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ACRONYMS

ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASRS	Automatic Stacker/Retriever System
AC	Alternating Current
AE	Architect Engineer
AV	Automated Vehicle
BDAT	Best Demonstrated Available Technology
BFS	Blast Furnace Slag
CASS	Computer Automated Surveillance System
CCTV	Closed Circuit Television
CDR	Conceptual Design Report
CFR	Code of Federal Regulations
DC	Direct Current
DMS	Data Management System
DOE	United States Department of Energy
FACP	Fire Alarm Control Panel
FDC	Functional Design Criteria
FM	Factory Mutual
GPT	General Plant Telephone
HEPA	High Efficiency Particulate Air
HID	High Intensity Discharge
HLAN	Hanford Local Area Network
HMI	Human-Machine Interface
HVAC	Heating, Ventilation, and Air Conditioning
IEEE	Institute of Electrical and Electronic Engineers
IVDTS	Integrated Voice and Data Telecommunications System
LAN	Local Area Network
LIMS	Laboratory Information Management System
MIL-STD	Military Standard
MW	Mixed Waste (radioactive and hazardous constituents)
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturing Association
NFPA	National Fire Protection Association
NFPC	National Fire Protection Code
OIU	Operator Interface Units
OPC	Ordinary Portland Cement
PAX	Private Automatic Exchange
PCS	Plant Control System
PDM	Plant Data Management
PE	Polyethylene
PFA	Pulverized Fly Ash
PMS	Plant Management System
RCA	Radiological Controlled Area
RCRA	Resource Conservation and Recovery Act

ACRONYMS (continued)

RFAR	Radio Fire Alarm Reporting
SDC	Standard Design Criteria
SDRD	Supplemental Design Requirements Document
SMA	Sample Management Area
SPC	Special Protective Coatings
SWITS	Solid Waste Information Tracking System
SNP	Special Work Permit
SWB	Standard Waste Box
TBD	To Be Determined
UL	Underwriter Laboratories
UPS	Uninterruptable Power Supply
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company
WRAM	Westinghouse Radiation Area Monitoring
WRAP	Waste Receiving and Processing

DEFINITIONS

The following definitions are to be used when these words are used throughout this document.

Debris:

The EPA defines debris "as solid material exceeding 60-mm (2.5-inch) particle size that is: (1) A manufactured object; or (2) plant or animal matter; or (3) natural geologic material (e.g., cobbles and boulders)" (EPA 1992). A solid is a material that retains its shape at room temperature without a container. Obviously, liquids and gases are not debris, but liquids trapped within the matrix and even oozing out are allowed. The material must be greater than 60-mm, meaning at least one dimension is greater than 60 mm. Also, during treatment the debris cannot be reduced to particles smaller than 60 mm or the material is not considered debris except under certain conditions. The material must be intended for disposal; material in use (like a building) is not considered debris until use is discontinued.

The EPA debris definition has a number of exceptions and conditions including

- A specific treatment standard of Subpart D, part 268 (EPA 1991a), does not apply.
- A debris is not an intact, nonruptured container containing at least 75% of the original volume
- Debris is not soil or compacted clumps of fine-grained materials, like clay, which could agglomerate into particle sizes greater than 60 mm
- Debris is not process residues such as slag, incinerator ash, water-treatment sludges, etc.
- Cement is not debris if it used to stabilize hazardous waste
- Debris is not a radioactive waste with an established treatment standard per 40 CFR 268.42 table 3 (e.g., D008 lead subcategory)

Macroencapsulation:

Macroencapsulation is the application of surface coating materials such as polymeric organics (e.g., resins and plastics) or the use of a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. The treatment standard requires that the encapsulating material must completely encapsulate the debris (i.e., the encapsulant must

completely surround the debris and be unbroken). Further, the encapsulating material must be resistant to degradation by the debris and its contaminants and materials into which it may come into contact after placement (leachate, other waste, microbes) to ensure that the likelihood of migration of toxic contaminants has been substantially reduced.

Microencapsulation:

Microencapsulation is stabilization of the debris with the following reagents (or waste reagents) such that the leachability of the hazardous contaminants is reduced: Portland cement; or lime/pozzolans (e.g., fly ash and cement kiln dust). Reagents (e.g., iron salts, silicates, and clays) may be added to enhance the set/cure time and/or compressive strength, or to reduce the leachability of the hazardous constituents. The performance standard for microencapsulation requires that the leachability of the hazardous contaminants must be reduced.

Stabilization:

As defined in the RCRA Land Disposal Restrictions:

"Stabilization with the following reagents (or waste reagents) or combination of reagents: (1) Portland Cement; or (2) lime/pozzolans (i.e. fly ash, and cement kiln dust) - this does not preclude the addition of reagents (e.g. iron salts, silicates, and clays) designed to enhance the set/cure time and/or compressive strength, or to overall reduce the leachability of the metal or inorganic."

SUPPLEMENTAL DESIGN REQUIREMENTS DOCUMENT
PROJECT W100

1.0 INTRODUCTION

1.1 Background

The Supplemental Design Requirements Document (SDRD) is used to communicate plant design information from Westinghouse Hanford Company (WHC) to the United States Department of Energy (DOE) and the cognizant Architect Engineer (A/E). The SDRD is prepared after the completion of a project Conceptual Design Report (CDR) and prior to the initiation of definitive design. Information in the SDRD serves two purposes: to convey design requirements that are too detailed for inclusion in a Functional Design Criteria (FDC) report; and to serve as a means of change control for design commitments in the CDR and ACOR.

The Waste Receiving and Processing Module 2A (WRAP 2A) SDRD has been restructured from the equipment based outline used in previous SDRD's to a functional systems outline. This was done to facilitate identification of deficiencies in the information provided in the initial draft SDRD and aid design confirmation. The format and content of this SDRD adhere as closely as practicable to the requirements of WHC-CM-6-1, Standard Engineering Practices for Functional Design Criteria.

1.2 Scope

The mission of WRAP 2A on the Hanford site is the treatment of contact handled low level mixed waste (MLM) for final disposal. The overall systems engineering steps used to reach construction and operation of WRAP 2A are depicted in Figure 1. The WRAP 2A SDRD focuses on the requirements to address the functional analysis provided in Figure 1. This information is provided in sections 2 through 5 of this SDRD. The mission analysis and functional analysis are to be provided in a separate supporting document. The organization of sections 2 through 5 corresponds to the requirements identified in the WRAP 2A functional analysis.

WRAP 2A FUNCTIONAL ANALYSIS

FIGURE 1

1.3 Site Location

The WRAP 2A will be near the southwest corner of the intersection of 23rd Street and Dayton Avenue in the 200 West Area. The WRAP 2A facility will be adjacent to the WRAP 1 and Phase V storage buildings.

1.4 Project Interfaces

- a. All MW arriving at WRAP 2A will be sufficiently characterized to permit treatment with no further characterization sampling or analysis to confirm the incoming waste characteristics.
- b. The Phase V subproject shall be physically connected to WRAP 2A by a covered transfer corridor.
- c. The transfer point for all waste coming from or going to the W-112 subproject shall be at the interface of the WRAP 2A/W-112 transfer corridor. Any guided vehicle controls (Automated or otherwise) within WRAP 2A shall be provided as part of WRAP 2A design and shall interface with W-112 systems.
- d. All shipping and receiving of waste to or from WRAP 2A shall be through the Phase V subproject.
- e. All shipping and receiving of new empty 208 liter drums and empty product containers and consumable materials required to operate the WRAP 2A processes shall be through a WRAP 2A shipping and receiving area separate from the waste shipping and receiving area.
- f. Any samples of waste (during treatment), and final product (during or after treatment) shall be prepared in WRAP 2A and shipped through the Phase V subproject if shipment to a off site laboratory is required.
- g. All samples of materials used to operate the WRAP 2A processes and which are not contaminated shall be prepared in Module 2A and shipped through the WRAP 2A shipping and receiving area if shipment to a lab is required.
- h. WRAP 2A shall have provisions for future expansion to allow additional processes to be added to WRAP 2A. An area within the process area, 5 meters wide by 5 meters high shall be maintained free of obstructions to allow future expansion within the process area. Provisions for transfer of similar WRAP 2A type waste to the expansion shall also be provided. The size of the waste transfer area shall be based on the established size of the waste transfer corridor providing waste transfers to WRAP 2A. No additional facility utilities, services or features shall be added to support the expansion.

2.0 PROJECT CRITERIA

2.1 Project Design Bases

2.1.1 Functional Requirements

This document supplements SD-W100-FDC-001, Revision 2, Functional Design Criteria for Waste Receiving and Processing Facility Module 2A, Project W-100. As an extension of the FDC, the information in this SDRD shall not conflict with the FDC. The FDC shall govern when contradictions occur. The SDRD provides additional requirements, summarizes key WHC design guidance and establishes baseline technical agreements to be used in definitive design of the WRAP 2A facility.

The requirements provided in this document do not relieve the Design Engineer of any design initiative or responsibility. The information contained herein represents the WHC technical position based on experience with similar facilities and is in the interest of consistency with other DOE facilities where possible.

This document contains design bases and supplemental requirements which, if changed, could impact project cost or schedule. Therefore, deviations from this guidance must be made with WHC concurrence. Changes to this document will constitute a level II change in accordance with established WHC change control procedures.

2.1.2 Waste Feed Streams and Throughput Requirements

As shown in Figure 2, WRAP 2A must be capable of processing Debris simultaneously with Particulate and Sludge through either Polyethylene or Grout, but processing of Particulate and Sludge simultaneously through Polyethylene and Grout is not required. WRAP 2A must also be capable of processing Debris at reduced rates, simultaneously with campaigned waste.

WRAP-2A is required to be capable of processing a total annual volume of 29,000 cubic feet per year incoming waste (volume of incoming containers) based on single shift operation. Single shift operation is defined as one shift per operating day, 175 operating days per year, and 5.5-hours of actual operating time (includes all operations of startup, shutdown) per operating shift. WRAP 2A shall be designed to be capable of operating three shifts per day, five days per week, with the minimum throughput being 29,000 cubic feet per year incoming waste (volume of incoming containers) for each of the three shifts. Each of the three shifts is defined per operating day, 175 operating days per year, and 5.5-hours of actual operating time per operating shift. The 29,000 cubic feet per year will consist of several different types of waste, including campaigned waste during some years. The various combinations of waste types and yearly throughput which WRAP 2A shall be designed to accommodate is shown in Figure 2 above. A summary level description of the Waste Streams to be processed in WRAP 2A is provided in Tables 1 and 2.

FIGURE 2

Detailed descriptions of the waste feed streams is contained in supporting document WHC-SD-W100-RD-001.

WRAP 2A shall have the capability to treat the feedstreams through the specified treatment processes at the throughput rates specified in this section. The various throughput requirements for primary Waste Streams and campaign Waste Streams are summarized, respectively, in Tables 3 and 4.

Certain major unit operations (or functions) in WRAP 2A are perceived to be essential to meeting the throughput and simultaneous processing objectives. These major unit operations are shown in Figure 3. These major unit operations shall be designed to meet at least the throughput criteria identified in Table 5.

Table 1 WRAP 2A Primary Waste Streams

General Description				Waste Codes		Moisture	Bulk Density (lb/ft ³)	Receipt Packaging
Stream Identifier	Physical	Chemical	Characteristic & State	Listed				
1A 1B 1C 1D	183-K Waste	Dry to damp; powders, paste, and monoliths	Various inorganic salts; primarily nitrates and sulfates	D001, D007, W01, W02	P029, P030, P098, P104, P120, U123,	dry to 51 wtX	44-140	208 liter drums with rigid and/or flexible plastic liners; boxes with flexible plastic liners; 208 liter overpacked in 386 liter
2A	Ammonium Sulfate Powder	Dry Powdered solids	95 wtX Ammonium sulfate 2 wtX sodium 1 wtX silicon all others <1 wtX	D007, D009, W02	F001, F002, F003, F004, F005	dry	Ave 62	208 liter drums with rigid and/or flexible plastic liners
	Other C-018 Solids	Dry Powdered solids	88 wtX Sodium sulfate 6 wtX Silicon 2 wtX Potassium 1 wtX Nitrate 1 wtX Phosphate all others <1 wtX	D007, D009, W02	F001, F002, F003, F004, F005	dry	Ave 62	208 liter drums with rigid and/or flexible plastic liners
2B	IX Resins	Slurried plastic beads and granules	Styrene-divinyl benzene thermoset polymer	W02	F001, F002, F003, F004, F005	50 - 70 wtX	54	208 liter drums with rigid and/or flexible plastic liners
2C	Ferric Hydroxide Sludge	Damp Sludge	>99 wtX Ferric Hydroxide	unknown	None	70 - 80 wtX	140*	208 liter drums with rigid and/or flexible plastic liners
7	TIF Ash	Ash and slag; pieces of steel	Primarily silica and iron oxides	D002, D004, D005, D006, D007, D008, D009, D010, D011, W01, W02, W03	P029, P030, P120	none	100-250	208 liter drums with rigid and/or flexible plastic liners
9A	Particulate & Sludges	Dry to damp; powder to paste; solids & others	Variable	D001, D002, D004, D005, D006, D007, D010, D011, W01, W02, W03	None	dry - ?	Ave 68	208 & 386 liter drums with rigid and/or flexible plastic liners; boxes with flexible plastic liners;
9B	LBN Debris	Primarily dry miscellaneous materials	Variable	D001, D002, D003, D006, D007, D011, D018, W01, W02	F001, F002, F003, F005	none	31	208 liter drums with rigid and/or flexible plastic liners; boxes with flexible plastic liners

NOTE: Waste codes are preliminary evaluations. Final waste codes will be established at the time of waste generation and will be based on process knowledge, waste characterization or sampling.

* Presumably an error correct value most likely 60-90 lb/cf.

Table 2 WRAP 2A Campaign Waste Streams

Stream Identifier		General Description		Waste Codes		Moisture	Bulk Density (lb/ft ³)	Receipt Packaging
		Physical	Chemical	Characteristic & State	Listed			
SA1	Elemental Mercury	Liquid Elemental Mercury	Mercury	D009	U151	dry	30	36 and 208 liter drums with rigid and/or flexible plastic liners
SA2	Mercury Chemicals	Lab packs, sludges, batteries, light tubes, paints, absorbent	various inorganic salts & solutions	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, MC01, WT01, WT02	U151	dry & 10% liquid solutions	66	23, 136, and 208 liter drums with rigid and/or flexible plastic liners
SA3	Heterogenous Mercury	Debris, absorbent, batteries	various inorganic salts	D002, D005, D006, D008, D009, MC01, MC02, WT01, WT02	U151	none	36	36, 90, 136, and 208 liter drums with rigid and/or flexible plastic liners
SC1	Elemental Lead	Lead shielding and pipe	elemental lead	D008, WT01	none	none	74 - 97	9, 36, 45, 208, and 356-liter drums with rigid and/or flexible plastic liners; boxes with flexible plastic liners
SC2	Lead Chemicals	Lab packs & absorbent	various inorganic salts & solutions	D001, D006, MC01, WT02	none	dry & solutions	26	208 liter drums with rigid and/or flexible plastic liners
SC3	Heterogenous Lead	Debris, absorbent	various inorganic salts	D002, D003, D007, D008, MC01, WT01	none	none	35	208 liter drums with rigid and/or flexible plastic liners
9C	Contained Liquids	Lab packs & absorbent	various inorganic salts & solutions	D001, D002, D004, D005, D007, D010, D011, MC01, WT01, WT02	none	dry & solutions	37	22, 45, 68, 136, and 208 liter drums with rigid and/or flexible plastic liners

NOTE: Waste codes are preliminary evaluations. Final waste codes will be established at the time of waste generation and will be based on process knowledge, waste characterization or sampling.

Table 3 WRAP 2A Single Shift Throughput Requirements

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Primary Treatment Lines	Waste Categories Potentially Included	Throughput Requirements Cu Ft/year #Boxes/year		Comments
Grout Encapsulation	102 103-H Debris 98 Debris	11,600	30	During campaigning of special waste, this throughput requirement is reduced by 4,300 cf/year, but macroencapsulation of treated special wastes is required in addition to 7,300 cf/year of 98.
Grout Stabilization	1A 103-H Solidified Liquids 1B 103-H Crystal Solids 1C 103-H Sludge 1D1 103-H Sandblast Brit 2A C-018 Sodium Salts 2C L-045 Sludge 7 TTF Ash 9A Particulate & Sludge	17,400	10	The throughput requirement for particulate & sludge processing is that WRAP 2A be capable of processing 17,400 cf/year of the identified waste categories, including 10 boxes per year, using either Grout Immobilization or Polyethylene Encapsulation. Processing of 17,400 cf/year, including 10 boxes per year, through either Grout Immobilization or Polyethylene Encapsulation shall not reduce the capabilities of the facility to meet throughput requirements for Grout Encapsulation or Special Waste Processing.
Polyethylene Encapsulation	1A 103-H Solidified Liquids 1B 103-H Crystal Solids 1C 103-H Sludge 2A C-018 Ammonium & Sodium Salts IX Resins 9A Particulate & Sludge	17,400	10	Feedstream 1A will require size reduction & repackaging prior to treatment. Feedstream 2A is candidate for Grout Macroencapsulation only when it does not contain ammonium sulfate.
Primary Waste Subtotal		29,000	40	
Special Waste Processing	5A1 Elemental Mercury	130	-	Amalgamation followed by grout encapsulation of amalgam.
	5A2 Mercury Chemicals	80	-	BDAT followed by grout encapsulation.
	5A3 Heterogenous Mercury	560	-	Retort followed by amalgamation of recovered mercury and grout encapsulation of roasting residuals.
	5C1 Elemental Lead	2,030	5.3	Grout encapsulation.
	5C2 Lead chemicals	5	-	BDAT followed by grout encapsulation.
	5C3 Heterogenous Lead	315	0.8	Grout encapsulation.
	9C Contained & Absorbed Liquid	1,180	-	BDAT followed by grout encapsulation.
Special Waste Subtotal		4,300	6	
Box Breakdown	102 103-H Debris 9A Particulate & Sludge 98 Debris 5C1 Elemental Lead 5C3 Heterogenous Lead	Primary 0.5 9.7 29.7 - -	Special - - - 5.3 0.8	Volume of boxed waste is included in individual waste categories. During campaigned processing of special waste categories that include boxed waste, the number of boxes required to be processed for feedstreams 102 and 98 will be correspondingly reduced such that the total number of boxes processed through the Box Breakdown area remains 40 per year.
Box Breakdown Subtotal		40	4	

Table 4
Special Waste Campaigning Single Shift Requirements

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	Total Cu Ft*	CF/yr	Containers per Year		Operating Days per Campaign	Remarks
			Drums	Boxes		
5A1 Elemental Mercury	395	130	18	none	12	
5A3 Heterogenous Mercury	1,677	560	76	none	50	
5A2 Mercury Chemicals	1,003	80	11	none		Processing of streams 5A2, 5C2, and 9C is essentially one campaign because of the similarities in waste types and treatment required. After Mercury Wastestream (5A1 & 5A3) are worked off (estimated to take 3 years), campaign lengths for Chemical Wastestreams (5A2, 5C2, & 9C) may be extended to 175 days (35 weeks) per year.
5C2 Lead Chemicals	48	5	1	none		
9C Contained & Absorbed Liquids	<u>15,016</u>	<u>1,180</u>	<u>161</u>	none		
Chemicals Subtotals	16,069	1,264	173		113	
Mercury & Chemical Subtotals	18,141	1,955	267		175	
5C1 Elemental Lead	25,741	2,030	184	6	175	Elemental Lead and Heterogenous Lead Waste Processing has same BDAT and is essentially one campaign.
5C3 Heterogenous Lead	4,055	315	29			
Lead Subtotals	29,796	2,345	213	6	175	
Special Waste Totals	47,937	4,300	480	6	175	Campaign for Waste Streams 5A1, 5A2, 5A3, 5C2, and 9C will run concurrently with campaign for Waste Streams 5C1 and 5C3

* 30 year projection from Final Feed specification SD-W100-RD-001

TABLE 6
WRAP 2A Waste Processing Major Unit Operations Throughput Requirements

Number	Description		Requirement for Single Shift Operation	
1	Receipt		4,000	208 liter drums per year
			40	Incoming Boxes per year
2	Opening & Repackaging: Boxed Waste		40	Incoming Boxes per year
			100	Overpacked 208 liter drums per year*
			10	Drums greater than 900 kg
			12	Reworked Product Containers
			12	Destructive Exam Product Container
3	Drum Opening		4,000	208 liter drums per year
4	Empty Drum Compaction		4,000	Empty 208 liter drums per year
5	Sludge & Particulate Conditioning		495	cubic meters of waste per year
6	Debris & Oversized Waste Conditioning		360	cubic meters of waste per year
			4,000	Empty 208 liter drums per year
7	Special Waste Processing	mercury amalgamation	18	208 liter drums per year
		mercury roast & retort	76	208 liter drums per year
		lead & lead contaminated materials	70	cubic meters of waste per year
		mercury, lead, & miscellaneous chemicals	161	208 liter drums per year
8	Polyethylene Encapsulation		1,020	cubic meters of product (waste & PE) per year
9	Vibro Grout Filling		710	cubic meters of product (waste & grout) per year
10	Agitated Grout		1,020	cubic meters of product (waste & grout) per year
11	Cure/Cooling Storage Capacity		55	Product Boxes
12	Shipping		1,100	Product Boxes per year
13	Sampling		110	Product Boxes per year
			400	208 liter drums per year

* Overpacks are assumed to be drums

2.1.3 Source Terms

The information contained here is extracted from WHC-SD-W306-TI-001 Rev 1 and is repeated here for information to be used by the A/E for design.

2.1.3.1 Radiological Source Term

- A. Dose rates from the various types of waste packages are to be calculated using the assumed isotopic contents, assumed waste matrix, and the assumed weights for each type of package shown below. Calculated dose rates shall include: (1) maximum, routine instantaneous dose rates within the facility for posting purposes and (2) average, routine time-integrated doses to personnel, using appropriate occupancy factors and shielding (existent or proposed).
- B. Safety analyses are to be performed using source terms derived from the source terms shown below, incorporating revised inventory projections and other appropriate design changes as the project evolves. Source term variance versus probability shall be evaluated to ensure that bounding probable accident cases are used. Radiological releases and doses from both routine and upset/accident conditions shall be calculated.
- C. Radiological source term assumptions
 1. The waste to be processed within the WRAP 2A facility includes drums and boxes containing material from the following waste streams. The waste stream designations is from WHC-SD-W100-RD-001 Rev 0 WRAP 2A Feed Specification.

2B:	Liquid Effluent Treatment Plant Resins
2A & 2C:	Liquid Effluent Treatment Plant Salts and Sludges
1A, 1B, 1C, 1D:	Solar Basin Salts, Sludges and Miscellaneous Waste
5A1, 5A2, 5A3:	Mercury Waste from Retrievable Storage and New Generators
5C1, 5C2, 5C3:	Lead Waste from Retrievable Storage and New Generators
9A:	General Particulate/Sludge/Soil Waste from Retrievable Storage and New Generators
9B:	Heterogeneous Solids and Debris from Retrievable Storage and New Generators
9C:	Contained Liquid from Retrievable Storage and New Generators
7:	Ash from Thermal Treatment Plant
 2. The bounding radioactive waste processed by WRAP 2A will be ORIGIN Waste Code, decayed 25 years, with Cs-137 in equilibrium with Ba-137. This ORIGIN Code decayed waste does not contain all radionuclides that could be present in the waste, but does contain the bounding radionuclides with respect to dose consequences from accidents and routine operations. The radionuclides content may not be bounding with respect to

determination of waste category. It is assumed that no TRU (i.e. > 100 nCi/g) will be processed in the facility, however, it should be noted that the average feed drum contains some TRU alpha (about 0.58 nCi/g waste matrix).

3. Unless otherwise specified, weight percentages of waste matrix for combustibles are as follows:

Wood = 0.25%
 Plastic = 16.75%
 Rubber = 3.375%
 Paper = 8.25%
 Cotton = 4.0%

The above numbers are conservative in that they are actually percentages of net container weights for drums in retrievable storage. At the time of this writing, this is the best information available. The combustibles above do not include the chemical loading that will be considered in the chemical source terms below. For shielding purposes, the total waste matrix can be assumed to be cellulose-type materials with density 0.65 g/cm³. The remaining weight of the package, if any, can be assumed to be dense objects that do not attenuate external radiation (e.g., the objects are on the bottom of the container), or grout or polymer. This is a conservative assumption with respect to the shielding requirements for the facility.

4. Most of the waste packages within the WRAP 2A facility are conservatively and reasonably represented by the following 8 package types. All weights are net weights, unless indicated otherwise.

- a. Average Feed Drum (208 liter)

Total Activity = 0.01 Ci with the following isotopic contributions:

Cs-137	24.80 %
Ba-137m	24.80 %
Sr-90	19.40 %
Y-90	19.40 %
Pu-241	10.40 %
Am-241	00.79 %
Pu-239	00.41 %

The Curie quantity in the drum was calculated by assuming a contact dose rate of 10 mrem/hr, an overall gross drum density of 0.65 g/cm³, and a waste matrix of cellulose-type material. These are the assumptions that should be used for shielding calculations. The isotopic fractions above are based on the isotopic fractions for ORIGEN Waste, decayed 25 years. The Ba-

^{137m}I and ⁹⁰Y are assumed to be in equilibrium with the parents, ¹³⁷Cs and ⁹⁰Sr.

Weight: 135 kg/0.208 m³

Waste Matrix: Assume 50% of these waste packages contain combustibles and 50% contain non-combustibles. This is a very conservative assumption, since the vast majority of the WRAP 2A feed streams are not combustible (Kruger 1993b, page 5-3).

b. Maximum Feed Drum (208 liter)

Total Activity = 0.2 Ci, with the isotopic fractions given for the average drum above. The weight and waste matrix is also the same as the average drum. The Curie quantity of the maximum drum was derived from the fact that the maximum dose rate for contact handled waste packages is 200 mrem/hr at contact.

c. Average Product Box (1.2 x 1.2 x 1.2 meter)

As a bounding case, this box has the contents of 4.5 average feed drums. The Curie content is 0.23 Ci (3 1/2 average feed drums and one maximum feed drum) with the isotopic distribution of the average feed drum. Half the volume of the box is waste matrix, half is either grout or polyethylene.

The Curie content assumption for this package is very conservative, since it assumes a maximum drum goes into every product box. However, the conservatism is necessary to allow for campaigning.

d. Maximum Product Box (1.2 x 1.2 x 1.2 meter)

This is the same package as combining 4.5 maximum feed drums except that the waste matrix is 1/2 grout or polymer and 1/2 of the waste matrix for 4.5 maximum feed drums.

e. Average Feed Metal Waste Box (1.5 meter x 1.5 meter x 2.7 meter)

Total Activity = 0.01 Ci, with the isotopic fractions of the average drum. It is assumed that the average waste box will contain no more radioactivity than the average feed drum.

Weight: 3,000 kg (Based on the density of 9B waste)

Waste Matrix: Assume 25% of the box volume is waste matrix, the rest void space and dense objects.

f. Maximum Feed Metal Box (1.5 meter x 1.5 meter x 2.7 meter)

Total Activity = 0.2 Ci. This is based on the Curie quantity in the maximum feed drum, which assures that the maximum dose rate from a box is less than 200 mrem/hr.

Weight: 5,454 kg (Based on facility limitations)

Waste Matrix: Assume 25% of the volume is waste matrix, the rest void space and dense objects.

g. Average Sludge Drum (208 liter)

Total Activity: As a bounding case, use the Curie content and isotopic distribution of feed stream 2A (the 83% ammonium sulphate column), Kruger 1993b. The dose rate at contact from this drum is about 6 mrem/hr.

Weight: 189 kg net

Waste matrix: ammonium sulphate sludge (noncombustible)

h. Maximum Sludge Drum (208 liter)

Total Activity: As a bounding case, use the Curie content and isotopic distribution of feed stream 2A (the 0% ammonium sulphate column), Kruger 1993b. The dose rate at contact from this drum is about 38 mrem/hr.

Weight: 189 kg (net)

Waste matrix: sodium sulphate sludge (noncombustible)

5. Inventory Assumptions

The following maximum instantaneous waste package inventories are assumed for the indicated area:

Waste Drum Receiving Area
59 average feed drums
1 maximum feed drum

Particulate/Sludge Processing Area
4 average feed drums
1 maximum feed drum

Debris Processing Area

- 1 average feed drum
- 1 maximum feed drum
- 1 average product box (grout)

Special Waste Area

- 1 average feed drum
- 1 maximum feed drum
- 110 liter containers with:
 - Hydrofluoric acid (10 containers)
 - Nitric acid (90 containers)
 - Phosphoric acid (10 containers)
- 2000 liter containers with:
 - Hydrofluoric acid (40 containers)
 - Nitric acid (360 containers)
 - Phosphoric acid (40 containers)

Box Breakdown Area

- 1 maximum feed box
- 1 average feed drum (generated from box contents)
- 1 maximum feed drum (generated from box contents)

Grout Immobilization Area (Exit port and surge hopper)

- 2 average product boxes
- 2 maximum product box
- 4 equivalent average feed drums in hopper

Polymer Immobilization Area (Exit port and surge hopper)

- 1 maximum sludge drum
- 18 average sludge drums in hopper
- 18 maximum sludge drums in hopper

Sample Management Area

- 1 maximum feed drum
- 1 maximum product box

Cure Storage Area

- 35 average product boxes with grout
- 15 average product boxes with polymer
- 3 maximum product boxes with grout
- 2 maximum product boxes with polymer

6. Dose rates from the various types of waste packages can be calculated using the assumed isotopic contents, assumed waste matrix, and the assumed weights for each type of package. For example, the dose rate from package number 1 (average feed drum) is about 10 mrem/hr as calculated with MICROSIELD. The gamma ray spectrum from MICROSIELD should be used for other types of shielding calculations. Taylor build up factors and dose conversion factors from ANSI/ANS 1991 should be used. For a maximum feed drum with 200 mrem/hr @ contact, an adequate gamma ray spectrum and intensity is:

<u>ENERGY</u> <u>(MEV)</u>	<u>PHOTONS/SEC</u>
0.664	2.298 E+9 (side of drum, mid height)

For a maximum sludge drum with 38 mrem/hr @ contact, an adequate gamma ray spectrum and intensity is:

<u>ENERGY</u> <u>(MEV)</u>	<u>PHOTONS/SEC</u>
1.39	1.49E+6
1.07	4.33E+6
0.87	8.47E+5
0.65	1.29E+8
0.49	3.35E+8
0.45	1.05E+6
0.40	9.13E+6
0.29	8.20E+5
0.26	2.72E+5
0.12	8.33E+2

The arrays of drums or boxes chosen for shielding calculations should be the worst case array for the dimensions of the area and the number of drums or boxes in that area. For shielding calculations, assume that drums will not be stacked higher than three, and use the worst-case arrays allowed by the numbers of drums present and the dimensions of the area. Assume that final product containers are not stacked higher than two.

Besides drums and waste boxes, other sources of external radiation include contaminated equipment and surfaces in gloveboxes, contamination in duct work, and contamination on HEPA filters. For shielding purposes, assume that contamination levels on equipment, glovebox surfaces, and "hot side" ducts are equal to 200,000 dpm/cm² total beta/gamma/alpha activity, in the isotopic mix assumed above for drums. Assume that glovebox HEPAs read 200 mrem/hr @ contact, and that stack HEPAs read 10 mrem/hr @ contact.

Shielding design shall utilize the ALARA principles of DOE Order 6430.1A.

The following Table 6 provides shielding guidance for the WRAP 2A design.

TABLE 6

Zone Category	Access Time Allowed	Initial Design Level (mrem/hr)	Maximum (mrem/hr)
Uncontrolled Area	Full Time	0.05	0.1
Controlled Areas			
1	Full Time	0.25	0.5
2	Less than 1 hour per day	2	4
3	Less than 1 hour per week	10	20
4	Less than 10 hours per year	50	100
5	No normal access permitted	>100	

The table provides dose rate (time-weighted average) guidance for purposes of shielding design. Initial design levels for occupied levels are given in the third column and maximum levels for occupied areas are given in the fourth column.

The dose rates in the third column (Initial Design Level) are goals that should be used for initial design efforts. If the goals listed in the third column cannot be met, justification should be provided for exceeding these dose rates.

It is acceptable to calculate hourly dose rates for those instances where access times fall between those listed in the table. Dose rates should be based on a weekly initial design goal of 10 mrem/week allowable divided by the access time (i.e. a 27.5 hr access time per week in the WRAP 2A Process Area would provide an initial design goal of .364 mrem/hr).

If the column three limits are exceeded, and justification has been provided, higher instantaneous dose rates in occupied areas are acceptable provided that they do not exceed the maximum dose rates listed in the fourth column.

If the maximum dose rates in the fourth column are to be exceeded, a detailed cost/benefit analysis must be performed to justify the higher dose rates. Cost/benefit analysis should be performed in accordance with "Cost Benefit Analysis at Westinghouse Hanford Company" (Brown 1992).

Exposure rates for areas which will be accessed for maintenance shall meet WMC design criteria. The exposure rate for maintenance shall be based on the "average" drum and contamination buildup specified above.

Personnel exposure rates for areas accessed for operation, maintenance or recovery from upset conditions shall not exceed 100 mrem/hr based on the maximum dose container (200 mrem/hr at contact) and maximum contamination buildup factors. Temporary shielding may be utilized for areas requiring infrequent access (less than once per month).

2.1.3.2 Chemical Source Terms

- a. The waste streams to be processed within the WRAP 2A facility are given in the Radiological Source Term Assumptions section above. The source term described in this section does not include process chemicals that may be stored within the facility.
- b. It is assumed that the waste in retrievable storage provides a bounding case in that the chemical loading of newly generated waste will not exceed the chemical loading of retrievable stored waste that may be processed in the facility. This assumption is probably conservative considering current programs for waste minimization and segregation, which were not applied to the older, retrievable stored waste.
- c. It is assumed that although not all chemicals that could be in the waste are identified below, the chemicals that are identified are the bounding chemicals that could be present with respect to occupational health and safety and environmental concerns. The term hazardous as used below is not synonymous with the RCRA or WAC term, but rather has the more general meaning. It is also assumed that the chemical loading of the facility is contained in drums rather than burial boxes. This assumption is acceptable since neither the drums nor the boxes are fire rated.
- d. The bounding chemicals that could be present in drums processed in WRAP 2A are listed below, along with assumed maximum quantities from SWITS, except that no material can exceed 0.208 m³ per package. The inventories given below are conservative, since it is assumed that the SWITS listing gives the mass of the actual chemical rather than the mass of material contaminated with the chemical. The latter is more likely the case. On the other hand, the assumed loading is based on post-1987 data, when records of hazardous waste disposal were kept. It is possible that larger quantities were involved in pre-1987 operations. If additional studies of retrievable waste characteristics allow less conservative assumptions to be made, the quantities of hazardous chemicals listed below may be reduced. Contrary-wise, if the source term would be exceeded at any time within the facility,

administrative controls can be initiated to prevent an unresolved safety issue.

- e. Ammonium nitrate appears in the source terms for W-112 and W-113, but it is excluded from the W-100 source term. This is due to the fact that the only retrievable stored waste that enters WRAP 2A will go through WRAP 1 first, and any significant quantity of reactive ammonium nitrate would be removed in WRAP 1 as a restricted article. The WRAP 2A feed stream does include 3 drums containing ammonium nitrate, but these drums have been solidified.
- f. Any retrievable stored waste that may enter WRAP 2A must come through WRAP 1 first, propane does not appear on the list for WRAP 2A, since it would be removed as a restricted article. It is also assumed that free liquids that would require thermal treatment (e.g., flammable liquids) and reactive metals would be removed in WRAP 1 and not enter WRAP 2A.

The chemicals mercury, mercury compounds, lead, and lead compounds are added to the bounding list for WRAP 2A, since these chemicals are waste streams and are hazardous.

Hydrogen is not listed below because drum venting will prevent the build up of hydrogen gas within the drums. It is assumed that no significant quantities of reactive metals (Na, K, NaK, and U or Zr turnings) will be present in any of the feed streams.

- g. Specific chemicals that are expected in each waste stream are given in WMC-SD-W100-RD-001 Feed Specification and restated in Table 7.

TABLE 7
Bounding Chemicals for WRAP 2A

CHEMICAL	MAX. FEED DRUM KG	AVE. FEED DRUM KG	MAX. FEED BOX KG	AVE. FEED BOX KG	MAX. PRODUCT BOX KG	AVE. PRODUCT BOX KG
Ammonium fluoride	7.9	0	7.9	0	35.5	0
Ammonium sulfate	157	0	157	0	706	0
Beryllium	136.1	2.9	136.1	13.1	612.5	13.1
Hydrofluoric acid	52.3	0	52.3	0	235.4	0
Lead	664.0	0	664.0	0	2988.0	0
Lead compounds	1.8	0	1.8	0	8.1	0
Mercury	7.3	0	7.3	0	32.9	0
Mercury compounds	1.8	0	1.8	0	8.1	0
Nitric acid	60.1	1.4	60.1	6.3	0	0
Phosphoric acid	52.4	0	52.4	0	0	0
Potassium hydroxide	56.3	6.8	56.3	30.6	253.3	30.6
Sodium	2.6	0	2.6	0	11.7	0
Sodium hydroxide	443.0	0	443.0	0	1993.5	0
Sodium oxide	48.3	0	48.3	0	217.4	0
Sulfuric acid	3.3	0	3.3	0	14.9	0

- h. The average product box inventories above were obtained by multiplying the average feed drum by 4.5. The maximum product box inventories were obtained by assuming 4.5 maximum drum equivalents per box.
- i. The maximum feed drums and product boxes are strictly hypothetical; it is extremely unlikely that a single drum or box would contain significant quantities of more than one of the hazardous chemicals listed above. In incidents involving a single maximum drum, it is valid to assume a loading of only one of the chemicals listed above, which should be the worst case chemical for the incident being considered. In incidents involving multiple drums or boxes, it is appropriate to use average drums or boxes with a realistic number of maximum drums or boxes containing the worst chemical to bound the incident.
- j. The chemical content of sludge drums is given in feed stream 2A of WMC-SD-W100-RD-001. The product boxes that contain average feed drums are more bounding than the product boxes containing sludge; therefore, the sludge product boxes are not defined.

- k. Inventory assumptions - The drum and box inventory for the chemical source term is the same as the radiological inventory given above.
- l. For purposes of fire analyses, the radiological and chemical loading should be derived from the average number of packages present and the contents of the average and maximum packages, as specified above and in WHC-SD-W306-TI-001. For the maximum possible fire, the 95 percentile case should be used (i.e., an inventory should be chosen such that in 95% of the cases, the actual inventory at a given time would not exceed it).

2.2 Codes, Standards, and Orders

- a. Hanford Plant Standards shall be used where specified herein.
- b. The W-100 facility will conform to applicable WHC Manuals, as specified herein, and the latest revision of WHC-SD-W100-FDC-001, Functional Design Criteria for the Waste Receiving and Processing Facility Module 2A, Project W-100.
- c. The DOE Orders and references listed in the W-100 Functional Design Criteria shall apply to design and engineering of the W-100 project. In addition applicable sections of DOE Orders 5400.1 General Environmental Protection Program, DOE 5400.3 Hazardous and Radioactive Mixed Waste Program, DOE 5820.2A Radioactive Waste Management and DOE 5440.1E National Environmental Policy Act Compliance Program shall also apply.

3.0 PROCESS CRITERIA

3.1 Waste Handling

3.1.1 Ship and Receive Waste

- a. All solid MW entering and leaving the facility will pass through the transfer corridor shipping and receiving area in waste drums and boxes from the Phase V storage facility via the transfer corridor. Waste transfer through the corridor will be by automated vehicle (AV) or forklift.
- b. Waste drums must be capable of being received on pallets, four to a pallet, and as individual drums not on a pallet.
- c. Pallets shall be made of metal to reduce the fire hazard as required in the W-112 Storage SDRD (WHC-SD-W112-SDRD-001). Pallets will be provided by W-112 and returned to W112 for reuse.
- d. The capability to receive, unload, and handle 208 liter drums weighing up to 900 kg, and 321 liter and 416 liter drums weighing up to 1360 kg shall be provided. Containers greater than the 900 kg shall go directly to the box breakdown area for processing.

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- e. Provide capability to recharge forklift and AV batteries for WRAP 2A vehicles only.
- f. Provide operator interface units to enter data into the Plant Management (PMS) system.
- g. If pallets are used, the ability to depalletize incoming waste drums will be required. Storage capability for empty pallets will be required to support 1 days operation. Unused pallets will be returned to W-112 for reuse or disposal.
- h. Conveniently located storage for radiological survey equipment needed to survey the surface dose rate and contamination levels of all waste containers and transport vehicles. A storage cabinet similar to an office storage cabinet is sufficient (6 feet tall, 3 feet wide, 1.5 feet deep).
- n. Capability to install and read bar code labels.
- o. The truck dock shall be sized for a maximum van or truck with the following general dimensions:
Van box: 5.5 to 8 meters long
Flat Bed length: 12 meters
Cab/Engine: 5 meters long
Overall length: up to 20 meters
Overall height: 4 meters
Height to bed: 137 to 139 centimeters
- p. All treated waste will be placed into a final container box that is nominally 1.2 meter x 1.2 meter x 1.2 meter with a maximum loaded weight of 5454 kgs.

- q. The following capabilities shall be included as part of the final product container:
1. Provide forklift handling capability
 2. Maintain structural integrity during filling and curing.
 3. Materials of construction shall be compatible with the final waste forms.
 4. Container must maintain its shape during normal handling and transport.
 5. Container must be sealable and resealable after opening.
 6. Container must have a 5 year shelf life and a 5 year loaded life.
 7. Container must have a removable lid.
 8. Container must have industry standard bung fittings.
 9. Container must have a permanent filtered vent
 10. Access to container must be provided as required for placement of waste and or binder materials into container.
 11. Box design shall minimize the ullage of container to less than 10% during all waste filling operations.
 12. Container must be capable of interfacing with all confinement locations in the facility where waste or immobilization materials are added to the container.

3.1.2 Transport Waste Internally

- a. Personnel protection shall be provided in all areas where personnel may come into direct or indirect contact with the incoming waste or with the final waste product. This shall include all areas of the process where the waste is either contained in containers or uncontained in RCA confinement. Personnel protection shall include as a minimum protection from hot materials, hot equipment, hearing protection, eye protection, and vapor inhalation.
- b. All untreated mixed waste shall have double containment at all times while in WRAP 2A.
- c. Provide a system which will provide total containment of all radioactive contamination during normal operations.

3.1.3 Confinement Equipment

- a. Confinement structures, either gloveboxes, enclosures, or confinement rooms, used for confinement shall conform to Hanford standards for the specific design features as discussed in WHC-CM-4-9 or other appropriate manuals for the specific type of feature selected during design.
- b. Fire protection shall be provided in accordance with WHC-CM-4-41 Section 7.4, "Glovebox Fire Protection".
- c. The design shall emphasize industrial safety through tooling safety features that protect operators from sharp objects, etc.

- d. Enclosure ventilation systems shall incorporate "push-through" style filters and filter housings, providing the ability to post in old filters with the introduction of the new filter.
- e. Design of operator interfaces for human-in-the-loop material handling devices and process equipment shall provide visual access by direct view of all operations using windows, elevated platform stations or closed circuit television (CCTV).
- f. Access ports shall be fabricated of stainless steel and either standard ring style (machined or formed) or a "push-through" style, with the latter only to be used in areas accessed for daily operations.
- g. Windows shall be of a bolted/clampstrip construction. Diamond style shall be incorporated as the primary "operations" window style. Triangular style shall be incorporated as the maintenance style near the ceiling of the process enclosures. Large rectangular windows should only be used where full-time observation is required.
- h. Shielding shall be located outside the enclosures. Lead is not the preferred shielding material, but if used there shall be no exposed lead surfaces.
- i. Material handling equipment installed in enclosures shall be modular design, for convenient removal and replacement. Where practicable, modules shall be sized to fit into 208 liter or 1.2 x 1.2 x 1.2 meter box for removal from the enclosure.
- j. Service penetrations shall enter through either the enclosure ceiling or wall utilizing separate service panel to separate liquid and electrical services.
- k. Entry and exit systems into the enclosure shall be provided for waste drums, small items and samples (as appropriate) that minimize waste generation, and that most cost-effectively maintain containment integrity.
- l. Lighting shall be provided and located so that it is not exposed to contamination and does not impact enclosure operations. It is preferred that the lighting be provided from external to the enclosure.
- m. Irregular or rough surfaces shall be minimized to enhance decontamination and housekeeping.
- n. Windows and gloveports shall be located to optimize ergonomic considerations, process operation, housekeeping and maintenance.
- o. Process enclosures shall have removable bulkheads to allow removal of large equipment items. Bulkheads shall be designed to allow their removal after facility startup.

3.2 Waste Conditioning

This area of the facility will be utilized to prepare the various waste defined in section 2.1.2 for further processing into one or both of the immobilization areas defined in section 3.3. The two immobilization processes will be either a grout based process or a polyethylene based process.

The waste conditioning process area consists of an opening/emptying area where all incoming waste drums are opened, the contents removed. The waste conditioning process area shall also include an area where boxes and other odd sized individual containers can be opened and the waste pretreated to allow treatment in other portions of the facility. All waste shall be treated in lots or campaigns based on the feed stream characteristics, generator, or other classifications determined during operations of the facility.

The following requirements are applicable to all waste types independent of characteristics.

- a. Segregation of waste by radionuclides category (no mixing of Class 1 and Class 3 waste) shall be maintained throughout the waste treatment in WRAP 2A. Designation shall be based on category established as waste enters WRAP 2A. Designation of the waste and traceability of the waste must be maintained throughout the process and to final disposal.
- b. Provide a system that will minimize generation of secondary waste.
- c. Provide a system that will minimize maintenance and decontamination/decommissioning requirements by locating mechanical drives and other mechanical components outside of the confinement structure.
- d. Provide a system that is readily amenable and adaptable to decontamination and decommissioning practices.
- e. Provide capability to process 208 liter and 322 liter metal drums.
- f. Provide capability to lift 208 liter drums with drum lifts that have a maximum weight of 900 kg without need for operator intervention.
- g. Provide a means to completely empty all the contents of 208 liter drums. Drums shall be empty as defined in WAC 173-303-160. Provisions shall be made for dealing with plastic liners with lids, both rigid and non rigid.
- h. Provide a capability to contain and collect any liquids that might accompany the particulate waste feeds in the waste drums.

- i. Provide the capability for sorting and removing objects that might require special treatment or are not to be treated, such as lead bricks, aerosol cans, gas cylinders, containers of flammable solvents or chemicals, containers of mercury, or other potentially dangerous items. It shall be assumed that removal of these items will be on a nonroutine basis.
- j. Provide the capability to collect and package any materials that have been separated or screened for transfer to their appropriate processing station.

3.2.1 Particulate, Sludge, Liquid Waste to Grout and Polyethylene

- a. The capability should be provided to handle dry particulate, wet particulate, sludge, and crystalline solid material. It should be assumed that agglomerations of particles (lumps, hard crystalline clumps) will exist with some regularity in the feed streams. Any free liquids associated with the waste should remain with the waste as it is processed through the appropriate operations. A coarse vibratory screen (60mm) shall be incorporated at the head-end of the process to remove debris (including plastic bags) associated with the waste. A method for removing the debris from the screen shall be provided. A method for manually aiding transport through the screen shall be provided (eg. use of manipulators or water spray down).
- b. Provide capability for processing feed materials that have a density up to 250 lbs/ft³. Particle sizes will range from very fine (< 200 mesh) to large (~10 mm equivalent diameter). Particle size distribution is unknown. A small amount (<1%) of the feed will contain large (>10 mm) non-friable particles (metals, rocks) which may need to be separated from the process in order to avoid damage to downstream equipment. A 3 mm screen shall be incorporated for material routed to the PE system.
- c. A batch dryer should be incorporated to dry all feeds to polyethylene encapsulation.
- d. Throughput of the dryer shall be based on the overall throughput for the polyethylene system (495 cubic meters/year - See section 2.1.2).
- e. The physical size of the dryer shall be based on the throughput requirements using a reference waste consisting of feedstream 2B (Ion Exchange Resins) drying from a nominal 50 wt% to 5 wt% moisture.
- f. The dryer must be able to reduce waste moisture content to less than 5% for any potential feedstreams.
- g. An offgas treatment system must be employed to condense evaporated moisture and remove regulated constituents that may also evaporate (eg. Mercury). The condensate should be routed to the active waste water handling system.

- h. Dryer internals should incorporate mixing and delumping/deagglomerating mechanics to ensure thorough drying and homogenization of the waste.
- i. A dryer should be selected that is not sensitive to particle size or physical condition of incoming waste.
- j. The capability to add small (bag or drum) quantities of chemicals (aqueous, or dry) directly to the dryer (during charging phase) should be provided. Floor space and metering/piping equipment should be allotted for this purpose, allowing manual (semi-manual) operations to prepare materials for automated transfer to the process. Design of the dryer should ensure that adequate blending of the chemicals with the waste will occur.
- k. The capability to operate the dryer non-heating mode to homogenize and blend in chemicals if desired should be provided.
- l. The dryer should discharge through a vibrating screen to separate material not suitable for feed to the extruder. (same as 3 mm screen mentioned in item b above).
- m. The oversized material which does not pass through the screen, should be collected in a container which will be sampled and transferred to storage or treatment elsewhere in the plant (eg. size reduction or encapsulation).
- n. Discharge from the dryer screen should be to the batch hold-up feeder for the polyethylene extruder.
- o. The majority of conditioning for the waste designated for cement treatment will occur in the batch mixing tank and those requirements are covered in that section of the SDRD.
- p. Some method of delumping large agglomerates should be employed for waste routed to the grout batch tank. The capability to protect equipment from a small amount of hard oversized items should be provided. Much of the delumping of friable agglomerates can take place in the batch tank.
- q. Some of the waste streams (particularly 1A, reworked products, and destructively tested samples will need to be significantly size reduced (via a crusher/grinder) prior to being fed to the particulate system.

3.2.2 Debris Type Waste to Grout

- a. Waste will be designated as debris prior to receipt at WRAP 2A. All incoming non-debris waste will be inspected to reveal the presence of waste that meets the definition of debris. All such wastes, whether categorized as debris by the generator or at WRAP 2A, shall be managed as debris. This waste will be redirected to the debris type treatment area.
- b. The capability to perform visual inspection of all waste defined as debris to ensure that it is debris prior to treatment. Debris definition is as stated in 40 CFR 260 and WAC 173-303.
- c. Vibratory screening or other mechanical means to remove any process residues, soils, caked soils, or other materials less than 60 mm in size from debris shall be provided in WRAP 2A. This process shall utilize a vibratory screen. The particulate material shall be collected and sampled, removal to storage or directly to another treatment process in WRAP 2A.
- d. Debris and non-debris wastes shall be kept physically segregated from each other.
- e. After non debris removal, size reduction limitations are dictated by the subsequent treatment process. Demonstration testing will establish what size reduction can be accomplished and still ensure that the debris can be adequately encapsulated. Assume that a shredded debris size of 60mm can be adequately treated. Size reduction capabilities for the following waste descriptions shall be provided:
 1. Empty 208 liter drums, lids, and locking rings/bolts
 2. Stainless steel or carbon steel pipe of all schedules and wall thicknesses up to 8 centimeter in diameter by 1.2 meters long
 3. paper, plastic cloth materials, rubber gloves
 4. Any material that is described as debris based on the definition in the LDR disposal regulations.
 5. Any material that is specified in the feed specification WMC-SD-W100-RD-001 feed stream 9B.
- f. Following size reduction, the debris will be vibratory encapsulated in grout. Based on the available treatment technologies WRAP 2A will use the microencapsulation technologies for treatment of debris.
- g. The facility design must provide the capability to transfer any materials removed from debris to either the Grout Immobilization line or the Polyethylene Macroencapsulation line. The facility design must also

provide the capability to transfer any debris materials separated from either of the particulate lines to the debris line for treatment by Grout Microencapsulation. Material shall be transferred between process areas by direct routing or by placement into a 208 liter drum. Before movement of material between lines, sampling of material is required to ensure that appropriate treatment can be accomplished. Material may need to be stored in W-112 before appropriate treatment can be accomplished.

- h. If size reduction of combustible material creates a potential for fire, the size reduction operation shall be performed in an oxygen deficient atmosphere to avoid potential fire.

3.2.3 Waste Contained in Boxes

- a. The box breakdown area will process boxes of waste that are too large to be entered into the normal 208 liter drum processing route and drums which cannot be processed in the drum size reduction and repack area due to physical restrictions or drum deterioration. The product of the box breakdown area will be waste that is of a suitable size to be transported in a 208 liter container, to the size reduction and repack operation or to the special waste treatment process or into a product container suitable for direct vibro grout infilling. Spread of contamination which may be on the exterior of the 208 liter drum or product container as a result of filling operation within the box breakdown area shall be avoided.
- b. The Box Breakdown enclosure shall be designed to handle:
 - size reduction & repackaging of overpacked 208 liter drums
 - size reduction & repackaging of overweight drums (up to 1400 kgs)
 - size reduction & repackaging of incoming boxes up to 1.5 meter x 1.5 meter x 2.7 meter and 5454 kgs
 - size reduction & repackaging of off-specification product containers
 - destructive examination of product containers
 - Overpacked 208 liter drums of Solidified Treated Waste (Stream 1A)

For the purposes of defining requirements for the Box Breakdown Enclosure, the term "incoming boxes" includes 416 liter drums.

- c. The 30 year average material balance for the Box Breakdown enclosure shall be based on receiving and processing approximately 40 incoming boxes per year, 100 overpacked drums (i.e. 208 liter drums in nominal 416 liter overpacks) per year (3,000 total over 30 years), 10 overweight 208 liter drums (i.e. over 454 kgs) per year (300 total over 30 years), 12 product containers per year for rework (1% of annual output), and 12 product containers per year for destructive examination (1% of annual output) based on 1 shift per day operations.

- d. Due to the different types of processing required for each of the Box Breakdown enclosure feeds, the processing of different feed types shall be accounted for by operational campaign strategies. The campaign lengths and sequences should be based on the throughput capabilities of the Box Breakdown enclosure as identified by Time & Motion studies and three shift operations should be utilized as needed.
- e. Provide the capability to receive large boxes and large drums from a delivery forklift, deliver the boxes or drums into confinement that is separate from the normal WRAP 2A drum process lines and open the containers to remove and segregate their contents. The box breakdown area shall be able to process 40 boxes or other special oversized containers per year based on 1 shift per day operations.
- f. Provide the capability to reduce the size of the container and the contents to a size that can be transported to and routinely be handled in the drum process area. If size reduction of combustible material creates a fire hazard the size reduction must be accomplished to avoid a fire potential.
- g. Provide the necessary metal working machinery, either fixed and mounted equipment or tools which will be utilized for size reduction of empty boxes, empty and filled drums, and large objects that have been removed from the boxes or drums to provide feed to subsequent processing.
- h. Provide capability to repackage size reduced waste for transfer to the drum process line(s).
- i. Provide capability to load waste directly into product container for grout vibro infilling if subsequent waste treatment or handling is not required.

3.3 Waste Immobilization

The two immobilization matrices used in WRAP 2A shall be grout and Polyethylene.

3.3.1 Waste Stabilization (Grout)

This section contains the design requirements for processing two types of waste into a grout stabilization binder material. The two types of material are 1) waste that consists of particulate (wet or dry), sludges, and liquid waste where the waste is mixed with the binder material prior to placement in the final container, and 2) debris waste as defined in the definitions section of the document where the waste is first placed in the container and the binder materials are added to the final container.

- a. Capability to stabilize dry or wet particulate waste using cement based or similar (dry-powder/water) stabilization materials shall be provided.

- b. Capability to encapsulate (coat and fill voids) oversized solids (some size reduced) using cement based or similar (dry-powder/water) stabilization materials shall be provided.
- c. Mixing of solidification materials and particulate/sludge/liquid waste shall be performed external to the container. Particle size from very fine particulate (less than 200 mesh) to coarse granular material (less than 1/2 inch equivalent diameter). The mixer must have the capability to handle mixtures with viscosities up to 120,000 cp and bulk densities up to 250 lbs/ft³.
- d. The mixer shall operate in a batch mode. Minimum batch size should be able to completely fill one outgoing container.
- e. Capability to add at least 4 different dry particulate binder materials to the mixing process shall be provided. Dry blend of routine binder materials shall be accomplished prior to adding to the batch mixer. However, capability to add small quantities of unblended materials in non-routine situations should also be provided. At least one-day's material requirements must be available to the process upon demand. These materials should include as a minimum one type of ordinary portland cement (OPC) and pulverized fly ash (PFA). Alternate materials that the system should be capable of handling include; gypsum based cements, blast furnace slag (BFS), bentonite or other mineral admixtures.
- f. Capability to add process and recycled radioactive water directly to the sludge/particulate mixer tank. Water addition shall utilize flow rate measurement and totalizer or metering pump for water addition control.
- g. Control of batch mixer fill shall be utilizing loss-in-weight on waste and dry blend feed hoppers. Verification and additional control shall be provided by weigh cells and level measurement on the batch tanks.
- h. Capability to add small (bag or drum quantities) quantities of additional materials (aqueous, or dry) directly to the batch mixer shall be provided. Floor space and metering/piping equipment shall be allotted for this purpose, allowing manual (semi-manual) operations to prepare materials for automated transfer to the process. (Example of aqueous - set retarding solutions. Example of dry - sodium silicate.)
- i. Control of the amounts binder materials and water to the batch tank should be the primary control mechanism for loading the tank. Materials should be metered with an accuracy of less than +/- 2% by mass.
- j. Total quantity of waste fed to the batch tank shall be predetermined by a number of incoming drums. Total quantity received should be verified by weigh cells on mixing tank.

- k. The ability to draw samples from the batch tank shall be provided. Capacity for several on-line instrument measurements should also be provided (level detection, mixer torque)
- l. Capability to prepare a pre-mix of all required solidification materials (dry materials, same materials as particulate system, and process water) and add directly to final container for encapsulation shall be provided. This system shall be maintained as a "clean" system and operated in a non-radioactive process area.
- m. Vibro-Grout paste make-up shall be performed in batch mixing.
- n. Batch tank sizing (for the vibro-system) should be based on 1/2 shift (2.25 cubic meters) operation.
- o. The capability to completely coat and fill voids in oversized solids shall be provided. The equipment must have the capability to handle waste material in solid and shredded form with densities up to that of elemental lead.
- p. All direct feeds to the final container shall be metered with an accuracy of less than +/- 2% by volume and mass.
- q. Overfilling of the container shall be prevented via automatic shut off valve.
- r. The oversized solids coating and filling shall be aided by container vibration utilizing a vibration source external to the final container.
- s. The capability to store curing product for a minimum of 2 days within the WRAP 2A process area shall be provided.
- t. The capability to visually inspect and perform penetrometer testing on the immobilized product at the end of the 2 day curing time frame shall be provided. The capability to return a container to cure storage prior to dispositioning shall be provided.
- u. The capability to remove free liquids, on an infrequent basis, from the top of the solidified product at the end of the 2 day curing time frame shall be provided.
- v. Accommodations shall be incorporated for an efficient clean-up system of the batch tanks (particulate and vibro) utilizing low liquid volume cleanout methods and wiping blades inside the tank.
- w. Batch tank (particulate line) shall be capable of discharging to the active waste water treatment system or retaining clean-up water for another batch of grout. Clean-up water from the vibro system mix tank shall be routed to the non-active waste water system or retained for the

next batch. Cement inhibiting/activating agents shall be used to ensure washings do not prematurely setup in the process.

- x. Dual batch tanks (particulate line) shall be incorporated to accommodate redundancy and a more continuous operation (mode of filling one tank while mixing/emptying another).
- y. Vibration mechanisms shall be provided on the particulate grout fill station similar to the debris line. This will aid in the filling process as well as allow potential utilization of the active grout system to infill debris.

3.3.2 Waste Immobilization (Polymer)

This section contains the design requirements for processing of a type of waste that will be immobilized in a polymer based binder material. This waste type of material is waste that consists of particulate (wet or dry), sludges, and liquid waste where the waste is mixed with the polymer binder material prior to placement in the final container. These waste types are not acceptable for placement into a grout based binder material or other factors (economics, waste loading) dictate that waste be placed in the polymer based binders.

- a. Capability to macro-encapsulate dry (<10% moisture content) particulate waste using thermoplastic polymer solidification materials shall be provided. Mixing needs to fully encapsulate each waste particle (i.e. all waste particles need to be coated with polymer. Process shall utilize a twin-screw, heated/cooled, vented extruder to melt the polyethylene and mix in the waste material. A dryer shall be incorporated for certain feedstreams in this process. Size reduction shall also be provided for some of the waste to be fed to the extruder (see waste conditioning for requirements).
- b. Capability must be provided to routinely add pretreatment chemicals (dry powders- eg. CaO, NaS) to the waste being treated in polyethylene shall be provided. This addition shall be accomplished prior to feeding the extruder (ie. in the dryer).
- c. The size of the extruder shall be based on the required throughput (Section 2.1.2) for the polyethylene system at a 40 wt% dry basis waste loading and a 15 wt% CaO addition.
- d. Capability to draw samples off of the extruder discharge during continuous routine operation shall be provided. Capacity for several on-line instrument measurements shall also be provided (infrared process monitor, motor torque, zone temperatures, motor power, screw speed, die pressures, viscometric measurement)
- e. All direct feeds to the container shall be metered to an accuracy of less than $\pm 2\%$ by volume and mass.

- f. Container filling shall be controlled by real-time weight and volume measurements on the container. Overfilling of the drum shall be prevented by interlocks on feed mechanisms (extruder motor) and the aforementioned measurements.
- g. The capability to mix particulate waste material with the solidification agents shall be provided. Incoming waste particle sizes from very fine particulate (less than 200 mesh) to coarse granular material (less than 1/2 inch equivalent diameter) shall be handled. Subsequent size reduction may be required as part of the process. (Equipment tolerance may require that pretreatment be employed to reduce the particle size on some feedstreams.)
- h. The capability to store product to allow cooling/curing for a minimum of 2 days within the WRAP 2A process area shall be provided.
- i. The capability to visually inspect the immobilized product at the end of the 2 day curing time frame shall be provided.
- j. Feed rate to the extruder shall be controlled with an accuracy of less than 2% by mass.
- k. Homogenized feed must be held up in batch immediately prior to feeding the extruder. The batch size shall at a minimum fill an entire container (waste and PE combined).
- l. At a minimum one shift worth of polyethylene shall be held for direct feed to the extruder within a non regulated area of the plant.
- m. Capability to separately feed polymer and waste material at different locations shall be provided. Waste feed may need to be fed into polymer melt.
- n. Capability to continuously fill product containers without interrupting extruder operation shall be provided.
- o. Capability to remove screws and barrels shall be provided. Worst case scenario would be with polymer hardened in extruder.
- p. Provision shall be made for automatic control of extruder zone temperatures via electric heat/air cooling and variable speed motor on extruder screws. Capability to control temperature of extruded material at exit of extrusion process shall be provided; this may required a heated/cooled die head.
- q. Off-gas collection and treatment for extruder vents shall be provided.

3.3.3 Special Waste Treatment

The characteristics and treatment throughput requirements for wastes identified as "special" wastes are provided in section 2.1.2. Throughput requirements need only be met for one shift per day of operations. Three shift operations is normally not required for campaign waste treatment to meet throughput for these types of waste. Treatment provisions shall be provided for campaign or "special" wastes as described in the following subsections.

- a. The design of WRAP 2A should provide for the sampling and storage in the Special Waste Process Enclosure of treated waste containers of Streams 5A1, 5C2, 9C, and those portions of waste streams 5A2 and 5A3 that fall in the Low-mercury subcategory.
- b. Provisions for storage of two weeks worth of processing of each of these feed streams during their respective campaigns to allow TCLP analysis shall also be provided.
- c. Provisions shall be provided for unloading glass and other containers of mercury and other contained liquids from 208 liter drums without breaking the containers or spilling the contents of the containers.
- d. The capability to load out small quantities of waste or treated waste from the special waste process area into fume hoods, where hands-on treatment, testing, load out of samples to other laboratories and other hands-on operations can be performed on the waste shall be provided.

3.3.3.1 Elemental Mercury Treatment

Capabilities shall be provided to treat radioactively contaminated elemental mercury by the process of amalgamation, as defined in 40 CFR 268.42. The amalgamation process shall enable mixing of the elemental mercury with inorganic reagents such as zinc to result in a non-liquid semi-solid amalgam. The amalgamation process shall treat elemental mercury from incoming waste containers as well as from the retort process described in section 3.3.3.2 (below). Incoming containers of elemental mercury will include 30 liter drums and 208 liter drums, with the actual containers of elemental mercury expected to be 4 liter or smaller. The amalgamated mercury shall be sealed in containers prior to being vibro grouted to minimize release of mercury vapors.

3.3.3.2 Heterogenous Mercury Waste Treatment

Capabilities shall be provided to treat radioactively contaminated mercury waste in the High Mercury (>260 mg/kg) subcategory of D009 by the process of roasting and retorting, as defined in 40 CFR 268.42. The retorting process shall vaporize elemental mercury in the waste material, condense and recover the elemental mercury, and result in a waste containing less than 260 mg/kg mercury. In accordance with the FDC, the retorting process shall be capable of performing its required function by operating at no greater than

500°F. Incoming containers of Heterogenous Mercury Waste will include 30 liter drums, 75 liter drums, 114 liter drums, and 208 liter drums.

Any Heterogenous Mercury Wastes that meet the size requirements for Debris as defined in 40 CFR 268.2 (i.e. primarily composed of materials exceeding a 60 mm particle size) may be treated in accordance with the microencapsulation treatment requirements identified in 40 CFR 268.45.

3.3.3.3 Elemental Lead Treatment

Capabilities shall be provided to treat radioactively contaminated elemental lead by the process of macroencapsulation, as defined in 40 CFR 268.42. The macroencapsulation process shall provide a means to coat and surround the lead waste with grout using the vibro-grout process. Incoming containers of elemental lead will include 7.5 liter drums, 30 liter drums, 37 liter drums, 208 liter drums, and boxes. WRAP 2A should be designed to manage the handling and treatment of elemental lead (Feed Stream 5C1) in lots separate from debris.

3.3.3.4 Heterogenous Lead Waste Treatment

Capabilities shall be provided to treat radioactively contaminated heterogenous lead waste by the process of macroencapsulation, as defined in 40 CFR 268.42. The macroencapsulation process shall provide a means to coat and surround the lead waste with grout using the vibro-grout process. Incoming containers of Heterogenous Lead waste will include 208 liter drums and boxes.

Any Heterogenous Lead Wastes that meet the size requirements for debris as defined in 40 CFR 268.2 (i.e. primarily composed of materials exceeding a 60 mm particle size) may be treated in accordance with the macroencapsulation treatment requirements identified in 40 CFR 268.45.

3.3.3.5 Contained Liquids Treatment

Capabilities shall be provided to treat radioactively contaminated contained liquids by the processes of neutralization, oxidation, reduction, sulfide precipitation, and grout solidification. These techniques will be used to meet the treatment objectives of Deactivation as identified in 40 CFR 261.42 for waste codes D001, D002, and D003, as well as to sufficiently reduce the solubility of toxic metals D004 through D011 to enable the treated wastes to meet the Table CCWE standards listed in 40 CFR 268.41, and the Table CCW standards listed in 40 CFR 268.43 as applicable. For individual D001 and D003 waste, which have been identified by the generator as "reasonably expected" to contain underlying hazardous constituents, treatment objectives will include verification that the treatment standards for F039 waste, for the identified underlying hazardous constituents, have been met.

Contained Liquid wastes will be received in 20 liter drums, 37 liter drums, 56 liter drums, 114 liter drums, and 208 liter drums, with the actual containers of liquids expected to be 3.78 liters or smaller.

3.4 Product Certification and Sampling

- a. The PMS shall track waste through the entire WRAP 2A process from the initiation of Waste Immobilization Demonstration treatability studies to final waste disposal. Data developed from generator waste characterization, treatability testing, waste assay, waste feed sample analysis, raw material analysis, process monitoring and product acceptability testing will be tracked and compiled in a final waste certification package.
- b. Provide sufficient Operator Interface Units (OIUs) so that operators may access the Plant Management System to obtain incoming sample information, status of analysis, analytic results, etc.
- c. Verification of record information on a lot of containers is a screening technique to verify lot identity prior to acceptance for treatment. If performed in the process enclosures, it is to be performed prior to the immobilization process. In the base case, verification sampling will be performed in the sample management area.
- d. Each of the process enclosures shall have the capability to retain and package for exit from the enclosure samples packaged in one-liter sized containers.
- e. The capability to extract samples from incoming waste containers and treated waste containers shall be available in a location where the sampling activity will not impact process throughput.
- f. The turnaround time for analysis of process control/monitoring samples is one hour maximum.
- g. Provide capability to manage samples requiring refrigeration at 4 °C.
- h. Archive storage within WRAP 2A shall accommodate retention of representative samples of each lot until the waste lot has been certified and released for disposal.
- i. Destructive examination capabilities in WRAP 2A will serve to evaluate the final waste form and confirm that the entire product container contents meets established waste acceptance criteria (i.e., void space and free liquids restrictions).
- j. Capability to perform penetration resistance testing of the waste surface of full product containers shall be provided for in the cure storage area.
- k. WRAP 2A shall have the capability to process for disposal excess sample media and secondary waste resulting from sample analysis conducted at both the SMA and external laboratories.

- l. The Sample Management Area (SMA) shall have a separate non-confinement area for handling of inactive samples and other laboratory materials that need not be managed in the confinement zones of the SMA
- m. The capability to load out small quantities of waste or treated waste from the Sample Management enclosure into fume hoods, where hands-on treatment, testing, load out of samples to other laboratories and other hands-on operations can be performed on the waste shall be provided.
- n. Provide functionally equivalent capabilities to acquire waste feed samples as indicated in Table 8.

TABLE 8. WASTE FEED SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample frequency	Analysis Required
Incoming Waste Drums (W2A-S01)	Sample Management Area	To Verify Waste Identity	1.Thief 2.Manipulators	Capability to sample from at least one drum of a lot or 20% of the waste containers of a lot, whichever is greater.	pH; Heavy Metals; Anions; Water Content
Boxes, Non-standard drums & feedstream 1A (W2A-S00)	Box Breakdown and Repect Area		Manipulators		
Drummed Waste Feed to Special Waste (W2A-S02)	Special Waste Area (Waste Drums)		Manipulators	22/day (max)	

- o. Provide functionally equivalent capability to obtain samples of binder feed materials as indicated in Table 9.

TABLE 9. BINDER FEED MATERIAL SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample Frequency	Analysis Required
Polyethylene Seeds (W2A-S20)	PE Bulk Store Storage Silo Discharge Lines	Quality Check	Valved Sample Point	1/month	Particle Size Range; Melt Index
Polyethylene Additive (W2A-S21)	Polyethylene Bulk Additive Storage Silo Discharge Lines	Quality Check	Valved Sample Point	1/month	Impurities; Moisture; Agglomeration
Ordinary Portland Cement (W2A-S22)	Storage Silos (T-09-101 through 104)	Quality Check	Valved Sample Point	Non-Routine (Time/Temp Dependant)	Chemical And Physical Properties: Particle Size Distribution; Moisture; Agglomeration.
blast Furnace Slag Powder (W2A-S23)					
Pulverized Fly Ash (W2A-S24)					
Grout Additive (W2A-S25)					

- p. Provide functionally equivalent capability to sample in-process to support process monitoring as indicated in Table 10.

TABLE 10. IN-PROCESS SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample Frequency	Analysis Required
Liquid Grout (M2A-S26)	Wet Grout Mixing Tank (T-05-212)	Quality Check to Confirm Successful Mix	Valved Sample Point	1) 10 samples/day; 2/3) At Process/Operations Discretion	1) Viscosity; 2) Compressive Strength; 3) Bulk Specific Gravity

- q. Provide functionally equivalent capability to sample product as indicated in Table 11.

TABLE 11. PRODUCT SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample Frequency	Analysis Required
Extruded Waste/Polymer Product (M2A-S10)	PE Waste Extruder	Product Certification	In-Line Sampler	Capability to obtain samples from a continuous operation at a rate equivalent to the FDC requirement (at a minimum, the capability to sample at least one container in each lot or 10% of the exiting lot of drums, whichever is greater.)	TCLP Metals
Sludge/Particulate Grout Product (M2A-S11)	Valve in mixer tank recycle lines. (T-05-214 A, B)		In-Line Sampler		
Treated Waste From Special Waste (M2A-S13)	Special Waste Area (Treatment Vessel)		Scoop		
Solidified Product (M2A-S12)	Sample Management Area		Core Drill	Non Routine - only used when analysis of samples acquired on-line are inconclusive.	

- r. The process areas and any enclosures shall have the functionally equivalent capability to sample secondary liquid waste as indicated in Table 12.

TABLE 12. SECONDARY LIQUID WASTE SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample Frequency	Analysis Required
Non-Active Aqueous Waste (W2A-S30)	Collection Tanks (T-07-101 A, B)	Water quality determination prior to recycling as waste feed to process	Valved Sample Point	Non-Routine (When Tank is Full)	pH; Total Dissolved Solids; Ion Conductivity
Treated Active Waste (W2A-S31)	Active Waste Treatment Tank (T-07-202)	Water quality and radionuclides content	Valved Sample Point	Non-Routine	pH; Total Dissolved Solids; Ion Conductivity; Gross Gamma
Active Waste (W2A-S32)	Active Waste Collection Tank (T-07-201)	Water quality	Valved Sample Point	Non-routine (When tank is full)	Solid Content
Special Waste Scrubber Liquor (W2A-S34)	Special Waste Area Scrubber Liquor Recycle Line	To determine if scrubber liquor requires changing.	Valved Sample Point	1/day	pH
Extruder Condensate (W2A-S36)	Condensate Pump	Presence of Organic	Valved Sample Point	1/day	Hydrocarbons (phase separation)
Grout Washings (W2A-S37)	Grout Washings Tank (T-05-218)	Process Control	Valve in grout washing tank recycle line	1/day	Solids content inhibitor concentration

- s. Provide for the functionally equivalent sampling of effluents as indicated in Table 13.

TABLE 13. EFFLUENT SAMPLES

Material To Be Sampled (Sample No.)	Where To Be Sampled	Reason For Sample	Sample Method	Sample Frequency	Analysis Required
Scrubber Off-Gas Condensate (W2A-S35)	Special Waste Area	To Determine If Scrubber Is Working	On-Line Sample/Analysis	Continuous	1. pH Of Vapor Condensate
HVAC Exhaust Gases (W2A-S33)	Discharge Stack	To Characterize Off-Gases	Valved Sample Point	Sampled Continuously (Samples collected 2 times/wk. for analysis)	Radionuclides Composition; (No monitoring will be required for toxics.)

- t. The analytical capabilities indicated in Table 14 will be provided within the WRAP 2A Sample Management area.

TABLE 14. WRAP SA SAMPLE MANAGEMENT AREA ANALYTICAL CAPABILITIES

SAMPLE FOR ANALYSIS	ANALYSIS REQUIRED	COMMENTS
POLYMER ENCAPSULATION SAMPLES		
Extruder Condensate (W2A-836)	Phase separation	Indicates presence of organic.
GROUT IMMOBILIZATION SAMPLES		
Liquid Grout (W2A-826)	Compressive Strength; Bulk Specific Gravity.	To determine if binder has sufficient fluidity for vibro-filling; Product quality; Confirm successful mixing.
Grout Washings (W2A-837)	Solids Content Inhibitor Concentration	Process Control- Determine quantity of activator and cement powders to be added
SECONDARY WASTE SAMPLES		
Non-active Aqueous Waste (W2A-830)	pH determination; Total Dissolved Solids; Ion Conductivity.	To assure water quality for immobilization with grout.
Treated Active Aqueous Waste (W2A-831)	pH determination; Total Dissolved Solids; Ion Conductivity.	To assure water quality for immobilization with grout.
Active Waste (W2A-832)	Solids Content	To evaluate filter performance in removal of grout solids.
SPECIAL WASTE AREA SAMPLES		
Scrubber Liquor (W2A-834)	pH	To determine if scrubber liquor requires changing.

- u. Capability to conduct in-house analysis and coordinate the receipt and transport of individual samples to external laboratory facilities at the maximum rates specified in Table 15:

TABLE 15. SAMPLING FREQUENCY

Samples per shift for transfer to external analytical facility (maximum) (nonactive/active)			Samples per shift for analysis within the SNA (maximum) (nonactive/active)		
Daily (per shift)	Weekly	Monthly	Daily (per shift)	Weekly	Monthly
0 nonactive 31 active	0	6 nonactive 2 active	10 nonactive 3 active	0	0

3.5 Secondary Waste Treatment

3.5.1 Liquid Waste Treatment

The requirements of the liquid waste collection and treatment systems will be described using terminology as follows:

- operating capacity - the largest volume and weight of liquid, sludge, and/or slurry which the vessel is required to contain under normal operating circumstances including allowances for such phenomena as vortexing or foaming.
 - maximum capacity - the largest volume and weight of liquid, sludge, and/or slurry which the vessel is required to contain under abnormal circumstances such as overfilling. Any open lines that would allow materials to drain from the vessel must be located above the maximum capacity level. The maximum capacity is required by the FDC to be at least 150% of the operating capacity for each vessel intended to contain liquid, sludge, and/or slurry.
 - freeboard - the vertical distance above the operating capacity level up to and including the maximum capacity level. Freeboard provides an spatial containment allowance for detection and responses to high level conditions.
- a. All piping and tank systems that may potentially contain dangerous liquid waste (radioactive and/or non-radioactive) shall be designed in compliance with WAC 173-303-640.
 - b. Segregated secondary containment systems shall be provided for tanks containing liquid wastes that are potentially incompatible with each other.
 - c. Potentially radioactively contaminated (active) liquid waste systems shall be isolated from non-radioactively contaminated (inactive) liquid waste systems.
 - d. The secondary waste systems shall be designed to minimize the generation of MW and provide separate collection/treatment for radioactive components and dangerous/hazardous/toxic components as much as possible.
 - e. Active Liquid Waste System Requirements

The active liquid waste system shall provide two collection tanks, each having an operating capacity of at least 20 cubic meters, with the capability to isolate either (i.e. route all new receipts to one or the other).

The active liquid waste system shall provide one treated waste tank having an operating capacity of at least 20 cubic meters.

The active liquid waste system shall provide capability of transferring liquid waste from either collection tank to the treated waste tank, from the treated

waste tank to either collection tank, from the treated waste tank to the agitated grout system, and from the treated waste tank to a tank trailer.

The active liquid waste system shall provide capability to treat waste from either collection tank by pH adjustment and filtration.

Both of the active liquid waste collection tanks and the active liquid treated waste tank shall be provided with agitation.

f. Inactive Liquid Waste System Requirements

The inactive liquid waste system shall provide one collection tank with an operating capacity of at least 12 cubic meters and having agitation.

The inactive liquid waste system shall provide capability to treat collected waste by pH adjustment and filtration.

The inactive liquid waste system shall provide capability of transferring liquid waste from the collection tank to the vibro grout system, and from the collection tank to drums.

3.5.2 Solid Secondary Waste Treatment

- a. Solid wastes generated during operations of WRAP 2A shall have segregated collection and storage in the following categories (as applicable): non-dangerous radioactive wastes; radioactive and dangerous mixed wastes; dangerous non-radioactive wastes; and non-radioactive non-dangerous wastes.
- b. RCRA satellite accumulation areas shall be provided for the collection of radioactive and non-radioactive solid wastes that may potentially be dangerous wastes.
- c. Waste minimization principles will be applied to waste generated and handled during all operations, maintenance and decontamination of WRAP 2A.
- d. The facility design shall provide the capability of compacting 30 empty drums per shift of drums to be managed as Low Level Waste. And it shall have the capability of shredding 30 empty drums per shift of drums to be managed as debris. It is not required that these operations be performed simultaneously each shift. Drums sizes to be accommodated range from 114 liter drums to 208 liter drums.
- e. Control systems for radioactive emissions and for toxic emissions shall be designed to achieve Best Available Control Technology standards.

3.6 Process Control

- a. The WRAP 2A Facility Plant Management PMS shall provide the means to integrate plant control elements and data management elements into a cohesive facility. This system shall be comprised of the Plant Control System (PCS) and the Data Management System (DMS). The PMS shall permit overall control of plant operations and management of container characterizations and reporting data. The PMS shall provide a means of coordinating the movement of all containers of waste (whether manually or automatically) to and from the various operating stations throughout the facility and provide the focal point for information related to waste containers within the facility.
- b. The PCS shall be an integrated control system based upon a modular, flexible and distributed architecture and shall provide a supervisory and control function over the process and other stand-alone controllers such as Heating, Ventilation, and Air Conditioning (HVAC), AVs and the ASRS. The PCS shall also perform data acquisition functions related to process/facility control (i.e., not DMS functions). Closed loop control shall be executed at the lowest possible level in the system hierarchy. The PCS shall be capable of automatic querying of the DMS database (Oracle based) for information required for PCS operation and be capable of automated updating of the DMS database with newly generated data about the waste containers as received from field/output devices connected to the PCS.
- c. The DMS shall gather and track characterization information for the waste. Gathering of information shall be through local data input terminals, analyzers and field input/output data as received through the PCS. Local input terminals shall be connected to the central DMS computer over an ethernet local area network complying to IEEE 802.3. The characterization information will be used for process and certification purposes. The DMS shall communicate with the Hanford site master waste tracking database SWITS to provide initial waste package data and to update the SWITS database with new characterization data. The DMS shall be the focal point for data communications with the other solid waste facilities and the Laboratory Information Management System (LIMS).
- d. PMS data and software shall be capable of being archived or "backed up" for use subsequent to a system failure.
- e. All supervisory level functions of the PCS shall be located in consoles in the WRAP control room. Supervisory functions include (but are not limited to) monitoring and operator interface of facility utility systems, stack data, process status, inventory, and internal transport. All facility alarms shall be displayed in the central control room at minimum. Localized alarms shall be provided where required for safety. All radiological alarms shall be relayed to the health physics office. The central control room shall also include equipment for integration of the WRAP complex AV control functions. Independent local control shall

be provided by consoles located near their respective processes and systems.

- f. The supervisory level of the PCS shall perform functions such as providing process status displays, alarms and control. Operator control of processes at this level shall include remote manual control of individual devices or initiation of automatic functions to be performed by local control units located on the plant floor. Local control units shall provide permissive, override, sequential and loop control. Permissive control shall be exercised when a specific facility function such as material transport requires information from another function. Override control of a function shall be exercised by the local control units when it is determined that safety or some other significant criteria have been, or may be, violated. Override controls can also be initiated by supervisory level through operator action and can be configured within the software during definitive design.
- g. Software changes to the PCS shall be controlled by password or keylock controls. Access shall be made internally only, except that access to the DMS for data management only may be accomplished through the Hanford Local Area Network (HLAN).
- h. The centralized database functions of the PCS shall consist of dynamic facility operational information and relatively static administrative information required to efficiently operate the facility. Specific data requirements and report formats shall be determined during definitive design.
- i. General supervisory functions of the PCS include current status displays, operator controls, data archival, and facility supervision. A complete set of supervisory functions shall be developed during definitive design.
- j. Process control and data acquisition is the lowest level in the PCS hierarchy and provides the principal interface with the physical world. The basic functions performed at this level are input/output and computation including sequential control and analog loop control.
- k. Inputs to the process control and data acquisition level take two forms: information and instructions. The system shall accept information from sensors, switches, and other electrical and electro-mechanical devices and from local Human-Machine Interfaces (HMI). Instructions shall be accepted from local HMI and from the supervisory level. Input required from primary elements/transmitters shall be defined during definitive design.
- l. The computation function of process control and data acquisition involves the manipulation of data and shall include activities such as engineering unit conversion, limit checks, and control computations. It shall also include the translation of instructions, received either

- locally or from the supervisory level, into required display or control output. Control computations shall provide the necessary sequences and interlock logic to safely and efficiently control the process and facility.
- m. The DMS shall be the focal point of all data related to waste within control of the facility. Prior to receipt of waste the DMS shall obtain all the waste's applicable records from the SWITS database. During processing the DMS shall be available to the PCS to provide required processing data and to receive newly generated characterization data from sensors and HMI's. The DMS shall be capable of updating SWITS with the revised characterization data on a demand basis. Once waste leaves the WRAP 2A system (i.e. shipped or disposed), SWITS will provide data archives. This will be for character based data only. Digitized or video images shall be archived locally (or on a centralized system at the W-112 Storage Facility, if provided).
 - n. The DMS shall provide an interface with HLAN using Ethernet Version 2 and configured per IEEE 802.3. The facility HLAN connection will provide the data exchange interface with Retrieval, SWITS, LIMS, and other modules on the Central Waste Complex.
 - o. The PCS shall provide a data interface with the DMS using Ethernet Version 2 and configured per IEEE 802.3. The PCS shall also provide an internal Local Area Network (LAN) to permit control function communications with all applicable areas of the WRAP 2A facility. Communications meeting IEEE-802.3 requirements are preferred for consistency with existing site standards. Other communications standards may be used for control systems communication if required to meet data throughput requirements or to support competitive bidding requirements. The control systems LAN shall not directly communicate with the HLAN.
 - p. The PMS shall be designed to support plant operation. Plant downtime due to PMS problems shall be less than 1% of the scheduled plant operating time. A system failure shall not degrade the availability of interfacing systems. As an example, the failure of the PCS shall not cause loss of local control of subsystems, nor shall the failure of one subsystem (e.g. HVAC) cause loss of local control of other subsystems (e.g. glovebox control system).
 - q. The PMS shall be designed for ease of maintenance. The design shall be such that plug-in module replacement will correct system failures and module repairs can be performed in a shop environment. The system shall be designed to utilize software diagnostics to determine system state-of-health and to localize failed hardware modules.
 - r. The PMS shall be designed so that maintenance and troubleshooting procedures can be performed without requiring total shutdown of the plant. Where there is hardware redundancy it shall be possible to

perform maintenance and repair on failed components without requiring system shutdown.

- s. The PMS shall be designed to minimize the need for calibration. Built-in calibration capability is preferred, but where required, portable calibration equipment may be used.
- t. The PMS shall accommodate a minimum future expansion of 25% of initial capability, without replacing existing hardware, software, or firmware components.
- u. Where a choice is available, the same family of hardware shall be used throughout the systems architectural levels. Vendors of equipment using proprietary control systems shall be required to provide communications drivers such that all architectural levels shall be capable of communicating.
- v. The PMS shall contain a clock which will provide current date and time for all hard copy, video monitor, CCTV and other displays. This time-of-day clock shall be the master clock for the facility, shall be controlled by the master system clock via the HLAN, and shall provide update signals as required.
- w. All PMS drawings shall use the Hanford Standard symbology (provided) and ANSI/ISA-S5.1 "Instrumentation Symbols and Identification" when depicting system components.
- x. All bar code equipment shall meet WMC standards. Bar code labels applied to waste shipping containers shall meet the standards of the waste disposal facility. All bar code information shall have data identifiers assigned per WMC-CM-2-6, Section 3.4, "Bar Code Identifier Standards."
- y. All supervisory level HMI shall be located in consoles in the control room. Local control consoles shall be located near their respective processes and systems. Remote terminals shall be provided, as required, to permit data input and preparation of such hardcopy items as off-line reports, shipping papers and bar code labels.

3.7 Raw Materials Handling

3.7.1 Receive and Move Non-Waste Materials

- a. Provide a shipping and receiving area that is capable of accepting incoming new product containers and other non-contaminated miscellaneous process materials that are routinely used within WRAP 2A. Bulk quantities of non-contaminated process supplies will be stored in silos or hoppers that are external to the facility and will not need to be received at the shipping/receiving area.

- b. Provide capability to receive new empty 208 liter drums and product containers used for transferring waste in process and containment of the treated final product, that are delivered by flatbed trucks to the shipping/receiving dock.
- c. Provide capability to temporarily store all operating supplies that are received for at least one day prior to relocation to their permanent storage location.
- d. Provide sufficient floor space to allow forklift access between the truck receiving station and the product container storage area.

3.7.1.1 New Container Storage

- a. The new container storage area shall provide sufficient covered space to accommodate enough new 1.2 x 1.2 x 1.2 meter boxes to support two weeks of three shift per day operation.
- b. Capability of receiving empty new 208 liter drums and product containers at either a new drum and container storage area dock or the shipping and receiving area shall be provided, and transfer of new empty drums and containers from the shipping and receiving area to the new container storage area shall be provided.
- c. The new container storage area shall provide the capability to install and read bar code labels on each new container.
- e. The new container storage area shall stack new containers a maximum of two high.

3.7.1.2 Chemical Storage and Makeup

This section applies to containerized reagents used for decontamination, waste conditioning, and equipment flushing. This section does not apply to analytic reagents that may be used in the sample management area or to bulk (non-containerized) raw materials.

- a. Separate storage systems shall be provided for bulk quantities of four different solid raw materials: PFA; OPC; BFS; and grout additive (e.g. lime) to support the grout immobilization process. Separate storage systems shall be provided for bulk quantities of different solid raw materials to support the polyethylene process as well. The specifics are defined in the grout and polyethylene sections.
- b. The receipt systems for the four solid raw materials shall have non-interchangeable fittings to prevent the inadvertent loading of a material into the wrong storage system.
- c. Separate storage areas shall be provided for small quantities of specialty reagents used in the waste treatment area. These reagents

will include non routine aqueous and dry reagents, additives to the grout process and acid and caustic makeup and feed for the water collection and treatment system. These reagents will be received in drums/bags/cases quantities and the size of storage shall be sized to support two weeks operations.

4.0 FACILITY CRITERIA

4.1 Utilities

4.1.1 Electrical

- a. The facility electrical system shall comply with applicable sections of the latest published version of the National Electrical Code (NEC) available at the start of definitive design, plus other codes and standards as listed in the WRAP 2A FDC.
- b. The system shall be designed to operate within performance specifications while exposed to the ambient electromagnetic environment. The following documents and standards shall be used as guidance in providing a compatible design:
 - b.1 IEEE STD 518-1982, "IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources"
 - b.2 IEEE STD 587-1980, "IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits"
 - b.3 IEEE STD 1-1982, "IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems"
 - b.4 MIL-HDBK-419A, "Military Handbook, Grounding, Bonding and Shielding for Electronic Equipment and Enclosures"
 - b.5 NFPA 70, "National Electrical Code"
 - b.6 NFPA 78, "Lightning Protection Code"
- c. The power transformers to step down the primary 13.8 Kv primary service to the building's utilization voltage of three-phase 480 volt are not to be sized such that one (1) transformer alone can supply the entire building. Primary and secondary protection shall be provided as required by the NEC for transformers rated over 600V. A ground grid shall be provided around the transformers' concrete pad. Traffic protecting posts shall be provided, if the transformers' pad is accessible to vehicular traffic. Power transformers construction shall be suitable for outdoor installation.
- d. The building's utilization voltage of three-phase 480 volt shall be metered and a loss of power alarm signal shall be sent to the control room for power loss/recovery procedures.
- e. The low voltage switchgear to distribute 480V service to the motor control centers shall be arranged in a split bus configuration with nonautomatic, normally open tie breaker(s) to prevent automatic

paralleling of loads without first shedding non-critical loads in order to prevent overloading of the power transformers. Protective device/relay settings based on the electrical coordination study for the WRAP 2A project electrical distribution system shall be provided at the time of final turnover or acceptance testing of the low voltage switchgear. Protective device/relay settings shall be on a drawing or supporting document that is in a usable format for use by the facility electrical maintenance craftsmen.

- f. The 480V motor control centers located throughout the plant shall be used for power distribution to 480V motor loads and process equipment. Motor control centers serving three-phase, four-wire loads shall be provided with a factory installed neutral bus. Elapse time clocks shall also be provided on each motor controller in the MCC.
- g. Power for miscellaneous loads and receptacles shall be derived from 480-208Y/120V dry type transformers and panelboards. No 230V and 240V motors shall be used on 208V systems. Instead motors specifically wound for 208V shall be specified or dry type transformers rated for 240/120V shall be provided. The secondary neutral point of dry type transformers shall be connected to the building ground grid via a grounding plate installed on the wall near the transformer location. Where a panelboard is supplied through a transformer, as in this case, the main overcurrent protection to be provided on the panelboard shall not exceed the overcurrent protection rating required for the transformer secondary protection.
- h. A lightning protection system designed per NFPA 78 and installed properly such that a Master Label can be obtained after completion of the system shall be provided for the building. Downcomers shall be physically protected and be connected to the building main ground grid. A lightning protection system drawing showing the air terminals, conductors, ground terminals, interconnecting conductors, and other connectors or fittings to complete the system shall be provided.
- i. Lightning and surge protection shall be provided on the incoming 13.8 Kv primary service.
- j. A grounding grid shall be established for the WRAP 2A Facility. A grounding grid system showing the ground grid including the location and method of attaching cables to structural members, noncurrent carrying parts of electrical equipment, grounding rods and other grounding electrodes shall be provided.
- k. A separate equipment "green" ground wire shall be provided for each feeder and branch circuit conductors and terminated in a factory installed ground bus, bar, or terminal lug that shall be provided in all the electrical distribution equipment.

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- l. A grounding conductor shall be included in the electrical duct bank concrete envelope (not in a duct) and connected to an existing ground, preferably at the power source.
- m. Wiring for alternating current (AC) and direct current (DC) power or control circuits shall not be in the same raceway or in the conductors of multi-conductor cables unless barriered or separated by 15 centimeters.
- n. Cable shields shall be electrically continuous and shall contain no splices between termination points. When two lengths of shielded cable are connected together at a terminal block, an adjacent point on the terminal block shall be used for connecting the shields. Cable shields shall be grounded at the same point as the signal circuit and only at that point.
- o. Motor control centers and distribution panelboards shall be so located such that voltage drop to the farthest electrical load served is limited to a value no more than 3% per NEC 215-2, FPN 2.
- p. Lighting and receptacle panelboards shall be so located such that voltage drop to the farthest electrical load served is limited to a value between 1 to 3%.
- q. Use of a larger size wire shall be considered in order to limit voltage drop in a circuit rather than based on the circuit ampacity required.
- r. Tabulated conduit and circuit schedule drawings showing the identification number, routing, number and type of conductors used in the facility shall be provided.
- s. Clear and permanent identification and marking of every conductor at every termination point in every circuit shall be provided.
- t. The equipment rating for all the electrical distribution equipment shall include a 25% extra capacity for future expansion.
- u. The power transformers to be used to step down the primary 13.8 Kv primary service to the building's utilization voltage of three-phase 480Y/277 volt shall have all the auxiliary equipment (except the cooling fans) for future forced air cooling.
- v. Spare circuit breakers, motor starters or spaces only shall be provided as required for all the electrical distribution equipment. As a minimum, the number of spares/spaces to be provided shall not be less than 25% of the active circuit breakers.
- w. Allow enough space at the end of switchgears and motor control centers where they are to be installed for the possible addition of future sections.

- x. Spare empty conduit systems for future expansion use shall be provided with pulling string installed in the conduit. Identify conduit future use at opposite termination point.
- y. Spare electrical/telecommunication conduits in the electrical/telecommunication duct banks shall be provided for future use. As a minimum, the number of spare electrical conduits to be provided shall not be less than 25% of the active electrical/telecommunication conduits, but not less than one spare. Plug or seal empty spare raceways installed in the electrical/telecommunication duct banks.
- z. Spare empty conduits stubbed out and capped above the suspended ceiling for future branch circuits shall be provided from flush or recessed mounted panelboards. As a minimum, the number of spare empty conduits shall not be less than 25% of the active electrical conduits, but not less than three - 3/4 inch conduits.
- aa. All terminal boxes and control panels shall be provided with a minimum of 25% spare terminal points.
- ab. Manual motor starters with low voltage protection shall be provided for equipment loads, where for personnel safety, requires that there is no automatic start-up after a power loss. Manual motor starter must be manually reset after a power loss.
- ac. Adjustable speed drives shall be sized at 150% of maximum horsepower requirements and shall be provided with a manual mode of backup operation. Manual mode of backup operation means providing the capability of operating the motor from a built-in by-pass across the line motor controller if the adjustable speed drive: fails to start, shut down due to a fault, or shutdown for both unscheduled/scheduled maintenance/repair. By-pass of the variable frequency motor control does not imply that motors are to automatically go to full speed.
- ad. Each electrical equipment located outdoors or roof mounted shall be provided with a non-fused, horsepower-rated, heavy-duty local disconnect switch (if none is provided with the equipment as manufactured) that is lockable (in the open position) and readily accessible/operable and placed within view of the equipment controlled.
- ae. All control systems shall be engineered and designed for safe failure positions in the event of a complete loss of electrical power, instrument/plant air systems, or hydraulic power.
- af. Human engineering practices in accordance with MIL-STD-1472D shall be used when designing HMI.

- ag. Control relays contacts shall be rated 10 amps minimum continuous at rated contact voltage. Relays shall have 2 spare convertible contacts in addition to the contacts required by the system control.
- ah. All devices requiring periodic operator adjustment shall be accessible without exposing operator to live electrical parts.
- ai. Indicating pilot lights shall be provided to indicate both normal and abnormal equipment or system operating status. Indicating pilot lights color indication (lamp on) shall be as follows:

ai.1 General requirements (except annunciators): Color indication (lamp on):

Safe or normal condition	green
Caution condition	amber or flashing amber
Danger or abnormal condition	red
Danger (personnel hazard)	flashing red

ai.2 For instrumentation or process use:

Process permissive	green
Process non-permissive	red

ai.3 Switchgear/circuit breakers/control circuits

Breaker open	green
Breaker closed	red
Breaker tripped (optional)	white
Circuit energized (optional)	amber

ai.4 Motor Control Centers

Motor stopped (power on)	green
Motor running	red

ai.5 Motorized or solenoid valves

Closed position	red
Open position	green

ai.6 Annunciators

Normal condition (lamp off or dim)	white
Alarm condition (lamp flashing)	white
Acknowledged alarm condition (lamp on steady, bright)	white
(other colors may be used for special purposes)	

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- aj. Motor control center unit compartments shall have mechanical interlocking provisions to prevent removal or reinsertion of a unit starter or circuit breaker when the disconnect is in the ON position. Also, a padlocking arrangement that will permit locking the disconnect device in the OFF position shall be provided.
- ak. Electrical installation shall comply with the NEC requirements for areas classified as hazardous locations.
- al. For hazardous location installations, the electrical equipment NEMA Type enclosure to be provided shall be specifically approved for the NEC class and Division hazardous classification of the installation.
- am. Intrinsically safe electrical devices shall be used as needed.
- an. Design and installation of all electrical equipment shall ensure safe operation during seismic (earthquake) disturbances based on a seismic Zone 2B location. Specific equipment, if any, that needs to remain functional shall be determined during definitive design.
- ao. Electrical equipment enclosures shall be of the following NEMA type designation:
 - ao.1 NEMA Type 1, general use purpose enclosure, for inside installation, unless noted otherwise, such as in the administrative areas and offices
 - ao.2 NEMA Type 4, dust tight and water tight, for the process areas and outside installation
 - ao.3 NEMA Type 4X, corrosion-resistant enclosure, for process areas subject to decontamination
- ap. Motor enclosures shall be of the following type:
 - ap.1 Outdoors or in wet locations: totally enclosed, fan-cooled
 - ap.2 Indoors in dry locations: open drip-proof
- aq. Enclosures for relays and controls shall be provided with breather and drain fittings.
- ar. Cables installed in radioactive environments shall be rated for the maximum anticipated radiation exposure.
- as. An underfloor raceway system for electrical, data and communication cabling shall be used for any open bay office area in the administrative areas of the building.
- at. Branch circuiting shall be so arranged, such that:
 - at.1 the panelboards bus phases serving single-phase 120V and 277V electrical loads are as closely balanced as possible

- at.2 loss of a single lighting circuit does not deprive an entire area of illumination
- at.3 a loss of a single electrical outlet circuit does not deprive an entire area of power
- at.4 the maximum number of electrical outlets on a 20 amp general use branch circuit shall not exceed eight
- at.5 electrical outlets serving office machines shall be circuited at no more than six, and less if the equipment to be fed so dictates.
- at.6 one electrical outlet for every 40 ft², or one electrical outlet for every ten linear feet of office wall space, whichever is greater, shall be provided.
- at.7 the branch circuit feeding the emergency lighting unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches
- au. Specification grade wiring devices shall be provided.
- av. Electrical equipment enclosures (NEMA Type 4X) shall be either stainless steel, fiber glass, or fiber glass reinforced polyester material when used in corrosive locations.
- aw. All equipment ground wires shall be insulated to prevent corrosion.
- ax. The motor control centers construction shall be a NEMA Class II, Type C wherein the starter units wiring are brought out to separate terminal blocks for customer interlocking wiring between starter units or to remote field mounted control devices.
- ay. A control/ladder diagram showing the schematic control wiring from remote field mounted devices and any interlocking wiring with other process equipment controllers to the motor control center starter unit of each major piece of process equipment shall be provided.
- az. Motor controllers shall be a minimum NEMA Size 1, with at least two normally open and two normally closed auxiliary contacts in addition to the holding circuit contact.
- ba. Non-computer equipment shall not be served by feeders or branch circuits serving the central control room, computer and telecommunication equipment.
- bb. The computer room shall have electrical power fed by a computer graded isolation transformer and shall have its own dedicated power panel with isolated ground.
- bc. A grounding plate(s) connected to the building ground grid shall be installed in the electrical closet(s), telecommunication room, central control room and computer room.

- bd. To assure continuity of service to critical equipment, not hard-wired to power sources, critical equipment shall be provided with cord plugs and outlets that are of the "twist-lock" type.
- be. Provide an automatically controlled electrical heat tracing system using self-limiting heating cable for all outside tanks and associated piping as required.
- bf. Collection devices shall have provisions for a failsafe high level detection and alarm system.
- bg. Outlets with ground fault circuit interrupters shall be located inside non-hazardous only process enclosures on a side wall in a readily accessible position.
- bh. The uninterruptable power supply (UPS) to be provided shall consist of a rectifier/charger, inverter, static bypass switch, maintenance bypass switch, battery circuit breaker and battery. The AC output of the UPS module shall be connected to a separately mounted UPS power panel serving the loads specified in the FDC. The battery shall be internally mounted and connected to the DC input through the battery circuit breaker. Utility AC power shall be connected to the normal source AC input of the UPS module.
- bi. A power receptacle shall be provided on the outside wall of the UPS room plugging in a WNC furnished portable 45 Kw diesel-generator as the bypass AC power source when needed in the event of an overload or degradation of the inverter's performance and the static bypass switch, rectifier/charger and inverter are electrically isolated for maintenance.
- bj. The UPS shall be forced air cooled with air inlets provided with filters that are changeable without opening cabinet doors.
- bk. Sufficient ventilation shall be provided in the room where the UPS is to be located to prevent electrical tripping out on high operating equipment temperature.
- bl. The UPS audible noise level is to be less than the noise exposure limits in Occupational Safety and Health Administration standard 1910.95.
- bm. The UPS enclosure maintenance access to the UPS electronics and batteries shall be through hinged doors requiring a special tool to open.
- bn. The UPS with bypass shall have a minimum of 100,000 hours mean-time-between-failure and a maximum of one hour mean-time-to-repair based on spare parts being available on-site.
- bo. Temporary power and lighting systems shall be located so that they can remain undisturbed during the construction project.

- bp. Overhead lines will be minimized within the construction area to assure safe crane access.
- bq. The use of available electrical parts and equipment presently at Hanford shall be considered for the design of temporary construction power and lighting.
- br. Lighting for construction will be installed during site preparation. General lighting of parking area, trailer village, and construction area will be required in accordance with Hanford Plant Standards at levels to allow safe access.
- bs. Construction power will be installed during site preparation and will consist of the following:
 - bs.1 Locate and tie into live 13.8 Kv.
 - bs.2 Design as necessary to provide orderly distribution and hookup of power to various contractors.
 - bs.3 All underground utilities shall be marked per Hanford Plant Standards Supplemental Design Criteria.

4.1.2 Water Systems

- a. The potable water source shall be from an existing 12 inch, 120 psig loop water main. Maximum operating pressure within WRAP 2A shall be 75 psig. The system shall be sized to supply the maximum flow usage requirements with a system minimum residual pressure of 30 psig.
- b. Local pressure indication shall be provided on the main header and at any pressure reducing stations within the facility.
- c. Process water shall be supplied from the potable water source and shall be used for decontamination, grout mixing, chemical scrubber makeup, aqueous makeup, HVAC makeup water, secondary liquid collection, and other areas as specified in the plant design. Isolation of the systems shall be by positive backflow prevention. The Process water shall be supplied from the main header to the process water header at 70 psig.
- d. Process chilled water system shall be divided into two loops, one for cooling of active system processes (particulate dryer, and extruder) and the second for non-active systems (Administrative area HVAC). Chilled water systems shall supply chilled water at 42 °F to the process users. Capacity of each system shall be determined during title design.

4.2 Building Systems

4.2.1 Compressed Air

- a. Compressed air shall be provided to the process area and other areas within the facility as needed.

- b. The compressed air pressure shall be reduced at the point of use by a certified pressure reducing device.
- c. Pressure reducing devices shall be designed to fail in a safe mode.
- d. Compressed air pressure shall not exceed 100 psig.
- e. Compressed air piping shall be of a construction material to ensure an operating life of 30 years.
- f. Compressed air pressure vessels shall be stamped ASME Section VIII Pressure Vessels.
- g. Compressed air pressure vessels and piping shall be protected with pressure relief devices set to activate at 125% of operating pressure and at or below the vessel's stamped design pressure as defined in item above.

4.2.2 Heating, Ventilating, and Air Conditioning

4.2.2.1 General HVAC Criteria

- a. Provide adequate heating and cooling as described in DOE 6430.1A, Section 1550, including adequate air conditioning for all temperature, humidity, or dust-sensitive equipment (e.g., computers and analytical equipment).
- b. The plant areas that are routinely used by personnel will be maintained within the temperature limits required by WHC-CM-4-3.
- c. Ambient weather conditions for this plant are specified in Hanford Plant Standard SDC-5.1. Temperatures and humidity shall be controlled per the requirements of DOE Order 6430.1A; paragraphs 1300-12.4.3, 1550-1.2.2 and 1595-4. Humidity control shall be provided if required for equipment protection, not for personnel comfort. The requirements of WHC-CM-4-3, Guide W-6 should be considered pertaining to temperature limits in work areas.
- d. The HVAC system shall be controlled by a distributed control system with monitoring, alarm reporting and reset capability through the central process control system.
- e. Provide moisture separators or heaters to minimize moisture loadings on filters.
- f. All HVAC systems that serve a space containing radioactive waste (including non-confinement systems used for storage) shall be isolated from other non-confinement systems.

4.2.2.2 Process Area HVAC

- a. The HVAC system shall ensure safe operation and maintain airflow from non-contaminated areas to areas of progressively higher potential contamination.
- b. Maintain airflow between different areas through the establishment of differential pressure zones for ventilation and contamination control.
- c. Require in-place testing of only final HVAC effluent HEPA filters.
- d. Provide parallel HEPA filter systems so that one may be changed out while the other is operating without disruption of normal production operations.
- e. The HVAC System shall serve zones as required by DOE 6430.1A, with pressure relationships established in accordance with WHC-CM-4-9 Radiological Design (Section 4 in draft) and WHC-CM-7-5 (Environmental Compliance) to control airborne radioactive and hazardous contamination. Constant pressures shall be established at the interface points with the WRAP facilities to avoid large pressure differentials.
- f. Air flowing through the maximum credible breach into the zone 1 enclosure shall be sufficient to provide a face velocity of 125 ± 25 feet per minute. The maximum credible breach of a zone 1 barrier shall be determined by analysis of the definitive design glovebox and other enclosures design. At a minimum this will be a single gloveport.
- g. Change rooms used for donning/doffing of Protective clothing shall be served by the Zone 3 ventilation system. (6430.1a, 1300-6.8)
- h. An atmospheric pressure reference header shall be provided and used as the reference point for control of zone pressures.
- i. The post design basis accident configuration of the HVAC systems shall be total system shutdown. Zone integrity (including exhaust ducting) shall be maintained up to the Zone 2 boundary. The exhaust system shall fail closed. Backflow prevention for confinement supply systems shall be provided per DOE 6430.1A. Air handlers servicing confinement zones shall be provided with 90% efficient filtration. The supply system shall fail open.
- j. The in-depth failure mode analysis report shall include consideration of component reliability, component redundancy, parallel systems, modes of providing power to essential systems, spare parts inventory, maintenance and repair scheduling. There shall be no release in excess of off-site dose limits as a consequence of any credible single active component failure. Sufficient redundancy of confinement systems will be provided to allow system maintenance without interruption of operations.

- k. In ventilation zones 1, 2 and 3, the airflow shall be directed downward, eddies and stagnant areas shall be minimized and airflow shall be designed to direct airborne material away from worker's breathing zones.
- l. Work space air sampling and monitoring shall be provided per the Westinghouse radiological design manual, WMC-CM-4-9, Section 10.0, Rev 0.
- m. Utilize welded joints (or equivalent) on ductwork carrying potentially contaminated materials.
- n. Minimize the ability of and provide means to detect buildup of radioactive materials in the ductwork.
- o. Provide changeable prefilters upstream of all HEPA filters except for glovebox HEPA's, along with fittings for checking prefilters. HEPA filters shall be located to minimize amount of ductwork contamination.
- p. Use bagout or self-contained filters and other features for changing contaminated components (including the changeable prefilters) wherever possible.

4.2.2.3 HVAC Process Offgas Discharge

- a. Provide representative effluent record sampling and continuous on-line monitoring for radioactive particulate and hazardous chemicals identified in the source term section 2.1.3.1 if quantities present exceeds prescribed limits.
- b. The effluent monitoring will be designed in accordance with Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR), Part 60, Appendix A and ANSI N13.1.
- c. In the event of ventilation system failure, the stack monitoring system shall continue to sample at a flow rate that would be isokinetic at the minimum detectable stack flow rate.
- d. All HVAC equipment downstream of the final filter train shall be located outside of the confinement zone in a structure designed to protect the equipment from weather.

4.2.3 Fire Protection

- a. Design of fire protection systems shall comply with applicable Hanford Plant Standards, DOE Orders, National Fire Protection Association (NFPA) standards, and Factory Mutual (FM) Loss Prevention Data Sheets (as applicable).
- b. In accordance with the Tri-Party Agreement, MAC 173-303-630 limits the application of the Uniform Fire Code to ignitable and reactive waste.

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- c. Facility waste and product storage areas will comply to Uniform Building Code as Group H, Division 3 occupancy design criteria. The design criteria for the remainder of the facility will be T80.
- d. Automatic fire sprinkler protection shall be provided throughout the facility.
- e. Water supplies provided by this project shall include provision of a minimum of two fire hydrants within 300 ft of each building.
- f. Design shall include features for control/containment of fire water runoff.
- g. Portable fire extinguisher shall be provided throughout each building based upon the requirements of NFPA 10.
- h. Buildings shall be of noncombustible or fire resistive construction as required by the Fire Hazards Analysis to be performed by the A/E during design.
- i. All equipment shall be Underwriters Laboratories (UL) listed or FM approved for the purpose intended.
- j. Conformance with the following is required:
 - j.1 NFPA 13, Standard for the Installation of Sprinkler Systems (1991)
 - j.2 NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances (1992)
 - j.3 NFPA 10, Standard for Portable Fire Extinguisher (1990)
 - j.4 NFPA 30, Flammable and Combustible Liquids Code
 - j.5 NFPA 70, National Electrical Code (1993)
 - j.6 NFPA 90A, Standard for Installation of Air Conditioning and Ventilation Systems
 - j.7 NFPA 101, Life Safety Code (1991)
 - j.8 NFPA 231C, Standard for Rack Storage of Materials
 - j.9 NFPA 496, Purged and Pressurized Enclosures for Electrical Equipment
 - j.10 American Waterworks Association Pacific Northwest Section Accepted Procedure and Practice in Cross Connection Control Manual
 - j.11 DOE Order 6430.1A, General Design Criteria
 - j.12 DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards
 - j.13 DOE RLIP 5480.4C, Environmental Protection, Safety, and Health Protection Standards for RI
 - j.14 DOE Order 5480.7A, Fire Protection (1993)
 - j.15 DOE RLIP 5480.7, Fire Protection
 - j.16 WMC-CM-4-41, Fire Protection Program Manual
 - j.17 WAC 173-303, Washington Administrative Code

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- k. Hydraulically designed sprinkler systems shall have flow and pressure factors each a minimum of 10 percent below the water supply curve at the demand point. This design shall include the basic 500 gpm hose stream allowance and any additional hose stream allowances and other water demands that may be part of the requirements, such as in-rack sprinkler demand or other process demand. The 500 gpm hose stream must be included in the water supply curve determination.
- l. FM Loss Prevention Data Sheets 2-84 provide maximum velocities for sprinkler piping and should be consulted. Avoid turbulent velocities in piping.
- m. MHC will provide sprinkler flow data upon request prior to design.
- n. An alarm check valve is needed on all new wet pipe sprinkler systems in permanent facilities having 20 or more heads.
- o. Distribution mains for either sanitary or raw water shall be at least 12 inches in diameter.
- p. Sectional valves shall be installed in accordance with a point system, such that no more than six points accumulate between sectional valves. The points for this arrangement are; one point for a fire hydrant, and two points for an automatic sprinkler system.
- q. Sprinkler Systems within the building shall be of the "grid type" and supply to the facility is from a looped main system.
- r. Sprinkler supply lead-ins shall be provided in accordance with the requirements of NFPA 24.
- s. Hydrants shall not be closer to the buildings being protected than 50 ft. Hydrants shall be placed so that hose lays from hydrants to the exterior portions of the protected buildings are no more than 300 ft.
- t. Water flow test data is required for Definitive Design. These data shall be included in the report or the design package that will have fire suppression systems installed. Water flow test data shall be requested from the Hanford Fire Department Fire Marshal.
- u. Sprinkler systems for the administrative area shall be designed to NFPA 13 Ordinary Hazard Group 1 occupancy or more conservative. Sprinkler systems for areas of the facility, other than the administrative area, shall be designed to NFPA 13 Ordinary Hazard Group 2 occupancy or more conservative, as determined to be appropriate for the application.

- v. Automatic sprinkler system drawings, underground fire main drawings and the Contractor's Materials and Test Certificates that are produced by a Off-Site Contractor are required to be stamped and signed by the holder of a current State of Washington Fire Sprinkler Certificate of Competency.
- w. Sprinkler systems having air or other gases in the piping (dry, pre-action, or deluge) shall be designed using internally and external galvanized piping. A "C" factor of 120 shall be used in the calculations.
- x. Air compressors installed on dry systems under 570 liter capacity shall be UL listed.
- y. Trim valves and accessories of alarm check valves, dry pipe valves, deluge valves etc. must be approved or listed for intended use as part of the approved trim package as supplied by the manufacturer.
- z. New halon systems shall not be installed.
- aa. The fire alarm system shall detect the operation of any signal-initiating device such as a flowswitch, manual pull station, detector, or tamper device and shall initiate a signal through the local fire alarm panel which will alarm locally and transmit a coded signal to the central receiving facility via the Radio Fire Alarm Reporting (RFAR) box.
- ab. The fire alarm system shall conform to the following requirements:
 - ab.1 NFPA 1221, Installation, Maintenance, and Use of Public Fire Service Communication Systems (1991)
 - ab.2 NFPA 70, National Electrical Code, (1993)
 - ab.3 NFPA 101, Life Safety Code (1991)
 - ab.4 NFPA 72 -1993 National Fire Alarm Code
 - ab.5 Hanford Plant Standard SDC 7.8, Standard Electrical Design Criteria for Fire Alarm Systems
- ac. The Fire Alarm Control Panel (FACP) alarm zones shall be assigned numbers beginning with zone one (1). Waterflow alarm zones shall be assigned the lowest ordinal numbers (i.e. 1,2,3 etc.).
- ad. Supervisory/trouble zones shall be assigned zone numbers beginning with the highest zone number available within the FACP. They shall be collectively signalled to the RFAR via the FACP system trouble contacts. Supervisory zones shall be configured per NFPA 72, 1993, with initiation switches wired in parallel and circuits supervised.
- ae. The FACP design shall include spare alarm/supervisory zones whose number shall be one, or 10% of existing zones, whichever is greater.

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- af. Fire alarm zones, as much as practical, shall be assigned with emphasis on geographic location within the facility. This implies that different types of initiating devices shall be included on a single zone if they indicate an alarm within a defined and logical geographic zone. However, each waterflow signal shall be assigned a unique zone.
- ag. FACP zone assignment shall be coordinated with the Hanford Fire Department and approved by Fire Protection Engineering.
- ah. The FACP system TROUBLE signal to the RFAR shall be fed directly from the panel system trouble contacts.
- ai. FACP shall be provided with alarm zone disconnect switches, if provided by the manufacturer. Disconnect switches shall initiate a trouble condition when activated.
- aj. The system design shall include a bell bypass switch mounted within the locked enclosure of the FACP. Operation of the bell bypass feature shall initiate a system trouble condition.
- ak. Operation of any remote function (such as HVAC or computer shutdown) in response to a fire condition detector shall be processed by the FACP. The remote function initiation circuit shall include a function bypass switch which shall initiate a trouble condition when activated.
- al. Construction Completion test certifications shall be provided in accordance with NFPA 72.
- am. Audible and visual alarm devices shall be provided. Audible devices shall be single strike chimes or bells of sufficient number and intensity to produce a minimum 80 db sound level that shall be distinctly audible above the ambient sound level from 10 feet away with a march rate of 60 to 120 strokes per minute.
- ao. FACP batteries shall be sized for a backup duration of 60 hours.
- ap. Exit signs shall be illuminated and green and white in color.
- aq. Fire walls used to limit the Maximum Possible Fire Loss to below \$150,000,000, shall be installed in accordance with FM Data Sheet 1-22, Maximum Foreseeable Loss Fire Walls. These loss limitation type walls shall be designed to remain standing even with the loss of the building on one side due to an uncontrolled fire.
- ar. Fire walls installed for separating occupancies as defined in NFPA 101 of non-compatible groups shall be rated at 2 hours, or better, and designed as required by NFPA codes. Wall, floor, and ceiling assemblies shall be tested and rated for their fire resistance by UL or similar nationally accredited testing laboratories, or shall be listed for their

fire resistance as approved by FM or similar national insurance organization.

- as. Final HEPA filter housings shall be protected by fire rated barriers or by locating the housings in a separate structure of noncombustible construction with noncombustible contents.
- at. All fire barrier penetrations shall be provided with approved through-penetration firestops and/or protected by approved operable fire door(s), fire damper(s), or fire window(s) having the appropriate fire resistance rating.
- au. Areas handling, processing, transferring, or storing flammable liquids or gases shall be electrically classified in accordance with Article 500 of the NEC.
- av. All explosion proof and intrinsically safe equipment shall be UL Listed or FM Approved.

4.2.4 Communications

- a. Data network design and installation shall provide inter-operability and inter-connectivity with the data networks currently being used on the Hanford Site.
- b. The local operating telephone contractor will install their facilities to a demarcation point within the facility's main telecommunications terminal room. The project will need to provide for all telecommunications facilities from this demarcation line.
- c. The implementation of an Integrated Voice and Data Telecommunications System (IVDTS) will transfer control of the telephone terminations to the Hanford Site. Auxiliary telephone terminals will be provided by private automatic exchanges and private branch exchanges.
- d. An internal plant intercom system shall be provided.
- e. The capability to interface with the Computer Automated Surveillance System (CASS) for critical off-shift alarms shall be provided.
- f. The requirements for telecommunications services are described in the following documents:
 - f.1 U.S. Department of Energy Order 5300.1B, Telecommunications, dated 12/12/88.
 - f.2 IEEE standards with particular attention to IEEE Standard 802.3. All LAN installations shall comply with IEEE Standard 802.3, with the possible exception of certain direct PCS network interfaces.
 - f.3 NFPA 70 "National Electrical Codes"

- f.4 NFPA National Fire Protection Association Codes--All telecommunication installations and design shall comply with National Fire Protection Association Code (NFPA) requirements.
- f.5 Local Telephone Operating Company Codes and Standards--Telecommunication circuits that interface with the GTE-NW and United Telephone shall comply with applicable local telephone operating company codes and standards.
- f.6 Telecommunications Industry Association Commercial Building Wiring Standard.
- f.7 Building Industry Consulting Service, International Telecommunications Distribution Methods Manual.
- f.8 Federal Standard 1090 - Telecommunications: Federal Building Telecommunications Wiring Standard. This specification adopts ANSI/EIA/TIA - 568.
- f.9 Federal Standard 1091 - Telecommunications: Commercial Building Standard for Pathways and Spaces. This specification adopts ANSI/EIA/TIA - 569.
- f.10 Federal Standard 1092 - Telecommunications: Residential and Light Commercial Telecommunications Wiring Standard. This specification adopts ANSI/EIA/TIA - 570.
- g. The PCS will be extensively linked with other telecommunications facilities. The use of conduit space and circuit routing for the PCS will be planned integrally with other telecommunications systems.
- h. Internal and external communication systems such as General Plant Telephone (GPT), Private Automatic Exchange (PAX) with public address capability and LAN shall be provided. Telecommunication systems to be provided shall be compatible to the systems currently being used on the Hanford Site including the IVDTs.
- i. The following emergency alarms with the corresponding audible sound generating equipment (the sounds for these alarms shall not be used for any other alarming or signaling purpose) uniformly used at the Hanford site:
 - i.1 fire alarm: sound of a metallic bell being struck at a frequency of two strokes per second
 - i.2 critical radiation alarm: described as an "AH-OO-GAH" sound generated by a motor-driven howler
 - i.3 evacuation alarm: described by a steady "ON" siren signal generated by a motor driven siren
 - i.4 telephone crash alarm: provides the necessary communication for the emergency warning system and described by a continuously ringing telephone bell.
- j. Audible alarms sound levels shall be a minimum of 80 db and distinctly audible above the ambient background noise sound level from ten feet

away. These alarms shall not subject personnel to sound levels greater than 125 decibels.

- k. All alarm equipment shall be connected to the WRAP 2A UPS system.
- l. The local fire alarm signal shall be transmitted to the remote station equipment located at the Hanford Fire Department central location. All other emergency alarms shall be transmitted to the PCS. The PCS will be extensively linked with other telecommunications facilities. The use of conduit space and circuit routing for the PCS will be planned integrally with other telecommunications systems.
- m. The telecommunication and instrumentation cabling/raceway systems shall be routed to avoid areas containing strong electromagnetic fields such as those generated by electric motors, generators, radio frequency equipment, or arc or inductive welding equipment.
- n. Whenever telecommunication cables are run in a bank of stacked cable trays containing instrumentation and controls cabling, telecommunication cables shall be located in the lowest tray levels of the stack.
- o. Cable trays and conduits shall be able to support the weights of all telecommunication cables expected to be run to the telecommunications room plus 100% to allow for future expansion.
- p. Polyvinyl chloride (PVC) coated rigid steel conduit shall be used for all communications cabling in process areas. Cable trays, if used, shall be made of corrosion-resistant material, or if made of metal, shall be adequately protected against corrosion.
- q. A microprocessor based CCTV system designed for process monitoring and control shall be provided. The system shall consist of video cameras, video monitors, video matrix switcher and video cassette recorders with the following design requirements:
 - q.1 Video cameras housing enclosures shall be sealed and pressurized to protect camera from the possibility of contamination.
 - q.2 Video matrix switcher shall be a microprocessor base system that will allow the operator to select video inputs and outputs and control pan, tilt, zoom, focus, and iris function of the selected video camera.
 - q.3 Video cassette recorders are to be provided in the design to record or playback process operations.
 - q.4 The CCTV system layout including conduit and wiring shall be shown on a floor plan drawing.

4.2.5 Lighting

- a. The enclosure lighting fixtures shall be located primarily on the outside roof of the process enclosure. The lighting fixtures shall

provide a maintained illumination level inside the process enclosure of one hundred (100) footcandles. Lighting shall be controlled from conveniently located switches mounted outside the process enclosure.

- b. Roadway/parking lot lighting standards overall height shall withstand the Hanford area design wind velocity conditions.
- c. For high ceiling areas, where high-intensity discharge (HID) fixtures are used, the emergency lighting system shall operate not only until the normal lighting system is restored, but also until the HID fixtures provide illumination. An auxiliary lamp shall be furnished for HID emergency lighting fixtures to provide light during warm-up and for emergency purposes.
- d. Emergency fluorescent fixtures ballast shall be provided with battery backup power source.
- e. Exit lights shall be provided with battery backup power source and automatic recharge.
- f. The type of lighting fixtures to be used shall be coordinated with the control room, computer, and telecommunication equipment in order to provide the required illumination without creating reflecting glares or electrical interferences.

4.2.6 Leak Detection Systems

- a. Leak detection alarm systems shall be made fail safe such that an alarm condition is annunciated on a loss of electrical signal. Redundancy of the leak detection system shall be evaluated based on the potential and consequences of a leak requiring detection.
- b. Collection devices shall have provisions for a failsafe high level detection and alarm system.

4.2.7 Instrument Air (IA) Systems

- a. The design of the instrument air system shall be based on the "Recommended Practices for Producing Quality Instrument Air ISA-RP7.7, latest version. The quality of the instrument air shall meet the standards specified in "Quality Standards for Instrument Air ANSI/ISA - 57.3 latest version.
- b. The amount of instrument air and the need for redundancy shall be established during title design to ensure that sufficient quantity and availability of air shall ensure that continuity of operations can be maintained to meet throughput requirements specified in this document.

4.2.8 Air Sampling Vacuum (AVS) System

- a. The air sampling vacuum system design shall be based around a dedicated central vacuum system which provides a minimum of 20-inHg vacuum at rated design flow. Each sampling point shall be designed to maintain a minimum flow of 2-ft³/min (CFM) under all normal and anticipated abnormal conditions.
- b. System design flow shall be determined during Title Design. Redundant vacuum pumps shall be provided, and each pump shall have a minimum 15% reserve displacement capacity over the system design flow.
- c. Either vacuum pump shall be capable of operating in the lead configuration with the other pump considered the backup unit. The backup pump shall be capable of automatic start if the lead pump should fail to provide adequate flow or vacuum. Automatic back-up power is not required for the ASV system. Plastic tubing/piping should be considered for distribution lines within the facility.
- d. Further detailed requirements for the ASV system are documented in WHC-CN-4-9 Section 10.0 and DOE/EV/1830-T5.

4.3 Structure and Site

4.3.1 Connect to Infrastructure

- a. The interface with electrical power will be at the 13.8 Kv line that runs along Dayton Avenue.
- b. The interface with the sanitary water or raw water, and sewer will be the primary lines in the utility easement along the main road.
- c. It is currently envisioned that the Phase V subproject will provide main roads.
- d. It is currently envisioned that the Phase V subproject will provide Module 2A rough site grading. Module 2A and Module 1 shall be at the same elevation.
- e. The WRAP 2A project electrical and telecommunication duct banks tie-in shall be coordinated with the electrical and telecommunication infrastructure upgrades being provided by the Phase V subproject.
- f. Coordination with other existing underground utilities within the WRAP 2A project site shall be required to avoid conflict with the new underground utilities required for the project.

4.3.2 Architecture

- a. All contract drawings, field reference points, and as-built drawings shall be referenced to the Hanford site coordinate system. The only exceptions may be in-plant dimensions from building column or grid lines which can be directly related to site coordinates.
- b. The building footprint should be uniform, with as few changes in footings and slab elevations as possible.
- c. The control room should have windows to view the waste processing activity.
- d. An area located on the ground floor level shall be designated as a contaminated equipment clean-up area.
- e. Where expansion bolts are needed, HILTI Kwik Bolts II shall be specified and shall be installed in accordance with Hanford Standard HS-Y-S-4020. If sole sourcing authority for HILTI Kwik Bolts cannot be secured from DOE, then Hanford Plant Standards Architectural-Civil Design Criteria (SDC) 4.2 shall be used for design and installation of expansion anchors.

4.3.3 Maintenance

- a. The WRAP Module 2A processing and support areas shall be designed for operation and maintenance to attain: 1) ALARA goals: WHC-CM-1-6, Radiological Control Manual, WHC-CM-4-9, Radiological Design, and WHC-CM-4-11, ALARA Program Manual and 2) Cost effectiveness: DOE Orders 6430.1A and 5480.11.

A cost benefit analysis shall be performed per WHC-SA-1533-FP Cost/Benefit Analysis at Westinghouse Hanford Company to ensure that the design will meet ALARA principles.

- b. A maintenance plan shall be developed in preliminary design that will determine methods, special tools and facility features needed for lay-down, access to and transport of failed equipment. Any non operational maintenance activities shall be performed during operating planned downtime, i.e. during the 30% of the 250 days per year (=75 days per year) the facility is not required to be operational. This shall include all routine maintenance, necessary cleanout of equipment between campaigns of waste processing, reconfiguration of process lines and other activities not directly associated with process operations. Hazardous and mixed waste generation considerations during maintenance shall be evaluated for incorporation of waste minimization practices as required in DOE Order 5400.1, DOE Order 5400.3 and DOE Order 5820.2A.

- c. The complexity of repairs and maintenance shall be such that the performance of those task can be directed by detailed written maintenance procedures.
- d. The design basis for maintenance within process enclosures shall be personnel working through gloved penetrations. Human factor limitations (reach, strength, endurance, dexterity) shall be carefully considered where gloved hand personnel involvement is required.
- e. Lifting and handling devices shall be selected for their maintenance utility, e.g., reach, load capacities, and clearances.
- f. Commercially available equipment and parts shall be selected for reliability and interchangeability.
- g. Where similar functions are being performed, a single type and size of device should be selected for all locations to the maximum extent practical.
- h. Components having potentially high failure rates shall be located outside of radiation zone areas to the extent possible.
- i. Instrumentation and equipment monitoring systems shall be designed to facilitate troubleshooting and replacement.
- j. Stainless steel linings or special wall coatings shall be provided to ease decontamination of walls, floors and ceilings. Two coats with differing colors shall be used to identify chipped paint.
- k. Facility and Equipment design shall reflect the following order of preference for performing maintenance:
 - k.1 Adjust item or unit in place
 - k.2 Repair item or unit by contact maintenance with radiation dose rates consistent with ALARA principles
 - k.3 Replace item or unit with spare unless it is more economical to perform remote maintenance or remove, decontaminate, repair and return to service
 - k.4 Any maintenance requiring personnel entry into ventilation zone 1 areas.
- l. Equipment shall be located and space envelopes designed to provide access for removal and reinstallation.
- m. Low-accessibility equipment shall designed to minimize in-place preventive maintenance during the expected useful life.
- n. Equipment items that require special maintenance tools shall be identified. Special instructions shall be included with the equipment and any special tools required to maintain equipment shall be provided.

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- o. Remote operated mechanical arms will not be installed for maintenance purposes.**
- p. Handling enclosure equipment, e.g. installed in enclosures, shall be modular for convenient removal and replacement. Where practicable, modules shall be sized to fit into 208 liter drums or 1.2 x 1.2 x 1.2 meter boxes for removal from enclosures.**
- q. To minimize the chance of operator injury, modules requiring removal shall be provided with smooth surfaces, rounded edges and corners, and good visibility of interfacing elements.**
- r. Equipment modules shall be configured for ease of removal by simple lateral or vertical motions; shall have easily accessible lifting device attachment points; shall be provided with ample wrench access to keeper-type bolts; and shall be provided with round and diamond pilot pins to simplify reinstallation.**
- s. Adequate visual access shall be provided to support maintenance through proper lighting and placement of windows or CCTV cameras for direct viewing. Use of mirrors is not acceptable.**
- t. Process Enclosure installed devices shall permit component-level troubleshooting by extending wiring leads outside the enclosure. Independent functioning modules are exempt from this requirement where troubleshooting to the module level can be performed.**
- u. Operate power transmission devices below 75% of manufacture's rating.**
- v. Select pumps to operate in the middle of their flow and head range.**
- w. Provide lag storage for process flow interruptions affected by maintenance.**

4.3.3.1 Coatings

- a. Project requirements for special protective coatings (SPC) and painting shall be developed in the preliminary design to assure correct vendor-contractor packaging, and to avoid rework later during construction. The NFPA code 101, Section 6-5.3.4 is applicable if coating thicknesses must exceed 0.09 cm. The following guidance is provided to assist in developing this packaging.**
- b. Painting requirements for room areas subject to decontamination solutions, acids, corrosive chemicals, and washdowns will vary considerably from those requiring only an architectural "aesthetic" finish. The room finish schedule along with detailed painting specifications should clearly and completely address these varying requirements.**

- c. Finish callouts are required for miscellaneous metal work, stairs, ladders, platforms, doors and frames, armor angle and miscellaneous embeds, conduit and boxes, field routed piping, tubing and instrument runs and miscellaneous hangers and supports.
- d. Criteria used to determine coating requirements may be HVAC zoning, radiological conditions, decontamination requirements, or chemical or corrosive material usage.
- e. Undercoat shall not be yellow and finish coat shall be a different color from the undercoat to facilitate identification of chipped and worn paint.
- f. The project specifications should address, in detail, surface preparation requirements for each type of surface for each type of coating system... "architectural type" paint, epoxy paint, and special protective coating.
- f. Concrete surface preparation and finish requirements must be coordinated between the concrete specification and the painting specifications regarding patching of surface defects, form removal, tie hole patching, and a once-over, steel trowel finish. Sandblasting and any other surface profile criteria must be identified.
- g. Surface proof of compatibility is required between the concrete curing compounds and form release agents and the SPC system through test results or documented recommendations by the coating system manufacturer.
- h. The coating specifications should require objective tests to assure acceptable dryness of the concrete surfaces that will be coated.
- i. The SPC contracts shall require preparation of a demonstration test wall at least 3 meters x 3 meters that has 1/3 left as concrete with acceptable surface preparation, 1/3 left with an acceptable application of SPC surfacer, and 1/3 painted with an acceptable SPC finish coat. This method not only establishes acceptance standards of quality of the SPC finish, but identifies the level of effort required to achieve required finish results.
- j. Painting specifications should identify the maximum and minimum required mil thickness (minimum 30 mil thickness), application temperature restrictions, curing temperatures and relative humidity requirements.
- k. Specific priming requirements for gypsum wall board must be addressed to assure compatibility with the specific SPC finish.
- l. The final coating of all painted and SPC surfaces should be semi-gloss. Office or administrative areas are acceptable exceptions.

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- m. Shop priming for pre-fabricated components must be compatible with field-applied finish coats.
- n. Coating system callouts must avoid use of different types of paints for adjacent surfaces as much as possible. If special wall coatings shall be provided for ease decontamination of walls, floors and ceilings, two coats with differing colors shall be used to identify chipped paint.
- o. The extent of coverage must be defined when SPCs are required. If all surfaces must be covered (floors, walls, ceilings, miscellaneous metal appurtenances) then all concrete areas in the room must be coated prior to start of follow-on mechanical, electrical or equipment contractor work.
- p. Painted surfaces will be damaged during follow-on work and must be recoated and touched up at the end of the project. Specifications must clearly define the extent of recoating expected. Project planning and cost estimates must account for the expected work.
- q. Floor areas are to be recoated at the last stages of the project. Repair of surface damage from heavy construction activities should be included.
- r. Miscellaneous metal and concrete embed specifications must coordinate primer requirements with SPC coating specifications for embedded metalwork where concrete shall receive SPC.

4.3.3.2 Decontamination and Decommissioning

Manual decontamination shall be used in conjunction with maintenance and operation when the cost of replacement is substantially higher than the cost of decontamination and repair, if equipment delivery times would impose substantial operational constraints on the plant, or if decontamination would reduce worker exposure within ALARA. ALARA shall be based on a cost benefit analysis per Cost/Benefit Analysis at Westinghouse Hanford Company, WMC-SA-1533-FP.

The decontamination function shall provide at least the following capabilities:

- a. Be designed to minimize the generation of secondary wastes, most significantly minimize generation of mixed waste by spent decontamination materials
- b. Prepare and deliver decontamination materials necessary for removal of alpha and beta-gamma contamination from metallic surfaces including, carbon steel, painted carbon steel, galvanized carbon steel, and stainless steel

- c. Collection, confinement and treatment for disposal of all radioactive, hazardous or mixed spent decontamination materials (liquid, solids or gases) shall be provided.
- d. Take smears and monitor for radiation dose rates and removable contamination levels of decontaminated items.

Decontamination and decommissioning of plant and equipment must be planned early. Features provided for maintenance-related decontamination must be augmented by decommissioning requirements. Decommissioning planning must differentiate between in situ decontamination versus equipment removal. Equipment removal paths and plant features must be defined early. Results of this planning shall be included in the Preliminary and Final Design Reports.

4.3.3.3 Equipment Reliability

The following references and criteria provide general guidance and are not intended to be all inclusive.

- a. Pumps which may be damaged under no flow conditions shall be interlocked with the process to prevent dry running. Priming capability is required for all pumps which need priming to start.
- b. Lubrication points shall be fitted with grease fittings, as applicable.
- c. Corrosive environment protection shall be provided as appropriate.
- d. Equipment shall be positioned away from potential leaks or provided with shielding.
- e. Protective coatings shall be used on all exposed carbon steel components when the equipment is located in a corrosive environment.
- f. Electrical conduit terminations shall meet the requirements of the NEMA. No exposed electrical wire terminals or connectors shall be used.
- g. Use of limit switches to control mechanical movement shall be minimized. Where it is necessary to use limit switches for positive stop or position indication, the limit switch shall be mounted in a stationary position and the actuator shall be mounted to the movable member. The limit switch shall be protected to preclude damage from inadvertent bumping. The positioning and configuration of the limit actuator shall prevent damage to the limit switch and actuator in the event of over travel, misalignment or malfunction. Fine adjustment of the actuator shall include a positive means of securing the final position.
- h. Pressure measuring instruments shall be equipped with an isolation valve assembly and capped or plugged test ports for easy calibration.

- i. All pressure measuring instruments shall be selected so that the normal operating pressure is between 25 and 75 percent of the instruments calibrated range.
- j. All instruments shall be fully calibrateable over their entire range.
- k. All instruments that provide outputs to the PCS, shall have non-loop interrupting output test jacks.
- l. Selection of individual pieces of equipment and components shall provide intrinsic reliability sufficient to ensure an interactive system (plant) availability of at least 70%. Achievement of this requirement shall be assisted and verified by performing appropriate failure modes analysis in conjunction with the application of mean-time-to-repair data and system simulation studies.
- m. Temperature measuring devices shall be installed into thermal wells so that periodic removal for calibration/maintenance can be performed without shutting down or depressurizing the system.

4.3.3.4 Corrosion Protection

- a. Underground tanks and piping shall be protected from corrosion. New corrosion protection systems shall not interfere with or counteract existing protection systems. The following standards and requirements apply:
 - a.1 NACE RP-01-69 (1983 Revision), National Association of Corrosion Engineers, "Recommended Practice: Control of External corrosion on Underground or Submerged Piping"
 - a.2 WAC-173-303-040, "WAC; Dangerous Waste Regulations, Definitions"
 - a.3 WAC-173-303-640, "WAC; Dangerous Waste Regulations, Tank Systems"
 - a.4 WAC-173-303-810, "WAC; Dangerous Waste Regulations, General Permit Conditions"

5.0 GENERAL REQUIREMENTS

5.1 Equipment Design Requirements

- a. All hydraulic, mechanical and electro-mechanical power transmission devices shall be designed and specified to have a 25% minimum derate, i.e., the performance requirement shall not exceed 75% of the devices' capabilities.
- b. Load testing embedments shall be provided external to process enclosures for all cranes and lifting devices which require periodic load testing.
- c. Permissive signals for operation of powered material handling devices may be supplied by the Plant Control System (PCS).

- d. Where collisions, spills or hazards may occur, interlocks and constraints for material handling devices shall be derived using positive hardware types (mechanical or magnetic limit switches, photo detectors, etc.). Purely administrative controls shall not be used.

5.1.1 Cranes

- a. A crane and hoist class shall be established after an assessment of the requirements and risks are made.
- b. Derate (hoist motions): The normal calculated performance shall not exceed 75% of the rated capacity.
- c. Speed (all motions): The speed range shall be selected by requiring that normal operating speed be between 50% and 60% of the available speed range.
- d. Speed (all motions): Infinitely variable speed control capabilities are required, with the operator interface having four or five preselected speed detents.
- e. Protection against load drop shall be provided in the design of the receiving/shipping area bridge crane and for all other hoists required to lift and transport radioactive waste containers.
- f. In the event of power failure, bridge and trolley motion shall go to the freewheeling mode and hoists on all systems handling radioactive waste shall stop and hold the suspended load.
- g. In the event of power failure, means shall be provided to assure manual positioning of cranes for maintenance work. These means are expected to fall within normal crane practices.
- h. Crane service in each area shall be carefully defined to determine the advisability of providing auxiliary hoist capability.
- i. Appropriate sections from the following codes shall be applied in determining hoisting equipment requirements:
 - i.1 ANSI/NOG-1
 - i.2 CMAA-70
 - i.3 CMAA-74
 - i.4 ANSI/ASME B-30-2
 - i.5 ANSI/ASME B-30-11
 - i.6 ANSI/ASME B-30-16
 - i.7 ANSI/ASME B-30-17
 - i.8 ANSI/ASME B-30-18

5.1.2 Automated Vehicles

These requirements are provided for use if AV's are selected to be used in WRAP 2A and to provide design requirements for providing design interfaces between WRAP 2A and W-112 and the transfer of waste into WRAP 2A using AV's.

5.1.2.1 Building Requirements

These requirements are applicable for use in areas where vehicles from W-112 will be interfacing with WRAP 2A.

- a. Any change in building elevation will be limited to less than 5% slope to accommodate AV travel.
- b. The AV path floor surface should be a high quality, industrial type with resistance to abrasion and wear. Floor flatness should vary less than 1/4 inch in 10 feet to maintain wheel traction of the AVs.
- c. The AV path shall accommodate AV traffic in two directions simultaneously. Collision barriers will be used to prevent vehicle collisions.
- d. The facility shall provide doorways wide enough to accommodate an AV moving in both directions with a load and maintain the minimum safe spacing specified for AV movement. At least 18 inches should be maintained between the vehicles and any other object.

5.1.2.2 Interface Requirements

- a. Automated vehicles are not required to stop due to liquid on the floor.
- b. Any AVs selected will be compatible with and of the same guidance type as the AVs in WRAP 1 and the W-112 Storage Facility. All interfaces with WRAP 2A facility and equipment must be compatible with the AV's used in W-112.
- c. A walking path for personnel will be provided in the transfer corridor. The AV path will be marked on the floor to prevent personnel from walking into the AV path. This walking path will not be used for general travel but only for access to repair equipment or respond to unexpected occurrences.

5.1.2.3 Vehicle Guidance System

- a. The floor surface will not be disturbed to install or maintain the AV guidance system.
- b. The AV guidance system must be easily maintainable in the desert climate, i. e. dust, dirt and high temperatures will not affect its

operation or require excessive maintenance to maintain its operation. The system must be compatible with the guidance system for W-112 AV's.

- c. The AV guidance system must allow changes in the travel path in a short period of time and limit the time required for personnel to spend in restricted areas due to As Low as Reasonably Achievable (ALARA) concerns.

5.1.2.4 Vehicle Safety Requirements

- a. AVs will have flashing lights or an audible warning system to warn of the vehicles approach.
- b. All AVs will have manual emergency stops provided in an easily accessible location.
- c. AVs will be provided with a system to detect objects or personnel in its travel path and will stop upon detection of an obstruction.
- d. An AV will have capability of positively restraining all loads during all transfers.
- e. Each AV shall have a retrieval method, without disassembly, from its normal operating location without increased exposure of personnel to radiation.
- f. A single battery charger shall be provided for each AV provided by WRAP 2A.

5.1.3 Piping and Vessels

- a. All vessels containing radioactive materials shall be designed and constructed in accordance with American Society of Mechanical Engineers (ASME) Section VIII, Division I.
- b. All utility and process piping systems shall meet the requirements of DOE Order 6430.1A. Specifically inaccessible piping and drains containing radioactive liquids shall be doubly contained, with leak detection and initial pressure testing capability.
- c. These vessels shall be kept under a negative pressure relative to the surrounding environment. As an alternative, the feasibility of venting directly to the surrounding environment through filters shall be determined.
- d. All tanks and ancillary equipment storing or handling hazardous waste shall comply with NAC 173-303.
- e. For plant utility distribution, a full loop header system with isolation valves shall be employed.

- f. Block valves shall not be placed in vessel vent lines.
- g. The pressure side of radioactive material transfer lines shall be designed to preclude the potential for cross connection to nonradioactive systems.
- h. All piping connections from non-radioactive services to process vessels shall be equipped with a back flow prevention device to prevent syphoning or other interchange between contaminated and non-contaminated systems.
- i. Automatic valves shall be designed to fail in a safe condition with respect to the process served.
- j. Utility stations shall be provided in process areas. Plant air and water will be provided as a minimum. Hose runs will not exceed 50 feet.
- k. Noncompatible liquids (eg., acids and bases) shall not be located within the same secondary containment dike.
- l. Water lines entering the building shall be fitted with backflow prevention devices.
- m. Pipe shall be seamless construction and materials selected shall be capable of withstanding corrosive and radiological atmospheres.
- n. All piping installation runs shall be sloped in the appropriate direction and liquid traps shall be avoided.
- o. Radioactive and nonradioactive piping connections shall be physically separated to the extent feasible to reduce the potential for accidental interconnections.
- p. Use of floor drains for radioactive systems shall be avoided. But if used, they shall be segregated according to contamination potential (zone) and radiation detection systems installed to monitor for radiation. Automatic diversion of drains to a catch tank, where high activity is detected or a setpoint exceeded, is required.
- q. Liquid waste sampling and transfer tanks shall have sufficient mechanical agitation to ensure uniform suspension of process solids and representation of sampling. Radiation monitors shall be used to monitor and detect buildup of radioactive material in the bottoms of tanks.
- r. Provisions shall be made for completely draining all vessels. The drains shall be hard piped to an approved drain or waste treatment system as applicable.
- s. All utility and process piping shall be labeled according to the service being provided. Labeling shall be per WMC-CM-4-3 Std G-4.

5.2 Rooms and Offices

- a. Change rooms shall be designed to accommodate a maximum single shift staff of 28 male and 12 female personnel. A total of 120 lockers shall be provided to accommodate 3 shifts operations.
- b. In accordance with WHC-CM-1.6, RCA areas shall be established where surface contamination exists or where doses can exceed 5 mrem/hr during normal operation. Protective clothing change areas shall be designed and integrated with non-RCA change areas to allow unimpeded movement of personnel to work areas without co-mingling of Protective clothing clad workers with non-protective clothing clad workers.
- c. Both soiled and clean laundry collection and storage points shall be located in close proximity to both RCA and non-RCA change rooms, with access designed to preclude spread of contamination. Soiled protective clothing laundry bins must be in a RCA zone.
- d. As a minimum, rest rooms shall be located in the locker rooms and the administrative areas of the facility. Rest rooms will not be located in RCA areas requiring protective clothing.
- e. Office space shall be provided for three Health Physics Technicians. Separate office space shall be provided for their Supervisor. Swear counting equipment, air sampling/monitoring counting and portable radiation meter storage shall be located in the RCA zone adjacent to the change room.
- f. The Westinghouse Radiation Area Management (WRAM) system is used to allow personnel access into monitored areas. Office space shall also be provided in an uncontrolled area for the WRAM system access. The plant shall be required to have the ability to access the WRAM system via HLAN. This system will require a computer workstation with an HLAN connection.
- g. Provisions shall be provided for the installation of Personnel Contamination Monitors at the RCA/locker room interfaces.
- h. All facility locksets shall be keyed to be compatible with the master key system to permit emergency entry by security and emergency response personnel.
- i. Handicap access shall be provided into all administrative areas of the facility as well as the main control room.
- j. Provisions shall be provided to allow the use of any freight lifts by operational personnel per ANSI Rule 207.4.

5.3 Safeguards and Security

- a. The PCS of this facility is not required to provide any classified information on any output device and will not interface with any classified data processing capability. There will be no alarms or CCTV signals sent to any security post or security alarm monitoring system.
- b. Existing safeguards and security measures will not be impacted by this project. No new measures beyond current practices will be required.
- c. Security space for patrol stations is not required within the facility.