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7. Abstract

This document presents the results of a preliminary investigation into options for preliminary flowsheets for ^{99}Tc removal from Hanford Site tank waste. A model is created to show the path of ^{99}Tc through pretreatment to disposal. The Tank Waste Remediation System (TWRS) flowsheet (Orme 1995) is used as a baseline. Ranges of important inputs to the model are developed, such as ^{99}Tc inventory in the tanks and important splits through the TWRS flowsheet. Several technetium removal options are discussed along with sensitivities of the removal schemes to important model parameters.

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TECHNETIUM REMOVAL:
PRELIMINARY
FLOWSHEET OPTIONS

October 1995

K. M. Eager

Westinghouse Hanford Company
Richland, Washington

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LIST OF TERMS

DF	Decontamination Factor
EDA	Ethylenediamine
HLW	High-level waste
LAW	Low-activity waste
LLW	Low-level waste
SWB	Sludge Wash B
SWD	Sludge Wash D
TPB	Tetraphenylborate
TPP	Tetraphenylphosphonium
TPP+	Tetraphenylphosphonium ion
TPPCI	Tetraphenylphosphonium chloride
TPPOH	Tetraphenylphosphonium hydroxide
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

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**TECHNETIUM REMOVAL:
PRELIMINARY
FLOWSHEET OPTIONS**

1.0 INTRODUCTION

This document presents the results of a preliminary investigation into options for preliminary flowsheets for ^{99}Tc removal from Hanford Site tank waste. A model is created to show the path of ^{99}Tc through pretreatment to disposal. The Tank Waste Remediation System (TWRS) flowsheet (Orme 1995) is used as a baseline. Ranges of important inputs to the model are developed, such as ^{99}Tc inventory in the tanks and important splits through the TWRS flowsheet. Several technetium removal options are discussed along with sensitivities of the removal schemes to important model parameters.

2.0 SUMMARY

The results of the low-level waste (LLW) performance assessment have the greatest impact on technetium removal. One preliminary performance assessment (Rawlins et al. 1994) indicates that to meet the recommended drinking water dose rate specification of 4 mrem/yr, without any engineering improvement to the disposal system, such as better glass performance, larger glass particles, vault water barriers, a sulfur matrix, etc., 95.3 percent and 97.8 percent of the soluble ^{99}Tc must be removed (overall decontamination factor [DF] of 21-46). The performance assessment (Rawlins et al. 1994) also indicates that even after technetium removal other radionuclides may be present in large enough quantities that the 4 mrem/yr specification will still not be met without their removal as well. The performance assessment (Rawlins et al. 1994) is currently being revised, but the results of this revision were not yet available for incorporation into this report. Another preliminary performance assessment (Kincaid and White 1995) indicate that only about 80 percent of the soluble technetium may require removal (overall DF of 5) to meet the 4 mrem/yr drinking water dose rate specification.

Even if ^{99}Tc is extensively removed, doses due to other radionuclides such as ^{129}I , ^{239}Pu , selenium, or uranium, may prevent meeting the required drinking water dose rate of 4 mrem/yr. These other radionuclides also may require removal, or an engineering improvement to the waste form may be needed to provide the further drop in dose rate. A combination of some technetium removal with some engineering improvement to the waste form may be the optimum of low cost and low technical risk. Assessments are needed of the overall costs and technological risks versus the benefits of technetium removal options and

also those of LLW form engineering options.

High ^{99}Tc removal requirements due to the performance assessment will not permit a selective removal strategy, i.e., removal of ^{99}Tc from only some tanks. An estimation of ^{99}Tc inventory distribution among the different waste types is not highly reliable at this point due to a lack of data. Preliminary indications, however, indicate technetium is distributed throughout the tank waste types to the extent that a selective removal scheme (i.e., removal from only certain tanks or waste types) would probably not be practicable particularly if ^{99}Tc removal requirements are high.

2.1 REMOVAL OPTIONS

The technetium removal options that will be discussed in this report are defined as follows:

Volatilization. This option involves removing technetium from the quench water stream of the LLW melter offgas system. Both the degree of ^{99}Tc volatility in the LLW melter and the degree of ^{99}Tc removal from the quench water define the overall DF. Only technetium precipitation from the neutralized LLW offgas quench stream will be discussed in detail. The precipitate is removed from the solution by filtration. Another option (not discussed in detail) would be to use Reillex-HPQ¹ resin to remove ^{99}Tc from the quench water.

Mixed Bed Anion Exchange. This option would use a new technetium specific resin called Tc-Spec 5² resin in a mixed bed configuration with a cesium ion exchange resin such as Duolite³ CS-100 to remove technetium from a high alkaline, high salt concentration supernate.

Anion Exchange with Reillex-HPQ Resin. This option is defined as using Reillex-HPQ resin for adsorption of pertechnetate anion from a high alkaline, high salt stream in a non-mixed bed configuration. Two sub-options for elution are evaluated in this report: (1) elution with nitric acid, and (2) elution with a solution of stannous chloride, ethylenediamine (EDA), and sodium hydroxide.

Alkaline Sulfide Precipitation. In this option, sodium sulfide would be added to high alkaline, high salt waste (possibly in-tank) to effect some precipitation of technetium. Filtration would follow.

¹Reillex-HPQ is a trademark of Reilly Industries Inc.

²Tc-Spec 5 is a trademark of Eichrome Industries, Inc.

³Duolite is a trademark of Rohm and Haas Inc.

Technetium removal technology options are summarized in Table 2-1 and are discussed in the following section.

Table 2-1. Technetium Removal Technology Options.

Technology option	Cost, \$ millions			Percent of soluble technetium removed	Cost, \$/Ci ⁹⁹ Tc
	Capital	Operating	Total		
Volatilization	30	20	50	95	2,300
Mixed bed ion exchange	38	120	158	99	7,200
Anion exchange	260	315	575	99	26,000
Tetraphenylphosphonium precipitation	No cost data available			90	Not available
Alkaline sulfide precipitation	No cost data available			50	Not available

Table 2-2 summarizes estimates of major secondary waste additions due to technetium removal for various technologies.

The volatilization technology option for technetium removal, i.e., volatilization of technetium from the LLW melter followed by precipitation as a sulfide from the neutralized LLW melter quench water, appears to be the most practical option based on economics and low secondary waste generation and is therefore recommended as the preferred option. A high technetium volatility (minimum of 95 to 99 percent) is required in the LLW melter to reduce technetium level in the LLW glass to those that would allow the currently estimated LLW performance assessment requirements to be met. Achieving this high of a ⁹⁹Tc volatility will likely represent the largest technological risk of this separation scheme and will require the greatest technological effort. The method may be more practicable in combination with some improvement to the LLW disposal system, e.g., larger glass particles, or some type of water barrier. The model developed to evaluate technetium removal from LLW shows that a high DF of the precipitation/filtration process itself is not as critical as a high-technetium volatility from the LLW melter. The technetium volatility in the LLW melter is the key factor in maintaining the required overall technetium DF. For example, the ⁹⁹Tc yield can be as low as 50 percent from the Tc₂S₇ precipitation/filtration operation (local DF of 2), but the required ⁹⁹Tc volatility from the LLW melter would have to be 98 to 99 percent (in this case) to achieve an overall technetium DF of 21 to 46.

Table 2-2. Estimate of Major Secondary Waste Additions due to Technetium Removal Operation for Various Technologies.

Component	Volatilization	Mixed bed anion exchange	Anion exchange with Reillex-HPQ		TPP precipitation	Alkaline sulfide precipitation
			Elution with HNO ₃	Elution with SnCl ₂ /EDA/Na OH		
Major additions to high-level waste (MT)						
Fe	0	0	0	0	0	3.43E+01
Mn	0	0	0	0	0	1.08E+01
Mo	0	0	0	0	0	7.22E-03
Na+	0	1.33 E+02	8.60 E+03	1.55 E+02	0	0
Ni	0	0	0	0	0	8.19E+00
Sn ²⁺	0	0	0	1.75 E+02	0	0
Cl ⁻	0	1.03E+02	0	1.03 E+02	5.60 E+01	0
NO ₃ ⁻	0	3.45 E+02	2.60 E+04	0	0	0
OH ⁻	0	4.38 E+00	0	1.15 E+02	0	0
PO ₄ ³⁻	0	0	0	0	1.76 E+02	0
S	1.93E+00	0	0	0	0	3.23E+01
H ₂ O	2.25 E+01	2.38 E+03	1.42 E+04	9.91 E+07	0	2.25E+01
Organic carbon	0	0	0	2.16 E+01	4.60 E+02	0
Tc ₂ S ₇	3.6 E-06	0	0	0	0	2.7 E-05
Major additions to low-level waste (MT)						
Na ⁺	0	1.25 E+02	3.63 E+03	1.04 E+03	0	5.16E+01
OH ⁻	0	1.25 E+02	0	7.66 E+02	0	0
NO ₃ ⁻	0	0	9.77 E+03	0	0	0
S	0	0	0	0	0	3.59E+00
H ₂ O	0	1.95 E+04	2.55 E+05	1.11 E+05	0	9.90E+02
Organic carbon	0	0	0	0	9.20 E+00	0
Resin	0	1.86 E+02	6.76 E+03	6.76 E+03	0	0

EDA = Ethylenediamine

TPP = Tetraphenylphosphonium.

Both LLW and HLW melter volatility data are needed to support a volatilization flowsheet. For the HLW melter, the ability of the melter to consistently capture some minimum percent of the technetium in the HLW glass under the ranges of conditions expected needs to be verified. For the LLW melter, a minimum technetium volatility needs to be verified, along with some minimum technetium yield for the Tc_2S_7 precipitation/filtration separation operation. Other data are needed from the LLW melter offgas testing, including composition data of the melter offgas quench (both aqueous and solid phases), including concentration of technetium, pH, and percent suspended solids. The Tc_2S_7 precipitation data should then be collected using this actual quench solution, or a simulant made based on the determined composition. The Tc_2S_7 data should include percent yield versus process conditions, and filterability data.

A new technetium specific resin, developed by Argonne National Laboratory and Eichrom Industries, Inc. for use in laboratory and analytical separations, has shown great promise for use in the TWRS flowsheet in a mixed bed configuration along with a cesium ion exchange resin such as Duolite CS-100. The Mixed Bed Anion Exchange option is recommended as a first alternate technology for ^{99}Tc removal. The resin called Tc-Spec 5 works in solutions stronger than 4M salt. The resin has shown potentially high distribution coefficients and elution with water or weak nitric acid (Horwitz 1995). Significant additional cold and hot laboratory development work is required to support a TWRS ^{99}Tc removal flowsheet. The main potential advantage to the resin is its ability to be effectively eluted with weak nitric acid or water, thus reducing secondary waste generation over other ^{99}Tc ion exchange schemes. Also, the resin possibly could be used in a mixed bed with a cesium ion exchange resin such as Duolite CS-100. The use of a mixed bed would reduce equipment costs, maintenance, and operational complexity. Needed data include an evaluation of compositional variations on the loading performance (e.g., varying anion and cation concentrations), basic kinetic data to determine a preliminary resin bed retention time or flowrate in bed volume per hour, and elution data.

The use of Reillex-HPQ anion exchange resin will require large resin beds. Current ^{99}Tc loading data (i.e., breakthrough, and kinetic data) indicate that bed volumes similar to those required by Duolite CS-100 resin for cesium removal will be required. The specific elution requirements of Reillex-HPQ resin will probably not permit its use in a mixed bed configuration. Large volumes of spent Reillex-HPQ resin are likely to be generated since, in one experiment (Schroeder et al. 1995), the resin showed a loss of over 50 percent capacity after 10 cycles.

Elution of Reillex-HPQ resin with a solution of 0.016M SnCl_2 , 0.1M ethylenediamine (EDA, $\text{C}_2\text{H}_8\text{N}_2$), 0.075M NaOH, has been shown to be effective with possible acceptable levels of secondary waste generation. The level of chloride added to the HLW melter appears to be acceptable based on preliminary calculations using the baseline TWRS Flowsheet. The acceptability of the level of organic addition to the HLW melter is an unknown. The Anion Exchange with Reillex-HPQ Resin option with SnCl_2 /EDA/NaOH

elution, i.e., use of Reillex-HPQ resin with $\text{SnCl}_2/\text{EDA}/\text{NaOH}$ elution, is recommended as a second alternate option for ^{99}Tc removal.

The Anion Exchange with Reillex-HPQ Resin option with nitric acid elution, i.e., a ^{99}Tc removal flowsheet that includes the use of Reillex-HPQ with nitric acid elution, is not recommended. High strength nitric acid solutions are needed to be effective, (6 to 8M), which create a potentially hazardous situation by combining reactive organic resin with strong nitric acid. A large evaporator would be required for the recycle of nitric acid to the elution process. Even with a high percentage of acid recycle, large amounts of secondary waste would pass to the HLW melter, significantly increasing the volume of HLW glass.

The Alkaline Sulfide Precipitation option promises potentially low generation of secondary waste, low capital cost, and ease of operation particularly if an in-tank process is used, although high percentages of technetium removal are not likely. Conclusive data as proof of concept are lacking at this point. Two experimental attempts to remove technetium from alkaline supernate (or supernate simulant) solutions by precipitating as a sulfide have shown conflicting results. One showed that no technetium was removed while the other set of testing showed that about 60 percent of the technetium was removed. Basic conditions for both sets of experiments are listed in Appendix A. Further tests are needed to determine if the amount of soluble technetium can be reduced by sulfide addition.

3.0 TECHNETIUM PATHWAY MODEL

The baseline ^{99}Tc pathway model, based on equipment configuration and other mass balance assumptions from the TWRS Flowsheet (Orme 1995), is shown in Figure 3-1. A summary of mass balance data for the important streams and components of the baseline case is shown in Appendix A.

Critical input data for the model are listed in Table 3-1. These data are for a rollup of all tank waste, i.e., a blend of all tank waste.

Table 3-1. Technetium Pathway Model Input Data.

Input data	Range used in model	Value used in Tank Waste Remediation System Flowsheet, Rev. 1
Total ^{99}Tc inventory in tank (kgs)	1,300 - 1,900	1,898
^{99}Tc to LLW at sludge wash (wt%)	60 - 90	70.5
^{99}Tc volatility at HLW melter (wt%)	40 - 100	50
^{99}Tc volatility at LLW melter (wt%)	40 - 100	50

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**Figure 3-1. Technetium Pathway
In Tank Waste Remediation
System Flowsheet.**

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3.1 LOW-LEVEL WASTE PERFORMANCE ASSESSMENT

The decision to remove technetium will be based on assessments of the performance of the LLW glass disposal system. Preliminary performance assessment work (Rawlins et al. 1994, Kincaid and White 1995) indicate the following:

- The generally accepted limit for technetium in the LLW is arrived at through a drinking water dose rate limit of 4 mrem/yr for a time period of at least 10,000 years. This requirement can be used to define the technetium removal requirements.
- The Rawlins et al. (1994) assessment indicates that if not removed, technetium would represent over 90 percent of the source of the drinking water dose and, even if all technetium is removed, the total dose rate may not drop below the 4 mrem/yr due to levels of other radionuclides, e.g., iodine-129 (^{129}I). It should be noted that a revision of the Rawlins et al. (1994) performance assessment is expected to be released shortly after the release of this document. The results of this revision were not available for review or for incorporation into this engineering study.
- The Kincaid and White (1995) assessment indicates that removal of 80 percent of the estimated soluble technetium (resulting in $4.8 \text{ E}+03 \text{ Ci } ^{99}\text{Tc}$ remaining in the LLW glass) would result in meeting the 4 mrem/yr specification. This amount of technetium removal would require an overall DF of about 5.

3.2 TANK INVENTORY

Estimates of the inventory of ^{99}Tc in Hanford Site tank waste have been reported at about 2,000 kgs ^{99}Tc (Jungfleisch 1984, and Shelton 1995), which is 100 percent of estimated ^{99}Tc production in the reactors. Recently, Colby and Petersen (1995) estimated that about 1,900 kgs ^{99}Tc were produced, of which about 27 percent was shipped offsite contained in reprocessed uranium oxide. About 4 percent was lost to the environment, leaving 69 percent, or about $1,310 \pm 220 \text{ kgs } ^{99}\text{Tc}$ remaining in the tanks. In Schmittroth et al. (1995), the remaining inventory of ^{99}Tc in the tank waste was estimated to be about 1,600 kgs ^{99}Tc based on ORIGEN2 reactor production and loss estimates. Schmittroth et al. (1995) studied tank waste sample data and developed an overall tank waste ^{99}Tc inventory of about 1,200 kgs. This value should be considered to contain a relative large error due to the small amount of sample data, the data scatter, the nonhomogeneous nature of the tank waste, and the relative error in the analytical methods themselves. For this model, 1,900 kgs will be used as a high estimate of the ^{99}Tc tank inventory, and 1,300 kgs will be used as a low estimate of the ^{99}Tc tank inventory.

3.2.1 Distribution of ^{99}Tc Among Waste Types

The quantity of technetium concentration data from existing tank waste samples is generally not considered adequate to provide a basis for design or operation. Few sample data are available considering the volume and the nonhomogeneous nature of the waste in the tanks. However, two independent interpretations of technetium concentrations from tank sample data allow estimates to be made of the technetium to sodium mole ratios for different waste types. Shelton (1995) developed technetium concentrations based on data from Colton (1995). Colton (1995) is an interpretation and summary of available tank sample data. Schmittroth et al. (1995) did an independent interpretation of available tank sample data. Table 3-2 lists the preliminary indications based on the two evaluations. A detailed breakdown of the data from the two estimates is given in Appendix A.

Table 3-2. Preliminary Estimates of Technetium to Sodium Mole Ratios Versus Tank Waste Type.

Waste	Percent of total ^{99}Tc in waste	Moles technetium per million moles sodium
Neutralized current acid waste	6	31 - 50
Complexant concentrate	37	19 - 29
Double-shell slurry feed/dilute noncomplexed	17	6 - 8
Single-shell tanks	40	2 - 3
Neutralized cladding removal waste	0	negligible - 3

3.3 SLUDGE WASH SPLIT

For this model, 60 percent to 90 percent of the technetium inventory will be assumed to go to the LLW melter. Revision 1 of the TWRS Flowsheet lists a sludge wash split of about 70 percent, i.e., 70 percent of ^{99}Tc inventories go to LLW melter.

3.4 TECHNETIUM VOLATILITY

This model assumes a range of 40 percent to 100 percent of the technetium that is fed to both the HLW and LLW melters will pass into the offgas system as a result of some combination of volatilization, entrainment, and aerosol formation. Existing technetium volatility data have varied over this chosen range (Vida 1994, Langowski et al. 1995),

depending on chemistry of technetium in the melt, time at melt temperature, and mass charge of technetium per mass of frit. Mass transport effects also are thought to play a large role in technetium volatility, e.g., surface area of the melt, gas flow through the melt, and mixing. The effects of mass transport on technetium volatility are factors of a full scale melter design and have probably not been greatly explored by the small crucible tests that have been done.

It is assumed that 100 percent of the ^{99}Tc in HLW offgas is captured in both the HLW and the LLW scrub systems. This should be a reasonable assumption since technetium is highly soluble in water as the pertechnetate anion.

No technetium is assumed to volatilize in evaporation. Two recent evaporator campaigns provide evidence of little or no volatilization (Guthrie 1994, and Guthrie 1995). Colby and Petersen also provides evidence of insignificant volatilization from different types of evaporators (alkaline, acid) (Colby and Petersen 1995).

3.5 MODEL SENSITIVITIES

The overall technetium DF as it is used in this report is defined as the mass of ^{99}Tc in the soluble stream from sludge washing divided by the mass of ^{99}Tc in the LLW glass. The overall technetium DF needed to meet the 4 mrem/yr drinking water dose rate specification is highly dependent upon the results of a LLW performance assessment. As mentioned earlier the performance assessment by Kincaid and White (1995) indicated that an overall technetium DF of about 5 is needed, while an earlier performance assessment (Rawlins et al. 1994) indicated that an overall technetium DF of 21 to 46 would be needed. The Rawlins et al. (1994) assessment is now being revised. The drinking water dose rate varies linearly with technetium inventory (Rawlins et al. 1994, Kincaid and White 1995). Melter volatilities do not effect the overall required technetium DF. This is because all technetium that enters the melter offgas recycle loops will eventually pass into the respective waste form as long as technetium volatility is less than 100 percent. If technetium is removed after the LLW melter, e.g., from the offgas recycle stream, then the technetium volatilities play a critical factor in meeting the overall DFs. However, the overall DFs are set and are not themselves effected by the melter volatilities.

Table 3-3 shows the overall soluble technetium removal DF requirements when certain waste form improvement options are exercised. These DF requirements are based on estimates of the LLW form performance versus the specified waste form improvement option (Rawlins et al. 1994). All waste form improvement options listed either reduce or eliminate the need for technetium removal. An assessment is needed to compare the costs versus benefits of the best LLW form improvement options and technetium removal options. The lower part of Table 3-3 shows that a combination of technetium removal and improvement to the LLW disposal system may be needed to meet performance assessment goals.

Table 3-3. Technetium Removal Requirements with Various Improvements to the Low-Level Waste Form.

Waste form improvement options	Estimated required overall technetium removal decontamination factor	
	High*	Low*
Matrix as Hydraulic Barrier	2	1
Gravel Water Shedder	23	1
Increase Vault Area by 20 percent	37	16
Matrix as Chemical Barrier	2	1
Improve Glass Performance by Factor of 10	5	2
Chemical Retardation Pad	23	1
Change layout of vaults	37	16

NOTE: a DF of 1 means that no removal is required.

High and low estimates are developed by applying model variation to DFs estimated in Rawlins et al. (1994).

4.0 TECHNETIUM REMOVAL OPTIONS

The options for technetium removal that are discussed in this report have been selected through a review of literature. Particular emphasis was placed on technetium removal processes that were recommended for further study in Raytheon/BNFL (1995) and Schulz et al. (1995), both of which discuss and preliminarily evaluate various technetium removal options.

4.1 ANION EXCHANGE

Among the anion exchange resins available for technetium separation, three appear to hold the most promise:

1. A new organic resin called Tc-Spec 5, being developed by Horwitz of Argonne National Laboratory, possibly could be used in a mixed bed configuration with a cesium ion exchange resin such as Duolite CS-100, or Resorcinol Formaldehyde resin.
2. Reillex-HPQ resin, which showed the highest technetium distribution coefficient after 30 minutes (Marsh et al. 1994), could be used.
3. Purolite A-520-E, which showed a lower technetium distribution coefficient than Reillex-HPQ after 30 minutes, however, had a slightly higher technetium distribution coefficient than Reillex-HPQ after 2 hours (Marsh et al. 1994), indicating that the kinetics of the resin are not as favorable as the Reillex-HPQ. The use of Purolite-A-520-E is not discussed in this report but this resin could potentially serve as a back-up or alternate resin to the use of Reillex-HPQ.

Any scheme to remove technetium using anion exchange from high salt, alkaline waste is likely to require rather large pieces of process equipment. This is because few technetium molecules exist in a large volume of waste. To effect exchange, all the waste must be contacted with the stationary ion exchange medium for a certain length of time. At the end of contact, the resin will contain very few ^{99}Tc molecules and a large number of other competitive anions, all of which must be removed by elution.

A significant percentage of technetium may not be in pertechnetate form in the tank waste, but rather in a reduced, complexed form that may not be amenable to anion exchange.

4.1.1 Mixed Bed Ion Exchange

A new organic resin in the early stages of development has shown great promise for the separation of technetium through sorption as TcO_4^- . The resin was synthesized by E. P. Horwitz at Argonne National Laboratory in collaboration with Professor R. Rogers of Northern Illinois University. The resin is manufactured on a very small scale for use in analytical separations by Eichrom Industries, Inc. Preliminary batch distribution tests show a very high affinity ($D_{\text{Tc}} > 100$) and selectivity for Tc(VII) from simulated alkaline waste solutions (Horwitz 1995). The resin is said to strongly adsorb technetium from high salt concentration (greater than 4M) solutions. The ^{99}Tc adsorption is less strong in solutions of lower salt concentration, which allows effective elution to be done with water or dilute nitric acid. The resin is said to be less affected by competing anions such as nitrate and carbonate than most anion exchange resins.

The resin holds promise for use in mixed beds of this resin with a cesium ion exchange resin, such as Duolite CS-100, for technetium and cesium removal from high salt streams. The use of a mixed bed would reduce capital and operating costs over that of two separate ion exchange systems.

4.1.1.1 Stage of Development. Only a few preliminary batch distribution tests have been done to date with this resin. Much testing is needed to be able to compare this resin with other options. Some needed testing is planned to start in early FY 1996, with results expected in early calendar year 1996. The testing includes technetium batch distribution tests, column loading and elution tests, radiation stability tests using simple Hanford Site waste simulants, and resin structural and chemical characterization testing. The resin has been manufactured only in very small quantities; the resin currently is not marketed. Some level of development work would be needed to be able to produce the resin uniformly in the large quantities likely needed for use at the Hanford Site. A preliminary part of this work will be done in early fiscal year 1996, specifically some resin characterization testing. Eichrom Industries, Inc. has the license for manufacture of the resin.

4.1.1.2 Secondary Waste Generation. No resin breakthrough, elution, or resin duration data are available to allow real material balance or secondary waste generation estimates to be made. The resin is expected, however, to be able to be operated in a mixed bed arrangement with the cesium ion exchange resin, e.g., Duolite CS-100, wherein the technetium would load and be eluted with the cesium.

4.1.1.3 Cost. No breakthrough data are available to perform specific equipment sizing or material balance calculations. However, a rough estimate of the cost of the mixed bed system is made by assuming that the bed volume of the combined resin and the elution volumes increase 25 percent over that of cesium only ion exchange. The capital and operating costs are then assumed to increase by 10 and 20 percent respectively. The capital and operating costs of the cesium-only ion exchange system are estimated to be \$380 and \$602 million (Slaathaug 1995, Table F-36). The incremental capital and operating costs for

the mixed bed arrangement with ^{99}Tc removal capability are \$38 and \$120 million. The total incremental cost of \$158 million results in an approximate cost of \$7,200/Ci of removed ^{99}Tc .

4.1.2 Reillex-HPQ Resin

Technetium removal from a high-salt alkaline solution using an anion exchange resin (in a non-mixed bed configuration) was demonstrated on a production scale to recover 27 Ci of ^{99}Tc at the Hanford Site (Beard 1964). Reillex-HPQ resin is the baseline technetium anion exchange resin. Reillex-HPQ resin was developed by Fred Marsh in collaboration with Reilly Industries for separation of plutonium nitrate complexes from concentrated nitric acid solutions. The resin has pyridium [$-\text{C}_5\text{H}_4\text{N}(\text{CH}_3)^+$] strong base sites for exchange of anions. The resin is relatively stable in nitric acid and to radiolysis. Reillex-HPQ resin was the highest ranked resin in an evaluation of 22 anion exchange resins based on their ability to separate technetium (McGinnis 1988). More recent data (Marsh et al. 1994) show that of 58 absorbers tested, Reillex-HPQ resin showed the best technetium sorption distribution coefficient from DSSF-7 solution within 30 minutes (K_d of 254).

Preliminary calculations included in Appendix A based on Schroeder et al. (1993, 1994, and 1995) indicate that the use of Reillex-HPQ resin to remove 99 percent of the soluble technetium from an alkaline waste stream will generate large volumes of spent resin as a secondary waste. Reillex-HPQ resin can be eluted with strong nitric acid (6 to 8M). Nitric acid as an elution option for Reillex-HPQ is unattractive for two reasons:

- Organic resins (such as Reillex-HPQ) are potentially extremely reactive with strong nitric acid creating a potential safety hazard. The potential hazards associated with the use of Reillex-HPQ resin and nitric acid elution would need evaluation should this option be chosen for further study.
- Even with a large system for acid recovery/recycle, very large amounts of secondary waste would be generated, particularly HLW.

Elution with a solution of stannous chloride, ethylenediamine (EDA), and sodium hydroxide shows promise as a potentially viable option. Levels of secondary waste generation, particularly HLW generation, are much lower than those of a nitric acid elution flowsheet and may be acceptable (Schroeder et al. 1995). The added chloride increases the weight percent loading of chloride in the HLW glass to 0.43 percent, which is under the current estimated specification of 1 wt% Cl^- maximum. Chloride ion represents a possible operation problem to the HLW melter. The addition of EDA organic and Sn^+ ion added to the HLW melter also may represent potential melter operation problems and/or a potential increase in the HLW volume.

Eleven cycles of loading followed by elution with the $\text{SnCl}_2/\text{EDA}/\text{NaOH}$ solution were performed, after which a drop in resin performance of 60 percent was seen. The loss of resin performance appears attributable to a combination of mechanical problems due to resin shrinking and swelling, incomplete technetium elution, and resin degradation. Further tests are needed to better define a mass balance based on elution with the $\text{SnCl}_2/\text{EDA}/\text{NaOH}$ solution.

Other potential drawbacks associated with the use of Reillex-HPQ resin include the following: nitrate anion competes for exchange sites with pertechnetate and reduces performance. Potential oxidation of the pyridinium functional group to a non-functional group by ferrocyanide, chromate, or other oxidants in the tank waste could also reduce resin performance.

4.1.2.1 Stage of Development. Reillex-HPQ resin is the most studied technology of the options mentioned in this report. Sufficient data exist to allow preliminary flowsheet mass balance estimates to be made. Batch technetium distribution coefficients have been taken over a varied range of technetium, hydroxide, and nitrate concentrations, which allows resin loading performance predictions to be made over a variety of feed compositions. Some kinetic data are available that allow resin bed size to be estimated. Sufficient elution data are available to allow elution mass balance estimates to be made for both nitric acid elution and elution with the stannous chloride/EDA solution. Further tests are needed to prove the viability of elution with solutions of $\text{SnCl}_2/\text{EDA}/\text{NaOH}$, and to provide better estimates of elution mass balances.

4.1.2.2 Secondary Waste Generation. Major secondary waste addition estimates based on using Reillex-HPQ resin with both nitric acid and $\text{SnCl}_2/\text{EDA}/\text{NaOH}$ elutions are given in Table 2-1. Details regarding these estimates are included in Appendix A.

4.1.2.3 Cost. The cost of technetium removal from a high-salt alkaline solution using an anion exchange resin (in a non-mixed bed configuration) is estimated based on the cost difference between two pretreatment facility and equipment designs presented in the *Tank Waste Technical Options Report* (Boomer et al. 1993). The two facilities are identified as Sludge Wash D (SWD), which includes a technetium anion exchange process, and Sludge Wash B (SWB), which does not include a technetium anion exchange process. Both facilities include sludge washing, solid/liquid separation, and cesium ion exchange. The capital cost estimates of the two facilities have been updated since the issue of the *Tank Waste Technical Options Report* (Boomer et al. 1993). These updated capital cost estimates are attached to this report as Appendix B. The difference in capital costs between the SWD and SWB facilities provides a basis for the cost difference between a LLW vitrification facility with and without technetium anion exchange. The difference in capital costs associated with the technetium anion exchange is \$260 million. The total operating cost associated with a technetium anion exchange process is estimated as \$315 million by taking the difference between the operating costs of the SWD and SWB cases as given in the *Tank*

Waste Technical Options Report (Boomer et al. 1993). Combining the capital and operating cost results in a total cost of \$26,000/Ci⁹⁹Tc removed.

4.2 PRECIPITATION

Two options for the precipitation of technetium from alkaline waste are discussed here: Tetraphenylphosphonium ion (TPP⁺) may be able to remove more than 90 percent of the soluble technetium. Tests are needed to prove the viability of this option.

4.2.1 Precipitation with Tetraphenylphosphonium Ion

Potential drawbacks are that addition of large quantities of tetraphenyl to the high activity waste, particularly for the extended period of time expected (until HLW vitrification plant goes on-line) may lead to unacceptable levels of benzene, and or hydrogen gas generation. Addition of phosphorous may increase the volume of HLW glass.

Pertechnetate ion has been shown to form an insoluble precipitate with the large cation TPP⁺ with Savannah River alkaline waste solutions (Stevens 1984, Walker et al. 1984, Walker and Ebra 1985). TPP chloride was used to obtain 90 percent removal of technetium in these experiments. Tetraphenylphosphonium hydroxide (TPPOH) may serve as substitute if the chloride proves to be a hinderance to the HLW vitrification.

It may be possible to add TPPOH directly to the tank waste as part of an in-tank precipitation scheme, but the consequences of added a large amount of organic to the tank waste for an extended time period (until HLW vitrification plant goes on-line) would have to be studied.

An advantage of out-of-tank technetium precipitation with TPP is that long term storage of the technetium/organic precipitate, as is required for with the in-tank precipitation process, could be avoided, thus avoiding potential problems of benzene and hydrogen gas generation. A disadvantage is that out-of-tank precipitation facilities would need to be constructed. A possible out-of-tank technetium precipitation scheme using TPP would be to add tetraphenylphosphonium chloride (TPPCI) to stream 233 of the TWRS Flowsheet (Orme 1995), which follows cesium ion exchange.

A cost estimate is not available for this option. Some development work has been done at Savannah River on this process, but a considerable amount of work needs to be done to prove that this option is compatible with Hanford Site flowsheets.

4.2.1.1 Stage of Development. Just enough testing with Savannah River alkaline waste has been done to show that this process is likely to work with alkaline Hanford Site waste streams. Data specific to Hanford waste compositions are needed that would allow a mass

balance and equipment sizing to be determined. The waste solutions used at Savannah River contained significant amounts of tetraphenyl borate that is used in a prior step to precipitate cesium. The Savannah River data show that the concentration of tetraphenyl borate had a significant effect on the percent of technetium recovery with TPP, and on the overall mass balance. Tetraphenyl borate is not expected to be present in Hanford Site waste.

4.2.1.2 Secondary Waste Generation. Assuming that addition of 0.35 g of TPPCl per liter of a solution containing $2.5 \times 10^{-5} M$ ^{99}Tc , will remove 90 percent of the soluble after filtration, about 56 MT of chloride ion, 50 MT phosphorus, and 540 MT of TPP⁺ would be sent to the HLW melter. This level of chloride ion addition is below that estimated to be generated by the Reillex-HPQ eluted with SnCl₂/EDA process described earlier, and is below the current estimated specification of 1 wt% Cl⁻ maximum in HLW glass. However, the mass of organic added as TPP⁺ is greater than the mass of organic (as EDA) added by the Reillex-HPQ eluted with SnCl₂/EDA process described earlier by a factor of 10.

Savannah River testing indicated that the quantity of potassium tetraphenylborate (TPB) that precipitated along with the TPPTcO₄ had a significant effect on the separation performance. The reason is thought to be that the TPB acts as a filter aid. For this reason, addition of a filter aid may be required to achieve separation.

4.2.1.3 Cost. No data are available to allow estimation of extra tank space needed to perform the precipitation. The extra tankage is likely to be the major cost of this process option.

4.2.2 Alkaline Sulfide Precipitation

Another possibility for precipitation of soluble technetium is to use sulfide ion. While high percentages of technetium removal are not likely to occur through the use of alkaline precipitation with sulfide, significant reductions of soluble technetium may be achievable. In one experiment with actual Hanford Site alkaline tank waste, the concentration of soluble technetium was reduced by about 40 percent by the addition of sodium sulfide followed by centrifugation (Herting 1994). These results are disputed by the results of another experiment (Winters 1988), which showed that only about 0.03 percent of the soluble technetium was removed by addition of sulfide to a simulated alkaline waste followed by filtration. New tests are needed to verify the viability of in-tank technetium precipitation by sulfide addition. A cost estimate is not present for this process in this report.

4.2.2.1 Stage of Development. An experiment done by Herting (1994) with a sample of actual alkaline waste supernate, showed that after addition of a solution of Na₂S followed by centrifuging, the concentration of technetium in solution was reduced by about 40 percent. An earlier attempt to precipitate technetium as Tc₂S₇ from Hanford Site alkaline waste simulants, showed that yields were very low (0.03 percent ^{99}Tc removal) (Winters 1988). It was presumed from the results that the high hydroxide and nitrate concentrations in the waste

form stable complexes with technetium that hinder Tc_2S_7 formation, and that yields would be higher from neutral or acidic solutions. The basic conditions for the two sets of experiments are listed in Table 4-1. Noticeable differences between the sets of experiments are the use of actual waste versus a simulant, and a high concentration of sulfide ion in the Herting experiment.

Table 4-1. Conditions of Two Different Sets of Experiments for the Precipitation of Technetium as a Sulfide from Alkaline Solution.

Experiment	Herting 1994	Winters 1988
% ^{99}Tc removed from solution	40	0
Solution type	Actual alkaline waste	Alkaline waste simulant
Sodium concentration (M)	5	7
Sulfide concentration (M)	9.09 E-02	10^{-4} , 10^{-3}
^{99}Tc concentration (M)	4.4 E-05	7.0 E-07, 6.8 E-05
Other parameters/procedures	Mixed solutions were stirred constantly for 24 hours, then were centrifuged for 12 minutes. After Na_2S addition the solution turned brown but no precipitate was visible.	The mixed solutions were allowed to sit overnight, then were filtered through a 0.25μ filter

Although removal of high percentages of technetium from alkaline waste by addition of sulfide ion for the purpose of technetium sulfide precipitation is not likely, if results similar to those seen by (Herting 1994) can be reproduced it could represent a method for significantly reducing the technetium inventory in the LLW. The Herting data need to be re-examined to verify the validity and/or similar experiments need to be repeated to measure any potential reduction in the solubility of technetium.

4.2.2.2 Secondary Waste Generation. A mass balance was developed for an out-of-tank alkaline sulfide technetium precipitation process (Raytheon/BNFL 1995). The process flowsheet estimates 75 percent removal of the soluble technetium, and 100 percent of the soluble iron, manganese, molybdenum, and nickel, through addition of sodium sulfide followed by filtration. The 1994 Herting reference is listed as the only supporting data for this estimate. Based on the Raytheon/BNFL study, the sulfide ion addition is calculated for this report assuming the following:

- Sulfide was added in a 1:1 mole ratio with iron, manganese, molybdenum, and nickel.
- Sulfide was added in a 7:2 mole ratio with technetium.
- A 10 percent excess of sulfide was added.

4.3 VOLATILIZATION

Volatilization of technetium from the LLW melter can be used as a separation scheme. Consistently high LLW melter ^{99}Tc volatilities may be achievable through melter design and control of melter chemistry, but represent the greatest technological risk of this separation method. This model estimates a technetium volatility in the LLW melter of 60 percent to 100 percent. The volatilized technetium needs to be removed from the large volume of offgas quench water before recycle to the melter. Precipitation of technetium from the offgas quench stream by adding sodium hydroxide and sodium sulfide is discussed in this section. Sulfide precipitation of technetium from the offgas quench stream has the advantage of low estimated capital and operations costs, and low secondary waste generation.

Reillex-HPQ resin should be amenable for removing technetium from the LLW melter offgas quench stream and thus represents another volatilization option. No data on loading of Reillex-HPQ resin with technetium under acidic or neutral conditions are available that would allow flowsheet mass balance estimates to be made. This option is not discussed in this report.

4.3.1 Volatilization Followed by Near-Neutral Sulfide Precipitation

Bibler and Wallace (1984) reported that a slight stoichiometric excess of 5 wt% Na_2S solution added to pertechnetate solutions at pH 6-7 caused precipitation of black Tc_2S_7 in 95 percent yield. According to Bibler and Wallace, the molar concentration of TcO_4^- must exceed 10^{-6}M for precipitation to occur. The Savannah River investigators also report that Tc_2S_7 is easy to filter and may be stored as solid or redissolved as the TcO_4^- ion in a 4M HNO_3 - H_2O solution. The solubility of technetium sulfide has been reported as $K_{\text{sp}} = 10^{-182}$ for Tc_2S_7 , and $K_{\text{sp}} = 10^{-67}$ for TcS_2 (O'Kelley 1987). A TWRS technology team visit to France in 1993 reported that the French are removing ^{99}Tc from LLW solutions by precipitation as sulfide at pH 8 - 9 (Wynne et al. 1993).

A ^{99}Tc precipitation process could be placed on a combination of streams 692 + 1115 of the TWRS flowsheet, which are the quench water streams of the LLW melter offgas. The TWRS flowsheet estimates a ^{99}Tc concentration in the 10^{-5} range in the LLW melter quench. Pre-filtration may be necessary to reduce the mass of non-Tc solids sent to HLW. An advantage to this process is that little secondary waste is added to the overall flowsheet.

Only about 1-2.5 MT of Tc_2S_7 would be produced.

Evolution of hydrogen sulfide gas at pH below 8 is a possible hazard associated with the use of sodium sulfide. To minimize the potential hydrogen sulfide hazard, addition of soluble sulfide salt should be done in a closed system with adequate ventilation, and sulfide dosage carefully controlled. A maximum excess of 0.5 mg/L free sulfide should be maintained. The use of ferrous sulfide may be advantageous because its own solubility is low enough to aid in maintaining a low free sulfide concentration, yet may be soluble enough to precipitate the TcO_4^- .

4.3.1.1 Stage of Development. Technetium volatilities from various calcining and vitrification operations have been shown to be as high as 95 percent (Langowski et al. 1995, Vida 1994). Much further development is needed to ensure that consistently high technetium volatilities can be achieved with a full scale melter design. Only one set of preliminary tests are known to exist to support the technetium precipitation as Tc_2S_7 from near neutral solutions (Bibler and Wallace 1984). More testing is needed to prove the viability of this precipitation process, to size equipment needs, and to provide mass balance estimates. The precipitation and filtration testing itself should be fairly simple. The challenge will be to estimate offgas quench compositions.

4.3.1.2 Secondary Waste Generation. Preliminary estimates of secondary waste generation were shown in Table 2-2. These estimates assume that inert solids in the LLW melter quench stream will be removed by prefiltration before technetium sulfide precipitation to reduce the volume of solids to the HLW melter. An excess of 0.5 mg S^{2-} /L sulfide charge is assumed to remove 95 percent of the technetium after filtration.

4.3.1.3 Cost. Incorporation of technetium volatilization into the baseline TWRS flowsheet requires addition of a caustic and sulfide addition systems and one or two additional filter systems on the LLW melter offgas quench stream. Allowances of \$30 million for capital costs and \$20 million for operating costs are assumed for this study. At a total capital and operating cost of \$50 million or \$2,300/Ci ^{99}Tc this is the lowest cost of any technetium removal option discussed in this study.

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5.0 TECHNETIUM DISPOSAL

5.1 HIGH-LEVEL WASTE

Disposal of technetium by immobilization in HLW glass is recommended as the leading option because no additional equipment or provisions for dealing with another waste form are needed. Vida (1994) showed that a borosilicate glass made in the laboratory from high-activity waste oxide simulant contained 0.449 wt% technetium (as Tc_2O_7). At this level of technetium inclusion, all the technetium at the Hanford Site could easily be included in the amount of HLW glass estimated to be produced by the TWRS Flowsheet (Orme 1995). Operational data from the PAMELA melter, a European HLW melter, show that an average of about 55 percent of the technetium that was fed to the melter was incorporated into the glass (Furrer and Weinlander 1990, and Kuhn et al. 1991). These data were for a power reactor waste feed with a technetium to glass charge mass ratio of about 0.05 wt%. The technetium to glass mass charge ratio for the TWRS flowsheet (Orme 1995) is about 0.007 wt%. The actual level of technetium inclusion into the HLW glass depends on the melter design and the HLW melt chemistry.

5.2 LOW-ACTIVITY WASTE

The performance assessment of the low-activity waste (LAW) form is likely to determine if technetium removal is necessary and, if so, the degree of removal required.

5.2.1 Glass

When hazardous wastes are vitrified, they generally become non-regulated, allowing them to be disposed of as sanitary waste. This avoids hazardous waste disposal costs and eliminates the potential for future liability in the event of improper hazardous waste disposal. Glasses exhibit the highest waste volume efficiency, low leach rates, and excellent chemical and physical stability under disposal conditions.

5.2.2 Grout

Equipment and operating simplicity are a distinct advantage of cement based processes. Grout processes are at a disadvantage with respect to immobilizing long lived monovalent fission products such as technetium. Slag (reducing) grout would provide a chemically reducing atmosphere for technetium thus helping to prevent formation of aqueously mobile pertechnetate.

5.2.3 Thermoplastic

In a thermoplastic stabilization process, waste is dried, heated (125 to 230 °C), and dispersed through a heated plastic matrix. Principal binding media include asphalt, bitumen, polypropylene, polyethylene, or sulfur. Bitumen is used to encapsulate Tc_2O_7 precipitate, along with other coprecipitated radionuclides, at the La Hague facility in France.

A spokesperson for NUMATECH, the U.S. vendor of French nuclear technology, indicates that they are trying to discontinue the use of bitumen encapsulation in lieu of concentration followed by HLW vitrification (Pradel et al. 1993).

5.2.4 Thermoset Plastic

Waste components are physically trapped within a cross-linked polymer. Principal binding agents include urea-formaldehyde, phenolics, epoxies, and polyesters. Waste must be dried first. The starting materials may be volatile and flammable. Resin matrix may biodegrade releasing the waste as leachate. The organic matrix will thermally decompose if exposed to a fire.

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APPENDIX A

CALCULATIONS

- Specific Activity of ^{99}Tc = $0.017\text{Ci }^{99}\text{Tc/g }^{99}\text{Tc}$

A1.0 TECHNETIUM PATHWAY MODEL

A1.1 ^{99}Tc Distribution Among Waste Types

Table A-1 presents preliminary estimates of technetium to sodium mole ratios versus waste type based on two independent interpretations of tank sample data. Shelton (1995) developed technetium concentrations based on data from Colton (1995). Colton (1995) is an interpretation and summary of available tank sample data. Mole ratios listed in Table A-1 under the Schmittroth (1995) column are adaptations from that document. Schmittroth (1995) did an independent interpretation of available tank sample data.

Table A-1. Technetium to Sodium Mole Ratios Versus Waste Type Based on Two Different Evaluations of Available Sample Data.

Based on data from Shelton (1995) that used Colton (1995) to develop ^{99}Tc concentrations		Based on data from Schmittroth (1995)	
Waste	Mole ^{99}Tc per million mole sodium	Waste	Mole ^{99}Tc per million mole sodium
Neutralized current acid waste	50	Dilute noncomplexed	55
Complexant concentrate	29	Neutralized current acid waste	31
Dilute noncomplexed	12	Plutonium Finishing Plant	23
Double-shell slurry feed	8	Complexant concentrate	19
Single-shell tank	5	Double-shell slurry feed	6
Neutralized cladding removal waste	negligible	Neutralized cladding removal waste	3
Plutonium Finishing Plant	negligible	Single-shell tank	2

A2.0 MODEL MASS BALANCE

A2.1 Baseline ⁹⁹Tc Mass Balance (TWRS Flowsheet Rev.1)

Table A-2. Mass Balance for Technetium Pathway Model.

Stream	1	34	318	344	317	924	326
Total ⁹⁹ Tc (kgs)	1898	561	1096	547	548	13	535
Tc as TcO4-dissolved (kgs)	1342	9.4	544	0	0	13	534
Tc as TcO2 dissolved (kgs)	0	0	0	0	547	0	0
Tc as TcO4-solid (kgs)	551	551	551	0	0	0	0
Tc as Tc2O7 solid (kgs)	0	0	0	547	1	1	1

Table A-2. Mass Balance for Technetium Pathway Model. (Continued)

Stream	101	406	441	410	907	630
Total ⁹⁹ Tc (kgs)	1,338	2,649	1,300	1,327	37	1,285
Tc as TcO4-dissolved (kgs)	1,336	2,593	0	0	36	1,236
Tc as TcO2 dissolved (kgs)	0	0	0	1,300	1	0
Tc as TcO4-solid (kgs)	3	0	0	0	0	0
Tc as Tc2O7 solid (kgs)	0	55	1,297	27	0	26

Location of potential technetium removal step within TWRS Flowsheet

Table A-3. Summary of Stream Data from TWRS Flowsheet
for Potential Location of Technetium Removal.

Stream	205	233	630	692 + 1115
Total volume (L)	5.18 E+08	6.02 E+08	3.09 E+08	4.41 E+08
Total activity (MCi)	65.3	5.1	0.1	0.1
Total mass ⁹⁹ Tc (kgs)	1,335	1,335	1,285	1,289
Mass dissolved ⁹⁹ Tc (kgs)	1,335	1,335	1,259	1,262
Mass suspended ⁹⁹ Tc (kgs)	0	0	26	26
Concn' ⁹⁹ Tc (M)	2.60 E-05	2.24 E-05	3.26 E-05	2.89 E-05
Concn' Na+ (M)	7.0	6.1		0.1
Spgr	1.31	1.27	1.05	1.07
Total dissolved solids (MT)	2.47 E+05	2.49 E+05	3.25E+04	3.50 E+04
Total suspended solids (MT)	9.51 E-01	9.52 E-01	9.04 E+03	9.82 E+03
~pH	> 13	> 13	0	0

A3.0 TECHNETIUM REMOVAL METHODS

A3.1 REILLEX-HPQ RESIN

A3.1.1 Loading

The technetium distribution coefficient is estimated using the following equation developed by (Schroeder 1995), using nitrate and hydroxide concentration from stream 205 of the TWRS Flowsheet Rev.1 (Orme 1995), based on an overall waste blend.

$$[\text{NO}_3^-] = 3.3$$

$$[\text{OH}^-] = 2.4$$

$$K_d = \frac{391 \pm 19}{(0.389 \pm 0.022) + ([\text{NO}_3^-])}$$

Although this equation is for $[\text{OH}^-]$ of 1.0, Figures 7 and 8 of (Schroeder 1995) show that a hydroxide concentration of 2.4 makes little difference over this range of $[\text{NO}_3^-]$. The ^{99}Tc K_d is 106 ± 6 ml/g. This is combined with the given resin density of 0.33 g dry resin/ml wet resin, to obtain a technetium distribution coefficient (λ) of 35 ± 2 .

Technetium distribution coefficients with Reillex-HPQ resin and DSS simulant have been shown to reach about 83 percent of their equilibrium value within 20 minutes, 90 percent within 40 minutes (Schroeder 1993). Based on this, an overall resin bed retention time of 40 minutes is assumed for the technetium ion exchange system. Assuming a flow rate of 100 L/min of 7M Na^+ solution through the ion exchange system, an on-line resin bed volume of 4,000 L is required. Two 4,000-L beds are required, so that one is on-line while the other is off-line being eluted.

About 21 bed volumes (4,000 L/bed volume) of the stream 205 feed is expected to be processed through this technetium ion exchange system between elutions, based on 97 percent ^{99}Tc removal.

A3.1.2 Elution with Nitric Acid

Schroeder (1995) reports the anion capacity of Reillex-HPQ resin as 3.27 meq/gram. Based on this, the stoichiometric requirements for complete elution are 0.0011 gmole HNO_3 /ml resin. Actual tests show that the actual requirements for 97 percent ^{99}Tc elution are 0.06 gmole HNO_3 /ml resin, which is 55 times more than the stoichiometric requirements. This is based on Figure 18 of Schroeder (1995) that shows 30 ml of 8M HNO_3 , to elute a 4 ml column of Reillex-HPQ to 97 percent ^{99}Tc removal.

Schroeder (1995) reports that of the total ion exchange sites only about 0.48 percent are occupied by technetium at full loading.

Table A-4. Estimated Elution and Wash Volumes.

Stream name	Stream number	Bed volumes*	Composition	Column effluent destination
Feed	205	21	7M Na^+ , 2.5 E-04M TcO_4^-	LLW
Feed flush	208	3	water	LLW
Sodium nitrate	210	7	1M NaNO_3	LLW
Dilute HNO_3	211	10	0.2M HNO_3	HLW
Elution acid	212	10	6M HNO_3	HLW
Eluant flush	214	3	water	1/2 HLW 1/2 LLW

*1 BV = 6,500 L.

HLW = High-level waste

LLW = Low-level waste.

For the overall waste blend the total volume at stream 205 is 4.736 E+08 L, the total number of cycles to process all feed is 5,630.

A3.2 TPP Precipitation

TPP⁺ could be added to stream 233 of the TWRS Flowsheet (Orme 1995), which follows cesium ion exchange. Per the TWRS flowsheet (based on an overall blend) stream 233 has a total volume of 6.02 E+08 L, with a technetium concentration of about 2.24 E-05 gmoles TcO₄⁻ per liter. Assume that 98 percent of the soluble ⁹⁹Tc can be removed with addition of 0.90 g TPP⁺ per liter of stream 233 solution. The following chemical additions are made to the HLW:

$$\frac{0.90 \text{ g TPP}^+}{\ell \text{ soln}} \left| \frac{\text{kg}}{1000 \text{ g}} \right| \frac{\text{MT TPP}^+}{1000 \text{ kg}} \left| \frac{6.02 \text{ E}+08 \ell \text{ soln}}{1} \right| = 541 \text{ MT TPP}$$

541 MT of TPP⁺ and 56 MT of Cl⁻, and 176 MT P as PO₄ would be added to the HLW melter to remove 98 percent of the soluble technetium through this method.

A4.0 REFERENCES

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APPENDIX B

COST ESTIMATES

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAE1

** TEST - INTERACTIVE ESTIMATING **
SW - D
S T U D Y
DOE_R01 - PROJECT COST SUMMARY

PAGE 1 OF 6
DATE 07/20/95
BY T.L. Weldo

COST CODE *****	DESCRIPTION *****	ESCALATED TOTAL COST *****	CONTINGENCY % *****	TOTAL *****	TOTAL DOLLARS *****
000	ENGINEERING	229,780,000	50	114,890,000	344,670,000
501	BUILDINGS	339,250,000	50	169,630,000	508,880,000
550	OTHER STRUCTURES	32,250,000	50	16,130,000	48,380,000
600	UTILITIES	17,180,000	50	8,590,000	25,770,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	403,100,000	50	201,550,000	604,650,000
	ROUNDING			(350,000)	(350,000)
=====					
PROJECT TOTAL		1,021,560,000	50	510,440,000	1,532,000,000

TYPE OF
ESTIMATE

ARCHITECT
ENGINEER

OPERATING
CONTRACTOR

REMARKS:

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WHC-SD-WM-TI-718
Revision 0

B-3

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAE1

** TEST - INTERACTIVE ESTIMATING **
SW - D
S T U D Y
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

PAGE 2 OF 6
DATE 07/20/95
BY T.L. Weldo

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
111000	ENGINEERING ALLOWANCE	146000000	0	146000000	0.00	0	73000000	219000000
	SUBTOTAL 111 ENGINEERING ALLOWANCE	146000000	0	146000000	0.00	0	73000000	219000000
	SUBTOTAL 1 ENGINEERING	146000000	0	146000000	0.00	0	73000000	219000000
222050	HVAC	22036230	0	22036230	0.00	0	11018115	33054345
222060	SUPPORT EQUIP REPAIR AND MAINT	1968600	0	1968600	0.00	0	984300	2952900
222110	FEED RECEIPT AND STORAGE	62290	0	62290	0.00	0	31145	93435
222270	SULFUR PLANT	105550	0	105550	0.00	0	52775	158325
222320	ELECTRICAL DISTRIBUTION	0	0	0	0.00	0	0	0
222420	MEDIUM PRESSURE STEAM	27350	0	27350	0.00	0	13675	41025
222430	PROCESS STEAM	1242520	0	1242520	0.00	0	621260	1863780
222450	PROCESS COOLING WATER	336440	0	336440	0.00	0	168220	504660
222470	PROCESS CHILLED WATER	31870	0	31870	0.00	0	15935	47805
222480	PROCESS WATER	42950	0	42950	0.00	0	21475	64425
222520	POTENTIALLY RAD LIQUID WASTE	612830	0	612830	0.00	0	306415	919245
222540	COLD CHEMICALS	531570	0	531570	0.00	0	265785	797355
222560	COLD FEED VENT	60170	0	60170	0.00	0	30085	90255
222610	DCS	21688810	0	21688810	0.00	0	10844405	32533215
222620	HEALTH PHYSICS	31276350	0	31276350	0.00	0	15638175	46914525
222660	MIS	4473730	0	4473730	0.00	0	2236865	6710595
	SUBTOTAL 222 OUT-OF-CELL EQUIPMENT	84497260	0	84497260	0.00	0	42248630	126745890
223110	ANALYTICAL EQUIPMENT	13280000	0	13280000	0.00	0	6640000	19920000
	SUBTOTAL 223 ANALYTICAL EQUIPMENT	13280000	0	13280000	0.00	0	6640000	19920000
224110	PROCESS EQUIPMENT - IN CELL	99053391	0	99053391	0.00	0	49526696	148580087
	SUBTOTAL 224 PROCESS EQUIPMENT - IN CELL	99053391	0	99053391	0.00	0	49526696	148580087
	SUBTOTAL 2 PROCUREMENT	196830651	0	196830651	0.00	0	98415326	295245977
312010	STRUCTURES	307310100	0	307310100	0.00	0	153655050	460965150
312050	HVAC	70011550	0	70011550	0.00	0	35005775	105017325

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WHC-SD-WM-TI-718
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **

SW - D
S T U D Y

DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

PAGE 3 OF 6
DATE 07/20/95
BY T.L. Waldo

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
312060	SUPPORT EQUIP REPAIR AND MAINT	728700	0	728700	0.00	728700	50	1093050
312200	RADIOACTIVE LIQUID WASTE	0	0	0	0.00	0	0	0
312210	PROCESS EQUIPMENT DECON	0	0	0	0.00	0	0	0
312270	SULFUR PLANT	784320	0	784320	0.00	784320	50	1176480
312320	ELECTRICAL DISTRIBUTION	15617120	0	15617120	0.00	15617120	50	23425680
312420	MEDIUM PRESSURE STEAM	34120	0	34120	0.00	34120	50	51180
312430	PROCESS STEAM	1537570	0	1537570	0.00	1537570	50	2306355
312450	PROCESS COOLING WATER	1625830	0	1625830	0.00	1625830	50	2438745
312470	PROCESS CHILLED WATER	83150	0	83150	0.00	83150	50	1247225
312480	PROCESS WATER	456230	0	456230	0.00	456230	50	6843455
312520	POTENTIALLY RAD LIQUID WASTE	3311670	0	3311670	0.00	3311670	50	4967505
312540	COLD CHEMICALS	3424960	0	3424960	0.00	3424960	50	5137440
312560	COLD FEED VENT	1364430	0	1364430	0.00	1364430	50	2046645
312610	DCS	3143270	0	3143270	0.00	3143270	50	4714905
312620	HEALTH PHYSICS	4240890	0	4240890	0.00	4240890	50	6361335
312660	MIS	8288160	0	8288160	0.00	8288160	50	12432240
312710	REMOTE HANDLING EQUIPMENT	716850	0	716850	0.00	716850	50	1075275
312720	COLD HANDLING EQUIPMENT	225740	0	225740	0.00	225740	50	338610
312730	COLD HANDLING EQUIPMENT - STRUCTURE	1102650	0	1102650	0.00	1102650	50	1653975
SUBTOTAL 312 VITRIFICATION BUILDING		424007310	0	424007310	0.00	424007310	50	636010965
321050	HVAC	33065670	0	33065670	0.00	33065670	50	49598505
321110	HLW WASTE STAGING/SAMPLING STRUCTUR	45671000	0	45671000	0.00	45671000	50	68506500
SUBTOTAL 321 HLW WASTE STAGING/SAMPLING		78736670	0	78736670	0.00	78736670	50	118105005
327010	STRUCTURES	29320180	0	29320180	0.00	29320180	50	43980270
SUBTOTAL 327 FAN HOUSE FILTER BUILDING		29320180	0	29320180	0.00	29320180	50	43980270
SUBTOTAL 32 CONSTRUCTION-FIXED PRICE		108056850	0	108056850	0.00	108056850	50	162085275
SUBTOTAL 3 CONSTRUCTION		532064160	0	532064160	0.00	532064160	50	798096240
411000	CONSTRUCTION MANAGEMENT	62889481	0	62889481	0.00	62889481	50	94334222
SUBTOTAL 411 CONSTRUCTION MANAGEMENT		62889481	0	62889481	0.00	62889481	50	94334222

PAGE 4 OF 6
DATE 07/20/95
BY T.L. Melido

** TEST - INTERACTIVE ESTIMATING **

SW - D
S T U D Y

DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
SUBTOTAL 41	CONSTRUCTION MANAGEMENT	62889481	0	62889481	0.00	62889481	50	94334222
SUBTOTAL 4	CONSTRUCTION MANAGEMENT	62889481	0	62889481	0.00	62889481	50	94334222
511000	PROJECT MANAGEMENT	83778429	0	83778429	0.00	83778429	50	125667644
SUBTOTAL 511	PROJECT MANAGEMENT	83778429	0	83778429	0.00	83778429	50	125667644
SUBTOTAL 51	PROJECT MANAGEMENT	83778429	0	83778429	0.00	83778429	50	125667644
SUBTOTAL 5	PROJECT MANAGEMENT	83778429	0	83778429	0.00	83778429	50	125667644
PROJECT TOTAL		1,021,562,721	0	1,021,562,721	0.00	1,021,562,721	50	1,532,344,083

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAE1

** TEST - INTERACTIVE ESTIMATING **
SLUDGEVASH - D
S T U D Y
DOE_R03 - ESTIMATE BASIS SHEET

PAGE 5 OF 6
DATE 7-20-95
BY T.L. WALDO

1. DOCUMENTS AND DRAWINGS

DRAWINGS: ES-S71-M01 THROUGH ES-S71-M08 (REV. 2), DATED 2-22-93.
FACILITY CONFIGURATION STUDY (FCS) COST ESTIMATE CASE 3B.
WHC COST ESTIMATE 91-18SLB, DATED 4-11-91.

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES

CURRENT KEH BASE CRAFT RATES, AS ISSUED BY KEH FINANCE (EFFECTIVE 10-01-93). INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 9-06-93). NON CRAFT HOURLY RATES ARE BASED ON THE 1994 FISCAL YEAR BUDGET LIQUIDATION RATES AS ISSUED BY KEH FINANCE (EFFECTIVE 10-01-93).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES

A.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP) BASED ON THE ESTIMATING FACTOR/BILLING SCHEDULE. THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE KEH SUMMARY REPORT D0807, INCLUDED WITH THIS ESTIMATE. (FINAL ESTIMATES MAY BE PARTIALLY MANLOADED AND INCLUDED WITHIN THE ESTIMATE DETAIL)

B.) FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES AND ARE REFLECTED IN THE "OH&P / B & I" COLUMN OF THE ESTIMATE DETAIL:

LABOR - 53% MATERIAL - 5% EQUIPMENT - 5% SUBCONTRACTS - 10%

5. ESCALATION

ESCALATION IS NOT INCLUDED AND THE COST ESTIMATE IS IN 1995 DOLLARS.

6. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE 1-32 SUBPARAGRAPH (H), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.
DUE TO THE COST OF PROJECT, ESTIMATE WAS ROUNDED TO THE NEAREST \$1,000,000 FOR TOTAL COST.

7. REMARKS

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- A.) THE ESTIMATE WAS CALCULATED USING THE FAST-C ("FREIMAN ANALYSIS SYSTEM TECHNIQUE") PARAMETRIC ESTIMATING PROGRAM DEVELOPED FOR THE DEPARTMENT OF ENERGY. THE PARAMETRIC VALUES ARE BASED UPON THE FACILITY CONFIGURATION STUDY (FCS) COST ESTIMATE CASE 38 DEVELOPED BY FLUOR-DANIEL AND REPRESENTS THE BEST INFORMATION AVAILABLE FOR A WASTE PROCESSING FACILITY.
- B.) THE ESTIMATE IS FOR DESIGN CONSTRUCTION OF A NEW FACILITY ONLY AND DOES NOT INCLUDE ANY COSTS FOR TIE-IN OR RADIOLOGICAL WORK WHICH WOULD BE DONE BY THE ON-SITE CONSTRUCTION CONTRACTOR.
- C.) ENGINEERING, PROJECT MANAGEMENT, CONSTRUCTION MANAGEMENT AND CONTINGENCY WAS APPLIED AS FOLLOWS:
 - ENGINEERING 30%
 - PROJECT MANAGEMENT 10%
 - CONSTRUCTION MANAGEMENT 10%
 - CONTINGENCY 50%PROJECT MANAGEMENT IS APPLIED TO BOTH ENGINEERING AND CONSTRUCTION MANAGEMENT AS WELL AS THE DIRECT CONSTRUCTION COSTS.
- D.) THE COST ESTIMATE IS IN 1995 DOLLARS AND DOES NOT INCLUDE ANY PERCENTAGES FOR ESCALATION SINCE A SCHEDULE HAS NOT BEEN PREPARED.
- E.) ALLOWANCES FOR CONTRACT DELAYS OR EXTENSION OF SCHEDULES IS NOT INCLUDED.
- F.) LABOR, MATERIAL, AND SUBCONTRACT OH & P WAS APPLIED AS FOLLOWS:
 - 1. LABOR 53%
 - 2. MATERIAL 5%
 - 3. EQUIPMENT 5%
 - 4. SUBCONTRACT 10%

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WHC-SD-WM-TI-718
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **
SW - D
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 1
DATE 07/19/95 12:45:45
BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
111000	ENGINEERING ALLOWANCE										
111000.00	TECHNICAL SERVICES										
111000.0000000	ENGINEERING \$146,000,000 / 2 =	000	1 LOT	0	0	0	0	73000000	0	0	73000000
111000.0000005	ENGINEERING \$146,000,000 / 2 =	000	1 LOT	0	0	0	0	73000000	0	0	73000000
SUBTOTAL	TECHNICAL SERVICES			0	0	0	146,000,000		0		146,000,000
TOTAL	COST CODE 00000 WBS 111000 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	146,000,000		0		146,000,000
TOTAL WBS 111000	ENGINEERING ALLOWANCE			0	0	0	146,000,000		0		146,000,000

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
=====	=====	---	=====	=====	=====	=====	=====	=====	=====	=====	=====
222050	HVAC										
222050.11	EQUIPMENT										
222050.1100005	HVAC	700	1 LOT	0	0	0	0	0	22036230	0	22036230

SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0	22,036,230			22,036,230

TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222050				0		0	22,036,230			22,036,230
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										

TOTAL WBS 222050 HVAC				0		0		0		0	
					0		0	22,036,230			22,036,230

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** TEST - INTERACTIVE ESTIMATING **
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

KATSER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222060	SUPPORT EQUIP REPAIR AND MAINT										
222060.11	EQUIPMENT		1 LOT	0	0	0	0	0	1968600	0	1968600
222060.110005	SUPPORT EQUIP REPAIR & MAINT	700		0	0	0	0	0	1,968,600	0	1,968,600
	SUBTOTAL EQUIPMENT										
	TOTAL										
	COST CODE 70011										
	WBS 222060										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 222060 SUPPORT EQUIP REPAIR AND MAINT										

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONEP / B & I	TOTAL DOLLARS
222110	FEED RECEIPT AND STORAGE										
222110.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	62290	0	62290
222110.1100005	FEED RECEIPT AND STORAGE										
				0	0	0	0	0	62,290	0	62,290
SUBTOTAL	EQUIPMENT										
				0	0	0	0	0	62,290	0	62,290
TOTAL	COST CODE 70011										
	WBS 222110										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0	0	0	0	0	62,290	0	62,290
TOTAL WBS 222110	FEED RECEIPT AND STORAGE			0	0	0	0	0	62,290	0	62,290

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASMD95

** TEST - INTERACTIVE ESTIMATING **

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222320	ELECTRICAL DISTRIBUTION										
222320.11	EQUIPMENT	600	1 LOT	0	0	0	0	0	0	0	0
222320.1100005	ELECTRICAL DISTRIBUTION SEE DOE CODE 600 FOR COSTS. INCLUDED WITH WBS 312320										
SUBTOTAL	EQUIPMENT			0	0	0	0	0	0	0	0
TOTAL	COST CODE 60011 WBS 222320 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	0	0	0
TOTAL WBS 222320	ELECTRICAL DISTRIBUTION			0	0	0	0	0	0	0	0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SHASND95

** TEST - INTERACTIVE ESTIMATING **

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
222420	MEDIUM PRESSURE STEAM										
222420.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	27350	0	27350
222420.1100005	MEDIUM PRESSURE STEAM			0	0	0	0	0	27,350	0	27,350
	SUBTOTAL EQUIPMENT			0	0	0	0	0	27,350	0	27,350
	TOTAL	COST CODE 70011 WBS 222420 (ESCALATION 0.00% - CONTINGENCY 50.00 %)		0	0	0	0	0	27,350	0	27,350
	TOTAL WBS 222420 MEDIUM PRESSURE STEAM			0	0	0	0	0	27,350	0	27,350

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WESTINGHOUSE HANFORD COMPANY
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222430	PROCESS STEAM										
222430.11	EQUIPMENT										
222430.1100005	PROCESS STEAM	700	1 LOT	0	0	0	0	0	1242520	0	1242520
SUBTOTAL	EQUIPMENT			0	0	0	0	0	1,242,520	0	1,242,520
TOTAL	COST CODE 70011 WBS 222430 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	1,242,520	0	1,242,520
TOTAL WBS 222430	PROCESS STEAM			0	0	0	0	0	1,242,520	0	1,242,520

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222450	PROCESS COOLING WATER										
222450.11	EQUIPMENT										
222450.1100005	PROCESS COOLING WATER	700	1 LOT	0	0	0	0	0	336440	0	336440
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		336,440		336,440
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222450				0		0		336,440		336,440
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222450	PROCESS COOLING WATER			0		0		0	336,440	0	336,440

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WESTINGHOUSE HANFORD COMPANY
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222470	PROCESS CHILLED WATER										
222470.11	EQUIPMENT										
222470.1100005	PROCESS CHILLED WATER	700	1 LOT	0	0	0	0	0	31870	0	31870
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		31,870		31,870
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222470				0		0		31,870		31,870
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
					0		0		31,870		31,870
TOTAL WBS 222470	PROCESS CHILLED WATER			0		0		0		0	
									31,870		31,870

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OK&P / B & I	TOTAL DOLLARS
222480	PROCESS WATER										
222480.11	EQUIPMENT										
222480.1100005	PROCESS WATER	700	1 LOT	0	0	0	0	0	42950	0	42950
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		42,950		42,950
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222480				0		0		42,950		42,950
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222480	PROCESS WATER			0		0		0		0	
					0		0		42,950		42,950

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DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
222540	COLD CHEMICALS										
222540.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	531570	0	531570
222540.1100005	COLD CHEMICALS			0	0	0	0	0	531,570	0	531,570
SUBTOTAL	EQUIPMENT			0	0	0	0	0	531,570	0	531,570
TOTAL	COST CODE 70011 WBS 222540 (ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222540	COLD CHEMICALS			0	0	0	0	0	531,570	0	531,570

KAISER ENGINEERS HANFORD
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
222560	COLD FEED VENT		1 LOT	0	0	0	0	0	60170	0	60170
222560.11	EQUIPMENT	700									
222560.1100005	COLD FEED VENT			0	0	0	0	0	60,170	0	60,170
SUBTOTAL	EQUIPMENT			0	0	0	0	0	60,170	0	60,170
TOTAL	COST CODE 70011 WBS 222560 (ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222560	COLD FEED VENT			0	0	0	0	0	60,170	0	60,170

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WESTINGHOUSE HANFORD COMPANY
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222610	DCS										
222610.11	EQUIPMENT										
222610.1100005	DCS	700	1 LOT	0	0	0	0	0	21688810	0	21688810
SUBTOTAL	EQUIPMENT			0	0	0	0	0	21,688,810	0	21,688,810
TOTAL	COST CODE 70011			0	0	0	0	0	21,688,810	0	21,688,810
	WBS 222610				0		0		21,688,810		21,688,810
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222610 DCS				0	0	0	0	0	21,688,810	0	21,688,810

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
222620	HEALTH PHYSICS										
222620.11	EQUIPMENT										
222620.1100005	HEALTH PHYSICS	700	1 LOT	0	0	0	0	0	31276350	0	31276350
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		31,276,350		31,276,350
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222620				0		0		31,276,350		31,276,350
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222620 HEALTH PHYSICS				0		0		0		0	
					0		0		31,276,350		31,276,350

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DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASH095

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / 8 & 1	TOTAL DOLLARS
222660	MIS										
222660.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	4,473,730	0	4,473,730
222660.1100005	MIS			0	0	0	0	0	4,473,730	0	4,473,730
SUBTOTAL	EQUIPMENT			0	0	0	0	0	4,473,730	0	4,473,730
TOTAL	COST CODE 70011 WBS 222660 (ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222660	MIS			0	0	0	0	0	4,473,730	0	4,473,730

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WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **

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DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
223110	ANALYTICAL EQUIPMENT										
223110.11	EQUIPMENT										
223110.1100005	ANALYTICAL EQUIPMENT \$12,073M X 1.1 (ESCAL.) FROM 91-18SLB	700	1 LOT	0	0	0	0	0	13280000	0	13280000
SUBTOTAL	EQUIPMENT			0	0	0	0	0	13,280,000	0	13,280,000
TOTAL	COST CODE 70011 WBS 223110 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	13,280,000	0	13,280,000
TOTAL WBS 223110	ANALYTICAL EQUIPMENT			0	0	0	0	0	13,280,000	0	13,280,000

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WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
224110	PROCESS EQUIPMENT - IN CELL										
224110.11	EQUIPMENT										
224110.1100005	PROCESS EQUIPMENT (IN CELL) REF. LOTUS FILE SMD95.WK4	700	1 LOT	0	0	0	1857589	4316335	92879467	0	99053391
SUBTOTAL	EQUIPMENT			0	0	0	1,857,589	4,316,335	92,879,467	0	99,053,391
TOTAL	COST CODE 70011 WBS 224110 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	1,857,589	4,316,335	92,879,467	0	99,053,391
TOTAL WBS 224110	PROCESS EQUIPMENT - IN CELL			0	0	0	1,857,589	4,316,335	92,879,467	0	99,053,391

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Kaiser Engineers Hanford
Westinghouse Hanford Company
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** TEST - INTERACTIVE ESTIMATING **
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / 8 & 1	TOTAL DOLLARS
312010	STRUCTURES										
312010.11	EQUIPMENT										
312010.1100005	STRUCTURES	501	1 LOT	0	0	0	0	76827525	0	0	76827525
	\$307,310,100 / 4 =										
312010.1100010	STRUCTURES	501	1 LOT	0	0	0	0	76827525	0	0	76827525
	\$307,310,100 / 4 =										
312010.1100015	STRUCTURES	501	1 LOT	0	0	0	0	76827525	0	0	76827525
	\$307,310,100 / 4 =										
312010.1100020	STRUCTURES	501	1 LOT	0	0	0	0	76827525	0	0	76827525
	\$307,310,100 / 4 =										
SUBTOTAL	EQUIPMENT			0	0	0	307,310,100		0		307,310,100
TOTAL	COST CODE 50111			0	0	0	307,310,100		0		307,310,100
	WBS 312010				0		0		0		307,310,100
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312010 STRUCTURES				0	0	0	307,310,100		0		307,310,100

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** TEST - INTERACTIVE ESTIMATING **
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DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312050	HVAC										
312050.11	EQUIPMENT										
312050.1100010	HVAC	700	1 LOT	0	0	0	0	70011550	0	0	70011550
SUBTOTAL	EQUIPMENT			0		0		70,011,550		0	
					0		0		0		70,011,550
TOTAL	COST CODE 70011			0		0		70,011,550		0	
	WBS 312050				0		0		0		70,011,550
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312050 HVAC				0		0		70,011,550		0	
					0		0		0		70,011,550

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312060	SUPPORT EQUIP REPAIR AND MAINT										
312060.11	EQUIPMENT										
312060.1100005	SUPPORT EQUIP REPAIR & MAINT	700	1 LOT	0	0	0	0	728700	0	0	728700
SUBTOTAL	EQUIPMENT			0		0		728,700		0	
					0		0		0		728,700
TOTAL	COST CODE 70011			0		0		728,700		0	
	WBS 312060				0		0		0		728,700
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312060	SUPPORT EQUIP REPAIR AND MAINT			0		0		728,700		0	
					0		0		0		728,700

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312200	RADIOACTIVE LIQUID WASTE										
312200.11	EQUIPMENT										
312200.1100005	RADIOACTIVE LIQUID WASTE	700	1 LOT	0	0	0	0	0	0	0	0
				0		0		0		0	
SUBTOTAL	EQUIPMENT				0		0		0		0
TOTAL	COST CODE 70011			0		0		0		0	0
	WBS 312200				0		0		0		
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
TOTAL WBS 312200	RADIOACTIVE LIQUID WASTE				0		0		0		0

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Kaiser Engineers Hamford
Westinghouse Hamford Company
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
312210	PROCESS EQUIPMENT DECON										
312210.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	0	0	0
312210.1100005	PROCESS EQUIPMENT DECON										
	SUBTOTAL EQUIPMENT			0	0	0	0	0	0	0	0
	TOTAL			0	0	0	0	0	0	0	0
	COST CODE 70011										
	WBS 312210										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312210 PROCESS EQUIPMENT DECON			0	0	0	0	0	0	0	0


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** TEST - INTERACTIVE ESTIMATING **
SW - D
STUDY
DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312320	ELECTRICAL DISTRIBUTION										
312320.11	EQUIPMENT										
312320.1100005	ELECTRICAL DISTRIBUTION	600	1 LOT	0	0	0	0	15617120	0	0	15617120
SUBTOTAL	EQUIPMENT			0		0		15,617,120		0	
					0		0		0		15,617,120
TOTAL	COST CODE 60011			0		0		15,617,120		0	
	WBS 312320				0		0		0		15,617,120
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312320	ELECTRICAL DISTRIBUTION			0		0		15,617,120		0	
					0		0		0		15,617,120

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SVASHD95

** TEST - INTERACTIVE ESTIMATING **
SV - 0
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312430	PROCESS STEAM										
312430.11	EQUIPMENT		1 LOT	0	0	0	0	1537570	0	0	1537570
312430.1100005	PROCESS STEAM			0	0	0	0	1,537,570	0	0	1,537,570
	SUBTOTAL EQUIPMENT										
				0	0	0	0	1,537,570	0	0	1,537,570
			50.00 %								
	TOTAL										
	COST CODE 70011										
	WBS 312430										
	(ESCALATION 0.00% - C										
				0	0	0	0	1,537,570	0	0	1,537,570
	TOTAL WBS 312430 PROCESS STEAM										

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312450	PROCESS COOLING WATER										
312450.11	EQUIPMENT	700	1 LOT	0	0	0	0	1625830	0	0	1625830
312450.1100005	PROCESS COOLING WATER							1,625,830	0	0	1,625,830
	SUBTOTAL EQUIPMENT										
	TOTAL										
	COST CODE 70011										
	WBS 312450										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312450 PROCESS COOLING WATER										

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** TEST ~ INTERACTIVE ESTIMATING **
                                SW - D
                                S T U D Y
DOE R08 - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312470	PROCESS CHILLED WATER										
312470.11	EQUIPMENT										
312470.1100005	PROCESS CHILLED WATER	700	1 LOT	0	0	0	0	83150	0	0	83150
SUBTOTAL	EQUIPMENT			0		0		83,150		0	
					0		0		0		83,150
TOTAL	COST CODE 70011			0		0		83,150		0	
	WBS 312470				0		0		0		83,150
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312470	PROCESS CHILLED WATER			0		0		83,150		0	
					0		0		0		83,150

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **
SW - D
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312480	PROCESS WATER										
312480.11	EQUIPMENT										
312480.1100005	PROCESS WATER EQUIPMENT	700	1 LOT	0	0	0	0	456230	0	0	456230
SUBTOTAL	EQUIPMENT			0	0	0	0	456,230	0	0	456,230
TOTAL	COST CODE 70011 WBS 312480 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	456,230	0	0	456,230
TOTAL WBS 312480	PROCESS WATER			0	0	0	0	456,230	0	0	456,230

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T.L. Waldo

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STUDY

TOTAL WBS 312560 COLD FEED VENT

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
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DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312610	DCS										
312610.11	EQUIPMENT										
312610.1100005	DCS	700	1 LOT	0	0	0	0	3143270	0	0	3143270
SUBTOTAL	EQUIPMENT			0	0	0		3,143,270	0	0	
					0			0			3,143,270
TOTAL	COST CODE 70011			0	0	0		3,143,270	0	0	
	WBS 312610				0			0			3,143,270
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312610 DCS				0	0	0		3,143,270	0	0	3,143,270

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KATSER ENGINEERS HANFORD
VESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312620	HEALTH PHYSICS										
312620.11	EQUIPMENT	700	1 LOT	0	0	0	0	4240890	0	0	4240890
312620.1100005	HEALTH PHYSICS			0	0	0	0	4,240,890	0	0	4,240,890
	SUBTOTAL EQUIPMENT			0	0	0	0	4,240,890	0	0	4,240,890
	TOTAL										
	COST CODE 70011										
	WBS 312620										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312620 HEALTH PHYSICS			0	0	0	0	4,240,890	0	0	4,240,890

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOUS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312660	MIS										
312660.11	EQUIPMENT	700	1 LOT	0	0	0	0	8288160	0	0	8288160
312660.1100005	MIS			0	0	0	0	8,288,160	0	0	8,288,160
	SUBTOTAL EQUIPMENT										
	TOTAL										
	COST CODE 70011										
	WBS 312660										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312660 MIS										

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BY T.L. Waldo

** TEST - INTERACTIVE ESTIMATING **
SU - D
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SVASHD95

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
312710	REMOTE HANDLING EQUIPMENT										
312710.11	EQUIPMENT	700	1 LOT	0	0	0	0	716850	0	0	716850
312710.1100005	REMOTE HANDLING EQUIPMENT			0	0	0	0	716,850	0	0	716,850
	SUBTOTAL EQUIPMENT							716,850	0	0	716,850
	TOTAL							0	0	0	716,850
	COST CODE 70011										
	WBS 312710										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312710 REMOTE HANDLING EQUIPMENT			0	0	0	0	716,850	0	0	716,850

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
312720	COLD HANDLING EQUIPMENT										
312720.11	EQUIPMENT	700	1 LOT	0	0	0	0	225740	0	0	225740
312720.1100005	COLD HANDLING EQUIPMENT			0	0	0	0	225,740	0	0	225,740
SUBTOTAL	EQUIPMENT										
TOTAL	COST CODE 70011 WBS 312720 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	225,740	0	0	225,740
TOTAL WBS 312720	COLD HANDLING EQUIPMENT			0	0	0	0	225,740	0	0	225,740

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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** TEST - INTERACTIVE ESTIMATING **
SU - D
S T U D Y

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
312730	COLD HANDLING EQUIPMENT - STRUCTURE										
312730.11	EQUIPMENT		1 LOT	0	0	0	0	1102650	0	0	1102650
312730.1100005	COLD HANDLING EQUIP. STRUCTU	501									
				0	0	0	0	1,102,650	0	0	1,102,650
	SUBTOTAL EQUIPMENT										
				0	0	0	0	1,102,650	0	0	1,102,650
	TOTAL										
	COST CODE 50111										
	WBS 312730										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0	0	0	0	1,102,650	0	0	1,102,650
	TOTAL WBS 312730 COLD HANDLING EQUIPMENT - STRUCTURE										
				0	0	0	0	1,102,650	0	0	1,102,650

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
SW - 0
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
321050	HVAC										
321050.11	EQUIPMENT										
321050.1100005	WASTE STAGING TANKS	700	1 LOT	0	0	0	0	0	33065670	0	33065670
SUBTOTAL	EQUIPMENT			0	0	0	0	0	33,065,670	0	33,065,670
TOTAL	COST CODE 70011 WBS 321050 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	33,065,670	0	33,065,670
TOTAL WBS 321050 HVAC				0	0	0	0	0	33,065,670	0	33,065,670

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
327010	STRUCTURES										
327010.11	EQUIPMENT										
327010.1100005	FAN HOUSE FILTER BLDG STRUCTURE	550	1 LOT	0	0	0	0	22565480	6754700	0	29320180
	SUBTOTAL EQUIPMENT							22,565,480	6,754,700	0	29,320,180
	TOTAL							22,565,480	6,754,700	0	29,320,180
	COST CODE 55011 WBS 327010 (ESCALATION 0.00% - CONTINGENCY 50.00 %)							0	0	0	0
	TOTAL WBS 327010 STRUCTURES							22,565,480	6,754,700	0	29,320,180

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SWASHD95

** TEST - INTERACTIVE ESTIMATING **
SW - D
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS

TOTAL WBS 411000 CONSTRUCTION MANAGEMENT				0		0	62,889,481		0		62,889,481

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. SVASHD95

** TEST - INTERACTIVE ESTIMATING **
SM - 0
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
511000	PROJECT MANAGEMENT										
511000.00	TECHNICAL SERVICES										
511000.0000000	PROJECT MANAGEMENT	000	1 LOT	0	0	0	0	14600000	0	0	14600000
511000.0000001	PROJECT MANAGEMENT	000	1 LOT	0	0	0	0	33925402	0	0	33925402
511000.0000002	ASSOCIATED WITH DOE 501										
511000.0000002	PROJECT MANAGEMENT	000	1 LOT	0	0	0	0	3225220	0	0	3225220
511000.0000003	ASSOCIATED WITH DOE 550										
511000.0000003	PROJECT MANAGEMENT	000	1 LOT	0	0	0	0	1717883	0	0	1717883
511000.0000004	ASSOCIATED WITH DOE 600										
511000.0000004	PROJECT MANAGEMENT	000	1 LOT	0	0	0	0	30309924	0	0	30309924
511000.0000004	ASSOCIATED WITH DOE 700										
SUBTOTAL	TECHNICAL SERVICES							83,778,429	0	0	83,778,429
TOTAL	COST CODE 00000							0	0	0	0
	WBS 511000							0	0	0	0
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)							83,778,429	0	0	83,778,429
TOTAL WBS 511000	PROJECT MANAGEMENT							83,778,429	0	0	83,778,429

Kaiser Engineers Hanford
Westinghouse Hanford Company
Job No. SWASMD95

** IEST - INTERACTIVE ESTIMATING **
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STUDY
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANNOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
				0		0	789,228,035			0
					0		1,857,589	230,477,097		***,***,***
REPORT TOTAL										

KAISER ENGINEERS HANFORD
VESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAC1

** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_R01 - PROJECT COST SUMMARY

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BY T.L. Waldo

COST CODE =====	DESCRIPTION =====	ESCALATED TOTAL COST =====	CONTINGENCY % =====	TOTAL TOTAL =====	TOTAL DOLLARS =====
000	ENGINEERING	195,650,000	50	97,830,000	293,480,000
501	BUILDINGS	299,840,000	50	149,920,000	449,760,000
550	OTHER STRUCTURES	26,650,000	50	13,330,000	39,980,000
600	UTILITIES	15,100,000	50	7,590,000	22,770,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	310,500,000	50	155,250,000	465,750,000
	(ADJUSTED TO MEET DOE 5100.4)			260,000	260,000
		==	=====		
	PROJECT TOTAL	84	50	424,180,000	1,272,000,000

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Revision 0

TYPE OF
ESTIMATE

ARCHITECT
ENGINEER

OPERATING
CONTRACTOR

REMARKS:

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAC1

** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

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DATE 07/20/95
BY T.L. Waldo

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
111000	ENGINEERING ALLOWANCE	118577800	0	118577800	0.00	0	59288900	177866700
	SUBTOTAL 111 ENGINEERING ALLOWANCE	118577800	0	118577800	0.00	0	59288900	177866700
	SUBTOTAL 1 ENGINEERING	118577800	0	118577800	0.00	0	59288900	177866700
222050	HVAC	20251400	0	20251400	0.00	0	10125700	30377100
222060	SUPPORT EQUIP REPAIR AND MAINT	1249020	0	1249020	0.00	0	624510	1873530
222110	FEED RECEIPT AND STORAGE	39520	0	39520	0.00	0	19760	59280
222270	SULFUR PLANT	66970	0	66970	0.00	0	33485	100455
222420	MEDIUM PRESSURE STEAM	17350	0	17350	0.00	0	8675	26025
222430	PROCESS STEAM	788340	0	788340	0.00	0	394170	1182510
222450	PROCESS COOLING WATER	213460	0	213460	0.00	0	106730	320190
222470	PROCESS CHILLED WATER	20220	0	20220	0.00	0	10110	30330
222480	PROCESS WATER	27250	0	27250	0.00	0	13625	40875
222520	POTENTIALLY RAD LIQUID WASTE	388820	0	388820	0.00	0	194410	583230
222540	COLD CHEMICALS	337270	0	337270	0.00	0	168635	505905
222560	COLD FEED VENT	38180	0	38180	0.00	0	19090	57270
222610	DCS	13760920	0	13760920	0.00	0	6880460	20641380
222620	HEALTH PHYSICS	19843920	0	19843920	0.00	0	9921960	29765880
222660	MIS	2838450	0	2838450	0.00	0	1419225	4257675
222760	REMOTE HANDLING EQUIPMENT	7332000	0	7332000	0.00	0	3666000	10998000
	SUBTOTAL 222 OUT-OF-CELL EQUIPMENT	67213090	0	67213090	0.00	0	33606545	100819635
223110	ANALYTICAL EQUIPMENT	13280000	0	13280000	0.00	0	6640000	19920000
	SUBTOTAL 223 ANALYTICAL EQUIPMENT	13280000	0	13280000	0.00	0	6640000	19920000
224110	PROCESS EQUIPMENT - IN CELL	71700730	0	71700730	0.00	0	35850365	107551095
	SUBTOTAL 224 PROCESS EQUIPMENT - IN CELL	71700730	0	71700730	0.00	0	35850365	107551095
	SUBTOTAL 2 PROCUREMENT	152193820	0	152193820	0.00	0	76096910	228290730
312010	STRUCTURES	271606500	0	271606500	0.00	0	135803250	407409750
312050	HVAC	44420280	0	44420280	0.00	0	22210140	66630420

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BY T.L. Waido

** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y

DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAC1

UWS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
312060	SUPPORT EQUIP REPAIR AND MAINT	462340	0	462340	0.00	462340	50	693510
312270	SULFUR PLANT	497630	0	497630	0.00	497630	50	746445
312320	ELECTRICAL DISTRIBUTION	13802680	0	13802680	0.00	13802680	50	20704020
312420	MEDIUM PRESSURE STEAM	21650	0	21650	0.00	21650	50	32475
312430	PROCESS STEAM	975550	0	975550	0.00	975550	50	1463325
312450	PROCESS COOLING WATER	1031540	0	1031540	0.00	1031540	50	1547310
312470	PROCESS CHILLED WATER	52760	0	52760	0.00	52760	50	79140
312480	PROCESS WATER	289470	0	289470	0.00	289470	50	434205
312520	POTENTIALLY RAD LIQUID WASTE	2101150	0	2101150	0.00	2101150	50	3151725
312540	COLD CHEMICALS	2173040	0	2173040	0.00	2173040	50	3259560
312560	COLD FEED VENT	865690	0	865690	0.00	865690	50	1298535
312610	PCS	1994320	0	1994320	0.00	1994320	50	2991480
312620	HEALTH PHYSICS	2690720	0	2690720	0.00	2690720	50	4036080
312660	MIS	5258590	0	5258590	0.00	5258590	50	7887885
312710	REMOTE HANDLING EQUIPMENT	454820	0	454820	0.00	454820	50	682230
312720	COLD HANDLING EQUIPMENT	143230	0	143230	0.00	143230	50	214845
312730	COLD HANDLING EQUIPMENT - STRUCTURE	974540	0	974540	0.00	974540	50	1461810
SUBTOTAL 312	VITRIFICATION BUILDING	349816500	0	349816500	0.00	349816500	50	524724750
321050	HLW WASTE STAGING/SAMPLING EQUIP.	20979200	0	20979200	0.00	20979200	50	31468800
321110	HLW WASTE STAGING/SAMPLING STRUCTUR	45671000	0	45671000	0.00	45671000	50	68506500
SUBTOTAL 321	HLW WASTE STAGING/SAMPLING	66650200	0	66650200	0.00	66650200	50	99975300
327010	STRUCTURES	24229430	0	24229430	0.00	24229430	50	36344145
SUBTOTAL 327	FAN HOUSE FILTER BUILDING	24229430	0	24229430	0.00	24229430	50	36344145
SUBTOTAL 32	CONSTRUCTION-FIXED PRICE	90879630	0	90879630	0.00	90879630	50	136319445
SUBTOTAL 3	CONSTRUCTION	440696130	0	440696130	0.00	440696130	50	661044195
411000	CONSTRUCTION MANAGEMENT	59288995	0	59288995	0.00	59288995	50	88933493
SUBTOTAL 411	CONSTRUCTION MANAGEMENT	59288995	0	59288995	0.00	59288995	50	88933493
SUBTOTAL 41	CONSTRUCTION MANAGEMENT	59288995	0	59288995	0.00	59288995	50	88933493

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEMASH - B
S T U D Y
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

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DATE 07/20/95
BY T.L. Waldo

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
SUBTOTAL 4	CONSTRUCTION MANAGEMENT	59288995	0	59288995	0.00	0	59288995 50	29644498 88933493
511000	PROJECT MANAGEMENT	77075674	0	77075674	0.00	0	77075674 50	38537837 115613511
SUBTOTAL 511	PROJECT MANAGEMENT	77075674	0	77075674	0.00	0	77075674 50	38537837 115613511
SUBTOTAL 51	PROJECT MANAGEMENT	77075674	0	77075674	0.00	0	77075674 50	38537837 115613511
SUBTOTAL 5	PROJECT MANAGEMENT	77075674	0	77075674	0.00	0	77075674 50	38537837 115613511
PROJECT TOTAL		847,832,419	0	847,832,419	0.00	0	847,832,419 50	423,916,210 1,271,748,629

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KAISER ENGINEERS HANFORD
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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
STUDY
DOE_R03 - ESTIMATE BASIS SHEET

PAGE 5 OF 6
DATE 7-20-95
BY T.L. WALDO

1. DOCUMENTS AND DRAWINGS

DRAWINGS: ES-S09-M01 THROUGH ES-S09-M08 (REV. 7), DATED 2-22-93.
FACILITY CONFIGURATION STUDY (FCS) COST ESTIMATE CASE 38.
WHC & KEH COST ESTIMATE 91-1BSLB, DATED 4-11-91.

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES

CURRENT KEH BASE CRAFT RATES, AS ISSUED BY KEH FINANCE (EFFECTIVE 10-01-93), INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 9-06-93). NON CRAFT HOURLY RATES ARE BASED ON THE 1994 FISCAL YEAR BUDGET LIQUIDATION RATES AS ISSUED BY KEH FINANCE (EFFECTIVE 10-01-93).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES

A.) ONSITE CONTRACT ADMINISTRATION AND CONSTRUCTION MANAGEMENT COSTS, ASSOCIATED WITH THE OVERALL MANAGEMENT OF THE FIXED PRICE CONTRACTS, ARE INCLUDED AS A COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE (FOR BID PACKAGE PREP) BASED ON THE ESTIMATING FACTOR/BILLING SCHEDULE. THE TOTAL COMPOSITE PERCENTAGE AND LUMP SUM ALLOWANCE ARE APPLIED AGAINST THE TOTAL FIXED PRICE CONTRACT AMOUNT WHICH IS REFLECTED ON THE KEH SUMMARY REPORT D0ER07, INCLUDED WITH THIS ESTIMATE. (FINAL ESTIMATES MAY BE PARTIALLY MANLOADED AND INCLUDED WITHIN THE ESTIMATE DETAIL)

B.) FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES AND ARE REFLECTED IN THE "ON&P / B & I" COLUMN OF THE ESTIMATE DETAIL:

LABOR - 53% MATERIAL - 5% EQUIPMENT - 5% SUBCONTRACTS - 10%

5. ESCALATION

ESCALATION IS NOT INCLUDED AND THE COST ESTIMATE IS IN 1995 DOLLARS.

6. ROUNDING

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE 1-32 SUBPARAGRAPH (M), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.
DUE TO THE COST OF PROJECT, ESTIMATE WAS ROUNDED TO THE NEAREST \$1,000,000 FOR TOTAL COST.

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7. REMARKS

=====

- A.) THE ESTIMATE WAS CALCULATED USING THE FAST-C ("FREIHAN ANALYSIS SYSTEM TECHNIQUE") PARAMETRIC ESTIMATING PROGRAM DEVELOPED FOR THE DEPARTMENT OF ENERGY. THE PARAMETRIC VALUES ARE BASED UPON THE FACILITY CONFIGURATION STUDY (FCS) COST ESTIMATE CASE 3B DEVELOPED BY FLUOR-DANIEL AND REPRESENTS THE BEST INFORMATION AVAILABLE FOR A WASTE PROCESSING FACILITY.
- B.) THE ESTIMATE IS FOR DESIGN CONSTRUCTION OF A NEW FACILITY ONLY AND DOES NOT INCLUDE ANY COSTS FOR TIE-IN OR RADIOLOGICAL WORK WHICH WOULD BE DONE BY THE ON-SITE CONSTRUCTION CONTRACTOR.
- C.) ENGINEERING, PROJECT MANAGEMENT, CONSTRUCTION MANAGEMENT AND CONTINGENCY WAS APPLIED AS FOLLOWS:
ENGINEERING	30%
PROJECT MANAGEMENT	10%
CONSTRUCTION MANAGEMENT	10%
CONTINGENCY	50%
- D.) THE COST ESTIMATE IS IN 1995 DOLLARS AND DOES NOT INCLUDE ANY PERCENTAGES FOR ESCALATION SINCE A SCHEDULE HAS NOT BEEN PREPARED.
- E.) ALLOWANCES FOR CONTRACT DELAYS OR EXTENSION OF SCHEDULES IS NOT INCLUDED.
- F.) LABOR, MATERIAL, AND SUBCONTRACT OH & P WAS APPLIED AS FOLLOWS:
1. LABOR	53%
2. MATERIAL	5%
3. EQUIPMENT	5%
4. SUBCONTRACT	10%

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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DATE 07/17/95 15:03:53
BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
111000	ENGINEERING ALLOWANCE										
111000.00	TECHNICAL SERVICES										
111000.0000000	ENGINEERING	000	1 LOT	0	0	0	0	59288900	0	0	59288900
	\$118,577,800 / 2=										
111000.0000005	ENGINEERING	000	1 LOT	0	0	0	0	59288900	0	0	59288900
	\$118,577,800 / 2=										
SUBTOTAL	TECHNICAL SERVICES			0		0	118,577,800		0		118,577,800
					0		0		0		118,577,800
TOTAL	COST CODE 00000			0		0	118,577,800		0		118,577,800
	WBS 111000				0		0		0		118,577,800
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 111000	ENGINEERING ALLOWANCE			0		0	118,577,800		0		118,577,800
					0		0		0		118,577,800

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BY T.L. Waldo

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WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAC1

** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

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DATE 07/17/95 15:04:02
BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222110	FEED RECEIPT AND STORAGE										
222110.11	EQUIPMENT										
222110.1100005	FEED RECEIPT AND STORAGE	700	1 LOT	0	0	0	0	0	39520	0	39520
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		39,520		39,520
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222110				0		0		39,520		39,520
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222110	FEED RECEIPT AND STORAGE			0		0		0	39,520	0	39,520

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OW&P / B & I	TOTAL DOLLARS
222270	SULFUR PLANT										
222270.11	EQUIPMENT										
222270.1100005	SULFUR PLANT	700	1 LOT	0	0	0	0	0	66970	0	66970
				0		0		0		0	
SUBTOTAL	EQUIPMENT				0		0		66,970		66,970
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222270				0		0		66,970		66,970
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
					0		0		66,970		66,970

TOTAL WBS 222270 SULFUR PLANT

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEMASH - B
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DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Valdo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222420	MEDIUM PRESSURE STEAM										
222420.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	17350	0	17350
222420.110005	MEDIUM PRESSURE STEAM										
				0	0	0	0	0	17,350	0	17,350
	SUBTOTAL EQUIPMENT			0	0	0	0	0	17,350	0	17,350
	TOTAL										
	COST CODE 70011										
	WBS 222420										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 222420 MEDIUM PRESSURE STEAM			0	0	0	0	0	17,350	0	17,350

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** TEST - INTERACTIVE ESTIMATING **

SLUDGEWASH - B

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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
222430	PROCESS STEAM										
222430.11	EQUIPMENT										
222430.1100005	PROCESS STEAM	700	1 LOT	0	0	0	0	0	788340	0	788340
				0		0		0		0	
SUBTOTAL	EQUIPMENT				0		0		788,340		788,340
				0		0		0		0	
TOTAL	COST CODE 70011										
	WBS 222430				0		0		788,340		788,340
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
					0		0		788,340		788,340
TOTAL WBS 222430 PROCESS STEAM											

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** TEST - INTERACTIVE ESTIMATING **
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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOUS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222450	PROCESS COOLING WATER										
222450.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	213,460	0	213,460
222450.1100005	PROCESS COOLING WATER			0	0	0	0	0	213,460	0	213,460
SUBTOTAL	EQUIPMENT			0	0	0	0	0	213,460	0	213,460
TOTAL	COST CODE 70011 WBS 222450 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	213,460	0	213,460
TOTAL WBS 222450	PROCESS COOLING WATER			0	0	0	0	0	213,460	0	213,460

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

KAISER ENGINEERS HANFORD
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222470	PROCESS CHILLED WATER										
222470.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	20220	0	20220
222470.1100005	PROCESS CHILLED WATER			0	0	0	0	0	20,220	0	20,220
	SUBTOTAL EQUIPMENT			0	0	0	0	0	20,220	0	20,220
	TOTAL	COST CODE 70011 WBS 222470 (ESCALATION 0.00% - CONTINGENCY 50.00 %)							20,220	0	20,220
	TOTAL WBS 222470 PROCESS CHILLED WATER			0	0	0	0	0	20,220	0	20,220

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
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DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222480	PROCESS WATER										
222480.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	27250	0	27250
222480.1100005	PROCESS WATER			0	0	0	0	0	27,250	0	27,250
	SUBTOTAL EQUIPMENT			0	0	0	0	0	27,250	0	27,250
	TOTAL	COST CODE 70011 WBS 222480 (ESCALATION 0.00% - CONTINGENCY 50.00 %)									
	TOTAL WBS 222480 PROCESS WATER			0	0	0	0	0	27,250	0	27,250

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** TEST - INTERACTIVE ESTIMATING **
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S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Matdo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222520	POTENTIALLY RAD LIQUID WASTE										
222520.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	388820	0	388820
222520.1100005	POTENTIALLY RAD LIQUID WASTE			0	0	0	0	0	388,820	0	388,820
	SUBTOTAL EQUIPMENT			0	0	0	0	0	388,820	0	388,820
	TOTAL										
	COST CODE 70011										
	WBS 222520										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 222520 POTENTIALLY RAD LIQUID WASTE			0	0	0	0	0	388,820	0	388,820

** TEST - INTERACTIVE ESTIMATING **
 SLUDGEWASH - 8
 S T U D Y
 DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

KAISER ENGINEERS HANFORD
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONHP / 8 & 1	TOTAL DOLLARS
222540	COLD CHEMICALS										
222540.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	337270	0	337270
222540.1100005	COLD CHEMICALS			0	0	0	0	0	337,270	0	337,270
	SUBTOTAL EQUIPMENT			0	0	0	0	0	337,270	0	337,270
	TOTAL										
	COST CODE 70011										
	WBS 222540										
	(ESCALATION 0.00X - CONTINGENCY 50.00 %)										
	TOTAL WBS 222540 COLD CHEMICALS			0	0	0	0	0	337,270	0	337,270

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONHP / 8 & 1	TOTAL DOLLARS
222560	COLD FEED VENT										
222560.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	38180	0	38180
222560.1100005	COLD FEED VENT			0	0	0	0	0	38,180	0	38,180
SUBTOTAL	EQUIPMENT			0	0	0	0	0	38,180	0	38,180
TOTAL	COST CODE 70011 WBS 222560 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	38,180	0	38,180
TOTAL WBS 222560	COLD FEED VENT			0	0	0	0	0	38,180	0	38,180

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_ROB - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222610	DCS										
222610.11	EQUIPMENT										
222610.1100005	DCS	700	1 LOT	0	0	0	0	0	13760920	0	13760920
				0		0		0		0	
SUBTOTAL	EQUIPMENT				0		0		13,760,920		13,760,920
				0		0		0		0	
TOTAL	COST CODE 70011										
	WBS 222610				0		0		13,760,920		13,760,920
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
TOTAL WBS 222610 DCS					0		0		13,760,920		13,760,920

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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
S T U D Y
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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DATE 07/17/95 15:05:27
BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANNOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	O&P / B & I	TOTAL DOLLARS
222620	HEALTH PHYSICS										
222620.11	EQUIPMENT	700	1 LOT	0	0	0	0	0	19843920	0	19843920
222620.1100005	HEALTH PHYSICS			0	0	0	0	0	19,843,920	0	19,843,920
	SUBTOTAL EQUIPMENT			0	0	0	0	0	19,843,920	0	19,843,920
	TOTAL										
	COST CODE 70011										
	WBS 222620										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 222620 HEALTH PHYSICS			0	0	0	0	0	19,843,920	0	19,843,920

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      ** TEST - INTERACTIVE ESTIMATING **
                                SLUDGEWASH - B
                                S T U D Y
DOE ROB - ESTIMATE DETAIL BY WBS / COST CODE

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222660	MIS										
222660.11	EQUIPMENT										
222660.1100005	MIS	700	1 LOT	0	0	0	0	0	2838450	0	2838450
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		2,838,450		2,838,450
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 222660				0		0		2,838,450		2,838,450
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222660 MIS				0		0		0		0	
					0		0		2,838,450		2,838,450

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** IEST - INTERACTIVE ESTIMATING **
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
222760	COLD HANDLING EQUIPMENT										
222760.11	EQUIPMENT										
222760.1100005	REMOTE HANDLING EQUIPMENT REF. SW A (1995)	700	1 LOT	0	0	0	0	325000	6500000	0	6825000
SUBTOTAL	EQUIPMENT			0		0		325,000		0	
					0		0		6,500,000		6,825,000
	SALES TAX 7.80 %						0		507000		507000
TOTAL	COST CODE 70011			0		0		325,000		0	
	WBS 222760				0		0		7,007,000		7,332,000
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 222760	COLD HANDLING EQUIPMENT			0		0		325,000		0	
					0		0		7,007,000		7,332,000

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
223110	ANALYTICAL EQUIPMENT										
223110.11	EQUIPMENT										
223110.1100005	ANALYTICAL EQUIPMENT \$12,073M X 1.1 (ESCAL.) FROM 91-18SLB	700	1 LOT	0	0	0	0	0	13280000	0	13280000
SUBTOTAL	EQUIPMENT			0	0	0	0	0	13,280,000	0	13,280,000
TOTAL	COST CODE 70011 WBS 223110 (ESCALATION 0.00% - CONTINGENCY 50.00 %)			0	0	0	0	0	13,280,000	0	13,280,000
TOTAL WBS 223110	ANALYTICAL EQUIPMENT			0	0	0	0	0	13,280,000	0	13,280,000

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
224110	PROCESS EQUIPMENT - IN CELL									
224110.11	EQUIPMENT	700	1 LOT	0	0	0	2251220	3626830	65822680	0 71700730
224110.1100005	PROCESS EQUIPMENT (IN CELL) REF. SLUDGE WASH - 8 (1991) LOTUS RUN									
	SUBTOTAL EQUIPMENT				0	0	3,626,830	0	0	71,700,730
	TOTAL				0	0	2,251,220	65,822,680	0	71,700,730
	COST CODE 70011									
	WBS 224110									
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)									
	TOTAL WBS 224110 PROCESS EQUIPMENT - IN CELL				0	0	3,626,830	65,822,680	0	71,700,730

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312010	STRUCTURES									
312010.11	EQUIPMENT									
312010.1100005	STRUCTURES	501	1 LOT	0	0	0	0 90535500	0	0	90535500
	\$271,606,500 / 3 =									
312010.1100010	STRUCTURES	501	1 LOT	0	0	0	0 90535500	0	0	90535500
	\$271,606,500 / 3 =									
312010.1100015	STRUCTURES	501	1 LOT	0	0	0	0 90535500	0	0	90535500
	\$271,606,500 / 3 =									
SUBTOTAL	EQUIPMENT									
					0	0	271,606,500	0	0	271,606,500
					0	0	0	0	0	0
TOTAL	COST CODE 50111									
	WBS 312010									
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)									
					0	0	271,606,500	0	0	271,606,500
					0	0	0	0	0	0
TOTAL WBS 312010	STRUCTURES				0	0	271,606,500	0	0	271,606,500

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312060	SUPPORT EQUIP REPAIR AND MAINT										
312060.11	EQUIPMENT										
312060.1100005	SUPPORT EQUIP REPAIR & MAINT	700	1 LOT	0	0	0	0	462340	0	0	462340
SUBTOTAL	EQUIPMENT			0	0	0	0	462,340	0	0	462,340
TOTAL	COST CODE 70011			0	0	0	0	462,340	0	0	462,340
	WBS 312060				0		0		0		462,340
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312060	SUPPORT EQUIP REPAIR AND MAINT			0	0	0	0	462,340	0	0	462,340

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JOB NO. 2353SAC1

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312420	MEDIUM PRESSURE STEAM										
312420.11	EQUIPMENT	700	1 LOT	0	0	0	0	21650	0	0	21650
312420.1100005	MEDIUM PRESSURE STEAM			0	0	0	0	21,650	0	0	21,650
	SUBTOTAL EQUIPMENT			0	0	0	0	21,650	0	0	21,650
	TOTAL	COST CODE 70011 WBS 312420 (ESCALATION 0.00% - CONTINGENCY 50.00 %)									
	TOTAL WBS 312420 MEDIUM PRESSURE STEAM			0	0	0	0	21,650	0	0	21,650

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** TEST - INTERACTIVE ESTIMATING **
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312430	PROCESS STEAM										
312430.11	EQUIPMENT										
312430.1100005	PROCESS STEAM	700	1 LOT	0	0	0	0	975550	0	0	975550
SUBTOTAL	EQUIPMENT			0		0		975,550		0	
					0		0		0		975,550
TOTAL	COST CODE 70011			0		0		975,550		0	
	WBS 312430				0		0		0		975,550
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312430 PROCESS STEAM				0		0		975,550		0	
					0		0		0		975,550

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312450	PROCESS COOLING WATER										
312450.11	EQUIPMENT										
312450.1100005	PROCESS COOLING WATER	700	1 LOT	0	0	0	0	1031540	0	0	1031540
SUBTOTAL	EQUIPMENT			0		0		1,031,540	0		
					0		0		0		1,031,540
TOTAL	COST CODE 70011			0		0		1,031,540		0	
	WBS 312450				0		0		0		1,031,540
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312450 PROCESS COOLING WATER				0		0		1,031,540	0		
					0		0		0		1,031,540

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312470	PROCESS CHILLED WATER										
312470.11	EQUIPMENT	700	1 LOT	0	0	0	0	52760	0	0	52760
312470.1100005	PROCESS CHILLED WATER			0	0	0	0	52,760	0	0	52,760
	SUBTOTAL EQUIPMENT							52,760	0	0	52,760
	TOTAL							52,760	0	0	52,760
	COST CODE 70011										
	WBS 312470										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312470 PROCESS CHILLED WATER			0	0	0	0	52,760	0	0	52,760

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312480	PROCESS WATER										
312480.11	EQUIPMENT	700	1 LOT	0	0	0	0	289,470	0	0	289,470
312480.1100005	PROCESS WATER EQUIPMENT										
	SUBTOTAL EQUIPMENT							289,470	0	0	289,470
	TOTAL							289,470	0	0	289,470
	COST CODE 70011										
	WBS 312480										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312480 PROCESS WATER							289,470	0	0	289,470


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** TEST - INTERACTIVE ESTIMATING **
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312520	POTENTIALLY RAD LIQUID WASTE										
312520.11	EQUIPMENT										
312520.1100005	POTENTIALLY RAD LIQUID WASTE	700	1 LOT	0		0	0	2101150	0	0	2101150
SUBTOTAL	EQUIPMENT			0		0		2,101,150		0	
							0		0		2,101,150
TOTAL	COST CODE 70011					0		2,101,150		0	
	WBS 312520						0		0		2,101,150
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312520	POTENTIALLY RAD LIQUID WASTE					0		2,101,150		0	
						0	0		0		2,101,150

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOUS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
312540	COLD CHEMICALS										
312540.11	EQUIPMENT		1 LOT	0	0	0	0	2173040	0	0	2173040
312540.1100005	COLD CHEMICALS			0	0	0	0	2,173,040	0	0	2,173,040
	SUBTOTAL EQUIPMENT			0	0	0	0	2,173,040	0	0	2,173,040
	TOTAL	COST CODE 70011 WBS 312540 (ESCALATION 0.00% - CONTINGENCY 50.00 %)									
	TOTAL WBS 312540 COLD CHEMICALS			0	0	0	0	2,173,040	0	0	2,173,040

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312560	COLD FEED VENT										
312560.11	EQUIPMENT										
312560.1100005	COLD FEED VENT	700	1 LOT	0	0	0	0	865690	0	0	865690
SUBTOTAL	EQUIPMENT			0	0	0	0	865,690	0	0	865,690
TOTAL	COST CODE 70011			0	0	0	0	865,690	0	0	865,690
	WBS 312560				0		0		0		865,690
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312560	COLD FEED VENT			0	0	0	0	865,690	0	0	865,690

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
312610	DCS										
312610.11	EQUIPMENT	700	1 LOT	0	0	0	0	1994320	0	0	1994320
312610.1100005	DCS			0	0	0	0	1,994,320	0	0	1,994,320
	SUBTOTAL EQUIPMENT			0	0	0	0	1,994,320	0	0	1,994,320
	TOTAL										
	COST CODE 70011										
	WBS 312610										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312610 DCS			0	0	0	0	1,994,320	0	0	1,994,320

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312620	HEALTH PHYSICS										
312620.11	EQUIPMENT										
312620.110005	HEALTH PHYSICS	700	1 LOT	0	0	0	0	2690720	0	0	2690720
	SUBTOTAL EQUIPMENT							2,690,720	0	0	2,690,720
	TOTAL							2,690,720	0	0	2,690,720
	WBS 312620 (ESCALATION 0.00% - CONTINGENCY 50.00 %)							0	0	0	0
	TOTAL WBS 312620 HEALTH PHYSICS							2,690,720	0	0	2,690,720

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OR&P / B & I	TOTAL DOLLARS
312660	MIS										
312660-11	EQUIPMENT		1 LOT	0	0	0	0	5258590	0	0	5258590
312660-1100005	MIS			0	0	0	0	5,258,590	0	0	5,258,590
	SUBTOTAL EQUIPMENT										
	TOTAL										
	COST CODE 70011										
	WBS 312660										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312660 MIS										

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312710	REMOTE HANDLING EQUIPMENT										
312710.11	EQUIPMENT	700	1 LOT	0	0	0	0	454,820	0	0	454,820
312710.1100005	REMOTE HANDLING EQUIPMENT			0	0	0	0	454,820	0	0	454,820
SUBTOTAL	EQUIPMENT							454,820	0	0	454,820
TOTAL	COST CODE 70011 WBS 312710 (ESCALATION 0.00% - CONTINGENCY 50.00 %)							454,820	0	0	454,820
TOTAL WBS 312710	REMOTE HANDLING EQUIPMENT							454,820	0	0	454,820

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
312720	COLD HANDLING EQUIPMENT										
312720.11	EQUIPMENT										
312720.1100005	COLD HANDLING EQUIPMENT	700	1 LOT	0	0	0	0	143230	0	0	143230
SUBTOTAL	EQUIPMENT			0		0		143,230		0	
					0		0		0		143,230
TOTAL	COST CODE 70011			0		0		143,230		0	
	WBS 312720				0		0		0		143,230
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
TOTAL WBS 312720	COLD HANDLING EQUIPMENT			0		0		143,230		0	
					0		0		0		143,230

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
312730	COLD HANDLING EQUIPMENT - STRUCTURE										
312730.11	EQUIPMENT		1 LOT		0	0	0	974,540	0	0	974,540
312730.1100005	COLD HANDLING EQUIP. STRUCTU	501			0	0	0	974,540	0	0	974,540
	SUBTOTAL EQUIPMENT				0	0	0	974,540	0	0	974,540
	TOTAL				0	0	0	974,540	0	0	974,540
	COST CODE 50111										
	WBS 312730										
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
	TOTAL WBS 312730 COLD HANDLING EQUIPMENT - STRUCTURE				0	0	0	974,540	0	0	974,540

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
321050	HVAC										
321050.11	EQUIPMENT										
321050.1100005	WASTE STAGING TANKS	700	1 LOT	0	0	0	0	0	20979200	0	20979200
SUBTOTAL	EQUIPMENT			0		0		0		0	
					0		0		20,979,200		20,979,200
TOTAL	COST CODE 70011			0		0		0		0	
	WBS 321050				0		0		20,979,200		20,979,200
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
				0		0		0		0	
					0		0		20,979,200		20,979,200
TOTAL WBS 321050 HVAC				0		0		0		0	
					0		0		20,979,200		20,979,200

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BY T.L. Waldo

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
321110	HLW WASTE STAGING/SAMPLING STRUCTUR										
321110.11	EQUIPMENT										
321110.1100005	HLW WASTE STAGING/SAMPLING STRUCTURE FROM CASE 3B	700	1 LOT	0	0	0	0	45671000	0	0	45671000

SUBTOTAL	EQUIPMENT			0		0		45,671,000		0	

					0				0		45,671,000

TOTAL	COST CODE 70011			0		0		45,671,000		0	
	WBS 321110				0			0		0	45,671,000
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										

TOTAL WBS 321110	HLW WASTE STAGING/SAMPLING STRUCTUR			0		0		45,671,000		0	

					0			0		0	45,671,000

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. 2353SAC1

** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
STUDY
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
411000	CONSTRUCTION MANAGEMENT										
411000.00	TECHNICAL SERVICES										
411000.0000000	CONSTRUCTION MANAGEMENT	501	1 LOT	0	0	0	0	27258104	0	0	27258104
SUBTOTAL	TECHNICAL SERVICES			0		0		27,258,104	0		
					0			0			27,258,104
TOTAL	COST CODE 50100			0		0		27,258,104		0	
	WBS 411000				0			0			27,258,104
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
411000.00	TECHNICAL SERVICES										
411000.0000000	CONSTRUCTION MANAGEMENT	550	1 LOT	0	0	0	0	2422943	0	0	2422943
SUBTOTAL	TECHNICAL SERVICES			0		0		2,422,943		0	
					0			0			2,422,943
TOTAL	COST CODE 55000			0		0		2,422,943		0	
	WBS 411000				0			0			2,422,943
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
411000.00	TECHNICAL SERVICES										
411000.0000000	CONSTRUCTION MANAGEMENT	600	1 LOT	0	0	0	0	1380268	0	0	1380268
SUBTOTAL	TECHNICAL SERVICES			0		0		1,380,268		0	
					0			0			1,380,268
TOTAL	COST CODE 60000			0		0		1,380,268		0	
	WBS 411000				0			0			1,380,268
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										
411000.00	TECHNICAL SERVICES										
411000.0000000	CONSTRUCTION MANAGEMENT	700	1 LOT	0	0	0	0	28227680	0	0	28227680
SUBTOTAL	TECHNICAL SERVICES			0		0		28,227,680		0	
					0			0			28,227,680
TOTAL	COST CODE 70000			0		0		28,227,680		0	
	WBS 411000				0			0			28,227,680
	(ESCALATION 0.00% - CONTINGENCY 50.00 %)										

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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS

TOTAL WBS 411000 CONSTRUCTION MANAGEMENT				0		0		59,288,995		0	59,288,995

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
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** TEST - INTERACTIVE ESTIMATING **
SLUDGEWASH - B
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ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
=====											
REPORT TOTAL				0		0	674,325,569			0	
					0		2,251,220	171,255,630			847,832,419

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