclear Packaging
WN-HIC-09	Nuclear Packaging
WN-HIC-10	Nuclear Packaging
WN-HIC-11	Nuclear Packaging
WN-HIC-12	Nuclear Packaging
WN-HIC-13	Nuclear Packaging
WN-HIC-14	Nuclear Packaging
WN-HIC-15	(SEG) LN Technologies
WN-HIC-16	(SEG) LN Technologies
WN-HIC-17	(SEG) LN Technologies
WN-HIC-18	(SEG) LN Technologies

Radioactive waste containing Ra-226 and/or TRU radionuclides is acceptable provided that the Ra-226 and TRU nuclides are essentially evenly distributed within a homogeneous waste form. In all the cases, Ra-226 concentration limits must be ≤ 10 nCi/g (for Class A) and ≤ 100 nCi/g (for Class C) LLW. The disposal of waste in which the radium or TRU radionuclides are not evenly distributed or in excess of Class A limits requires the specific approval of the Washington State Department of Health.

Waste packages must be marked as either Class A-U (unstable), Class A-S (stable), B, or C. Void spaces within the waste and between the waste and its package shall be reduced to the maximum extent practicable. Unless specifically approved by the US Ecology, void spaces in Class A stable, Class B, and Class C waste packages shall be less than 15% of the total volume of the disposal package, provided the disposal package is not a HIC nor contains activated metals that are too large to put into HIC. For Class B and Class C waste packages containing activated metals, voids shall be reduced to the extent practicable and shall be demonstrated to be structurally stable. The waste shipments must be accompanied by the following:

- Properly completed waste shipment documentation, certification by a representative of the shipper/generator of the waste in accordance with the Washington State rules and Regulations for Radiation Protection, and any other documentation or permits required under the state or federal laws and regulations.

- Washington State Patrol or Washington State Utilities and Transportation Commission vehicle inspection certificate, or a current visible Washington State 90-day vehicle inspection seal.

8.2.1.1.4 Envirocare Facility

The Envirocare Facility is licensed by the State of Utah under the State Agreement with NRC to dispose of LLW and mixed LLW with very low level of radioactivity (less than Class B and C). The Envirocare license prohibits disposal of waste classified as Class B or C. Based on a press release, on November 3, 1999, the Envirocare announced that it had requested an amendment to its license. The amendment is to allow the facility to dispose of Class B and C wastes which will either be stabilized on concrete or packaged in HIC.

The following table shows the radionuclide activity limits currently imposed for disposal at the Envirocare.[26]

Table 11. Envirocare nuclide activity limits for disposal.

Nuclide	Average concentration per container on receipt (pCi/g)
Am-241	1.0E04
Am-243	1.0E04
Sb-124	4.4E08
Sb-125	4.4E08
Ba-133	1.0E05
Be-7	4.4E08
Bi-207	5.0E04
Cd-109	4.4E08[a]
Ca-45	4.4E08
C-14	5.0E05
Ce-139	4.4E08
Ce-141	4.4E08
Ce-144	4.4E08[a]
Cs-134	4.4E08
Cs-135	4.4E08
Cs-137	6.0E04[a]
Cr-51	4.4E08
Co-56	4.4E08
Co-57	4.4E08
Co-58	4.4E08
Co-60	3.0E04
Cu-67	4.4E08
Cm-242	2.0E06
Cm-243	1.0E04
Cm-244	1.0E04
Eu-152	2.0E04
Eu-154	3.0E04
Eu-155	4.4E08
Gd-153	4.4E08
Ge-68	4.4E08[a]
Au-195	4.4E08
Hf-181	4.4E08

Table 11. (continued).

Nuclide	Average concentration per container on receipt (pCi/g)
H-3	2.5E07
I-125	4.4E08
I-129	3.3E03
Ir-192	4.4E08
Fe-55	4.4E08
Fe-59	4.4E08
Pb-210	2.0E06[a]
Mn-54	4.4E08
Hg-203	4.4E08
Np-237	1.0E04[b]
Ni-59	1.4E07
Ni-63	2.2E06
Nb-94	1.3E04
Pu-238	1.0E04
Pu-239	1.0E04
Pu-240	1.0E04
Pu-241	3.5E05
Pu-242	1.0E04
Po-210	4.4E08
K-40	1.0E04
Pm-147	4.4E08[a]
Ra-226	1.0E08[a]
Ra-228	1.0E08[c]
Rb-83	4.4E08
Ru-106	4.4E08[a]
Sm-151	4.0E06
Sc-46	4.4E08
Se-75	4.4E08
Ag-108m	5.0E04
Ag-110m	4.4E08
Na-22	4.4E08
Sr-85	4.4E08
Sr-89	4.4E08

Table 11. (continued).

Nuclide	Average concentration per container on receipt (pCi/g)
Sr-90	2.5E04[a]
S-35	4.4E08
Ta-182	4.4E08
Tc-99	1.9E05
Tl-204	4.4E08
Th-230	1.5E05
Th-232	1.0E04[a]
Sn-113	4.4E08
U-233	5.0E02
U-234	3.7E05
U-235	1.7E03
U-238	3.3E05[b]
U-natural	6.8E05[b]
U-depleted	3.7E05[b]
Y-88	4.4E08
Y-91	4.4E08
Zn-65	4.4E08
Zr-95	4.4E08[a]

a. Decay products are assumed in concentrations equal to parent.

b. Short-lived decay products of U-239 (Th-234 and Pa-234) and of Np-237 (Pa-233) are assumed to be present in concentrations equal to parent.

c. Ra-228 with its decay products at the times indicated after separation as pure Ra-228.

When a mixture of radionuclides are present in the waste, then the concentration in the waste must be limited so that the following relationship exists:

$$\frac{Ca}{avgCa}+\frac{Cb}{avgCb}+\frac{Cc}{avgCc}\leq 1$$

a, b, and c are radionuclides with concentrations C_a, C_b, and C_c, and with the average concentrations $avgC_a$, $avgC_b$, and $avgC_c$, respectively. The average concentration limits must all be taken from Table 11.

The Envirocare is not a "compact facility" under the LLRWPA, and therefore can accept waste from sites throughout the country. It is the only facility currently permitted to dispose of treated mixed LLW (commercial and DOE) from other states.[21] Envirocare accepts a number of listed wastes with F, P, and U codes that are treated to LDR specifications. Delisting would not be required for the listed HWNs currently assigned to the INTEC wastes.

8.2.1.2 DOE LLW Disposal Facilities

8.2.1.2.1 Background

It is the DOE's policy that DOE-generated LLW and mixed LLW be disposed at the site where it is generated, to the extent practical, or if onsite disposal is not available, at another DOE disposal facility. DOE has undertaken a review of the LLW management program across the nuclear weapons complex. This includes a review of the regulatory structure for the program as well as an assessment of current operating facilities for the treatment and disposal of LLW and mixed LLW. As part of this effort, DOE issued a ROD to allow Hanford Site and NTS to be used for disposal of LLW from DOE sites with no disposal capacity.[15] For mixed LLW disposal, DOE will use NTS and Hanford for off-site waste.[15] However, this decision does not preclude DOE's use of commercial treatment facilities.[22]

DOE provides a set of general criteria for treatment and disposal of LLW and mixed LLW in DOE Manual 435.1. The requirements address waste form acceptability, waste characterization, packaging and transportation, and waste certification for shipment. In addition to these general criteria, each DOE Site has developed specific waste acceptance and disposal criteria. The disposal sites evaluated in this study include a New INEEL LLW facility, the Hanford Site, and the NTS. It is assumed that the criteria for accepting waste at a new INEEL facility would be comparable to or the same as those currently established for the INEEL Radioactive Waste Management Complex (RWMC). Therefor, the RWMC criteria are used here as a basis to proceed with the waste acceptance issues for a future INEEL LLW disposal facility.

8.2.1.2.2 DOE LLW General Disposal Criteria

DOE has established a set of general criteria in DOE Order 435.1 for LLW disposal. In addition to the general criteria, each DOE Site has developed specific waste acceptance and disposal criteria. A detailed description of the acceptance criteria of the RWMC, the NTS, and the Hanford Site are provided below.

8.2.1.2.3 RWMC, NTS, and Hanford Waste Acceptance Criteria

The following criteria are based on the current DOE LLW management policies and practices EPA, and DOT requirements. Any waste streams that do not meet these basic requirements must be evaluated on a case-by-case basis and must not compromise the performance objectives for the disposal site or violate any permit requirements.

8.2.1.2.3.1 RWMC Waste Acceptance Criteria

The document titled "INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria"[27] contains the criteria that apply to CH and RH LLW for shipping to and disposal at the RWMC. As required by DOE Order 435.1, waste acceptance package certification documenting the waste characteristics must be submitted to the RWMC for advance approval to ship a waste package, and shall certify, prior to shipment, that the waste meets the receiving WAC for disposal. In addition to meeting all the other general DOE criteria established in the DOE Order 435.1, the following acceptance criteria must be met before shipping waste to the RWMC for disposal:

8.2.1.2.3.1.1 Criteria for CH-LLW

The criteria for CH-LLW are listed as follows:

- LLW resulting from treated mixed waste must meet all the applicable LDR treatment requirements and must not exhibit any characteristic hazard. LDR treated waste must not bear any listed HWNs. In addition, the waste must have all the necessary LDR notification and certifications documentation.

- Radionuclides concentration limits for the waste volume in each waste package must meet the values listed in Table 12 (sum of the fractions is < 1). Waste exceeding the limits will require a case-by-case evaluation and approval from the RWMC prior to disposition.

- Radionuclides in the waste volume must not exceed the concentration limits for LLW Class C as defined in Tables 1 and 2 of 10 CFR 61.55. These tables correspond to Tables 12.a and 12.b of this report, respectively. Waste exceeding the limits will require a case-by-case evaluation (Performance Assessment) and approval from the DOE-HQ prior to disposition as LLW, TRU, or special case waste (SCW).

- Nuclide reporting requirements for waste being sent to the RWMC for disposal are as follows:

  - Radionuclides listed in Table 12 are reported when values meet or exceed the lower reporting limits.

  - Radionuclides with half-lives of less than 5 years, except for Cm-242, are reported when their concentrations are greater than 7 $\mu Ci/cm^3$ of waste.

  - Radionuclides not identified above are reported when their concentrations are greater than 1% of the total activity in the waste form.

  - For the waste packages containing a mixture of radionuclides listed in Table 12, sum of the fractions discussed for NRC LLW classification determination applies. Waste packages with sum of the fractions < 1 are disposed.

  - Daughter products in secular equilibrium with the parent radionuclides do not require reporting. Only the curie value of the parent radionuclides must be reported.

Daughter products in secular equilibrium include only those radionuclides with half-lives ≤ 10 days and ≤ their parent radionuclides.

- Absorbents and stabilizing agents used to eliminate free liquids have undergone the generator's bench-scale testing which demonstrates that:

  - Performance is as specified by the vendor, or an improved specific-use methodology has been developed [best management practice (BMP)].

  - Liquids do not separate from the absorbents or stabilizing agents due to ambient temperature cycles ranging from -50°F to 110°F.

- Dry-loaded waste packages such as drums, boxes, or inserts having a potential for free liquid have:

  - An optimum absorbent or stabilizing agent used to ensure immobilization of free liquid (BMP)

  - An absorbent or stabilizing agent placed inside the innermost waste bag or container where the free liquid is suspect (BMP)

  - Absorbents and stabilizing agents placed as close as practical to inaccessible liquid (BMP).

- Tritium waste has been prepared for disposal to prevent exceeding an equivalent package release rate of 40 $Ci/m^3/y$.

- Packages are painted or coated with material that enhances the package lifetime and decontamination ability (BMP).

- Fissile material concentration does not exceed the fissile material threshold value concentrations listed in Table 13. Waste exceeding the limits stated in Table 13 will require a case-by-case evaluation and approval from the RWMC facility manager prior to disposition.

- Packages for LLW pass the requirements in 49 CFR 173.475, "Quality Control Inspection Requirements to Qualify for Shipment."

- Applicable standard containers for LLW are any of the following: (BMP)

  - DOT authorized drums:

    - 55-gallon drum

    - 30-gallon drum

    - 71-gallon square drum

  - DOT 6M Shipping Packages (ES-51526), (see 49 CFR 178.354 and 173.403 for the description of 6M packages)

- DOT 7A Type A Steel Bin used by Argonne National Laboratory – East (ANL-E)
- M-III Bin [comparable to an Industrial Package (IP)[o] (see 49 CFR 173.403 and 173.411 for the description of IP]
- Mark III DOT 7A Type A Concrete Box
- DOT 7A Type A Steel Boxes
- DOT and DOE-ID Surface Contaminated Objects (SCO)/Low Specific Activity (LSA) non-accident resistant packages (see 49 CFR 173.403 for the definition of SCO and LSA)

• Waste packages comply with requirements of Table 14.

[o]. Personal communication with Dale J. Wells, Consulting Technical Specialist with LMITCO, September 1, 1999.

Table 12. Performance assessment waste volume concentration limits for CH-LLW disposal.

Nuclide	Waste Volume Concentration Limit Ci/m^3		
	Vault	**Pit**	**Lower Reporting Limit**[b]
Be-10	14	14	0.014
C-14	8	8	0.0008
C-14 (in activated metals)	80	80	0.008
Cm-242	3,700 nCi/g	3,700 nCi/g	20 nCi/g
Co-60	166,000	83,000	7
Cs-137	16	8	0.01
H-3	40[a]	40[a]	0.4
I-129	0.08	0.08	0.00008
Nb-94 (in activated metals)	0.2	0.2	0.0002
Ni-59 (in activated metals)	220[a]	180	0.18
Ni-63	3,300	3,300	0.035
Ni-63 (in activated metals)	3,300	3,300	0.035
Pu-241	250 nCi/g	250 nCi/g	0.25 nCi/g
Sr-90	24	12	0.0004
Tc-99	3	3	0.0003
TRU (except Pu-241 and Cm-242)	10 nCi/g	10 nCi/g	0.1 nCi/g
U-233	0.015	0.015	0.00015
U-234	0.035	0.035	0.00035
U-235	0.015	0.015	0.00015
U-238	0.04	0.04	0.0004

a. Limits listed in the NRC Class A limit. Requests for increased concentration levels will be considered in a case-by-case basis.

b. Otherwise, radionuclides should be listed on shipment manifests and data bases in compliance with 49 CFR 173.433.

Table 13. Fissile material waste matrix groups.

Group	TVC[a,b,c]		TVC[c] U-233	
	g/lb	g/kg	g/lb	g/kg
Polyethylene	3.10	6.82	4.98	11.0
Cellulose	1.30	2.86	2.16	4.75
Metal (Al)[d]	0.82	1.8	0.38	0.84
Concrete	0.38	0.84	0.62	1.36
Brick	0.23	0.51	0.34	0.75
Glass/Slag	0.09	0.20	0.15	0.33
Graphite	0.02	0.04	0.03	0.07
Salt	5.53	12.17	4.27	9.39

Waste matrix group assignments are determined by the RWMC. Contact a generator interface (GI) for assistance.

a. Threshold value concentration (TVC).

b. For all fissile radioisotopes except U-233.

c. Fissile limit for each waste package is 380 grams.

d. To be conservative the threshold value for metal is calculated on aluminum.

Table 14. CH-LLW disposal criteria at the RWMC.

Characteristic	DOT Steel Drum	INEEL Wooden Boxes[a]	Criterion Basis
Gross weight	DOT limit or ≤ 20-lb/gallon[b]	≤ 12,000 lb/box	(BMP)
Dimension	5-gallon minimum	4 x 4 x 4 ft	(BMP)
	55-gallon (1,000 lb max.)	2 x 4 x 8 ft	
	71-gallon preferred	4 x 4 x 8 ft	
Radiation Limit	< 500 mrem/h at 1 m	< 500 mrem/h at 1 m	(BMP)
Fissionable material[c]	See Table 13	See Table 13	(RWMC SAR)
Liner (minimum)[d]	N/A	3-ply reinforced plastic	(BMP)
Lid gasket	Secured	Secured	(49 CFR 173.24)

Characteristic	**DOT 7A Type A Steel Box**	**M-III Bin**	**Criterion Basis**
Gross weight	≤ 12,000 lb	≤ 8,000 lb/bin	(Design)
Dimensions	4 × 4 × 6, 7, or 8 ft	4 × 5 × 6 ft	(Design)
Radiation limit	< 500 mrem/h at 1 m	< 500 mrem/h at 1 m	(BMP)
Fissionable material[c]	See Table 13	See Table 13	(RWMC SAR)
Liner (minimum)[d]	N/A	N/A	(BMP)
Lid gasket	Mfg. Installed	Neoprene gasket	(49 CFR 173.24)

Characteristic	**Mark III DOT 7A Type A Concrete Box**[e]	**DOT or DOE-ID Non-accident Resistant Package**	**Criterion Basis**
Gross weight	≤ 21,800 lb/box	TBD[f]	(Design)
Dimensions	4 × 4 × 8 ft	TBD[f]	(Design)
Radiation limit	< 500 mrem/h at 1 m	< 500 mrem/h at 1 m	(BMP)
Fissionable material[c]	See Table 13	See Table 13	(RWMC SAR)
Liner (minimum)[d]	N/A	N/A	(BMP)
Lid gasket	By design	N/A	(49 CFR 173.24)

a. These boxes are banded with ¾-in. steel banding material. As a minimum, five bands are used. Three horizontal bands are used and during closure two vertical bands are applied, 1/3 the length of the box from each end. The generator provides sufficient blocking to keep heavy items in place and to distribute the load uniformly within the container. The waste material is LSA/SCO and is ≤ DOT A2 quantity.

b. DOT limit for a UN 1A2 55-gallon drum is 1,000 lb, and for a UN 1A2 71-gallon square drum is 1,300 lb. The 20-lb/gallon limit for the 55- and 71-gallon drums qualifies for a DOT strong, tight container. This limit is permitted because the drums passed the DOT 7A drop test at that loaded weight.

c. Fissionable material limits are based on assumed low-density waste contaminated with small amounts of volumetric average fissionable material. Low-density waste is waste containing of materials such as paper, polyethylene wrap, tape, glass, rags, blotting paper, scrap metal, and piping. Volumetric average is defined as concentration obtained by dividing the total fissionable material content of a container by its volume..

d. Wrapping of individual waste items in one 8-mil yellow polyethylene is equivalent to liner. Liner is 3-ply linear low density polyethylene copolymer and nylon yarn laminate.

e. This container is specifically designed for underwater loading.

f. TBD – It means as long as the package is in compliance with the DOT or DOE-ID accident resistant requirements, it will be evaluated/considered, on a case-by-case basis, for disposal.

8.2.1.2.3.1.2 Criteria for RH-LLW

In addition to meeting the criteria described above, except for radiation limits and authorized containers, the following acceptance criteria shall also be met before shipping RH-LLW to the RWMC for disposal:

- RH-waste container labels are permanently affixed, the container identification number is located on the container top and visible and legible through remote visual verification equipment. This number is directly traceable to INEEL Form L-0435.20, "Stored, Disposed, or Processed Radioactive Waste and database record (BMP)."

- Standard containers for RH-LLW are any of the following: (BMP)

  - RWMC 55-ton insert

  - Test Reactor Area (TRA) resin system (commercial)

  - Mark III DOT 7A Type A Concrete Box

  - ANL-W Hot Fuel Examination Facility (HFEF)-5 Waste Canister

  - Other:

    - Argonne National Laboratory-West (ANL-W) 55-gallon crimp-head drum

    - Nuclear Reactor Facility (NRF) and TRA concrete vaults

    - NRF-A1W sealed resin columns waste package

    - NRF Expended Core Facility Water Pit Demineralizer Type V Tank Assembly

    - Remote Analytical Laboratory (RAL) 30-gallon insert

    - 6M Shipping Packages (ES-51526).

- Waste packages comply with requirements of Table 15.

Table 15. RH-LLW disposal criteria at the RWMC.

Characteristic	55-ton Insert	TRA Resin System	Criterion Basis
Gross weight	≤ 12,000 lb/insert	≤ 20,000 lb/package	(Design/NRC License)
Dimension	4 ft dia × 8 ft	6 ft dia × 7 ft	(Design)
Radiation limit[a]	> 500 mrem/h at 1 m	> 500 mrem/h at 1 m	(RWMC)
Fissionable material[b]	See Table 13	See Table 13	(RWMC SAR)

Characteristic	Mark III Concrete Box	HFEF-5 Canister	Criterion Basis
Gross weight	≤ 21,800 lb/box	≤ 1,000 lb/canister	(Design)
Dimension	4 × 4 × 8 ft	—	(BMP)
Radiation limit[a]	> 500 mrem/h at 1 m	> 500 mrem/h at 1 m	(BMP)
Fissionable material[b]	See Table 13	See Table 13	(RWMC SAR)
Lid gasket	By design	Seal welded or bolted with Viton™ seal, no leakage	(RWMC EDF)

Characteristic	Other	Criterion Basis
Gross weight	Package design limit	(Design)
Radiation limit[a]	> 500 mrem/h at 1 m	(BMP)
Fissionable material[b]	See Table 13	(RWMC SAR)
Lid gasket	Container design	(Design)

a. The radiation level of the package is ≥ 500 mrem/h at 1 meter to qualify as remote-handled waste. An upper limit has not been defined.

b. Fissionable material limits are based on assumed low-density waste contaminated with small amounts of volumetric averaged fissionable material. Low-density waste is waste consisting of materials such as paper, polyethylene wrap, tape, glass, rags, blotting paper, scrap metal, and piping. Volumetric average is defined as concentrations obtained by dividing the total fissionable material content of a container by its volume.

8.2.1.2.3.2 NTS Waste Acceptance Criteria

The waste acceptance criteria provided here are based on the current version (Revision 1) of the NTS WAC document.[28] This document is currently being revised to include clarifications on some of the waste acceptance issues. The new revision (Revision 2) will be available sometime this year. According to Gary Pyles, the DOE-Nevada Operations Office (DOE-NV) Radioactive Waste Acceptance Program Technical Lead (personal communication on 05/26/99), the changes will be minor and will not affect the current acceptance criteria.

NTS accepts LLW (Class A, B, or C, as defined in 10 CFR 61.55)[p] and mixed LLW for disposal from generators who are designated by DOE Headquarters (DOE-HQ) and subsequently approved by the DOE-NV. Presently, the INEEL is neither a designated nor an approved generator (personal communication with Mr. Pyles on 05/26/99). The approval process is a number of steps the generator and the DOE-NV follow resulting in receiving approval to sent waste to the NTS. The generator must have DOE-HQ approval before initiating the approval process with DOE-NV. All official interactions and coordinating activities relating to the approval process between the generator and the DOE-NV should take place through the generator's oversight office.

DOE-NV requires that the generator develop an NTS WAC compliant program for obtaining the DOE-NV approval. The WAC compliant program includes development and/or completion of certain waste acceptance documentation demonstrating waste characterization plan and QA requirements for waste certification. Prior to the compliant program development, the DOE-NV Waste Management Division (WMD) must be contacted to verify that waste is acceptable at NTS.

DOE-NV has established criteria for LLW and mixed LLW disposal at the NTS. However, the acceptance criteria for disposal of mixed LLW generated outside the State of Nevada have not been defined at this time because this waste type is currently not accepted from the off-site generators (personal communication with Mr. Pyles on 05/26/99). The LLW criteria are based on DOE management policies and practices defined in DOE Order 435.1 and other regulations established by EPA, State of Nevada, and DOT. The applicable criteria for waste shipment to and disposal at the NTS are provided below under the following categories: waste acceptance documentation, physical/chemical waste form criteria, packaging criteria, and radiological criteria.

8.2.1.2.3.2.1 Waste Acceptance Documentation

The waste documentation includes waste acceptance package (WAP) which consists of waste profile(s) (WP) and a waste certification program plan (WCPP), and a list of authorized certification personnel. Waste characterization and WAC compliance must be summarized on the WP.

8.2.1.2.3.2.2 Physical/Chemical Waste Form Criteria

The LLW form physical/chemical criteria are the same as those identified above for the RWMC. In addition, DOE-NV has adopted the following waste packaging criteria from DOE Order 435.1 and implied DOT and NRC requirements (10 CFR and 49 CFR):

- **Closure**—The package closure shall be sturdy enough that it will not come open under normal handling conditions.

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[p] Greater than Class C LLW is not accepted for disposal at the NTS.

- **Strength**—The disposal package (packaging and content) shall be capable of supporting a uniformly distributed load of 1,644 kg/m^2 (3,375 lb/ft^2). This is required to support other waste packages and earth cover without crushing during stacking and covering operations. These requirements do not apply to waste packaged in steel drums.

- **Handling**—All waste packages shall be provided with permanently attached or removable skids, cleats, offsets, rings, handles, or other auxiliary lifting devices to allow handling by means of forklifts, cranes, or similar handling equipment. Removable skids are preferred to assist in meeting NTS performance objectives for reducing disposal cell subsidence. Lifting rings and other auxiliary lifting devices on the package are, permissible, provided they are recessed, offset, or hinged in a manner that does not inhibit stacking the packages. The lifting devices must be designed to a 5:1 safety factor based on the ultimate strength of the material.

- **Size**—1.2 × 1.2 × 2.1-m (4 × 4 × 7-ft) or 1.2 × 0.6 × 2.1-m (4 × 2 × 7-ft) boxes (width x height x length, ±1/2 in) or 208-liter (55-gallon) drums should be used. Innovative alternative packages (i.e., supersacks, burrito wraps) will be considered by NTS, however, the NTS operating personnel must be consulted to ensure equipment compatibility.

- **Weight**—In addition to the weight limits set for specific packaging designs, the NTS imposes limits of 4,082 kg (9,000 pounds) per box and 544 kg (1,200 pounds) per drum.

- **Loading**—Waste packages must be loaded to ensure that the interior volume is as efficiently and compactly loaded as practical to avoid void space. High density loading will allow efficient disposal space utilization and provide a more stable waste form that will reduce subsidence and enhance the long-term performance of the disposal site.

- **Package protection**—The pre-shipment storage environment should prevent package deterioration and intrusion.

- **Marking, labeling, and coding**—Each waste package must be marked, labeled, and bar coded according to the requirements given below:

  - Code 39.

  - Low to medium density; low density preferred.

  - 1.0" high bar code.

  - Human Readable Interpretation (HRI) 0.5" high printed, below the bar code.

  - Spacing between bar code and HRI will be 0.10".

  - Minimum left and right margin will be at least 0.25".

  - Bar codes and HRI will be stacked with a minimum separation of 0.5" and in the following order: shipment number, container number.

  - A total of two bar code labels must be placed on each package or drum.

8.2.1.2.3.2.3 Radiological Criteria

The DOE-NV expects that generators identify those radionuclides known or reasonably expected to be present in the final waste form. These radionuclides shall be reported if they meet the following criteria:

- The activity concentration in the final waste exceeds 1% of the Action Level shown in Table 16. These radionuclides should require the greatest level of characterization and verification.

- The activity concentration in the final waste exceeds 1% of the total activity concentration. The total activity concentration includes the activity of all reporting radionuclides. Process knowledge is sufficient for characterization of these radionuclides and those present at a level less than the detection limit, or occurring at concentration less than 1% of the Action Level.

Table 16. Radionuclide Action Levels for waste characterization and reporting.

Nuclide	Action Level (Bq[a]/m³)	Nuclide	Action Level (Bq/m³)
Unlisted nuclide with a half life < 5 years	No limit	Ac-227	1.0×10^{12}
H-3	5.6×10^{15}	Th-227	4.1×10^{9}
C-14	2.3×10^{8}	Th-229	3.1×10^{9}
Cl16-	1.1×10^{10}	Th-230	8.1×10^{8}
Ni-59	8.1×10^{12}	Pa-231	1.4×10^{9}
Ni-63	2.6×10^{14}	U-232	9.3×10^{9}
Co-60	No limit	U-233	3.1×10^{10}
Sr-90	1.5×10^{12}	U-234	3.7×10^{10}
Zr-93	1.4×10^{13}	U-235	1.2×10^{10}
Tc-99	1.1×10^{11}	U-236	1.2×10^{11}
Pd-107	1.3×10^{14}	U-238	5.9×10^{10}
Sn-126	5.9×10^{8}	Np-237	7.0×10^{8}
I-129	3.0×10^{9}	Pu-236	2.3×10^{11}
Ba-133	No limit	Pu-238	1.2×10^{11}
Cs-135	2.8×10^{12}	Pu-239	2.3×10^{10}
Cs-137	3.4×10^{11}	Pu-240	2.3×10^{10}
Sm-151	1.2×10^{15}	Pu-241	5.2×10^{11}
Eu-152	4.8×10^{13}	Pu-242	2.4×10^{10}
Eu-154	1.2×10^{16}	Am-241	1.8×10^{10}
Pb-210	1.3×10^{13}	Am-243	7.0×10^{9}
Bi-207	1.1×10^{11}	Cm-242	2.4×10^{13}
Ra-226	1.3×10^{9}	Cm-244	8.1×10^{12}
Ra-228	No limit	Cm-248	6.3×10^{9}

a. Bq: Stands for Becquerel that is an SI unit of radioactivity. 1 Bq = 1 disintegration/sec = 2.7×10^{-11} Ci. 1 Ci = 3.7×10^{10}/sec

8.2.1.2.3.3 Hanford Waste Acceptance Criteria

This section contains the criteria for waste disposal at the Hanford Site, as specified in the Hanford Site WAC document.[29] Based on the existing Hanford Site WAC, all non-Hanford Site waste generators must receive approval from the DOE Richland Operations Office (DOE-RL) before acceptance by and shipment of waste to Hanford Site. It is required that the customer requesting approval contact its DOE Operations or Field Office Interface and request that the Field Office approach DOE-RL regarding the possible shipment of waste to the Hanford Site. Currently, the DOE–RL interface for this activity is Mr. Rudolph Guercia, Hanford Solid Waste Program Manager, and for the DOE-ID is Ms. Lori Fritz. If DOE-RL determines that management of the waste stream is in compliant and consistent with the Hanford Site criteria and long-term waste management strategies, the customer will be approved. Approval from DOE-HQ may also be required.

Once the customer is approved by DOE-RL, prior to shipping waste to the Hanford Site, the customer must prepare and submit the required waste certification documents for evaluation. The customer must provide specific data for each waste container, the annual waste forecast and funding arrangements for the forecasted waste volumes, and certify that the waste meets the Hanford acceptance criteria. The waste stream information is reviewed against the Hanford Site WAC and if the waste stream data are sufficient and meet the applicable acceptance criteria, the shipment is approved. The Hanford criteria for LLW and mixed LLW acceptance and disposal at Hanford site are described below.

Hanford Site accepts LLW for disposal at its LLW disposal unit known as "unlined portion of the Low-level Burial Grounds" (LLBG). This area is designated for disposal of LLW not regulated as hazardous waste under 40 CFR 261, the State of Washington dangerous waste (defined in WAC 173-303), or Toxic Substances Control Act (TSCA) PCB waste under 40 CFR 761. The lined portion of the LLBG, identified as trenches 31 and 34, is a RCRA-permitted disposal unit for certain mixed LLW that meets federal and the State of Washington LDR requirements.

The State of Washington Department of Ecology has established the term "dangerous waste" and defined regulations for management of such wastes in Chapter 173-303 WAC.[q,30] "Dangerous waste" is referred to waste designated as hazardous, extremely hazardous, or mixed waste. The department has assigned dangerous waste numbers to a variety of discarded chemical products, chemicals with dangerous waste sources, and others. The numbers are the same as those used by the EPA for designating the RCRA hazardous waste constituents, and they include certain F, P, U, K, and W waste codes.

Section 173-303-070 of Chapter 173-303 WAC, contains procedures for designation of dangerous waste. To determine whether or not a waste is designated "dangerous," the waste must be checked against the procedures established for the following items and in the following order:

- Discarded chemical products
    - Acutely (P and U waste codes) and moderately (U codes) dangerous chemicals
- Dangerous waste sources

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[q] According to Mr. John Brueck, a compliance officer at the DEQ (personal communication on 06/01/99), the Sate of Idaho does not use the term "dangerous waste" and has no specific or separate regulations for management of dangerous waste. The wastes designated as "dangerous" by the State of Washington are managed in Idaho under the Idaho Hazardous Waste Management Act of 1983. Pursuant to this Act, such wastes are subject to the federal RCRA regulations, adopted by the State of Idaho for management of hazardous waste. The RCRA requirements are administered and implemented by the Idaho DEQ.

- From non-specific sources: certain F codes,
- From specific sources: certain K and W001 waste codes

- Dangerous waste characteristics (corrosive, reactive, ignitable)
- Dangerous waste criteria – toxic dangerous waste, persistent dangerous waste, and carcinogenic dangerous waste

Testing and process knowledge can be used to determine if a solid waste is considered dangerous. The tests must be conducted in accordance with the procedures contained in Chapter 173-303 WAC. Once a material has been determined to be a dangerous waste, then any solid waste generated from treatment, storage, and disposal of such waste is a dangerous waste unless and until proven other wise. For example, if a generator can prove through demonstration samples that a material is no longer considered dangerous or a listed waste is granted exemption, in such cases, a generator is not required to comply with the regulations in Chapter 173-303 WAC. Wastes designated as dangerous are managed in accordance with the federal LDR regulations in 40 CFR 268 as adopted by reference in WAC 173-3030-140, "Land disposal restrictions of dangerous wastes."

Based on the existing data, the INTEC wastes associated with the Tank Farm contain a number of chemicals that are considered "dangerous" by the State of Washington. The State of Washington requires that dangerous wastes be sent only to the TSD facilities that operate under the permits issued in accordance with the requirements of Chapter 173-303 WAC.

In addition to compliance with the dangerous waste regulations, acceptance of waste at the Hanford Site is contingent upon effective implementation of the requirements defined in Hanford WAC document. These requirements are described below.

A waiver for one or more of the Hanford requirements may be requested in writing and granted in certain cases. The process to obtain approval of an exception is determined by the source and type of the requirements from which the specific acceptance criterion is derived. The request for waiver will need evaluation and approval of DOE-RL or Waste Management Federal Services of Hanford, Inc. (WMH) for approval.

8.2.1.2.3.3.1 Waste Acceptance Documentation

Waste generators are required to supply the receiving units with certain waste documentation and certification information to ensure that the waste received meets the acceptance criteria of the disposal unit. The documentation must contain information about the physical, chemical, and radiological, and packaging characteristics of the waste.

8.2.1.2.3.3.2 Physical/Chemical Criteria

Liquid waste and Liquid-Containing Waste

All free liquids must be sorbed or stabilized, or otherwise removed from the waste. Liquid waste must be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid. The amount of liquid cannot exceed 1% of the volume of the waste or 0.5% of waste processed to a stable form. Organic liquids and chelating compounds exceeding 1% of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds.

Sorbents and stabilizing products must be non-hazardous, compatible with the waste being sorbed or stabilized, and non-biodegradable as defined in 40 CFR 264.314 (e). The general classes of sorbents and stabilizing materials allowed by Hanford Site to meet the free liquid requirements or to provide a safer waste form for handling include the following:

- Inorganic mineral sorbents including, aluminosilicates; clays; vermiculite; zeolites; lime; silica; diatomaceous earth; perlite; and fly ash and other inorganic materials used for absorption.

- High molecular weight synthetic polymers including, polyethylene; high density polyethylene (HDPE); polypropylene; polyacrylate; and other synthetic polymers. This excludes polymers derived from biological material (e.g., cellulose-based materials), and polymers specifically designed to be degradable.

- Stabilizing materials include concrete, portland cement, lime/pozzolans, and a variety of other inorganic materials.

- Specialty stabilization agents for organic liquids include certain products that stabilize organic liquids. These products chemically react with organic liquids to prevent their release in the disposal environment.

Selection of specific products must be from the Hanford "Approved Sorbents/Stabilizing Materials List." The list of approved materials and their manufacturers or vendors are available on the Hanford Site Solid Waste Acceptance Program Internet web page at the following address: http://www.hanford.gov/wastemgt/wac/index.htm. For using the products not on the approved list, information could be obtained from the manufacturer, submitted to WMH acceptance organization[r] for approval, and added to the list.

Hanford requires that twice the minimum amount of sorbent be used, based on the minimum ratio of sorbent to liquid data provided by the manufacturer or testing. The sorbed waste for disposal must not release liquid under 20 pounds per square inch (138 kPa) pressure. A determination whether the waste will release liquids at 20 pounds per square inch (138 kPa) can be made from manufacturer's data or by testing. The EPA Liquid Release Test Procedure, SW-846 Method 9090, can be modified to test at 20 pounds per square inch (138 kPa). Other test methods can be approved by the WMH acceptance organization.

Land Disposal Restrictions

Waste that was originally designated only with HWNs D001 through D043 can be disposed at the unlined portions of LLBG provided that it meets all of the applicable LDR treatment standards in 40 CFR 268, and that it is no longer hazardous.

The lined portions of the LLBG (known as Trenches 31 and 34) are RCRA-compliant units used for disposal of certain mixed LLW. Currently, only LLW originally designated with RCRA HWNs D001 through D043, certain listed waste numbers (F001 through F005, and F039 derived from F001 through F005 waste), and Washington state-only dangerous waste (except waste number WSC2) are accepted in trenches 31 and 34. All waste accepted at trenches 31 and 34 must meet the applicable LDR treatment

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[r] WMH acceptance organization. The organization within WMH that is responsible for waste acceptance, including approval of waste stream documentation and approval of individual waste packages and shipments, and for coordinating the approval of case-by-case evaluations for specific criteria and exceptions to the acceptance criteria.

standards of 40 CFR 268 and WAC 173-303 (Washington's dangerous waste regulations). Waste designated with any RCRA U, P, or K waste numbers, any F-listed waste other than those mentioned above are prohibited for disposal at the trenches 31 and 34 of the LLBG.

A copy of the applicable notification to the EPA Regional Administrator, as specified in 40 CFR 268.7, and data supporting this notification must be provided to the WMH acceptance organization.

Heat Generation

Waste containers, packaging, and shipping must meet the DOT requirements. The thermal limitation on a waste container is 3.5 watts/m^3 (0.1 watts/ft^3). Waste materials that generate heat in excess of the limit may require special packaging and disposal requirements to prevent excessive temperatures in the buried waste. Such waste materials must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in the LLBG. This evaluation must be approved by the WMH acceptance organization.

Gas Generation

Gas generation must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kPa absolute pressure). If gas generation exceeds the limit, the following mitigating measures (or alternative measures approved by the WMH acceptance organization) must be used. For control of hydrogen from radiolytic decomposition, a Nucfil 013TM filter or equivalent should be used. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs could be used to control hydrogen concentrations in the container.

8.2.1.2.3.3.3 Radiological Criteria

Radiological Characterization

The radiological characteristics of a waste must be determined with sufficient accuracy and details to properly designate or categorize the waste for disposal at the LLBG. This requires that the radionuclide inventory of the waste be established using a method or combination of methods capable of identifying and quantifying the major radionuclides present. The methods chosen must ensure that the waste is correctly categorized to be acceptable for disposal at the LLBG. The following characterization methods can be used individually or in combination to establish the radionuclide inventory of the waste.

- Process knowledge – Process knowledge includes documented knowledge of the radioactive constituents and the processes contributing to the radiological content of the waste. This method is generally not sufficient to quantify the radionuclide inventory of a waste.

- Radionuclide material accountability – The content of a given radionuclide can be determined by documented logs detailing the mass or activity of that radionuclide added to and leaving the waste in a controlled process. Data on the total inventory of a radionuclide in a process or facility can also be used to establish the radionuclide inventory, but must be corroborated periodically with direct measurement methods.

- Direct measurement methods – Methods such as nondestructive assay (NDA) and radiochemical analysis must be selected to detect and quantify the major radionuclides. Analysis methods that measure gross activity (i.e., not radionuclide-specific) must be used in conjunction with other methods to determine the relative concentration (scaling factors) of each suspected radionuclide, and must be corroborated periodically with radionuclide-specific analysis.

- Computer modeling - Computer modeling could be used in conjunction with other methods, but must be corroborated periodically with direct measurement methods.

- Scaling factorss - Scaling factors can be used to relate the concentration of a readily-measured radionuclide to more difficult to measure radionuclides. Scaling factors must be developed from one of the previous methods, and must be corroborated periodically with radionuclide-specific analysis.

Other methods could be used, but must be clearly documented and approved by the WMH acceptance organization. The documentation must include a detailed description of the method, the radionuclides identifiable by the method, and a discussion of precision, accuracy, quality assurance, and quality control methods.

The major radionuclides are defined as those that meet any of the following conditions:

- Any fissionable radionuclide present in the waste in a quantity exceeding 0.1 FGE per container.

- Any radionuclide that accounts for more than 1% of the total radiological activity of the waste.

- Any radionuclide present in concentration exceeding 1% of its respective Category 1 limit in Table 17.

- Any mobile radionuclide present in concentration that exceeds its reporting limit (Table 17).

- Any TRU nuclide in concentration greater than 1nCi/g.

- For waste that has no detectable radiological activity but cannot be radiologically released, major radionuclides are those radionuclides believed to contribute more than 1% each of the radiological activity based on available process knowledge. The estimated concentration of the radionuclides should be based on the limit of detection of the analysis method used.

The list of major radionuclides and the category limits for these radionuclides identified in the Hanford Site WAC are shown in Table 17. The Hanford methodology for determining category of the radionuclide content of waste is shown in reference 14, Appendix D. Appendix D of reference 14 also contains other radiological calculation methods such as those for calculating NRC LLW Class C, thermal power of the waste, etc.

Acceptable Conditions for Disposal

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[5] Scaling factors. Radionuclides may be roughly organized into two groups. (1) those which are amenable to direct measurement by the generator (e.g., gamma energy analysis or assay equipment), and (2) those which require more costly and time consuming analysis generally beyond the capability of the generator (e.g., chemical separation and alpha/beta analysis). To simplify the determination of group 2 isotope activities, activity ratios may be established for a given waste stream which relate the concentration of readily-measured group 1 radionuclides to group 2 radionuclides. These activity ratios are known as scaling factors.

A waste must meet all of the following conditions to be acceptable for disposal at the LLBG:

- Waste category shall not exceed Category 3, except with an analysis coordinated by the WMH acceptance organization demonstrating that the LLBG Performance Assessment conditions are met.[t]

- Category 3 waste can be disposed of only if the waste meets one of the following waste form stability criteria:

  - Packaging in a Hanford HIC that meets the testing requirements of the HIC, 300 Year specification.[u]

  - Packaging in a HIC approved by the WMH acceptance organization. A list of approved HICs is provided below.

  - Stabilization in concrete or other stabilization agents. The stabilized waste must meet the compression strength and leach index criteria of the NRC Technical Position Paper on Waste Form.[24] The NRC Paper provides guidance and information for demonstrating long-term (300-year) structural stability that is required by 10 CFR 61.56 for Class B and C wastes. The paper focuses on cement stabilization of LLW. It requires a generic testing data to be used to demonstrate waste form stability:

    - Solidified waste specimen should have compressive strength of at least 60 psi when tested in accordance with ASTM C 39.[31] Compressive strength test should be performed in accordance with ASTM D1074.[32] May solidification agent such as cement will be easily capable of meeting the 60 psi limit.

    - Leach testing should be performed for a minimum of 90 days in accordance with the procedures in ANS 16.1.[33]. The leachability index, as calculated in accordance with ANS 16.1, should be greater than 6.0.

  - Inherently stable waste that meets the NRC stability requirements in 10 CFR 61 and the NRC Technical Position Paper on Waste Form. The requirements are intended to ensure that the waste does not structurally degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. To comply with the NRC stability requirements:

    - Waste must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment,

[t] According to Mark Ellefson with the Hanford Site Waste acceptance Program (personal communication on 7/8/99), when waste exceeds Category 3, these are some flexibility to encapsulate and/or average the concentration of the radioisotopes over a larger portion of the disposal trench. Mr. Ellefson suggested that in such specific cases the Hanford Site performance assessment team be contacted for information and waste evaluation.

[u] HIC with 300 year specification. A type of container that holds its corrosion integrity for 300 years after burial. An alternative to such type of container is a polyethylene container placed in a concrete vault structure that can provide corrosion resistant environment for 300 year after burial. According to Mark Ellefson, the Hanford Site Waste acceptance Program (personal communication on 7/8/99), there are construction specifications for the Hanford concrete vault and generators can pay the Category 3 disposal rate, and use of this vault is included in the price.

the presence of moisture, thermal degradation, microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.

- Liquid waste or waste containing liquid must be converted into a form that contains as little free standing liquid as is reasonably achievable, but in no case the amount of liquid can exceed 1% of the volume of the waste or 0.5% of waste processed to a stable form.

- Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.

- TRU content shall not exceed 100 nCi/g of waste.

- Waste shall not exceed the NRC Class C limits.[v]

- If the concentration of any mobile radionuclide exceeds the limit shown in Table 17, stabilization could be required. This will be determined on case-by-case evaluation by the WMH. Stabilization would normally consist of waste placement in a HIC, but additional stabilization might be required based on factors such as waste form and radionuclide content.

- Waste must meet the interim safety basis (ISB) limit (as calculated in Appendix D of reference 14), with the following exception: if a combustible waste exceeds the combustible waste limit, but does not exceed the limit for noncombustible, an evaluation will be performed by the WMH acceptance organization to determine proper mitigation measures (stabilization or segregation).

The definition of combustible and noncombustible for use in defining the limits given in Table 17 is as follows: "Noncombustible waste forms are waste forms which will not burn even on prolonged exposure to open flame and moderately intense heat. These consist of waste forms that experience no evidence of combustion or decomposition upon exposure to 538°C (1,000°F) for ten minutes." All other forms are combustible.[29] Waste packages that exceed the limits indicated in Table 17 will require additional safety analysis before they can be accepted. Any additional requirements for a waste that exceeds the limits will be identified as part of the waste acceptance process.

Hanford Site Approved HICs

The approved HICs include those available at the Hanford Site, commercial HICs, and special HICs. Waste generators can also provide their own HICs. The WMH acceptance organization performs an evaluation of the loading of all HICs to ensure that they will withstand the soil overburden in the LLBG. The following is a list of approved configurations of HICs available at the Hanford Site, approved commercial containers, and of packages approved as special HICs:

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[v] Based on my phone conversation with Mark Ellefson of Hanford on 4/6/00, in the next revision of Hanford WAC (HNF-EP-0063), there will no longer be any reference to the Class C limits. DOE-RL has removed that requirement based on the transition from DOE O 5820.2A to 435.1. There will be no changes to the Category 3 limits. They are based on the LLB Performance Assessment, which has been approved by DOE and has not been revised; nor are there immediate plans for revision.

HIC configurations available at the Hanford Site

- Culvert Type I Concrete HIC (6 ft. diameter by 6 ft. high)
- Culvert Type II Concrete HIC (8 ft. diameter by 7 ft. high)
- Vault type concrete HIC (10.5 ft. long by 7 ft. wide by 9.5 ft. high)

Commercially available HICs

- Arrow Pak High Density Polyethylene (HDPE) HIC
- SEG Enduro Pak HDPE HIC
- SEG SQ113 Concrete HIC
- Any NRC-approved HIC

Special HICs

- Hanford IXM unit (Hanford Specification H-1-46279)
- Vectra 95 drum capacity HIC

Table 17. Radiological content limits for disposal at the Hanford LLBG.

Nuclide	Activity Limits (Ci/m³)				
	Mobile Radionuclide Reporting Limit	Category 1 Waste Limit	Category 3 Waste Limit	ISB Noncombustible Waste Limit	ISB Combustible Waste Limit
H-3	4.4 E+00	9.9 E+04	NL	4.0 E+07	5.0 E+02
Be-7	NL	NL	NL	2.6 E+07	6.6 E+05
Be-10	NL	1.1 E+00	2.4 E+02	1.0 E+04	2.5 E+02
C-14	1.3 E-04	9.1 E-02	2.1 E+01	1.8E+06	4.4 E+04
C-14[a]	1.3 E-04	9.1 E-01	2.1 E+02	1.8 E+06	4.4 E+04
Na-22	NL	NL	NL	4.3 E+05	1.1 E+04
P-32	NL	NL	NL	2.3 E+05	5.8 E+03
S-35	NL	NL	NL	1.5 E+06	3.7 E+04
Cl-36	3.1 E-05	6.4 E-05	1.4 E-01	1.7 E+05	4.2 E+03
K-40	NL	1.8 E-03	3.8 E-01	3.0 E+05	7.5 E+03
Ca-45	NL	NL	NL	5.5 E+05	1.4 E+04
Sc-46	NL	NL	NL	1.2 E+05	3.6 E+03
V-49	NL	NL	NL	1.1 E+07	2.6 E+05
Cr-51	NL	NL	NL	1.0 E+07	2.5 E+05
Mn-54	NL	NL	NL	5.2 E+05	1.3 E+04
Fe-55	NL	NL	NL	1.3 E+06	3.3 E+04
Co-56	NL	NL	NL	9.2 E+04	2.3 E+03
Co-57	NL	NL	NL	4.3 E+05	1.1 E+04
Co-58	NL	NL	NL	3.2 E+05	8.1 E+03
Fe-59	NL	NL	NL	2.4 E+05	5.9 E+03
Ni-59	NL	3.9 E+00	8.5 E+02	2.9 E+06	7.1 E+04
Ni-59[a]	NL	3.9 E+01	8.5 E+03	2.9 E+06	7.1 E+04
Co-60	NL	7.5 E+01	NL	1.8 E+04	4.6 E+02
Co-60[a]	NL	7.5 E+02	NL	1.8 E+04	4.6 E+02
Ni-63	NL	5.9 E+00	2.0 E+04	1.2 E+06	3.0 E+04
Ni-63[a]	NL	5.9 E+01	2.0 E+05	1.2 E+06	3.0 E+04
Zn-65	NL	NL	NL	2.0 E+05	4.9 E+03
Ge-68	NL	NL	NL	7.0 E+04	1.8 E+03
Se-75	NL	NL	NL	4.3 E+05	1.1 E+04
Se-79	3.4 E-05	5.1 E-01	1.1 E+02	3.9 E+05	9.7 E+03
Sr-82	NL	NL	NL	5.9 E+04	1.5 E+03

Nuclide	Activity Limits (Ci/m³)				
	Mobile Radionuclide Reporting Limit	Category 1 Waste Limit	Category 3 Waste Limit	ISB Noncombustible Waste Limit	ISB Combustible Waste Limit
Kr-85	NL	NL	NL	2.1 E+09	2.6 E+04
Sr-85	NL	NL	NL	2.0 E+06	4.9 E+04
Rb-86	NL	NL	NL	5.5 E+05	1.4 E+04
Y-88	NL	NL	NL	1.3 E+05	3.2 E+03
Sr-89	NL	NL	NL	6.7 E+05	1.7 E+04
Sr-90--Y-90	NL	1.6 E-02	5.4 E+04	1.5 E+04	3.8 E+02
Mo-93	2.1 E-04	8.7 E-01	2.0 E+02	1.3 E+05	3.2 E+03
Nb-93m	NL	NL	NL	1.2 E+05	3.0 E+03
Zr-93	NL	2.5 E+00	5.4 E+02	4.6 E+03	1.2 E+02
Nb-94	NL	2.2 E-04	4.8 E-02	9.2 E+03	2.3 E+02
Nb-94[a]	NL	2.2 E-03	4.8 E-01	9.2 E+03	2.3 E+02
Nb-95	NL	NL	NL	5.7 E+05	1.4 E+04
Zr-95--Nb-95m	NL	NL	NL	9.2 E+04	2.3 E+03
Tc-99	2.1 E-04	2.3 E-02	5.0 E+00	4.0 E+05	1.0 E+04
Ru-103--Rh-103m	NL	NL	NL	3.9 E+05	9.7 E+03
Ru-106--Rh-106	NL	NL	NL	8.0 E+03	2.0 E+02
Pd-107	NL	1.5 E+01	3.3 E+03	2.9 E+05	7.1 E+03
Ag-108m	NL	NL	NL	2.2 E+04	5.4 E+02
Cd-109	NL	NL	NL	2.5 E+04	6.1 E+02
Ag-110m--Ag-110	NL	NL	NL	1.0 E+04	2.5 E+02
Cd-113m	NL	7.6 E-01	NL	1.8 E+03	4.5 E+01
Sn-113	NL	NL	NL	3.2 E+05	8.1 E+03
Sn-119m	NL	NL	NL	6.0 E+05	1.5 E+04
Sn-121m	NL	6.7 E-01	2.2 E+04	3.1 E+05	7.7 E+03
Te-121	NL	NL	NL	1.9 E+06	4.8 E+04
Te-123	NL	NL	NL	1.4 E+05	3.4 E+03
Sb-124	NL	NL	NL	1.4 E+05	3.5 E+03
I-125	NL	NL	NL	5.0 E+04	1.3 E+00
Sn-126--Sb-126m	NL	1.6 E-04	3.4 E-02	3.6 E+04	9.1 E+02
Te-125m	NL	NL	NL	2.2 E+06	5.5 E+04
Sb-125	NL	NL	NL	2.8 E+05	7.0 E+03
Te-127m--Te-127	NL	NL	NL	1.7 E+05	4.2 E+03

Nuclide	Activity Limits (Ci/m³)				
	Mobile Radionuclide Reporting Limit	Category 1 Waste Limit	Category 3 Waste Limit	ISB Noncombustible Waste Limit	ISB Combustible Waste Limit
I-129	1.0 E-06	8.5 E-03	1.8 E+00	7.1 E+03	1.8 E-01
Te-129m	NL	NL	NL	1.6 E+05	3.9 E+03
Xe-131m	NL	NL	NL	7.5 E+08	9.4 E+03
Ba-133	NL	7.1 E-01	NL	4.6 E+05	1.2 E+04
Cs-134	NL	NL	NL	8.6 E+04	2.1 E+03
Cs-135	NL	1.6 E-01	3.5 E+01	8.0 E+05	2.0 E+04
Cs-137--Ba-137m	NL	5.5 E-03	1.2 E+04	1.2 E+05	3.0 E+03
Ba-140	NL	NL	NL	3.9 E+05	9.7 E+03
Ce-141	NL	NL	NL	4.1 E+05	1.0 E+04
Ce-144--Pr-144	NL	NL	NL	1.0 E+04	2.5 E+02
Nd-147	NL	NL	NL	5.5 E+05	1.4 E+04
Pm-147	NL	NL	NL	9.2 E+04	2.3 E+03
Sm-147	NL	1.7 E-02	3.7 E+00	2.9 E+01	7.1 E-01
Eu-150	NL	1.4 E-03	6.7 E+02	1.4 E+04	3.5 E+02
Sm-151	NL	4.6 E+01	2.1 E+05	7.1 E+04	1.8 E+03
Eu-152	NL	4.8 E-02	NL	1.7 E+04	4.4 E+02
Gd-152	NL	6.4 E-03	1.4 E+00	3.6 E+00	9.1 E-02
Gd-153	NL	NL	NL	1.1 E+05	2.7 E+03
Eu-154	NL	7.5 E-01	NL	1.3 E+04	3.3 E+02
Eu-155	NL	NL	NL	6.7 E+04	1.7 E+03
Tm-170	NL	NL	NL	1.4 E+05	3.5 E+03
Hf-175	NL	NL	NL	6.5 E+05	1.6 E+04
Hf-181	NL	NL	NL	1.2 E+05	3.1 E+03
Ta-182	NL	NL	NL	8.0 E+04	2.0 E+03
W-185	NL	NL	NL	4.6 E+06	1.2 E+05
Re-187	3.3 E-02	3.6 E+01	7.8 E+03	6.3 E+07	1.6 E+06
Au-195	NL	NL	NL	2.8 E+05	7.0 E+03
Hg-203	NL	NL	NL	5.0 E+05	1.3 E+04
Tl-204	NL	NL	NL	1.5 E+06	3.8 E+04
Bi-207	NL	TBD	TBD	1.8 E+05	4.5 E+03
Pb-210	NL	3.7 E-02	2.1 E+06	1.8 E+02	4.6 E+00
Po-210	NL	NL	NL	1.8 E+02	4.6 E+00

Nuclide	Activity Limits (Ci/m³)				
	Mobile Radionuclide Reporting Limit	Category 1 Waste Limit	Category 3 Waste Limit	ISB Noncombustible Waste Limit	ISB Combustible Waste Limit
Ra-226	NL	1.7 E-04	4.3 E-02	4.4 E+02	1.1 E+01
Ac-227	NL	4.2 E-03	3.0 E+05	3.1 E-01	7.7 E-03
Ra-228	NL	1.7 E+01	NL	8.6 E+02	2.1 E+01
Th-228	NL	NL	NL	7.1 E+00	1.8 E-01
Th-229	NL	4.4 E-04	9.8 E-02	7.1 E-01	1.8 E-02
Th-230	NL	2.1 E-03	1.5 E-01	4.6 E+00	1.2 E-01
Pa-231	NL	1.4 E-04	3.0 E-02	1.1 E+00	2.7 E-02
Th-232	NL	1.1 E-04	2.3 E-02	8.6 E-01	2.1 E-02
Total U	1.4 E-05	NL	NL	NL	NL
U-232	See Total U	4.6 E-04	4.6 E+00	5.5 E+00	1.4 E-01
U-233	See Total U	7.4 E-03	9.7 E-01	2.7 E+01	6.67 E-01
Th-234	NL	NL	NL	1.0 E+05	2.5 E+03
U-234	See Total U	8.9 E-03	1.9 E+00	2.7 E+01	6.8 E-01
U-235	See Total U	2.8 E-03	5.0 E-01	2.9 E+01	7.3 E-01
Pu-236	NL	NL	NL	1.4 E+01	3.5 E-01
U-236	See Total U	9.5 E-03	2.0 E+00	2.9 E+01	7.1 E-01
Np-237[b]	1.1 E-05	6.8 E-04	1.5 E-01	2.6 E+00	6.4 E-02
Pu-238[b]	NL	4.7 E-03	2.4 E+01	5.2 E+00	1.3 E-01
U-238	See Total U	5.7 E-03	1.2 E+00	3.1 E+01	7.7 E-01
Pu-239[b]	NL	1.9 E-03	4.2 E-01	4.6 E+00	1.2 E-01
Pu-240[b]	NL	1.9 E-03	4.3 E-01	4.6 E+00	1.2 E-01
Am-241[b]	NL	2.1 E-03	8.5 E-01	4.4 E+00	1.1 E-01
Pu-241	NL	6.1 E-02	2.5 E+01	2.4 E+02	5.9 E+00
Am-242m[b]	NL	1.9 E-03	1.6 E+00	4.6 E+00	1.2 E-01
Cm-242	NL	NL	NL	2.0 E+02	5.1 E+00
Pu-242[b]	NL	2.0 E-03	4.3 E-01	5.0 E+00	1.3 E-01
Am-243[b]	NL	1.0 E-03	2.3 E-01	4.4 E+00	1.1 E-01
Cm-243[b]	NL	1.8 E-02	3.4 E+02	6.7 E+00	1.7 E-01
Cm-244	NL	1.4 E-01	1.6 E+02	8.6 E+00	2.1 E-01
Pu-244[b]	NL	6.1 E-04	1.3 E-01	5.0 E+00	1.3 E-01
Cm-245[b]	NL	1.3 E-03	2.2 E-01	4.4 E+00	1.1 E-01
Cm-246[b]	NL	1.8 E-03	4.2 E-01	4.3 E+00	1.1 E-01

Nuclide	Activity Limits (Ci/m^3)				
	Mobile Radionuclide Reporting Limit	Category 1 Waste Limit	Category 3 Waste Limit	ISB Noncombustible Waste Limit	ISB Combustible Waste Limit
Bk-247[b]	NL	TBD	TBD	3.0 E+00	7.4 E-02
Cm-247[b]	NL	5.6 E-04	1.2 E-01	4.8 E+00	1.2 E-01
Cm-248[b]	NL	5.1 E-04	1.1 E-01	1.2 E+00	3.0 E-02
Cf-249[b]	NL	TBD	TBD	3.0 E+00	7.4 E-02
Cf-250	NL	TBD	TBD	6.7 E+00	1.7 E-01
Cm-250[b]	NL	TBD	TBD	2.1 E-01	5.3 E-03
Cf-251[b]	NL	TBD	TBD	2.9 E+00	7.3 E-02
Cf-252	NL	NL	NL	1.4 E+01	3.6-01
Es-254	NL	NL	NL	5.2 E+01	1.3 E+00

NL. Means that there is no applicable limit for this isotope.

TBD. Means that a limit is under development

a. Limit for isotope in activated metal.

b. TRU isotope (half-life > 20 years)

Criticality Safety

Criticality safety requirements depend on the type of waste in the waste packages. These requirements must be developed on a case-specific basis. Table 18 provides the limits for fissionable material content for certain waste containers. The fissionable material limits must be expressed in Pu-239 FGE. Table 19 is used to determine the total quantity of fissionable material in a waste container. This value (i.e., total Pu-239-FGE) can be obtained by multiplying the gram quantity of each isotope listed in Table 19 by its respective FGE correction factor and summing the results.

Table 18. Fissionable material content limits for certain standard containers.

Container Type	Fissionable Material Content
208-liter (55-gallon) or larger steel drum, where fissile material is contained in 20% or more of the container volume.	177 FGE[a]
208-liter (55-gallon) or larger steel drum, where fissile material is contained in less than 20% of the container volume.	100 FGE[a]
208-liter (55-gallon) lead-lined steel drum	100 FGE[a]
DOT or NRC Approved Containers	Maximum fissile content may not exceed that which is acceptable for transportation as specified in the DOT regulations or the NRC C of C.
Steel box containing flushed and drained equipment and/or HEPA filters	• 325 FGE per piece of equipment • 353 FGE per cubic meter (10 FGE per cubic foot) on HEPA filters • 15 FGE in waste other than equipment or HEPA filters • 250 FGE total in box larger than 0.76 x 0.76 x 0.7 meters (2.5 x 2.5 x 2.5 feet) • 325 FGE total in box larger than 0.9 x 1.4 x 1.5 meters (3 x 4 x 5 feet) • 1,000 FGE total in box larger than 1.2 x 1.2 x 2.1 meters (4 x 4 x 7 feet)

a. This limit assumes that the steel drum weighs a minimum of 23 kilograms (50.7 pounds) excluding the liner. Any drum that weighs less than 23 kilograms (50.7 pounds) requires overpacking or completion of a criticality safety evaluation.

Table 19. Pu-239 FGE correction factors.

Isotope	Correction factor	Isotope	Correction factor
U-233[a]	1.0 E+00	Am-242m	3.46 E+01
U-235[b]	1.0 E+00	Am-243	1.29 E-02
Np-237	1.5 E-02	Cm-243	5.0 E+00
Pu-238[c]	1.13 E-01	Cm-244	9.00 E-02
Pu-239[c]	1.0 E+00	Cm-245	1.50 E+01
Pu-240[c]	2.25 E-02	Cm-247	5.00 E-01
Pu-241[c]	2.25 E+00	Cf-249	4.50 E+01
Pu-242[c]	7.50 E-03	Cf-251	9.00 E+01
Am-241	1.87 E-02		

a. U-233 is normally negligible unless the materials have been enriched in U-233.

b. U-235 is not included in calculating FGE unless it is enriched (greater than or equal to 0.72 wt % U-235 in U).

c. For conservatism, all Pu is normally considered to be Pu-239 unless the isotopic composition is known.

Package Dose Rate Limits

The radiation limit for CH-LLW is ≤200 mrem/hr at any point on the surface and ≤ 100 mrem/hr at 30 cm from the waste container. However, a container larger than 208 liters may have a marked point with surface dose rate up to 1,000 mrem/hr on the bottom or side as long as the 30 cm dose rate is not exceeded. Such points shall be marked with large red painted dots. For RH-LLW, the limit is >200 mrem/hr at any point on the surface.

8.2.1.2.3.3.4 Packaging criteria

Waste packages that meet the applicable DOT requirements in 49 CFR or have been evaluated through an approved packaging safety analysis are acceptable for disposal. Drums or boxes not exceeding 2.74 meters long by 1.6 meters wide by 1.7 meters high (9 feet x 5.25 feet wide x 5.5 feet high) should be used whenever possible to facilitate receipt verification. Larger containers require the approval of the WMH acceptance organization.

All packages must be configured for safe unloading by forklift or crane. Alternate means of unloading could be allowed with prior approval. All waste shall be packaged in a form that minimizes settling and subsidence of the LLBG to the maximum extent feasible. The following forms will be considered to meet these criteria:

- Inherently stable waste that will not subside in the disposal environment.
- Waste stabilized by grouting or packaging in a HIC.
- Containerized waste that fills at least 90% of the internal volume of the container. To calculate the volume of void spaces in the waste, only voids exceeding 5.1 centimeters (2 inches) in all dimensions need be considered.

Waste containers shall be labeled in accordance with the regulations established by DOT. Hanford requires that each container be labeled with a bar code showing the unique container identification number (CIN#). For off-site generators, a bar code will be attached when the container is received on the Hanford Site. The CIN# will be provided by the waste generator. The WMH acceptance organization should be contacted for guidance on assigning a CIN#.

9. SECONDARY WASTES

The secondary waste streams include the final process solvents, HEPA filters, and PPE. All the secondary waste streams would be considered mixed wastes as a result of the RCRA mixture rule and would be subject to the RCRA LDR Subtitle C requirements prior to disposition. In addition, the wastes must meet the criteria of the respective repositories they are destined to be shipped to. The secondary waste streams are listed wastes and would require delisting to be managed as radioactive wastes only after applicable LDR treatment requirements are met. The specific final waste forms would depend on the treatment options selected. The determination of the treatment options relies on the nature and chemical composition of these wastes. The wastes must be characterized using both process knowledge and analytical testing to determine the appropriate treatment method and disposal path.

The secondary wastes can be considered for onsite processing or sent to offsite treatment facilities. The applicable treatment methods would include those currently being used at the INEEL and commercial facilities. The current treatment and disposal plan for the secondary wastes is described below.

Process Solvents

Several hundred gallons of process solvents would remain at the end of the treatment campaign. It is suggested that these solvents be stripped of actinides and other radioactive elements so that it can be classified as CH-LLW from radiological standpoint. The waste solvents, at a minimum, would require solidification in preparation for disposal. The solvent constituents alone are not hazardous per RCRA, however, when they get mixed with the listed SBW they would become listed mixed wastes as a result of the RCRA mixture rule. The only way to remove this type of waste mixture from RCRA regulation is to have it delisted after the LDR treatment requirements are met. The SBW is also a characteristic waste. Based on the RCRA mixture rule, when a characteristic waste is mixed with a solid waste, the resulting mixture is only hazardous if it continues to exhibit a characteristic. Testing is required to determine if the resulting mixture exhibits a characteristic. If the mixture exhibits a characteristic, it would have to meet the applicable LDR treatment for characteristic waste prior to disposal.

Spent HEPA Filters

The spent HEPA filters would be treated using the processes presently used at INTEC. These include HEPA filter leaching to remove the RCRA hazardous constituents and to reduce the radioactivity content. After leaching, the filters should be ready for disposal as LLW at a facility such as Hanford or as TRU waste at WIPP. The leachate generated by HEPA filter leaching will be managed in INTEC liquid radioactive wastewater treatment system [process equipment waste (PEW), liquid effluent treatment and disposal (LET&D), and INTEC Tank Farm]. The decontamination solutions can also be processed through the PEW evaporator and LET&D systems. These systems perform volume reduction of the liquid waste rather than LDR treatment. The resulting waste would be included in the Tank Farm liquid waste streams.

Used PPE

The PPE would require treatment (e.g. incineration) followed by stabilization of the ash, if necessary, for disposal as LLW at a LLW disposal facility such as Hanford. If the PPE is determined to be TRU waste (CH-TRU), they would be packaged for disposal at WIPP.

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Appendix H

Facility Personnel Estimate

In order to process the sodium bearing waste using the UNEX and modified UNEX processes, an estimate of the number of personnel required to staff the operations need to be determined. This estimate allows for administrative space considerations to be taken into account. The major operations involved in the UNEX process are solids removal, centrifugal extraction, evaporation of CH-LLW and RH-LLW streams, acid fractionation, crystallization of RH-LLW, neutralization, and grouting. Due to the number of drums required to complete total solidification, the grouting activity will be the most labor intensive.

Assumptions:

- The number of staff needed for start-up is equal to the number of staff for on-going operations.
- The number of years for start-up is estimated as three total years.
- The UNEX process facility will be in operation for approximately 3 years from January 2008 to December 2010.
- Shipment of CH TRU drums to WIPP is independent of the process (Modified-UNEX), in that this activity will be performed from the interim storage facilities location, and is anticipated to occur from January 2008 through December 2021.
- Shipment of RH TRU drums to WIPP is independent of the process (UNEX).
- Process operations are based on twenty-four hours per day, 7 days a week, with up-time of 200 days per year. The 200 days is rounded from 205 and based on previously used HLW program drivers stating that operations will be based on a 75% up-time at 75% efficiency (0.75x0.75x365=205).
- Four rotating shifts of personnel will be required to support the schedule for main process and drum output to handling/transfer to storage. Included in the 4 rotating shifts are personnel for process maintenance, QA, Safety, and Rad Con.
- New facility space will be required for final drum analysis to meet WIPP requirements (Modified UNEX).
- Activities related to WIPP validation occur only during the day shift (Modified UNEX).
- All personnel listed will be included for estimating Life Cycle Costs.
- Office space is available in existing nearby facilities, therefore new administrative facility space is not included in the study. Personnel not housed in the process facility include the facility administration, engineering support, and training staffs. Operating costs for the facilities they use are a cost incurred by the project.
- A single day shift will include personnel for administration, administrative support, technical support, general building maintenance, and activities related to drum videography, drum head space gas analysis, and CH-TRU drum shipments to WIPP (Modified UNEX).
- Management for support functions – QA, Safety, RadCon, Training, Engineering, Drafting, and Maintenance – is supplied from the existing INTEC infrastructure. Proportional costs for this management and their space are a cost incurred by the project.
- Ancillary and support functions critical to the process will be housed within the same physical facility.
- INTEC will have infrastructure services and capabilities to accommodate some tasks not unique to this project such as additional engineering and drafting support, common warehouse and storage, and major support areas such as machine, weld, sheetmetal, fitter, electrician, and electronics/instrument shops, common warehouse and storage, mock-up area(s), and laydown area(s).
- No special personnel requirements are requirements are required for the interim storage facilities that can not be handled by day shift and rotating shift personnel.
- Space needs are based on an average 150 ft^2 allowance for office personnel and 500 ft^2 for a single shift of operations personnel. The office space allowance is slightly above the current 130 ft^2 used at INTEC to be conservative, considering the space is related to an operating facility and not typical office space.

OPERATION SUMMARY

The following processes are involved in UNEX extraction:

- Solids Removal
- Centrifugal Extractors
- CH-LLW Evaporation
- Acid Fractionation
- RH-LLW Evaporation
- RH-LLW Crystallization
- Neutralization
- Grouting

Among these processes, grouting will require the most personnel. This is because:

1. The grouting process is designed for 55-gallon drums (6 grouting stations). With the amount of CH-LLW projected, between 5000 to 6000 grouts would be needed per one years amount of SBW processed.
2. The drums of grouted material need to be bagged out and this activity is labor intensive (3 men per bag-out).

ADMINISTRATION AND SUPPORT REQUIREMENTS (Total = 12)

	Day Shift
ADMIN/ADMIN SUPPORT (Total = 6)	
Operations Managers	2
Administrative Support	1
• Secretarial/Clerical	
• Budget Cost/Control	
• Schedule	
Waste Tracking/Data Acquisition Tech	2
• Receipt, Examination	
• Sampling, Repack	
• Storage/Shipping (Manifest, Chain-of-Custody)	
Document Control Personnel	1
TECHNICAL SUPPORT (Total = 3)	
Engineers	2
Drafters	1
TRAINING (Total = 2)	
Trainers	2
ADMIN FACILITY MAINTENANCE (Total = 1)	
Janitor (admin areas)	1

PROCESS FACILITY/OPERATIONS (Total = 97)

	Day Shift	Rotating
OPERATIONS ADMINISTRATION (Total = 11)		
Shift Supervisors	2	4
Operations Technicians	0	4
Process Coordinator	1	0
PROCESS OPERATORS (Total = 54)		
Material Receipt • SBW retrieval from tank farm to feed tanks • Feed sampling and related activities • Raw material receipt – cement, slag, flyash, drums,etc.	1	0
Solids Removal Process	0	8
Solvent Extraction Process	0	4
Evaporation Process (CH LLW)	0	4
Evaporation Process (RH LLW) • Crystallization • Placement into cask	0	4
Grouting Process • Monitor process • Drum movements and Bag-out • Movement of drums to interim storage	0	24
Waste Validation • TCLP sampling (CH LLW) • Shipping from interim storage • Filled drum videography (RH/CH TRU) • Drum head space gas analysis (RH/CH TRU)	9	0
QA, SAFETY, RADCON (Total = 14)		
QA	1	4
Safety	0	4
RadCon	1	4

Physical requirements – Equipment storage (surveillance, analyzers, etc.)

	Day Shift	Rotating
PROCESS MAINTENANCE (Total = 12)		
Electrical	0	4
Mechanical	0	4
I&C	0	4

PROCESS FACILITY MAINTENANCE (Total = 6)

Electrical	1	0
Mechanical	1	0
I&C Technicians	1	0
Maintenance Planner/PMs/Work Orders	1	0
Attendant	1	0
Janitor	1	0

SPACE REQUIREMENTS

- Small Lunch Room
- Toilet Rooms
- Janitor Room
- Storage
- Circulation
- Electrical
- Communications
- Mechanical
- Equipment (surveillance, analyzers, etc.)
- Anti-C Issue Rooms
- Change Rooms/Shower Rooms
- Personnel Decon Area
- Ready Room (Break Room)
- Contaminated, Hot Maintenance Area
- Drum Handling Systems (i.e., carts) Survey, Decon and Maintenance areas
- Tool Room – Storage of Issue Tools
- Long Term Storage – Clean Containers
- Short Term Storage – Lag/Lead for drums

Total estimated number of personnel is 109, 83 of whom are considered radiation workers. New office space for 9 and operating space for 14 individuals is required. For initial start-up, it is assumed that 109 workers would be required over a three year period.

	Day Shift	Rotating Shifts (4)	Radiation Workers	New Facility Office Space	New Facility Ops/Maint
Facility Admin	6	0	0	0	0
Engineering Support	3	0	0	0	0
Training	2	0	0	0	0
Operations Admin	3	8	0	3	0
Process Operators	19	44	54	2	11
QA, Safety, RadCon	2	12	14	3	0
Process Maintenance	0	12	12	0	3
Facility Maintenance	7	0	3	1	0
Total	42	76	83	9	14

Appendix I

Radionuclide Dose Rate Calculations

Appendix I

Dose Rate Calculations

The dose rate calculations for the UNEX and Modified UNEX processes were based on analytical equations that used a cylindrical volume source with finite height. Figure I.1 shows the relationship of the point of calculation (detector response at point '*P*') to the cylinder of interest.

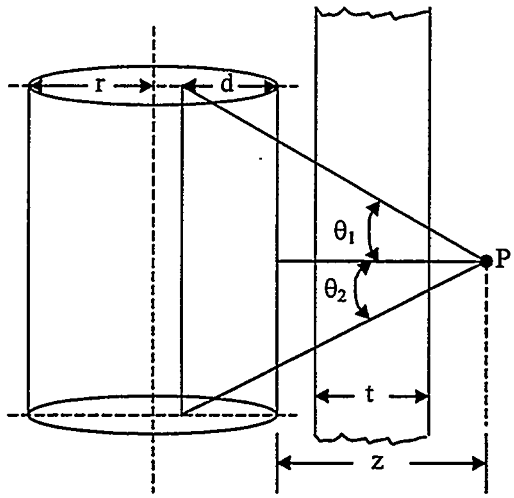

Figure I.1. Geometry used for calculating the detector response at '*P*'.

The variables in the above figure are as follows:

$r =$	radius of the cylinder
$d =$	perpendicular distance from the cylinder wall to a point within the cylinder
θ_1, $\theta_2 =$	angles based on the distance of point P from the cylinder wall and the cylinder height
$t =$	thickness of the shield
$z =$	perpendicular distance from P to the cylinder wall.

Assuming that the source is distributed evenly throughout the volume, the following equation can be used to calculate the detector response (in units of particles/cm^2/sec):

$$\phi_{cyl}(z,t) = \frac{S_v r^2}{4(z+d)}\left[F(\theta_1, \mu t + \mu_v d) + F(\theta_2, \mu t + \mu_v d)\right]$$

where S_v is the volumetric source rate or strength; μ and μ_v are the attenuation coefficients for the shield and volumetric source, respectively; $F(\theta, x)$ is the secant integral[1]; and the remaining variables were previously defined.

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[1] The secant integral, sometimes called the Sievert integral, is defined as $F(\theta,x) \equiv \int_0^{\theta} e^{-x\sec\theta}\, d\theta$

The volumetric source rate was given by the mass balance sheets for each specific stream; the attenuation coefficients were found from the literature; and the remaining variables were assumed from the spreadsheets for the 2x10 caniste[illegible] (UNEX, stream 320) and the 55 gallon drums (Modified UNEX, stream 530). In particula[illegible] was set equal to r, z was set equal to t, and θ_1 was equal to θ_2. The resulting equation for a dete[illegible]r placed at the midplane of a cylinder is:

$$\phi_{cyl}(t) = \frac{S_v r^2}{2(t+r)}\left[F(\theta, \mu t + \mu_v r)\right]$$

which gives a particle flux, and can then be converted to a dose rate based on the particle energy and corresponding buildup factor. Conversion tables can be found in the literature to convert the energy and nuclide dependent flux to a dose rate, as well as the plutonium equivalent activity and equivalent fissile components. A sample of the data sheets used for calculating the dose rates are attached to the end of this appendix, and include various shield materials and thicknesses.

In calculating the appropriate wall thickness for the hot cell, the same methodology was used, where the highest activity tank and canister were placed against the cell wall, and the dose rate at the outside of the wall was calculated. Note that the beta-particle emissions (including the Sr-Y nuclides) do not contribute significantly to the dose rate due to the canister/tank wall and the high gamma component for the UNEX process, and were not considered. However, in the case of breaching a canister or tank, this would not be the case, and the dose contribution of these nuclides would become important. Also, the beta dose is a significant contributor in the case of the modified UNEX process.

As a quality check, the UNEX (stream 320) 2x10 canister dose rates were calculated using the code Microshield. The differences between the calculated and code results were less than 10%. Typically the errors associated with dose rate calculations are on the order of ±20%. Therefore, for the purposes of this study, the calculated results are considered to be sufficient.

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2x10 Canister, UNEX Stream 320

Stream 320		Density= 580 kg/m^3	Canister Volume= 0.8896 m^3	Total Volumetric Source Rate	Branching Ratio	Photon Volumetric Source Rate	Photon Energy	F(theta,x) Variable	Secant Integral, F(theta,x)	Buildup Factor	Cannister Radius	Particle Flux	Flux-to-Dose Rate Conversion	Estimated Dose
Radionuclides	Ci/kg	Ci/m^3	Ci	particles/m^3/sec		photons/m^3/sec	MeV				m	particles/cm^2/sec	(rem/hr)/(part./cm^2/sec)	rem/hr
Am-243	9.22E-07	5.35E-04	4.76E-04	1.98E+07	0.8096	1.60E+07	7.47E-02	3.2303	2.38E-02	20.34	0.3048	1.17E+02	8.28E-08	9.71E-06
	9.22E-07	5.35E-04	4.76E-04	1.98E+07	0.0704	1.39E+06	4.35E-02	3.7686	1.31E-02	13.01	0.3048	3.58E+00	5.95E-08	2.13E-07
	9.22E-07	5.35E-04	4.76E-04	1.98E+07	0.0704	1.39E+06	3.11E-02	4.5245	5.71E-03	5.70	0.3048	6.85E-01	4.90E-08	3.35E-08
	9.22E-07	5.35E-04	4.76E-04	1.98E+07	0.106	2.10E+06	1.18E-01	2.8279	3.75E-02	20.18	0.3048	2.39E+01	1.21E-07	2.90E-06
Cm-242	8.18E-07	4.74E-04	4.22E-04	1.75E+07	0.26	4.56E+06	4.41E-02	3.7531	1.33E-02	13.39	0.3048	1.23E+01	6.00E-08	7.37E-07
Cm-244	5.96E-05	3.45E-02	3.07E-02	1.28E+09	0.233	2.98E+08	4.28E-02	3.7885	1.28E-02	12.51	0.3048	7.20E+02	5.89E-08	4.24E-05
Np-237	9.03E-05	5.24E-02	4.66E-02	1.94E+09	0.2209	4.28E+08	8.65E-02	3.1141	2.71E-02	20.82	0.3048	3.65E+03	9.22E-08	3.37E-04
	9.03E-05	5.24E-02	4.66E-02	1.94E+09	0.2491	4.83E+08	2.94E-02	4.8117	4.18E-03	4.95	0.3048	1.51E+02	4.70E-08	7.10E-06
	9.03E-05	5.24E-02	4.66E-02	1.94E+09	0.2741	5.31E+08	5.72E-02	3.4581	1.85E-02	21.09	0.3048	3.12E+03	7.00E-08	2.19E-04
Pu-238	1.56E-02	9.05E+00	8.05E+00	3.35E+11	0.28	9.38E+10	4.35E-02	3.7697	1.31E-02	12.98	0.3048	2.40E+05	5.95E-08	1.43E-02
Pu-239	1.96E-03	1.14E+00	1.01E+00	4.21E+10	0.151	6.36E+09	1.30E-02	3.5636	1.64E-02	37.80	0.3048	5.96E+04	1.54E-08	9.20E-04
	1.96E-03	1.14E+00	1.01E+00	4.21E+10	0.73	3.08E+10	7.50E-05	101.0843	1.56E-45	0.48	0.3048	3.49E-40	1.00E-20	3.49E-60
Pu-240	4.51E-04	2.62E-01	2.33E-01	9.69E+09	0.266	2.58E+09	4.52E-02	3.7206	1.38E-02	14.20	0.3048	7.63E+03	6.10E-08	4.65E-04
Pu-241	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.0166	3.35E+09	1.60E-01	2.6412	4.63E-02	15.70	0.3048	3.68E+04	1.67E-07	6.12E-03
	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.4897	9.88E+10	1.49E-01	2.6943	4.36E-02	16.72	0.3048	1.09E+06	1.53E-07	1.66E-01
	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.2656	5.36E+10	1.04E-01	2.9824	3.15E-02	22.74	0.3048	5.79E+05	1.07E-07	6.18E-02
	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.06142	1.24E+10	7.70E-02	3.2023	2.46E-02	20.03	0.3048	9.21E+04	8.47E-08	7.80E-03
	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.02057	4.15E+09	1.21E-01	2.8700	3.57E-02	20.28	0.3048	4.54E+04	1.25E-07	5.65E-03
	9.40E-03	5.45E+00	4.85E+00	2.02E+11	0.10043	2.03E+10	4.42E-02	3.7498	1.34E-02	13.48	0.3048	5.51E+04	6.01E-08	3.31E-03
Pu-242	5.43E-07	3.15E-04	2.80E-04	1.16E+07	0.26	3.03E+06	4.49E-02	3.7299	1.37E-02	13.97	0.3048	8.72E+00	6.07E-08	5.29E-07
Th-230	3.26E-08	1.89E-05	1.68E-05	6.99E+05	0.234	1.64E+05	6.77E-02	3.3138	2.17E-02	21.33	0.3048	1.14E+00	7.75E-08	8.85E-08
U-232	5.68E-08	3.30E-05	2.93E-05	1.22E+06	0.32	3.90E+05	5.78E-02	3.4464	1.87E-02	21.41	0.3048	2.36E+00	7.05E-08	1.66E-07
U-233	1.52E-09	8.81E-07	7.84E-07	3.26E+04	0.132	4.30E+03	4.24E-02	3.7991	1.27E-02	12.25	0 3048	1.01E-02	5.86E-08	5.90E-10
U-234	2.41E-05	1.40E-02	1.24E-02	5.17E+08	0.28	1.45E+08	5.32E-02	3.5288	1.71E-02	19.14	0.3048	7.15E+02	6.73E-08	4.81E-05
U-235	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.2451	3.56E+06	2.05E-01	2.4478	5.78E-02	12.34	0.3048	3.83E+01	2.23E-07	8.55E-06
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.2451	3.56E+06	1.63E-01	2.6264	4.71E-02	15.42	0.3048	3.90E+01	1.71E-07	6.66E-06
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.0798	1.16E+06	1.09E-01	2.9473	3.27E-02	21.95	0.3048	1.26E+01	1.12E-07	1.41E-06
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.117	1.70E+06	1.95E-01	2.4872	5.52E-02	12.97	0.3048	1.84E+01	2.11E-07	3.87E-06
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.0432	6.27E+05	1.41E-01	2.7443	4.12E-02	17.69	0.3048	6.90E+00	1.45E-07	9.97E-07
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.0126	1.83E+05	7.50E-02	3.2268	2.39E-02	20.30	0.3048	1.34E+00	8.31E-08	1.11E-07
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.0036	5.23E+04	5.13E-02	3.5636	1.64E-02	18.17	0.3048	2.35E-01	6.59E-08	1.55E-08
	6.76E-07	3.92E-04	3.49E-04	1.45E+07	0.0036	5.23E+04	3.15E-02	4.4978	5.88E-03	5.91	0.3048	2.74E-02	4.93E-08	1.35E-09
U-236	1.26E-06	7.29E-04	6.49E-04	2.70E+07	0.26	7.01E+06	4.94E-01	1.7579	1.29E-01	5.04	0.3048	6.90E+01	5.84E-07	4.03E-05
U-238	4.15E-07	2.41E-04	2.14E-04	8.91E+06	0.23	2.05E+06	4.95E-02	3.6011	1.58E-02	17.18	0.3048	8.37E+00	6.50E-08	5.44E-07
Ba-137m	1.02E+00	5.94E+02	5.29E+02	2.20E+13	1	2.20E+13	6.62E-01	1.5461	1.67E-01	3.91	0.3048	2.16E+08	7.89E-07	1.71E+02
Ce-144	3.21E-07	1.86E-04	1.65E-04	6.88E+06	0.18624	1.28E+06	1.34E-01	2.7908	3.91E-02	18.63	0.3048	1.41E+01	1.37E-07	1.93E-06
	3.21E-07	1.86E-04	1.65E-04	6.88E+06	0.0016128	1.11E+04	5.35E-02	3.5234	1.72E-02	19.28	0.3048	5.55E-02	6.75E-08	3.74E-09
	3.21E-07	1.86E-04	1.65E-04	6.88E+06	0.003648	2.51E+04	3.36E-02	4.3444	6.96E-03	7.13	0.3048	1.88E-02	5.10E-08	9.58E-10
	3.21E-07	1.86E-04	1.65E-04	6.88E+06	0.045	3.10E+05	8.01E-02	3.1653	2.56E-02	19.65	0.3048	2.35E+00	8.72E-08	2.05E-07
Co-60	8.67E-09	5.03E-06	4.47E-06	1.86E+05	0.9975	1.86E+05	1.33E+00	1.1189	2.82E-01	2.29	0.3048	1.81E+00	1.51E-06	2.73E-06
	8.67E-09	5.03E-06	4.47E-06	1.86E+05	0.9988	1.86E+05	1.12E+00	1.2210	2.48E-01	2.58	0.3048	1.80E+00	1.29E-06	2.32E-06
Cs-134	4.28E-04	2.48E-01	2.21E-01	9.19E+09	0.7	6.43E+09	6.05E-01	1.6126	1.54E-01	4.19	0.3048	6.25E+04	7.21E-07	4.51E-02
	4.28E-04	2.48E-01	2.21E-01	9.19E+09	0.7	6.43E+09	7.96E-01	1.4248	1.93E-01	3.32	0.3048	6.23E+04	9.46E-07	5.89E-02
Cs-137	1.09E+00	6.30E+02	5.60E+02	2.33E+13	0.946	2.20E+13	6.62E-01	1.5461	1.67E-01	3.91	0.3048	2.17E+08	7.89E-07	1.71E+02
Eu-152	6.45E-05	3.74E-02	3.33E-02	1.38E+09	0.015	2.08E+07	3.44E-01	2.0418	9.25E-02	7.24	0.3048	2.10E+02	3.97E-07	8.33E-05
	6.45E-05	3.74E-02	3.33E-02	1.38E+09	0.01	1.38E+07	1.22E-01	2.8662	3.59E-02	20.20	0.3048	1.51E+02	1.25E-07	1.90E-05
Eu-154	3.83E-03	2.22E+00	1.97E+00	8.21E+10	0.143	1.17E+10	1.23E-01	2.8580	3.62E-02	20.02	0.3048	1.29E+05	1.27E-07	1.63E-02
	3.83E-03	2.22E+00	1.97E+00	8.21E+10	0.33368	2.74E+10	1.27E+00	1.1467	2.72E-01	2.37	0.3048	2.67E+05	1.45E-06	3.87E-01
Eu-155	1.86E-03	1.08E+00	9.60E-01	3.99E+10	0.2574	1.03E+10	8.65E-02	3.1138	2.71E-02	20.83	0.3048	8.76E+04	9.23E-08	8.09E-03
	1.86E-03	1.08E+00	9.60E-01	3.99E+10	0.4606	1.84E+10	1.05E-01	2.9719	3.18E-02	22.50	0.3048	1.99E+05	1.08E-07	2.15E-02
	1.86E-03	1.08E+00	9.60E-01	3.99E+10	0.09	3.59E+09	6.00E-02	3.4067	1.96E-02	22.49	0.3048	2.39E+04	7.21E-08	1.72E-03
Sb-125	2.17E-09	1.26E-06	1.12E-06	4.65E+04	0.296	1.38E+04	4.28E-01	1.8673	1.14E-01	5.81	0.3048	1.37E-01	5.02E-07	6.88E-08
	2.17E-09	1.26E-06	1.12E-06	4.65E+04	0.17919	8.33E+03	6.01E-01	1.6164	1.53E-01	4.21	0.3048	8.10E-02	7.16E-07	5.80E-08
	2.17E-09	1.26E-06	1.12E-06	4.65E+04	0.11475	5.33E+03	6.36E-01	1.5817	1.60E-01	4.04	0.3048	5.19E-02	7.58E-07	3.93E-08
	2.17E-09	1.26E-06	1.12E-06	4.65E+04	0.104	4.83E+03	4.64E-01	1.8081	1.22E-01	5.38	0.3048	4.78E-02	5.47E-07	2.61E-08
Sm-151	1.86E-07	1.08E-04	9.58E-05	3.99E+06	0.009	3.59E+04	2.15E-02	7.2877	2.95E-04	3.02	0.3048	4.81E-04	3.52E-08	1.70E-11
I-129	1.59E-10	9.24E-08	8.22E-08	3.42E+03	1	3.42E+03	3.96E-02	3.8995	1.13E-02	10.35	0.3048	6.05E-03	5.61E-08	3.40E-10
		Total Activity	2.17E+03										Total	343
													% Cs	99.76%

Stream 320, using thicker cannister	Cannister Thickness	F(theta,x) Variable	Secant Integral, F(theta,x)	Buildup Factor	Cannister Radius	Particle Flux	Flux-to-Dose Rate Conversion	Estimated Dose
Radionuclides	m				m	particles/cm^2/sec	(rem/hr)/(part./cm^2/sec)	rem/hr
Ba-137m	0.02	2.44	5.86E-02	3.71	0.2848	6.36E+07	7.89E-07	50.17
Cs-137	0.02	2.44	5.86E-02	3.71	0.2848	6.37E+07	7.89E-07	50.27
							Total	100

2x10 Canister, UNEX Stream 320 (cont.)

Stream 320	Heat Generation Conversion	Activity	Heat Generation		We Fac.	PE-Ci		Atomic Wt.	Avogadro's	Half-life	Weight	Weighting Factor	Pu-239 FGE
Radionuclides	Watts/Ci	Ci	Watts					g/mol	1/mol	sec	g		
Am-241	3.28E-02	1.15E+00	3.78E-02		1	1.1531		241	6.02E+23	1.36E+10	3.36E-01	1.87E-02	6.29E-03
Am-243	3.16E-02	4.76E-04	1.50E-05		1	0.0005		243	6.02E+23	2.32E+11	2.38E-03	1.29E-02	3.07E-05
Cm-242	3.62E-02	4.22E-04	1.53E-05		30	0.0000							
Cm-244	3.44E-02	3.07E-02	1.06E-03		1.9	0.0162		244	6.02E+23	5.71E+08	3.79E-04	9.00E-02	3.41E-05
Np-237	2.85E-02	4.66E-02	1.33E-03		1	0.0466		237	6.02E+23	6.75E+13	6.61E+01	1.50E-02	9.91E-01
Pu-238	3.26E-02	8.05E+00	2.62E-01		1.1	7.3218		238	6.02E+23	2.77E+09	4.70E-01	1.13E-01	5.31E-02
Pu-239	3.05E-02	1.01E+00	3.09E-02		1	1.0129		239	6.02E+23	7.60E+11	1.63E+01	1	1.63E+01
Pu-240	3.06E-02	2.33E-01	7.12E-03		1	0.2329		240	6.02E+23	2.07E+11	1.03E+00	2.25E-02	2.31E-02
Pu-241	3.18E-05	4.85E+00	1.54E-04		51	0.0951		241	6.02E+23	4.54E+08	4.71E-02	2.25	1.06E-01
Pu-242	2.90E-02	2.80E-04	8.12E-06		1.1	0.0003		242	6.02E+23	1.18E+13	7.10E-02	7.50E-03	5.33E-04
Th-230	2.77E-02	1.68E-05	4.66E-07										
U-232	3.15E-02	2.93E-05	9.23E-07										
U-233	2.86E-02	7.84E-07	2.24E-08		3.9	2.01E-07		233	6.02E+23	5.02E+12	8.13E-05	1	8.13E-05
U-234	2.82E-02	1.24E-02	3.51E-04										
U-235	2.70E-02	3.49E-04	9.43E-06					235	6.02E+23	2.22E+16	1.61E+02	1	1.61E+02
U-236	2.67E-02	6.49E-04	1.73E-05										
U-238	2.48E-02	2.14E-04	5.32E-06										
					Total	9.9						Total	178.9
Ba-137m	3.54E-03	5.29E+02	1.87E+00										
Ce-144	6.10E-04	1.65E-04	1.01E-07										
Co-60	1.54E-02	4.47E-06	6.89E-08										
Cs-134	1.01E-02	2.21E-01	2.24E-03										
Cs-135	3.99E-04	1.12E-02	4.45E-06										
Cs-137	1.11E-03	5.60E+02	6.21E-01										
Eu-152	7.39E-03	3.33E-02	2.46E-04										
Eu-154	8.72E-03	1.97E+00	1.72E-02										
Eu-155	6.49E-04	9.60E-01	6.23E-04										
Pm-147	3.67E-04	1.41E-05	5.16E-09										
Pr-144	7.35E-03												
Ni-63	1.02E-04	9.04E-06	9.17E-10										
Ru-106	5.95E-05	9.27E-09	5.51E-13										
Sb-125	3.09E-03	1.12E-06	3.45E-09										
Sm-151	1.17E-04	9.58E-05	1.12E-08										
Sr-90	1.16E-03	5.15E+02	5.97E-01										
Tc-99	6.00E-04	2.11E-03	1.27E-06										
Y-90	5.54E-03	5.15E+02	2.85E+00										
H-3	3.37E-05	6.71E-06	2.26E-10										
I-129	4.72E-04	8.22E-08	3.88E-11										
		Total	6.30E+00										

55 Gallon Drum, Modified UNEX Stream 530

Stream 530		Density= 1400 kg/m^3	Canister Volume= 0.2315 m^3	Total Volumetric Source Rate	Branching Ratio	Photon Volumetric Source Rate	Photon Energy	Buildup Factor	Cannister Radius	F(theta,x) Variable	Secant Integral, F(theta,x)	Particle Flux	Flux-to-Dose Rate Conversion	Estimated Dose
Radionuclides	Ci/kg	Ci/m^3	Ci	particles/m^3/sec		photons/m^3/sec	MeV		m			particles/cm^2/sec	(mrem/hr)/(part./cm^2/sec)	rem/hr
Am-243	2.23E-08	3.13E-05	7.24E-06	1.16E+06	0.8096	9.36E+05	7.47E-02	122.73	0.2921	6.9726	5.52E-04	9.16E-01	8.28E-08	7.59E-08
	2.23E-08	3.13E-05		1.16E+06	0.0704	8.14E+04	4.35E-02	86.39	0.2921	8.1344	1.20E-04	1.22E-02	5.95E-08	7.29E-10
	2.23E-08	3.13E-05		1.16E+06	0.0704	8.14E+04	3.11E-02	21.93	0.2921	9.7662	2.17E-05	5.61E-04	4.90E-08	2.75E-11
	2.23E-08	3.13E-05		1.16E+06	0.106	1.23E+05	1.18E-01	268.06	0.2921	6.1039	1.04E-03	4.93E-01	1.21E-07	5.97E-08
Cm-242	1.98E-08	2.77E-05	6.41E-06	1.03E+06	0.26	2.67E+05	4.41E-02	90.90	0.2921	8.1011	1.25E-04	4.37E-02	6.00E-08	2.62E-09
Cm-244	1.44E-06	2.02E-03	4.67E-04	7.47E+07	0.233	1.74E+07	4.28E-02	80.75	0.2921	8.1774	1.15E-04	2.34E+00	5.89E-08	1.38E-07
Np-237	2.41E-06	3.37E-03	7.81E-04	1.25E+08	0.2209	2.76E+07	8.65E-02	146.42	0.2921	6.7218	5.37E-04	3.14E+01	9.22E-08	2.89E-06
	2.41E-06	3.37E-03		1.25E+08	0.2491	3.11E+07	2.94E-02	17.25	0.2921	10.3860	1.14E-05	8.82E-02	4.70E-08	4.15E-09
	2.41E-06	3.37E-03		1.25E+08	0.2741	3.42E+07	5.72E-02	213.75	0.2921	7.4643	2.44E-04	2.59E+01	7.00E-08	1.81E-06
Pu-238	3.82E-04	5.34E-01	1.24E-01	1.98E+10	0.28	5.53E+09	4.35E-02	86.06	0.2921	8.1369	1.20E-04	8.27E+02	5.95E-08	4.92E-05
Pu-239	4.80E-05	6.71E-02	1.55E-02	2.48E+09	0.151	3.75E+08	1.30E-02	606.55	0.2921	7.6919	1.92E-04	6.32E+02	1.54E-08	9.75E-06
	4.80E-05	6.71E-02		2.48E+09	0.73	1.81E+09	7.50E-05	1.00	0.2921	218.1903	1.47E-96	3.86E-92	1.00E-20	3.86E-112
Pu-240	1.11E-05	1.55E-02	3.59E-03	5.73E+08	0.266	1.52E+08	4.52E-02	100.86	0.2921	8.0309	1.34E-04	2.99E+01	6.10E-08	1.82E-06
Pu-241	2.30E-04	3.23E-01	7.47E-02	1.19E+10	0.0166	1.98E+08	1.60E-01	194.24	0.2921	5.7010	1.60E-03	8.90E+02	1.67E-07	1.48E-04
	2.30E-04	3.23E-01		1.19E+10	0.4897	5.85E+09	1.49E-01	214.30	0.2921	5.8155	1.41E-03	2.56E+04	1.53E-07	3.91E-03
	2.30E-04	3.23E-01		1.19E+10	0.2656	3.17E+09	1.04E-01	318.13	0.2921	6.4375	7.27E-04	1.06E+04	1.07E-07	1.13E-03
	2.30E-04	3.23E-01		1.19E+10	0.06142	7.33E+08	7.70E-02	110.68	0.2921	6.9121	4.39E-04	5.15E+02	8.47E-08	4.36E-05
	2.30E-04	3.23E-01		1.19E+10	0.02057	2.46E+08	1.21E-01	274.66	0.2921	6.1948	9.42E-04	9.19E+02	1.25E-07	1.15E-04
	2.30E-04	3.23E-01		1.19E+10	0.10043	1.20E+09	4.42E-02	91.90	0.2921	8.0939	1.26E-04	2.00E+02	6.01E-08	1.20E-05
Pu-242	1.32E-08	1.85E-05	4.29E-06	6.86E+05	0.26	1.78E+05	4.49E-02	97.96	0.2921	8.0509	1.32E-04	3.32E-02	6.07E-08	2.02E-09
Th-230	7.88E-10	1.10E-06	2.55E-07	4.08E+04	0.234	9.55E+03	6.77E-02	168.57	0.2921	7.1527	3.40E-04	7.92E-03	7.75E-08	6.14E-10
U-232	1.38E-09	1.93E-06	4.46E-07	7.13E+04	0.32	2.28E+04	5.78E-02	220.46	0.2921	7.4390	2.51E-04	1.83E-02	7.05E-08	1.29E-09
U-233	3.68E-11	5.15E-08	1.19E-08	1.90E+03	0.132	2.51E+02	4.24E-02	77.83	0.2921	8.2005	1.12E-04	3.18E-05	5.86E-08	1.86E-12
U-234	5.84E-07	8.18E-04	1.89E-04	3.03E+07	0.28	8.47E+06	5.32E-02	175.91	0.2921	7.6169	2.08E-04	4.48E+00	6.73E-08	3.02E-07
U-235	1.64E-08	2.29E-05	5.31E-06	8.49E+05	0.2451	2.08E+05	2.05E-01	131.95	0.2921	5.2836	2.50E-03	9.94E-01	2.23E-07	2.22E-07
	1.64E-08	2.29E-05		8.49E+05	0.2451	2.08E+05	1.63E-01	188.76	0.2921	5.6691	1.65E-03	9.39E-01	1.71E-07	1.60E-07
	1.64E-08	2.29E-05		8.49E+05	0.0798	6.77E+04	1.09E-01	304.15	0.2921	6.3617	7.89E-04	2.35E-01	1.12E-07	2.64E-08
	1.64E-08	2.29E-05		8.49E+05	0.117	9.93E+04	1.95E-01	143.46	0.2921	5.3685	2.29E-03	4.71E-01	2.11E-07	9.91E-08
	1.64E-08	2.29E-05		8.49E+05	0.0432	3.67E+04	1.41E-01	230.56	0.2921	5.9235	1.26E-03	1.54E-01	1.45E-07	2.23E-08
	1.64E-08	2.29E-05		8.49E+05	0.0126	1.07E+04	7.50E-02	121.15	0.2921	6.9651	4.15E-04	7.77E-03	8.31E-08	6.46E-10
	1.64E-08	2.29E-05		8.49E+05	0.0036	3.06E+03	5.13E-02	158.90	0.2921	7.6920	1.92E-04	1.35E-03	6.59E-08	8.89E-11
	1.64E-08	2.29E-05		8.49E+05	0.0036	3.06E+03	3.15E-02	23.24	0.2921	9.7086	2.31E-05	2.37E-05	4.93E-08	1.17E-12
U-236	3.04E-08	4.26E-05	9.86E-06	1.58E+06	0.26	4.10E+05	4.94E-01	28.52	0.2921	3.7945	1.26E-02	2.14E+00	5.84E-07	1.25E-06
U-238	1.00E-08	1.41E-05	3.26E-06	5.20E+05	0.23	1.20E+05	4.95E-02	142.60	0.2921	7.7729	1.76E-04	4.35E-02	6.50E-08	2.83E-09
Ba-137m	5.87E-05	8.22E-02	1.90E-02	3.04E+09	1	3.04E+09	6.62E-01	18.40	0.2921	3.3173	2.14E-02	1.73E+04	7.89E-07	1.36E-02
Ce-144	7.76E-09	1.09E-05	2.51E-06	4.02E+05	0.18624	7.48E+04	1.34E-01	246.35	0.2921	6.0240	1.13E-03	3.02E-01	1.37E-07	4.14E-08
	7.76E-09	1.09E-05		4.02E+05	0.0016128	6.48E+02	5.35E-02	178.65	0.2921	7.6052	2.11E-04	3.53E-04	6.75E-08	2.38E-11
	7.76E-09	1.09E-05		4.02E+05	0.003648	1.47E+03	3.36E-02	31.27	0.2921	9.3773	3.26E-05	2.16E-05	5.10E-08	1.10E-12
	7.76E-09	1.09E-05		4.02E+05	0.045	1.81E+04	8.01E-02	97.82	0.2921	6.8324	4.78E-04	1.22E-02	8.72E-08	1.06E-09
Co-60	1.50E-05	2.09E-02	4.85E-03	7.75E+08	0.9975	7.73E+08	1.33E+00	7.55	0.2921	2.4152	5.85E-02	4.94E+03	1.51E-06	7.46E-03
	1.50E-05	2.09E-02		7.75E+08	0.9988	7.74E+08	1.12E+00	9.32	0.2921	2.6356	4.57E-02	4.77E+03	1.29E-06	6.15E-03
Cs-134	1.72E-08	2.41E-05	5.57E-06	8.91E+05	0.7	6.24E+05	6.05E-01	20.97	0.2921	3.4807	1.79E-02	3.37E+00	7.21E-07	2.43E-06
	1.72E-08	2.41E-05		8.91E+05	0.7	6.24E+05	7.96E-01	14.22	0.2921	3.0754	2.80E-02	3.58E+00	9.46E-07	3.39E-06
Cs-137	6.22E-05	8.70E-02	2.01E-02	3.22E+09	0.946	3.05E+09	6.62E-01	18.70	0.2921	3.3600	2.04E-02	1.68E+04	7.89E-07	1.33E-02
Eu-152	1.56E-06	2.19E-03	5.06E-04	8.09E+07	0.015	1.21E+06	3.44E-01	52.62	0.2921	4.4073	6.47E-03	5.97E+00	3.97E-07	2.37E-06
	1.56E-06	2.19E-03		8.09E+07	0.01	8.09E+05	1.22E-01	273.28	0.2921	6.1868	9.51E-04	3.04E+00	1.25E-07	3.80E-07
Eu-154	9.29E-05	1.30E-01	3.01E-02	4.81E+09	0.143	6.89E+08	1.23E-01	270.25	0.2921	6.1689	9.69E-04	2.61E+03	1.27E-07	3.30E-04
	9.29E-05	1.30E-01		4.81E+09	0.33368	1.61E+09	1.27E+00	8.00	0.2921	2.4752	5.47E-02	1.02E+04	1.45E-06	1.47E-02
Eu-155	4.50E-05	6.31E-02	1.46E-02	2.33E+09	0.2574	6.01E+08	8.65E-02	146.83	0.2921	6.7210	5.38E-04	6.86E+02	9.23E-08	6.33E-05
	4.50E-05	6.31E-02		2.33E+09	0.4606	1.07E+09	1.05E-01	313.90	0.2921	6.4148	7.45E-04	3.63E+03	1.08E-07	3.94E-04
	4.50E-05	6.31E-02		2.33E+09	0.09	2.10E+08	6.00E-02	244.05	0.2921	7.3534	2.75E-04	2.04E+02	7.21E-08	1.47E-05
Sb-125	3.80E-06	5.32E-03	1.23E-03	1.97E+08	0.296	5.83E+07	4.28E-01	36.16	0.2921	4.0305	9.76E-03	2.97E+02	5.02E-07	1.49E-04
	3.80E-06	5.32E-03		1.97E+08	0.17919	3.53E+07	6.01E-01	21.13	0.2921	3.4890	1.77E-02	1.91E+02	7.16E-07	1.37E-04
	3.80E-06	5.32E-03		1.97E+08	0.11475	2.26E+07	6.36E-01	19.69	0.2921	3.4141	1.92E-02	1.24E+02	7.58E-07	9.37E-05
	3.80E-06	5.32E-03		1.97E+08	0.104	2.05E+07	4.64E-01	31.82	0.2921	3.9028	1.12E-02	1.06E+02	5.47E-07	5.78E-05
Sm-151	3.21E-04	4.49E-01	1.04E-01	1.66E+10	0.009	1.49E+08	2.15E-02	5.86	0.2921	15.7305	4.49E-08	5.68E-04	3.52E-08	2.00E-11
I-129	4.62E-07	6.47E-04	1.50E-04	2.39E+07	1	2.39E+07	3.96E-02	58.40	0.2921	8.4170	8.95E-05	1.81E+00	5.61E-08	1.01E-07
		Total Activity	4.82E-01										Gamma Total	0.062
													Gamma + Beta	0.144

55 Gallon Drum, Modified UNEX Stream 530 (cont.)

Stream 530	Heat Generation Conversion	Activity	Heat Generation		Weighting Factor	PE-Ci		Atomic Wt.	Avogadro's	Half-life	Weight	Weighting Factor	Pu-239 FGE
Radionuclides	Watts/Ci	Ci	Watts					g/mol	1/mol	sec	g		
Am-241	3.28E-02	1.75E-02	5.74E-04		1	1.75E-02		241	6.02E+23	1.36E+10	5.11E-03	1.87E-02	9.56E-05
Am-243	3.16E-02	7.24E-06	2.29E-07		1	7.24E-06		243	6.02E+23	2.32E+11	3 62E-05	1.29E-02	4.67E-07
Cm-242	3.62E-02	6.41E-06	2.32E-07		30	2.14E-07							
Cm-244	3.44E-02	4.67E-04	1.61E-05		1.9	2.46E-04		244	6.02E+23	5.71E+08	5.77E-06	9.00E-02	5.19E-07
Np-237	2.85E-02	7.81E-04	2.23E-05		1	7.81E-04		237	6.02E+23	6.75E+13	1.11E+00	1.50E-02	1.66E-02
Pu-238	3.26E-02	1.24E-01	4.03E-03		1.1	1.12E-01		238	6.02E+23	2.77E+09	7.22E-03	1.13E-01	8.15E-04
Pu-239	3.05E-02	1.55E-02	4.74E-04		1	1.55E-02		239	6.02E+23	7.60E+11	2.50E-01	1	2.50E-01
Pu-240	3.06E-02	3.59E-03	1.10E-04		1	3.59E-03		240	6.02E+23	2.07E+11	1.58E-02	2.25E-02	3.55E-04
Pu-241	3.18E-05	7.47E-02	2.37E-06		51	1.46E-03		241	6.02E+23	4 54E+08	7.25E-04	2.25	1.63E-03
Pu-242	2.90E-02	4.29E-06	1.25E-07		1.1	3.90E-06		242	6.02E+23	1.18E+13	1.09E-03	7.50E-03	8 17E-06
Th-230	2.77E-02	2.55E-07	7.08E-09										
U-232	3.15E-02	4.46E-07	1.40E-08										
U-233	2.86E-02	1.19E-08	3.40E-10		3.9	3.06E-09		233	6.02E+23	5.02E+12	1.24E-06	1	1.24E-06
U-234	2.82E-02	1.89E-04	5.35E-06										
U-235	2.70E-02	5.31E-06	1.44E-07					235	6.02E+23	2.22E+16	2.46E+00	1	2.46E+00
U-236	2.67E-02	9.86E-06	2.64E-07										
U-238	2.48E-02	3.26E-06	8.09E-08										
					Total	0.152						Total	2.7
Ba-137m	3.54E-03	1.90E-02	6.73E-05										
Ce-144	6.10E-04	2.51E-06	1.53E-09										
Co-60	1.54E-02	4.85E-03	7.48E-05										
Cs-134	1.01E-02	5.57E-06	5.66E-08										
Cs-135	3.99E-04	2.60E-07	1.04E-10										
Cs-137	1.11E-03	2.01E-02	2.23E-05										
Eu-152	7.39E-03	5.06E-04	3.74E-06										
Eu-154	8.72E-03	3.01E-02	2.63E-04										
Eu-155	6.49E-04	1.46E-02	9.48E-06										
Pm-147	3.67E-04	1.52E-02	5.60E-06										
Pr-144	7.35E-03												
Ni-63	1.02E-04	9.80E-03	9.95E-07										
Ru-106	5.95E-05	1.00E-05	5.98E-10										
Sb-125	3.09E-03	1.23E-03	3.81E-06										
Sm-151	1.17E-04	1.04E-01	1.21E-05										
Sr-90	1.16E-03	7.55E-03	8.76E-06										
Tc-99	6.00E-04	3.57E-03	2.15E-06										
Y-90	5.54E-03	7.55E-03	4.18E-05										
H-3	3.37E-05	7.27E-03	2.45E-07										
I-129	4.72E-04	1.50E-04	7.07E-08										
		Total	5.75E-03										

Tank T-202-14, UNEX Stream 210

Stream 210	Density= 1.02 g/cc	Total Volumetric Source Rate	Branching Ratio	Photon Volumetric Source Rate	Photon Energy	Cannister Thickness	F(theta,x) Variable	Secant Integral, F(theta,x)	Buildup Factor	Cannister Radius	Particle Flux	Flux-to-Dose Rate Conversion	Estimated Dose
Radionuclides	Ci/liter	particles/m^3/sec		photons/cc/sec	MeV	m				m	particles/cm^2/sec	(rem/hr)/(part./cm^2/sec)	rem/hr
Am-243	7.12E-08	2.63E+06	0.8096	2.13E+06	7.47E-02	0.003	12.9095	1.00E-06	114.45	0.762	4.64E-03	8.28E-08	3.84E-10
	7.12E-08	2.63E+06	0.0704	1.85E+05	4.35E-02	0.003	15.0606	1.00E-06	79.96	0.762	2.82E-04	5.95E-08	1.68E-11
	7.12E-08	2.63E+06	0.0704	1.85E+05	3.11E-02	0.003	18.0818	1.00E-06	20.94	0.762	7.39E-05	4.90E-08	3.62E-12
	7.12E-08	2.63E+06	0.106	2.79E+05	1.18E-01	0.003	11.3012	1.00E-06	237.67	0.762	1.26E-03	1.21E-07	1.53E-10
Cm-242	6.31E-08	2.34E+06	0.26	6.07E+05	4.41E-02	0.003	14.9990	1.00E-06	84.03	0.762	9.70E-04	6.00E-08	5.82E-11
Cm-244	4.60E-06	1.70E+08	0.233	3.96E+07	4.28E-02	0.003	15.1402	1.00E-06	74.88	0.762	5.64E-02	5.89E-08	3.32E-09
Np-237	6.97E-06	2.58E+08	0.2209	5.70E+07	8.65E-02	0.003	12.4452	1.00E-06	135.22	0.762	1.47E-01	9.22E-08	1.35E-08
	6.97E-06	2.58E+08	0.2491	6.43E+07	2.94E-02	0.003	19.2294	1.00E-06	16.56	0.762	2.02E-02	4.70E-08	9.52E-10
	6.97E-06	2.58E+08	0.2741	7.07E+07	5.72E-02	0.003	13.8199	1.00E-06	192.84	0.762	2.59E-01	7.00E-08	1.82E-08
Pu-238	1.21E-03	4.46E+10	0.28	1.25E+10	4.35E-02	0.003	15.0651	1.00E-06	79.67	0.762	1.89E+01	5.95E-08	1.12E-06
Pu-239	1.52E-04	5.61E+09	0.151	8.47E+08	1.30E-02	0.003	14.2413	1.00E-06	531.98	0.762	8.56E+00	1.54E-08	1.32E-07
	1.52E-04	5.61E+09	0.73	4.09E+09	7.50E-05	0.003	403.9712	1.00E-06	1.00	0.762	7.78E-02	1.00E-20	7.78E-22
Pu-240	3.48E-05	1.29E+09	0.266	3.43E+08	4.52E-02	0.003	14.8689	1.00E-06	92.98	0.762	6.06E-01	6.10E-08	3.70E-08
Pu-241	7.26E-04	2.69E+10	0.0166	4.46E+08	1.60E-01	0.003	10.5552	1.00E-06	172.88	0.762	1.47E+00	1.67E-07	2.44E-07
	7.26E-04	2.69E+10	0.4897	1.32E+10	1.49E-01	0.003	10.7673	1.00E-06	190.34	0.762	4.76E+01	1.53E-07	7.26E-06
	7.26E-04	2.69E+10	0.2656	7.13E+09	1.04E-01	0.003	11.9187	1.00E-06	281.21	0.762	3.81E+01	1.07E-07	4.07E-06
	7.26E-04	2.69E+10	0.06142	1.65E+09	7.70E-02	0.003	12.7976	1.00E-06	103.79	0.762	3.26E+00	8.47E-08	2.76E-07
	7.26E-04	2.69E+10	0.02057	5.53E+08	1.21E-01	0.003	11.4695	1.00E-06	243.22	0.762	2.56E+00	1.25E-07	3.18E-07
	7.26E-04	2.69E+10	0.10043	2.70E+09	4.42E-02	0.003	14.9855	1.00E-06	84.93	0.762	4.36E+00	6.01E-08	2.62E-07
Pu-242	4.19E-08	1.55E+06	0.26	4.03E+05	4.49E-02	0.003	14.9059	1.00E-06	90.39	0.762	6.92E-04	6.07E-08	4.20E-11
Th-230	2.51E-09	9.30E+04	0.234	2.18E+04	6.77E-02	0.003	13.2430	1.00E-06	154.52	0.762	6.39E-05	7.75E-08	4.96E-12
U-232	4.39E-09	1.62E+05	0.32	5.20E+04	5.78E-02	0.003	13.7730	1.00E-06	198.69	0.762	1.96E-04	7.05E-08	1.38E-11
U-233	1.17E-10	4.34E+03	0.132	5.73E+02	4.24E-02	0.003	15.1828	1.00E-06	72.23	0.762	7.87E-07	5.86E-08	4.61E-14
U-234	1.86E-06	6.89E+07	0.28	1.93E+07	5.32E-02	0.003	14.1024	1.00E-06	159.66	0.762	5.85E-02	6.73E-08	3.94E-09
U-235	5.22E-08	1.93E+06	0.2451	4.74E+05	2.05E-01	0.003	9.7824	1.00E-06	118.43	0.762	1.07E-03	2.23E-07	2.38E-10
	5.22E-08	1.93E+06	0.2451	4.74E+05	1.63E-01	0.003	10.4962	1.00E-06	168.11	0.762	1.51E-03	1.71E-07	2.59E-10
	5.22E-08	1.93E+06	0.0798	1.54E+05	1.09E-01	0.003	11.7785	1.00E-06	269.00	0.762	7.89E-04	1.12E-07	8.86E-11
	5.22E-08	1.93E+06	0.117	2.26E+05	1.95E-01	0.003	9.9396	1.00E-06	128.51	0.762	5.52E-04	2.11E-07	1.16E-10
	5.22E-08	1.93E+06	0.0432	8.35E+04	1.41E-01	0.003	10.9672	1.00E-06	204.60	0.762	3.25E-04	1.45E-07	4.70E-11
	5.22E-08	1.93E+06	0.0126	2.43E+04	7.50E-02	0.003	12.8956	1.00E-06	113.05	0.762	5.23E-05	8.31E-08	4.35E-12
	5.22E-08	1.93E+06	0.0036	6.96E+03	5.13E-02	0.003	14.2415	1.00E-06	144.66	0.762	1.91E-05	6.59E-08	1.26E-12
	5.22E-08	1.93E+06	0.0036	6.96E+03	3.15E-02	0.003	17.9751	1.00E-06	22.17	0.762	2.93E-06	4.93E-08	1.44E-13
U-236	9.70E-08	3.59E+06	0.26	9.34E+05	4.94E-01	0.003	7.0253	1.00E-06	26.52	0.762	4.71E-04	5.84E-07	2.75E-10
U-238	3.20E-08	1.19E+06	0.23	2.73E+05	4.95E-02	0.003	14.3913	1.00E-06	130.23	0.762	6.75E-04	6.50E-08	4.39E-11
Ba-137m	7.91E-02	2.93E+12	1	2.93E+12	6.62E-01	0.003	6.2209	1.00E-02	17.53	0.762	9.76E+06	7.89E-07	7.70E+00
Ce-144	2.48E-08	9.16E+05	0.18624	1.71E+05	1.34E-01	0.003	11.1532	1.00E-06	218.43	0.762	7.08E-04	1.37E-07	9.72E-11
	2.48E-08	9.16E+05	0.001613	1.48E+03	5.35E-02	0.003	14.0808	1.00E-06	162.07	0.762	4.55E-06	6.75E-08	3.07E-13
	2.48E-08	9.16E+05	0.003648	3.34E+03	3.36E-02	0.003	17.3617	1.00E-06	29.65	0.762	1.88E-06	5.10E-08	9.61E-14
	2.48E-08	9.16E+05	0.045	4.12E+04	8.01E-02	0.003	12.6499	1.00E-06	92.34	0.762	7.23E-05	8.72E-08	6.31E-12
Co-60	6.69E-10	2.48E+04	0.9975	2.47E+04	1.33E+00	0.003	4.4716	1.00E-02	7.19	0.762	3.37E-02	1.51E-06	5.09E-08
	6.69E-10	2.48E+04	0.9988	2.47E+04	1.12E+00	0.003	4.8797	1.00E-02	8.84	0.762	4.16E-02	1.29E-06	5.36E-08
Cs-134	3.30E-05	1.22E+09	0.7	8.56E+08	6.05E-01	0.003	6.4444	1.00E-02	19.62	0.762	3.19E+03	7.21E-07	2.30E-03
	3.30E-05	1.22E+09	0.7	8.56E+08	7.96E-01	0.003	5.6941	1.00E-02	13.40	0.762	2.18E+03	9.46E-07	2.06E-03
Cs-137	8.38E-02	3.10E+12	0.946	2.93E+12	6.62E-01	0.003	6.2209	1.00E-02	17.53	0.762	9.78E+06	7.89E-07	7.71E+00
Eu-152	4.98E-06	1.84E+08	0.015	2.76E+06	3.44E-01	0.003	8.1599	1.00E-02	48.29	0.762	2.54E+01	3.97E-07	1.01E-05
	4.98E-06	1.84E+08	0.01	1.84E+06	1.22E-01	0.003	11.4546	1.00E-02	242.01	0.762	8.48E+01	1.25E-07	1.06E-05
Eu-154	2.95E-04	1.09E+10	0.143	1.56E+09	1.23E-01	0.003	11.4215	1.00E-02	239.36	0.762	7.12E+04	1.27E-07	9.00E-03
	2.95E-04	1.09E+10	0.33368	3.65E+09	1.27E+00	0.003	4.5828	1.00E-02	7.61	0.762	5.28E+03	1.45E-06	7.65E-03
Eu-155	1.44E-04	5.31E+09	0.2574	1.37E+09	8.65E-02	0.003	12.4438	1.00E-02	135.57	0.762	3.52E+04	9.23E-08	3.25E-03
	1.44E-04	5.31E+09	0.4606	2.45E+09	1.05E-01	0.003	11.8767	1.00E-02	277.52	0.762	1.29E+05	1.08E-07	1.40E-02
	1.44E-04	5.31E+09	0.09	4.78E+08	6.00E-02	0.003	13.6145	1.00E-02	219.25	0.762	1.99E+04	7.21E-08	1.44E-03
Sb-125	1.67E-10	6.19E+03	0.296	1.83E+03	4.28E-01	0.003	7.4623	1.00E-02	33.45	0.762	1.16E-02	5.02E-07	5.85E-09
	1.67E-10	6.19E+03	0.17919	1.11E+03	6.01E-01	0.003	6.4597	1.00E-02	19.77	0.762	4.17E-03	7.16E-07	2.98E-09
	1.67E-10	6.19E+03	0.11475	7.10E+02	6.36E-01	0.003	6.3210	1.00E-02	18.44	0.762	2.49E-03	7.58E-07	1.89E-09
	1.67E-10	6.19E+03	0.104	6.44E+02	4.64E-01	0.003	7.2260	1.00E-02	29.52	0.762	3.61E-03	5.47E-07	1.97E-09
Sm-151	1.43E-08	5.30E+05	0.009	4.77E+03	2.15E-02	0.003	29.1244	1.00E-02	5.81	0.762	5.27E-03	3.52E-08	1.86E-10
I-129	1.23E-11	4.55E+02	1	4.55E+02	3.96E-02	0.003	15.5838	1.00E-02	54.57	0.762	4.72E-03	5.61E-08	2.65E-10
												Total	15

Tank T-202-14, UNEX Stream 210 (cont.)

Calculation for Hot Cell Thickness, Stream 210	Density= 1.02 g/cc	Total Volumetric Source Rate	Branching Ratio	Photon Volumetric Source Rate	Photon Energy	Concrete Thickness	F(theta,x) Variable	Secant Integral, F(theta,x)	Buildup Factor	Cannister Radius	Particle Flux	Flux-to-Dose Rate Conversion	Estimated Dose
Radionuclides	Ci/liter	particles/m^3/sec		photons/cc/sec	MeV	m				m	particles/cm^2/sec	(rem/hr)/(part./cm^2/sec)	rem/hr
Ba-137m	7.91E-02	2.93E+12	1	2.93E+12	6.62E-01	0.6096	18.0179	4.30E-09	17.53	0.762	3.00E+00	7.89E-07	2.37E-06
Cs-137	8.38E-02	3.10E+12	0.946	2.93E+12	6.62E-01	0.6096	18.0179	4.30E-09	17.53	0.762	3.01E+00	7.89E-07	2.37E-06
													4.74E-06

Appendix J

Hydrogen Generation Analysis

Purpose

To determine compliance with gas generation and other transportation requirements for INEEL RH-TRU waste consisting of a column of 500 kg of guanidine carbonate which will be directly loaded in an RH-TRU canister.

Parameters Evaluated

⇒ Hydrogen gas generation rate

⇒ Decay Heat

⇒ Fissile Requirements

⇒ Shielding Requirements

Assumptions

It is assumed that the waste would have met the following requirements prior to transportation:

⇒ Restrictions on physical and chemical form of the RH-TRU waste as defined in Appendix 1.3.7 of the SAR

⇒ Restrictions on chemicals to ensure chemical compatibility as defined in Appendix 1.3.7 of the SAR

Based on the description provided for the waste form it is evident that the following requirements have been met:

⇒ Weight

⇒ Fissile Requirements as per restrictions provided in Section 9.3 of Appendix 1.3.7 of the SAR (See Attached Excel Spreadsheet)

⇒ Shielding Requirements as per curie limits provided in Section 12.0 of Appendix 1.3.7 of the SAR

Evaluation of Compliance with Gas Generation Requirements

Two options are available to evaluate compliance of RH-TRU waste with the gas generation requirements:

⇒ Option 1 – Convert 5% restriction on hydrogen concentration to a limit on the allowable hydrogen generation rate and evaluate for compliance with the rate requirements

⇒ Option 2 – Convert 5% restriction on hydrogen concentration into a limit on the allowable decay heat per waste container and evaluate for compliance with the decay heat requirements

Based on the data provided, the maximum allowable gas generation rates as per Option 1 and the maximum allowable decay heat limits as per Option 2 were calculated to be 3.5421E-07 moles/second/canister and 0.566 watts/canister respectively. These calculations were based on the following assumptions:

⇒ Volume of column is 31.4 cubic feet (889 liters)

⇒ Bulk density of waste (based on 500 kg of column and its volume of 889 liters) is 0.562 g/cc

⇒ Solid density for guanidine carbonate is 1240 kg/cubic meter

⇒ Void Volume within the canister calculated as void volume within the waste matrix (porosity times total volume = 486 liters) plus void volume in the canister (volume of canister – volume of column assumed to be negligible) is 486 liters

⇒ G value conservatively assumed to be 6.35 based on the worst case value for organic nitrogen compounds (pyrollidine) as Guanidine carbonate currently does not have a G value

⇒ Waste contains 10% moisture

⇒ The effective G value is based on 90% of guanidine carbonate and 10% of water (1.6) and is equal to 5.875

The decay heat value for the waste form based on the isotopic data provided was calculated to be 1.86 watts, which fails the decay heat limit and therefore, the waste form will need to be subjected to gas generation testing as per Option 1. This being a homogenous waste matrix, a small sample of the waste may be subjected to testing methodology as described in Attachment 2 of Appendix 1.3.7 of the SAR for evaluating compliance with the gas generation rate requirements.

Conclusion

The waste form fails the decay heat limit requirements based on assumptions described earlier and shall be subjected to gas generation testing for evaluating compliance with the gas generation requirements.

Radionuclide	Ci/kg	Total curies, assuming	Specific Activity, ci/g	grams of fissile rads	Pu239FGE	Sum FGE
^{241}Am	6.58E-04	3.29E-01	3.47E+00	9.48E-02	1.87E-02	1.77E-03
243Am	2.72E-07	1.36E-04	2.02E-01	6.73E-04	1.29E-02	8.69E-06
242Cm	2.41E-07	1.21E-04	3.35E+03	3.60E-08	0	0.00E+00
244Cm	1.75E-05	8.75E-03	8.18E+01	1.07E-04	9.00E-02	9.63E-06
237Np	2.66E-05	1.33E-02	7.13E-04	1.87E+01	1.50E-02	2.80E-01
238Pu	4.60E-03	2.30E+00	1.73E+01	1.33E-01	1.13E-01	1.50E-02
239Pu	5.78E-04	2.89E-01	6.29E-02	4.59E+00	1	4.59E+00
240Pu	1.33E-04	6.65E-02	2.30E-01	2.89E-01	2.25E-02	6.51E-03
241Pu	2.77E-03	1.39E+00	1.04E+02	1.33E-02	2.25	3.00E-02
242Pu	1.60E-07	8.00E-05	3.97E-03	2.02E-02	7.50E-03	1.51E-04
230Th	9.59E-09	4.80E-06	2.04E-02	2.35E-04	0	0.00E+00
232U	1.67E-08	8.35E-06	2.16E+01	3.87E-07	0	0.00E+00
233U	4.47E-10	2.24E-07	9.76E-03	2.29E-05	1	2.29E-05
234U	7.10E-06	3.55E-03	6.32E-03	5.62E-01	0	0.00E+00
235U	1.99E-07	9.95E-05	2.19E-06	4.54E+01	1	4.54E+01
236U	3.70E-07	1.85E-04			0	0.00E+00
238U	1.22E-07	6.10E-05			0	0.00E+00
137Ba	0.302	1.51E+02			0	0.00E+00
144Ce	9.44E-08	4.72E-05			0	0.00E+00
60Co	2.55E-09	1.28E-06			0	0.00E+00
134Cs	1.26E-04	6.30E-02			0	0.00E+00
135Cs	6.37E-06	3.19E-03			0	0.00E+00
137Cs	0.32	1.60E+02			0	0.00E+00
152Eu	1.90E-05	9.50E-03			0	0.00E+00
154Eu	1.13E-03	5.65E-01			0	0.00E+00
155Eu	5.48E-04	2.74E-01			0	0.00E+00
147Pm	8.03E-09	4.02E-06			0	0.00E+00
63Ni	5.16E-09	2.58E-06			0	0.00E+00
106Ru	5.29E-12	2.65E-09			0	0.00E+00
125Sb	6.38E-10	3.19E-07			0	0.00E+00
151Sm	5.47E-08	2.74E-05			0	0.00E+00
90Sr	0.294	1.47E+02			0	0.00E+00
99Tc	1.21E-06	6.05E-04			0	0.00E+00
90Y	0.294	1.47E+02			0	0.00E+00
3H	3.83E-09	1.92E-06			0	0.00E+00
129I	4.69E-11	2.35E-08			0	0.00E+00
		6.10E+02				5.04E+01