AR TARGET SHEET

The following document was too large to scan as one unit, therefore it has been broken down into sections.

DOCUMENT # NA

EDMC # 42753

SECTION 2 OF 2

0042753
2 of 2

Request Number 45

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Joan Young Date: 3/20/95

Phone Number: 946-7112 Fax Number: 943-6812

Requested Information: Data request for modelling of risk from routine operations
Item 4 Priority C

Need Date: 4/7/95

Response: Confirmation of assumption attached

Data Source/Accuracy:

Prepared By: Dave Murray Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

For the No Action, ISV, and Cs and Sr Capsules Alternatives:

The dose to the average and maximally exposed remediation worker must be identified as well as the associated sources for the No Action, ISV, and Cs and Sr Capsules Alternatives. The source for the remediation worker is the amount of radionuclides or hazardous chemicals resulting in an average and a maximum occupational exposure. Please provide the sources, the average and maximum occupational doses, the number of workers exposed, and the duration of exposure.

3. IDENTIFICATION OF ROUTINE EMISSIONS DURING TANK CLOSURE

For TPA and ISV Alternatives:

There may be routine remediation worker exposures and/or releases during tank closure. ISV and TPA Alternatives will require barriers for tank farms and/or LLW disposal vaults. TPA will also require backfilling of voids created by the removal of tank wastes. Closure may potentially include removal and D&D of contaminated soils, in-tank equipment, and equipment around the tanks. Please provide the source terms for routine risks from tank closure and from excavating quarry sites and borrow sources or the rationale for excluding these actions from the analysis.

4. CONFIRM THE FOLLOWING ASSUMPTIONS FOR CALCULATING RISK FROM ROUTINE OPERATIONS OF TWRS PROCESSES

For the No Action, ISV, and Cs and Sr Capsules Alternatives:

a. It will be assumed that there are no risks to the remediation worker, nearby worker, or the public from liquid effluents, because all liquid releases will be sent to the liquid effluent treatment facility.

b. There will be no risk to the remediation worker from direct exposure to hazardous or toxic chemicals during TWRS separation and treatment processes, since there is limited use of hazardous or toxic chemical compounds in TWRS process operations.

c. There will be no risk to the nearby worker and the public from inhalation and ingestion of hazardous and toxic chemicals released to the atmosphere, because atmospheric emissions of these compounds will be tightly controlled.

5. PROVIDE RATIONALE FOR EXCLUDING HAZARDOUS CHEMICAL EMISSIONS FROM THE TANK FARMS DURING RETRIEVAL AND IN TANK SLUDGE WASHING

For the TPA, No Action, and ISV Alternatives:

Hazardous and toxic chemical emissions or exposures from the tank farms have not been addressed in the engineering data packages received to date. According to ASI Engineering Data

EIR#45: Assumption for Calculating Risk from Routine Operations. For No Action, ISV, And Capsule Alternatives.

Liquids: all liquid releases from treatment facilities will be sent to the Effluent Treatment Facility.

Hazardous or Toxic Chemicals: The data packages show that there will be limited used of hazardous or toxic chemicals in the above alternatives. It may be assumed that there is no direct exposure, inhalation or ingestion of hazardous or toxic chemicals.

Request Number 46

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Joan Young Date: 3/20/95

Phone Number: 946-7118 Fax Number: 943-6812

Requested Information: Data request for modelling of risk from routine operations
Item 5 Priority C

Need Date: 4/7/95

Response: Response is Composed of attached responses to EIR's 55 and 57

Data Source/Accuracy:

Prepared By: Dave Murray Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

For the No Action, ISV, and Cs and Sr Capsules Alternatives:

The dose to the average and maximally exposed remediation worker must be identified as well as the associated sources for the No Action, ISV, and Cs and Sr Capsules Alternatives. The source for the remediation worker is the amount of radionuclides or hazardous chemicals resulting in an average and a maximum occupational exposure. Please provide the sources, the average and maximum occupational doses, the number of workers exposed, and the duration of exposure.

3. IDENTIFICATION OF ROUTINE EMISSIONS DURING TANK CLOSURE

For TPA and ISV Alternatives:

There may be routine remediation worker exposures and/or releases during tank closure. ISV and TPA Alternatives will require barriers for tank farms and/or LLW disposal vaults. TPA will also require backfilling of voids created by the removal of tank wastes. Closure may potentially include removal and D&D of contaminated soils, in-tank equipment, and equipment around the tanks. Please provide the source terms for routine risks from tank closure and from excavating quarry sites and borrow sources or the rationale for excluding these actions from the analysis.

4. CONFIRM THE FOLLOWING ASSUMPTIONS FOR CALCULATING RISK FROM ROUTINE OPERATIONS OF TWRS PROCESSES

For the No Action, ISV, and Cs and Sr Capsules Alternatives:

a. It will be assumed that there are no risks to the remediation worker, nearby worker, or the public from liquid effluents, because all liquid releases will be sent to the liquid effluent treatment facility.

b. There will be no risk to the remediation worker from direct exposure to hazardous or toxic chemicals during TWRS separation and treatment processes, since there is limited use of hazardous or toxic chemical compounds in TWRS process operations.

c. There will be no risk to the nearby worker and the public from inhalation and ingestion of hazardous and toxic chemicals released to the atmosphere, because atmospheric emissions of these compounds will be tightly controlled.

5. PROVIDE RATIONALE FOR EXCLUDING HAZARDOUS CHEMICAL EMISSIONS FROM THE TANK FARMS DURING RETRIEVAL AND IN TANK SLUDGE WASHING

For the TPA, No Action, and ISV Alternatives:

Hazardous and toxic chemical emissions or exposures from the tank farms have not been addressed in the engineering data packages received to date. According to ASI Engineering Data

Request No. 018, hazardous and toxic chemical emissions for in-tank sludge washing and retrieval are not provided due to the fact that actual characterization of the air being expelled from the tank ventilation systems has not been performed in sufficient detail to allow comparison to regulatory lists. Given this lack of data, emissions of hazardous air pollutants from the tanks during retrieval and in-tank sludge washing have been assumed to be negligible for the TPA Alternative. Please indicate the following:

a. Is this a valid assumption? If so, please provide the rationale to be used in the TWRS EIS to justify the assumption that hazardous emissions from the tank farms are negligible.

b. Does this same rationale apply to the remaining alternatives? Is so, please state. If not, please describe the situations where different assumptions should be used.

6. CONFIRM THE ASSUMPTION THAT THERE WILL BE NO AIR EMISSIONS FROM LLW DISPOSAL VAULTS DURING DISPOSAL OPERATIONS AND FROM HLW DURING INTERIM STORAGE.

For Cs and Sr Capsules (TPA) Alternative:

For the TPA Alternative, it was assumed that air emissions from the LLW disposal vaults during disposal operations and the HLW casks during interim storage will be controlled such that the dose to remediation workers, nearby workers, and the public does not exceed administrative dose limits and the public dose does not exceed current limits (ASI Engineering Data Request No. 21 1995). A specific risk from these unit operations was not calculated. Is this assumption valid for the Cs and Sr Capsules (TPA) Alternative as well?

References

ASI Engineering Data Request No. 018. Internal memo dated January 27, 1995.

WHC. 1994. Engineering Data Package for the No Separations Alternative, WHC-SD-WM-EV-COLBY, Rev. A.

cc: Alex Nazarali
Mitch Pelton
Andy Stanley
Reed Kaldor
John Shrock
Mike Harker
File 587.2.11.2.2
File 587.2.11.2.5

EIR #46. Hazardous and Toxic Emissions from Tanks During Retrieval and Sludge Washing.

Hazardous Emissions: These can be assumed to be negligible since ventilation systems using fans and filters will be installed on each tank prior to retrieval. The final HEPA filters will capture the hazardous constituents of the ventilation stream, since these would be as particulates.

Toxic Emissions: These emissions cannot be captured by HEPA filters, and will escape from the tanks during routine operations (such as are carried out at present), and during active ventilation during retrieval. An estimate of the quantities of VOC emissions has been made to answer EIR #55, and this estimate is attached. It is based on the analysis of the vapors in the headspace for a single tank, C-103. This is the only tank to be analyzed as of this date.

Other Alternatives:

- An estimate for emission rates for No Action, Tanks has been made in answer to EIR #57, and this estimate is attached.
- For ISV the VOC's will be oxidized to carbon dioxide and pass through the filter system and up the stack. The mass balance for ISV shows no toxic compounds in the stack gases so these may be assumed to be negligible.

DATA REQUEST 055

The attached calculation estimates the concentration and volume of gas released from a selected number of tanks. These VOC emissions are a result of storing the waste in the tanks and are not specifically related to extensive retrieval operations. These emissions can be viewed as on going until the wastes are removed from the tanks.

During the retrieval process an exhauster will be hooked up to the ventilation system of the tank being retrieved. Those tanks that will have waste retrieval operations going on will have active ventilation. This will tend to increase the overall mass of VOC emitted, from both the increased air flow and stirring the wastes up with the sluicer. The increase in mass will be at a significantly lower concentration than that seen in the head space data for tank C-103.

An actively ventilated tank has a ventilation flow rate of 500-1600 cubic meters per hour. The passively vented tank estimate for ventilation flow is 0.33 cubic meters per hour. This represents a 1500-4800 fold increase in air flow from the tank.

Another point is that the wastes have been sitting in the tanks for a number of years and most of the wastes have been through an evaporator, thus the majority of the volatiles have already left the tanks. The VOCs coming out of the tanks now may be decay products of the heavier organics in the tanks.

The following method to estimate the VOC emissions from a tank during retrieval is as follows:

- assume that the mass of VOC emitted from a tank remains constant
- the ventilation flow rate goes from 0.33 cu meter/hr to 4000 cu. meters/hr
- two of the organic tanks get retrieved per year once retrieval operations begin
- to maintain a constant mass emission per tank the concentration of the organic from the C-103 head space data should be ratioed by (0.083/4000) 2.1E-5. This is the annual average volumetric flow from a passively ventilated tank divided by the volumetric flow of an actively ventilated tank.

To estimate organic emissions during evaporator operations, we asked WHC for organic emissions data from 242A evaporator operations (currently operating). WHC replied that organic emissions from the evaporator are not measured but instead are reported based on calculations using the feed stream concentrations. The calculations for recent evaporator runs ar not yet completed, but should be done in the next few weeks.

Using the attached calculation the following table is developed for organic emissions.

Pollutant	Source	Peak Hourly Volume Released (m3/hr)	Annual Average volume of release (m3/yr)	Chronological Phase
see note 1	TF9E (1 tank)	0.33	720	see note 2
"	TF8E (1 tank)	0.33	720	"
"	TF3E (1 tank)	0.33	720	"
"	TF4E (2 tank)	0.66	1450	"
"	TF5W (2 tanks)	0.66	1450	"
"	TF6W (2 tanks)	0.66	1450	"
"	TF1W (1 tank)	0.33	720	"
"	TF3W (2 tanks)	0.66	1450	"
"	TF2W (1 tank)	0.33	720	"
"	TF4W (7 tanks)	2.31	5060	"
see note 3	any source	4000		during retrieval
see note 3	any source	4000		during retrieval

Note 1: The organic compounds and their concentrations are assumed to be those for the mid point data from Tank C-103 head space analysis. (see attached table)

Note 2: These emissions should remain constant until retrieval operations begin in 2003. These emissions should decline approximately 6-7% per year between 2003 and 2015 due to tank retrieval. After 2018 VOC emissions from the tanks should go to zero.

Note 3: At any time during retrieval operations two organic tanks may be subject to retrieval operations. These tanks could come from any two source areas. These tanks will have organic compounds identified in the Tank C-103 headspace analysis. The concentration of these compounds will be ratioed down from the mid point concentrations identified for Tank C-103 by the factor 2.07E-5.

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

TANK FARM	SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
		x coord.	y coord.		
BY	TF1E	573556	137442	200	AREA
BX	TF2E	573556	137282	200	AREA
B	TF3E	573771	137252	200	AREA
C	TF4E	575075	136493	200	AREA
AN	TF5E	575332	136378	205	AREA
AZ	TF6E	575365	136279	205	AREA
AY	TF7E	575281	136157	205	AREA
AX	TF8E	575380	136159	205	AREA
A	TF9E	575310	136015	210	AREA
AW	TF10E	575304	135806	210	AREA
AP	TF11E	575481	135747	210	AREA
T	TF1W	566738	136662	210	AREA
TY	TF2W	566715	136373	210	AREA
TX	TF3W	566689	136146	210	AREA
U	TF4W	566744	135000	205	AREA
S&SY	TF5W	566750	134399	205	AREA
SX	TF6W	566746	134162	205	AREA
	TA1W	566833	136570	210	AREA
	TA2W	566886	134878	205	AREA
	TA3W	566930	134444	205	AREA
	TA1E	573755	137383	200	AREA
	TA2E	575163	136336	200	AREA
SITE C	PROC	573879	135229	215	AREA
	BTCH	571332	135953	225	AREA
	SMIN	574425	135978	215	AREA
	ST-L	574120	135901	215	AREA
	ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. pg 1

BY _____ CHKD. _____ JOB NO. _____

METHOD FOR ESTIMATING VOC Releases:

- Assume all organic emissions come from the 20 organic watch list tanks (>3% TOC)

- Assume that the concentration on actively vented tanks is small and will therefore be neglected. The actual mass of voc from active ventilated tanks may be higher but concentration should be much lower than passi
- The following are the organic watch list tanks:

A101	(A)	SX103	(A)	U105	(P)
AX102	(P)	SX106	(A)	U106	(P)
B103	(P)	T111	(P)	U107	(P)
C102	(P)	TX105	(P)	U111	(P)
C103	(P)	TX118	(P)	U203	(P)
S102	(P)	TY104	(P)	U204	(P)
S111	(P)	U103	(P)		

(P) = PASSIVELY Vented (A) = Active Vent

- 17 OUT OF 20 TANKS ARE PASSIVELY VENTED.

- TANK C103 IS ON THE ABOVE LIST AND IS THOUGHT to be an organic tank with some of the highest vapor concentrations (WHC-SD-WM-SARR-011)
- ASSUME OTHER TANKS DO NOT HAVE ANY VOC EMISSIONS.

Approach: Calculate the headspace volume in a typical tank. Assume an atmospheric pressure change and calculate the volume of air exchanged between the tank and the atmosphere.

Assume the air coming out of the tanks contains organics at a concentration equal to the midpoint data collected for tank C103 (Ref WHC-SD-WM-SARR-011)

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. pg 2

BY _____ CHKD. _____ JOB NO. _____

Volume of Release.

- Tank breaths as a function of atmospheric pressure changes.

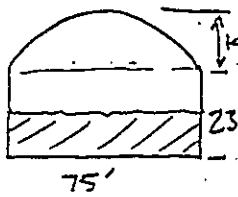
Volume of RELEASE:

$$PV = nRT \quad \text{OR} \quad \frac{P_1V_1}{RT_1} = \frac{P_2V_2}{RT_2}$$

- Assume Temp inside the tank remains Constant

$$P_1V_1 = P_2V_2$$

$$V_2 = \frac{P_1V_1}{P_2}$$



Assume tank is ½ full of waste.

Vapor space = ½ tank Capacity + dome Volume.

$$\text{Vapor Space} = \frac{\pi d^2}{4}h + \frac{1}{6}\pi h\left(3(r^2) + h^2\right)$$

$$= \frac{\pi\, 75^2}{4}(11.5) + \frac{1}{6}\pi(14)\left(3(37.5)^2 + 14^2\right)$$

$$\text{Vapor Space} = 50805 + 32360 = 83165\ ft^3$$

$$\text{Vapor Space} = 83165\ ft^3\left(.02832\ m^3/ft^3\right) = 2355\ m^3$$

$$\text{Vapor Space} = 2355\ m^3.$$

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

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BY _____ CHKD. _____ JOB NO. _____

if $\Delta P = 1/10$ IN of Hg $= \frac{1}{10}'' \left(\frac{.4912 \text{ psi}}{\text{IN Hg}}\right) = .05$ psi

$$V_2 = \frac{14.7 \text{ psi}}{14.65 \text{ psi}} (V_1) = 1.0034\ V_1$$

$$V_2 = 1.0034 (2355\ m^3) = 2363\ m^3$$

$$\Delta V = 2363 m^3 - 2355 m^3 = 8\ m^3$$

if the ΔP occurs in a 24 hr period

the hourly flow rate is:

$$8\ m^3/24 hr = 0.33\ m^3/hr.$$

this $0.33\ m^3/hr$ should be peak hourly in light of the following.

The hourly emission is:

$$17 \text{ tanks} \times 0.33\ m^3/hr = 5.6\ m^3/hr.$$

Release Volume = $5.6\ m^3/hr$

Release Concentration = mid pt data from attached table

This method estimates an hourly emission rate of .017 Kg VOC/hr. OR .04 Kg VOC/24 hr.

WHC OPS DATA Estimates 0.68 Kg VOC emissions for 1995.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 4.

BY _____ CHKD. _____ JOB NO. _____

AT 0.4 Kg VOC/day the ANNUAL Emission would be 146 kg VOC/yr.

Since the pressure change will not occur every day conservatively assume that the pressure changes 50% of the time, and half the time air must be sucked into the tank.

Annual release per tank = 0.33 m^3/hr x 24 hr/day x 365 day/yr x 0.5

Annual Release per tank = 723 m^3/yr/tank

Annual Average Volume flow from tank = .083 m^3/hr.

AS A CHECK OF THE METHOD ESTIMATE ANNUAL VOC EMISSIONS.

$$20 \text{ tanks} \times 723 \frac{m^3 \text{ Headspace gas}}{yr/tank} \times 3080 \, mg/m^3 \times \frac{1 g}{1000 mg} \times \frac{1 kg}{1000 g}$$

= 44.5 Kg VOC/yr.

This is Higher than the 0.68 kg VOC/yr emission estimate in the WHC current operations data tables.

FORM 91-005-1 (4/81)

TABLE 1. PRELIMINARY DATA FOR C-103 HEADSPACE

CHEMICAL	MAXIMUM DATA POINT (mg/m^3)	MID DATA POINT (mg/m^3)	MINIMUM DATA POINT (mg/m^3)
Acetone	299	77	0.44
Acetonitrile	182	30	0.20
Ammonia	202	202	202
Benzene	21	4.1	0.05
1,3-Butadiene	0.32	0.30	0.22
Butanal	176	7.4*	7.4*
Butanol (n-butyl alcohol)	597	198	0.64
Hexane	187	12	0.50
2-Hexanone (methyl n-butyl ketone)	32	10	0.03
Methylene chloride (dichloromethane)	318	33	0.02
Dodecane	3713	1376	16
Tridecane	4500	1090	82
Propane nitrile	132	29	0.06
Tributylphosphate	302	12	1.3

* The mid and minimum data points for butanal are the same because of the nature of the data and the method used to determine these points.

As new data become available, they should be incorporated into the release consequence calculations. Current Tri-Party Agreement milestones for characterization are as follows (Osborne 1994):

- M-40-06 Complete vapor sampling and characterization of tank 241-C-103 by August 30, 1994.
- M-40-08 Complete vapor sampling and characterization of all Organic Watch List tanks by November 1995.
- M-40-03 Complete vapor sampling and characterization of all Ferrocyanide Watch List tanks by November 1995.

DATA REQUEST 57

No Action Alternative - Tanks

For No Action the following activities will take place:

SST wastes will be left in place following the completion of salt well pumping.

DST wastes will be retrieved and transferred into new DSTs twice during the 100 year period where institutional control will be maintained.

The following activities will be completed for DST wastes:

Construction

Note: The following will be constructed for each retrieval campaign. (Each construction activity will take place twice)

Build DST transfer piping

- connect existing DST facilities to new tank farms and new evaporator
- Build replacement evaporator
- Build tank retrieval systems
- Build new tanks
  - 26 new DSTs will replace existing 28 DSTs
  - Diesel generator building
  - Gas sampling and stack monitoring facilities
  - Administration building
  - Possible weather enclosure over tank farm
  - Tank ventilation systems

Operation

Retrieve DST wastes

- Direct transfer supernate to new DSTs
- Add dilution liquids to remaining wastes, run mixer pumps and slurry pump to evaporator
- Process slurry through evaporator
- Retrieve 99% of DST waste

Monitor SSTs

Operate Evaporator

- Evaporate all slurry transfer to maintain waste volume
- Treat condensate of liquid effluent treatment facility

From the No Action Data Package the following emissions estimated are made:

Non Radiological Operating Emissions: (For additional tank emission data see Request No. 55)

- Table 5-5 attached
- These emissions were taken from the HDW EIS and represent an estimate for emissions associated with tank farm surveillance during the 100 year institutional control period
- These emissions appear to be vehicle emissions
- If these are to be modeled, they can be divided by 100 to get an average annual emission. A peak emission could be estimated using the following factor:

$$\frac{\text{Non Rad Operating Emission}}{\text{18 (tank farms)}} \times \frac{1}{\text{100 yrs}} \times \frac{\text{1 yr}}{\text{2,000 hrs}} \times \text{2 (peak factor)}$$

Emission quantity X 5.6 X 10^{-7} (peak hourly emission) kg/hr - tank farm

Thus the peak hourly emission for any of the pollutants in table 5-5 can be calculated using the above factor.

Emissions will be very small. For example: The CO estimate is for 710 kg.

The CO peak hourly emission rate per tank farm is:

$$710 \text{ kg} \times 5.6 \times 10^{-7} = 4 \times 10^{-4} \text{ kg/hr}$$

Radiological Operating Emissions:

- Table 5-6 attached
- Memo and attached hand calculation from Chris Memg (WHC) to Dave Murray (attached)
- Engineering data package Appendix B (attached)

The following points should be made for the radiological operating emissions:

- The radiological emissions are estimated using measured emission data for the tank farms in 1993. Emission data was obtained only for areas 3EDS and 5EDS (3DS = tank farms AN, AY, AZ, sources TF5E, TF6E, TF7E), (5EDS = tank farms AP, AW, sources TF10E, TF11E)

The memo noted above states that the emissions from other tank farms were either below detection or below reportable amounts.

- The quantities reported in table 5-6 are for the 100 year institutional control period
- Appendix B summarizes the calculations for determining the emissions based on the measured 1993 data

- Annual emissions can be calculated for any year using the following expression:

$$N = No e^{-\lambda t}; \qquad \lambda = \frac{\ell n 2}{t^{1/2}}$$

For Cs, $N = 5.3 \times 10^{-5}$ Ci $\times e^{-.0231t}$ (t in years from 1995)

Sr, $N = 8.4 \times 10^{-6}$ Ci $\times e^{-.0247t}$ (t in years from 1995)

I, $N = 4.6 \times 10^{-5} \times e^{-4.08 \times 10^{-8}t}$ (t in years from 1995)

- The air emission from tank farms are not a result of any processing activities and should remain constant throughout the 100 year period without any peaks.

- The radiological air emissions from tank farms can be identified as follows:

Pollutant	Source ID	Peak Hourly	Annual Average (Ci)	Phase
Cs 137	TF5E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF6E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF7E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF10E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF11E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Sr 90	TF5E	-	$1.68 \times 10^{-4} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF6E	-	$1.68 \times 10^{-4} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF7E	-	$1.68 \times 10^{-4} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF10E	-	$1.68 \times 10^{-4} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF11E	-	$1.68 \times 10^{-4} e^{-.0247t}$	Yrs 1995-2042
I 129	TF5E	-	$9.2 \times 10^{-4} e^{-4.04E-4t}$	Yrs 1995-2042
I 129	TF6E	-	$9.2 \times 10^{-4} e^{-4.04E-4t}$	Yrs 1995-2042
I 129	TF7E	-	$9.2 \times 10^{-4} e^{-4.04E-4t}$	Yrs 1995-2042
I 129	TF10E	-	$9.2 \times 10^{-4} e^{-4.04E-4t}$	Yrs 1995-2042
I 129	TF11E		$9.2 \times 10^{-4} e^{-4.04E-4t}$	Yrs 1995-2042

After the year 2042 all DST wastes will have been retanked into new DSTs located in the same area as the TPA vitrification facilities.

Making the assumption that all releases from the new DST tank farms will occur from the TPA HLW vitrification stack source location the following table is developed.

Pollutant	Source	Peak Hourly	Annual Average (Ci)	Phase
Cs 137	ST-H	-	$5.3 \times 10^{-5} e^{-.0231t}$	Yrs 2042-2095
Sr 90	ST-H	-	$8.4 \times 10^{-4} e^{-.0247t}$	Yrs 2042-2095
I 129	ST-H	-	$4.6 \times 10^{-5} e^{-4.048E-4t}$	Yrs 2042-2095

Note the emissions for any given year falling in the phase noted can be calculated by subtracting the year from 1995 and using the result ~~as~~ to evaluate the expression in the annual average column for the pollutant of interest. This was done because of the continuously changing emissions resulting from the short half life of Cs & Sr.

For evaporator emissions the following breakdown applies:

Pollutant	Source	Peak Hourly* Ci/Hr	Annual Average** Ci/Yr	Phase
Cs 137	ST-H	6.3×10^{-7}	2.76×10^{-3}	Yrs 2037-2042
H 3	ST-H	9×10^{-3}	39	Yrs 2037-2042
Sr 90	ST-H	7×10^{-7}	3.1×10^{-3}	Yrs 2037-2042
I 129	ST-H	6×10^{-7}	2.72×10^{-3}	Yrs 2037-2042
Total Beta	ST-H	4×10^{-10}	1.9×10^{-6}	Yrs 2037-2042
Total Alpha	ST-H	4.6×10^{-10}	2×10^{-6}	Yrs 2037-2042
Cs 137	ST-H	2×10^{-7}	8.7×10^{-4}	Yrs 2087-2092
H 3	ST-H	5.3×10^{-4}	2.3	Yrs 2087-2092
Sr 90		2×10^{-7}	9×10^{-4}	Yrs 2087-2092
I 129		6.2×10^{-7}	2.7×10^{-3}	Yrs 2087-2092
Total Beta		1.2×10^{-10}	5.4×10^{-7}	Yrs 2087-2092
Total Alpha		4.7×10^{-10}	2.08×10^{-6}	Yrs 2087-2092

***Peak Hourly:** Annual Average X 1 yr/365 days X 1 day/24 hrs X 2 (peak factor).
**** Annual Average:** Evaporator estimate (10 yr)/5 yrs operation period. These evaporator emissions were annualized without using the decay equations.

<u>For Construction Emissions:</u>

The new tanks will be located in the same area as the TPA facilities so the source for No Action should correspond to PROC (ESE source area for TPA construction emissions).

The construction duration is 6/2033 - 6/2037 and 6/2083 - 6/2087.

Pollutant	Source	Peak Hourly	Annual Average	Phase
Particulate	PROC	16.25 kg/hr	16,250 kg	Construction
SO_x	PROC	2 kg/hr	2,000 kg	Construction
CO	PROC	4,500 kg/hr	4,500,000kg	Construction
Hydrocarbons	PROC	225 kg/hr	225,000 kg	Construction
NO_x	PROC	237 kg/hr	237,500 kg	Construction
Aldehydes-(HCHO)	PROC	7.4 kg/hr	7,375 kg	Construction
Organic Acids	PROC	0	0	Construction
Thermal (J)	PROC	9.5×10^{10} J/hr	9.5×10^{13} (J)	Construction
Fugitive dust	PROC	.07 mt/hr	68.75 metric ton	Construction

Peak Hourly: Annual Average X 1/365 days X 1 day/8 hrs X 3 peak factor.
Peak Hourly: Annual Average X .001.
Annual Average: Total estimate/8 years.

NOTE: SEE TABLE 5-11 attached.

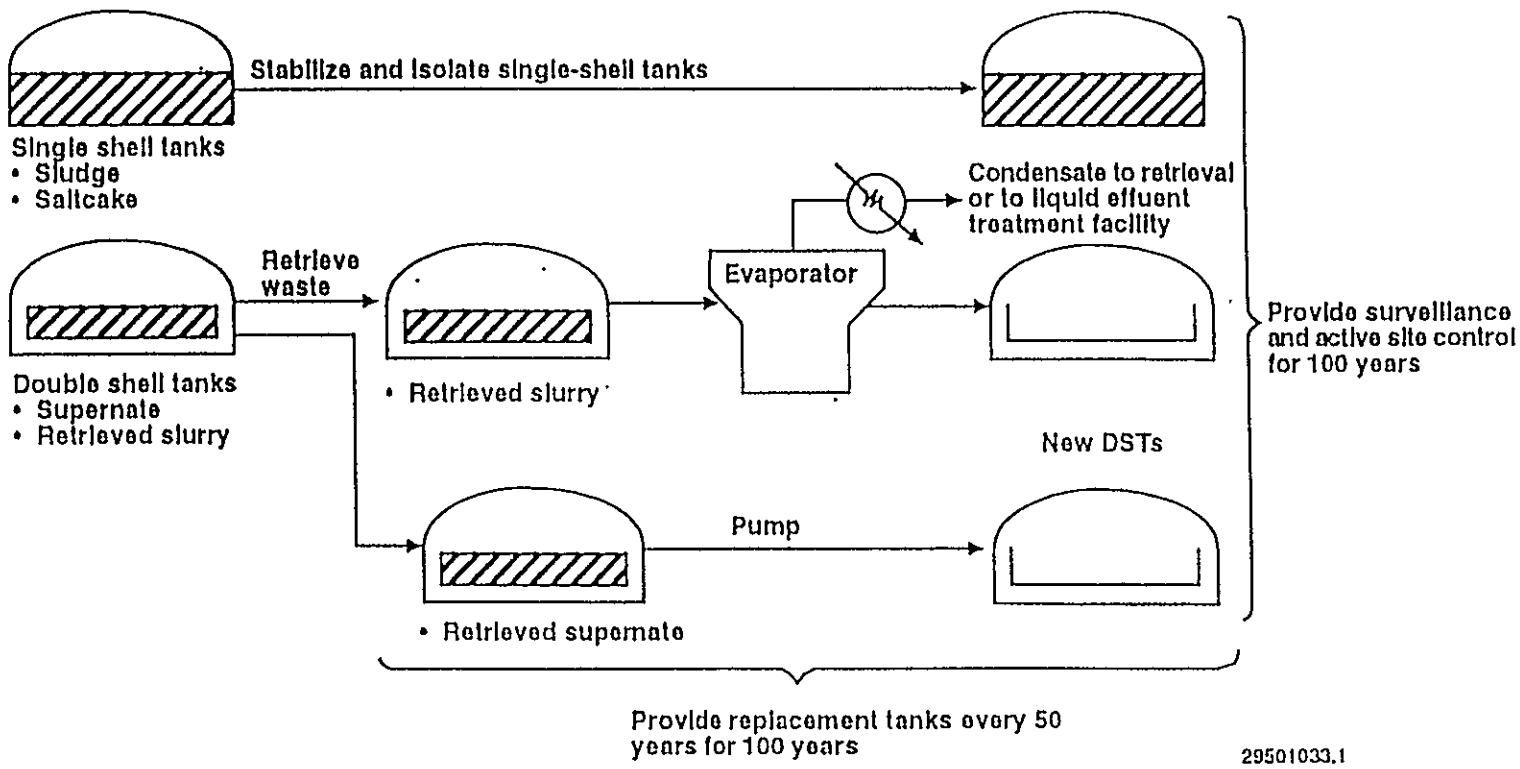

Figure 1-5. No Disposal Action Alternative Flowsheet.

Table 5-5. Nonradiological Operating Emissions
(Units as Indicated).

Item	No Disposal Action[1]
Thermal releases	1.1×10^{13} J
Particulate	20 kg
Volatile organic compounds	68 kg
Fugitive dust	n/a
Toxic Air Pollutants[2]	not available
NOx (as nitrogen dioxide)	.77 kg
SOx (as sulfur dioxide)	12 kg
Carbon Monoxide	710 kg

Notes:

J = joule
kg = kilogram

[1]The values for these emissions (over the 100-year period) were taken from RHO-RE-ST-30 P, Table 4-17, pages 4-24 and 4-25 (*Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS*.

[2]The list of Toxic Air Pollutants present in the tank farms has not been completed yet. The final list will include only those species that are present in sufficient quantities to be regulated. Vapor characterization of Tank 241-C-103 head space is being used as a worst case to estimate the amount of Toxic Air Pollutants given off by the tank farms. The data for the Toxic Air Pollutants will be in the soon to be released Draft Tank Farms Air Operating Permit.

RHO, 1985, *Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS*, RHO-RE-ST-30 P, Rockwell Hanford Operations, Richland, Washington.

Table 5-10. Nonradiological Construction Emissions (units as indicated).

Construction Emission Pollutant	No Disposal Action[1]
Particulate (kg)	130,000
SO_x as sulfur dioxide (SO_2) (kg)	16,000
Carbon monoxide (kg)	36,000,000
Hydrocarbons (kg) (exhaust and fugitive)	1,800,000
NO_x as nitrogen dioxide (NO_2) (kg)	1,900,000
Aldehydes (kg) (as HCHO)	59,000
Organic acids (kg)	0
Thermal releases (J)	7.60×10^{14}
Fugitive dust (t)	550

Notes:

J = joule
kg = kilogram
NO_x = Nitrous oxides
SO_x = Sulfurous oxides
t = metric ton

[1]The values in this table were factored from the No Separations alternative by using a ratio of the construction costs.

Table 5-11. Transportation of Earthen Borrow Construction Material (Units as Indicated).

Item	No Disposal Action
Borrow source location (state)	3 km NW of site
Route location (state mileage)	Route 3 to Route 4 (5 Km)
Road type (gravel or asphalt)	Gravel, level
Total number of trips Truck[1] Train Barge	 31,000 0 0
New road construction (miles)	0
Load volumes (m^3)	6.1

Notes:

km = kilometer
m^3 = cubic meter
NW = northwest

[1]The values in this table were factored from the No Separations alternative by using a ratio of the construction costs.

Note: The 31,000 trips indicated above should result in fugitive dust emissions that are split between the borrow site and the Construction site. This is NOT shown on the Response to the Engineering Information Request page 4 "Construction Emissions by source". Since the fugitive dust estimate is factored from the No Separations data package, the fugitive dust estimate can be split between the borrow site & Construction site in a similar manner to the TPA or No Separations data. Using No Separations data pkg 32% fugitive dust comes from borrow pit and batch plant operations.

Table 5-21. Overall Schedule (Calendar Year Start/Completion Date).

Activity	No Disposal Action[1]
Construction	06/2033 - 06/2037 06/2083 - 06/2087
Tank retrieval and re-evaporation	06/2037 - 06/2042 06/2087 - 06/2092
Decontamination and decommissioning	06/2042 - 06/2047 06/2092 - 06/2097
Monitoring and maintenance	01/1995 - 01/2095
Research and development	n/a

Notes:

[1]Figure 2-2 is a representation of the above schedule.

Table 5-6. Radiological Operating Emissions (Ci). for 100 yr's

Radionuclide[1]	No Disposal Action		
	Air Emissions from Tank Farms[2]	Air Emissions from Evaporator[3]	Water Emissions from Evaporator[4]
^{241}Am	0	n/a	0
^{14}C	0	n/a	0
^{137}Cs	2.1E-03	n/a	1.8E-02
^{3}H	Below Detection[5]	n/a[6]	2.1E02
^{129}I	4.6E-03	n/a	2.7E-02
^{239}Pu, ^{240}Pu	0	n/a	0
^{106}Ru	0	n/a	0
^{151}Sm	0	n/a	0
^{90}Sr	3.1E-04	n/a	2.0E-02
^{99}Tc	0	n/a	0
^{93}Zr	0	n/a	0
Total Alpha	n/a	2.1E-05	n/a
Total Beta	n/a	1.2E-05	n/a
Percent PM-10[7]	100	n/a	n/a

Notes:

[1]All values in Ci except for percent PM-10.

[2]Starting air releases for tank farms were taken from WHC-EP-0527-3, *Environmental Releases for Calendar Year 1993* (Thomas and Cum 1994). The release values were then decayed and summed over the 100-year period (see Appendix B).

[3]These releases were below the trip point for reporting individual radionuclides so total alpha and beta were reported in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas* (Coony et al.).

[4]These releases were based on the yearly releases of the evaporator while processing approximately 41,600 m^3 (11 million gal) of waste in a year as reported in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas* (Coony et al.). To evaporate 416,000 m^3 (110 million gal) of waste (at a 3-to-1 dilution) at 41,600 m^3 (11 million gal) a year, requires the equivalent of 10 years of operation for each retanking or 20 years of emissions at this level. The releases were calculated by decaying the 1987 releases to the point of evaporation and summing the releases over the evaporator operation while decaying the radionuclide during the evaporation (see Appendix B). The actual evaporation for retanking is scheduled for 5 years each time so the emissions may be more concentrated while remaining within release limits.

Table 5-6. Radiological Operating Emissions (Ci).

Notes: (Continued)

[5]Table 2-1 of the *Environment Releases for Calendar Year 1993* (Thomas and Curn 1994) indicates that air sampling was not done for tritium in the 200 Areas based on its known absence or extremely low concentrations and dose impact.

[6]No separate air emissions were compiled for different radionuclides in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management report for 1987: 200/600/1100 Areas* (Coony et al.); therefore, the tritium releases are contained in the total Beta entry in this column.

[7]Percent PM-10 is 100 percent as all released particulates are less than 10 microns.

Coony, F. M., D. B. Howe, and L. J. Voigt, 1988, *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas*, WHC-EP-0141, Westinghouse Hanford Compant, Richland, Washington.

Thomas S. J. and B. L. Curn, 1994, *Environmental Releases for Calendar Year 1993*, WHC-EP-0527-3, Westinghouse Hanford Company, Richland, Washington.

APPENDIX B

CALCULATION OF RADIOLOGICAL RELEASES TO AIR AND WATER FROM THE TANK FARMS AND EVAPORATOR OVER THE FIRST 100 YEARS

The amount of a radionuclide at a given time in its decay life is represented by:

$$N = N^o \, e^{-\lambda t}$$

where:

N = the amount of the radionuclide at time t
N° = the amount of the radionuclide at time zero
λ = the decay constant

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

$t_{1/2}$ = the half life or the amount of time before half the original amount of radionuclides decay

To find the amount of environmental releases over a 100-year period the decay equation is integrated over 100 years.

$$\int_0^{100} N^o \, e^{-\lambda t} \, dt = N^o \int_0^{100} e^{-\lambda t} \, dt =$$

$$= N^o \left[\frac{-e^{-\lambda t}}{\lambda}\right]_0^{100} =$$

$$= - N^o \left[\frac{e^{-\lambda 100}}{\lambda} - \frac{e^0}{\lambda}\right] =$$

$$= N^{o}\,[\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 100}}{\lambda}]$$

$$for\ ^{137}Cs\quad t_{1/2} = 30\ years\quad so\quad \lambda = \frac{\ln 2}{30\ y} = 0.0231\ y^{-1}$$

$$for\ ^{90}Sr\quad t_{1/2} = 28.1\ years\quad so\quad \lambda = \frac{\ln 2}{28.1\ y} = 0.0247\ y^{-1}$$

$$for\ ^{129}I\quad t_{1/2} = 1.7X10^{7}\ years\quad so\quad \lambda = \frac{\ln 2}{1.7X10^{7}\ y} = 4.08X10^{-8}\ y^{-1}$$

Current yearly tank farm air releases are:

$^{137}Cs = 5.3 \text{ X } 10^{-5}$ Ci

$^{90}Sr = 8.4 \text{ X } 10^{-6}$ Ci

$^{129}I = 4.6 \text{ X } 10^{-5}$ Ci

Tank Farm releases for 100 years for each of these radionuclides are:

for ^{137}Cs

$$5.3X10^{-5}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(100)}}{0.0231}] = 2.1X10^{-3}\ Ci$$

for ^{90}Sr

$$8.4X10^{-6}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(100)}}{0.0247}] = 3.1X10^{-4}\ Ci$$

for ^{129}I

$$4.6X10^{-5}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(100)}}{4.1X10^{-8}}] = 4.6X10^{-3}\ Ci$$

Yearly evaporator liquid releases for 1987 are:

$^{3}H = 4.30 \times 10^{2}$ Ci

$^{137}Cs = <4.91 \times 10^{-3}$ Ci

$^{90}Sr = <6.07 \times 10^{-3}$ Ci

$^{129}I = <1.36 \times 10^{-3}$ Ci

Yearly evaporator air releases for 1987 are:

Total Alpha = 1.04×10^{-6} Ci

Total Beta = 3.63×10^{-6} Ci

The first evaporation connected to retanking occurs in 2037. The releases above will be decayed to that time (50 years). The decayed releases then will be summed and decayed over the first ten year operation of the evaporator. The releases then will be decayed to the beginning of the second evaporation which starts in 2087 (another 50 years). The decayed releases then will be summed and decayed over the second ten year operation of the evaporator.

$$N = N^{o}\ e^{-\lambda t}$$

where:

N = the amount of the radionuclide at time t
N° = the amount of the radionuclide at time zero
λ = the decay constant

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

$t_{1/2}$ = the half life or the amount of time before half the original amount of radionuclides decay

$$\text{for } ^{137}Cs \quad t_{1/2} = 30 \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{30 \text{ y}} = 0.0231 \text{ y}^{-1}$$

$$\text{for } ^{90}Sr \quad t_{1/2} = 28.1 \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{28.1 \text{ y}} = 0.0247 \text{ y}^{-1}$$

$$\text{for } ^{129}I \quad t_{1/2} = 1.7X10^{7} \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{1.7X10^{7} \text{ y}} = 4.08X10^{-8} \text{ y}^{-1}$$

$$\text{for } ^{3}H \quad t_{1/2} = 12.3 \text{ years so } \lambda = \frac{\ln 2}{12.3 \text{ y}} = 0.0564 \text{ y}^{-1}$$

Therefore, the amount of the radionuclides after 50 years is:

for ^{3}H

$$N = 4.3X10^{2} \text{ Ci } e^{-0.0564(50)} = 25.7 \text{ Ci}$$

for ^{137}Cs

$$N = 4.91X10^{-3} \ Ci \ e^{-0.0231(50)} = 1.55X10^{-3} \ Ci$$

for ^{90}Sr

$$N = 6.07X10^{-3} \ Ci \ e^{-0.0247(50)} = 1.77X10^{-3} \ Ci$$

for ^{129}I

$$N = 1.36X10^{-3} \ Ci \ e^{-4.1X10^{-8}(50)} = 1.36X10^{-3} \ Ci$$

for Total Beta (decay the same as ^{90}Sr)

$$N = 3.63X10^{-6} \ Ci \ e^{-0.0247(50)} = 1.06X10^{-6} \ Ci$$

for Total Alpha (decay the same as Pu $t_{1/2}$ = 24,400 y λ = 2.84 X 10^{-5})

$$N = 1.04X10^{-6}\ Ci\ \ e^{-2.84X10^{-5}(50)} = 1.04X10^{-6}\ Ci$$

First evaporator releases over a 10 year period are calculated below:

$$N = N^{o}\ [\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 10}}{\lambda}]$$

Evaporator releases for 10 years for each of these radionuclides are:

for ^{137}Cs

$$Total = 1.55X10^{-3}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(10)}}{0.0231}] = 1.38X10^{-2}\ Ci$$

for ^{3}H

$$25.7\ \text{Ci}\ [\frac{1}{0.0564} - \frac{e^{-0.0564(10)}}{0.0564}] = 196.4\ \text{Ci}$$

for ^{90}Sr

$$1.77X10^{-3}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 1.56X10^{-2}\ Ci$$

for ^{129}I

$$1.36X10^{-3}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(10)}}{4.1X10^{-8}}] = 1.36X10^{-2}\ Ci$$

for Total Beta

$$1.06X10^{-6}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 9.36X10^{-6}\ Ci$$

for Total Alpha

$$1.04X10^{-6}\ Ci[\frac{1}{2.84X10^{-5}} - \frac{e^{-2.84X10^{-5}(10)}}{2.84X10^{-5}}] = 1.04X10^{-5}\ Ci$$

The second evaporation will occur after another 50 years of decay. Release concentrations after the second 50 years are:

$$N = N^{o}\ e^{-\lambda t}$$

for ^{137}Cs

$$N = 1.55X10^{-3}\ Ci\ e^{-0.0231(50)} = 4.87X10^{-4}\ Ci$$

for ^{3}H

$$N = 25.7\ e^{-0.0564(50)} = 1.53\ Ci$$

for ^{90}Sr

$$N = 1.77X10^{-3}\ Ci\ e^{-0.0247(50)} = 5.14X10^{-4}\ Ci$$

for ^{129}I

$$N = 1.36X10^{-3}\ Ci\ e^{-4.1X10^{-4}(50)} = 1.36X10^{-3}\ Ci$$

for Total Beta (decay the same as ^{90}Sr)

$$N = 1.06X10^{-6}\ Ci\ e^{-0.0247(50)} = 3.08X10^{-7}\ Ci$$

for Total Alpha (decay the same as Pu $t^{1/2}$ = 24,400 y $\lambda = 2.84\ X\ 10^{-5}$)

$$N = 1.04X10^{-6}\ Ci\ e^{-2.84X10^{-5}(50)} = 1.04X10^{-6}\ Ci$$

Second evaporator releases over a 10 year period are calculated below:

$$N = N^{o}\,[\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 10}}{\lambda}]$$

Evaporator releases for 10 years for each of these radionuclides are:

for ^{137}Cs

$$4.87X10^{-4}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(10)}}{0.0231}] = 4.35X10^{-3}\ Ci$$

for ^{3}H

$$1.53\ \text{Ci}\ [\frac{1}{0.0564} - \frac{E^{-0.0564(10)}}{0.0564}] = 11.7\ \text{Ci}$$

for ^{90}Sr

$$5.14X10^{-4}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 4.56X10^{-3}\ Ci$$

for ^{129}I

$$1.36X10^{-3}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(10)}}{4.1X10^{-8}}] = 1.36X10^{-2}\ Ci$$

for Total Beta

$$3.08X10^{-7}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 2.72X10^{-6}\ Ci$$

for Total Alpha

$$1.04X10^{-6}\ Ci[\frac{1}{2.84X10^{-5}} - \frac{e^{-2.84X10^{-5}(10)}}{2.84X10^{-5}}] = 1.04X10^{-5}\ Ci$$

Total releases for the evaporator is a sum of the first and second evaporator operation releases:
for ^{137}Cs

$$<1.38 \times 10^{-2} + <4.35 \times 10^{-3} = <1.8 \times 10^{-2} \text{ Ci}$$

for ^{3}H

$$196 \text{ Ci} + 12 \text{ Ci} = 210 \text{ Ci}$$

for ^{90}Sr

$$<1.56 \times 10^{-2} + <4.56 \times 10^{-3} = <2.0 \times 10^{-2} \text{ Ci}$$

for ^{129}I

$$<1.36 \times 10^{-2} + <1.36 \times 10^{-2} = <2.7 \times 10^{-2} \text{ Ci}$$

for Total Beta

$$9.36 \times 10^{-6} + 2.72 \times 10^{-6} = 1.2 \times 10^{-5} \text{ Ci}$$

for Total Alpha

$$1.04 \times 10^{-5} + 1.04 \times 10^{-5} = 2.1 \times 10^{-5} \text{ Ci}$$

DON'T SAY IT --- *Write It!*

DATE: 3/31/95

TO: Dave Murray

FROM: Chris Meng H5-27

Telephone: 376-2947

cc: Ed Fredenburg

SUBJECT: No Disposal Action - Open item - radioactive emissions

The air operating emissions from 1993 for the tank farms (Table 5-6) had data for areas 3EDS and 5EDS. No emission data was given for the other areas. This indicates that the amounts released may have been so low they were not detectable or the releases were below reportable amounts.

The releases of tritium are associated with the operation of the evaporator. The evaporator releases and calculations remain the same and were not identified in the areas given. The tank farm releases and evaporator releases are separate in Table 5-6.

Please find attached the calculations for the releases from the areas where data was available.

Also, find attached the updated tables discussed earlier.

3EDS -

^{137}Cs	5.3 E - 5	Ci	Released in 1993
^{129}I	4.6 E - 5	Ci	
^{90}Sr	8.32 E - 6	Ci	

See Appendix B of WHC-SD-WM-EV-099 Rev. B for deffinitions. and equations (decay + integration).

Tank Farm releases for 100 years for each of these radionuclides are:

for ^{137}Cs

$$5.3\,E-5\ Ci\left[\frac{1}{0.0231} - \frac{e^{-0.0231(100)}}{0.0231}\right] = 2.1\,E-3\ Ci$$

for ^{129}I

$$4.6\,E-5\ Ci\left[\frac{1}{4.1\times10^{-8}} - \frac{e^{-4.1\times10^{-8}(100)}}{4.1\times10^{-8}}\right] = 4.6\,E-3\ Ci$$

for ^{90}Sr

$$8.32\,E-6\ Ci\left[\frac{1}{0.0247} - \frac{e^{-0.0247(100)}}{0.0247}\right] = 3.08\,E-4\ Ci$$

5EOS

^{137}Cs	1.6 E -7 Ci	Released in 1993
^{129}I	Not Detected	
^{90}Sr	9.3 E -8 Ci	

Tank Farm releases for 100 yrs for each of these radionuclides are:

for ^{137}Cs

$$1.6\,E-7\ Ci\left[\frac{1}{0.0231} - \frac{e^{-0.0231(100)}}{0.0231}\right] = 6.2\,E-6\ Ci$$

for ^{90}Sr

$$9.3\,E-8\ Ci\left[\frac{1}{0.0247} - \frac{e^{-0.0247(100)}}{0.0247}\right] = 3.4\,E-6\ Ci$$

Table 5-9. Construction Resource Requirements (Units As Indicated).

Construction Resource	No Discard Action
Land (m^2)[1]	
Surface committed	
Temporarily	360,000[2]
Permanently	190,000
Water (m^3)[3]	17,000
Energy[3]	
Electrical (GWh)	0.4
Propane (m^3)	7,500
Diesel fuel (m^3)	63
Gasoline (m^3)	86
Materials[4]	
Concrete (m^3)	120,000
Steel:	
Carbon steel (t)	12,000
Stainless steel (t)	22
Hastelloy (t)	0
Excavation (m^3)	3,700,000
Riprap (m^3)	0
Structure backfill (m^3)	3,500,000[5]
Total Contaminated Material (m^3)	0

Table 5-15. Decommissioning of Contaminated Treatment/Storage Facilities (Units as Indicated).

Item	No Discharge
Steel Quantity Disposition	20 t Low-level waste burial ground
Concrete Quantity Disposition	150 m^3 Low-level waste burial ground
Soil Quantity Disposition	0
Debris Quantity Disposition	140 m^3 Low-level waste burial ground

Notes:

m^3 = cubic meters
t = metric tons

As a part of this alternative, the current double-shell tanks and the new double-shell tanks would be left in place; therefore, no decontamination and decommissioning work would be done on them. The abandoned double-shell tanks may be filled with grout or gravel. Details of the closure of the double-shell tanks are in the *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Study* (Scanlon et al. 1995)

The two high-level waste evaporators built as part of this alternative would be decommissioned. The entries in this table are for those evaporators. The following assumptions were made for decommissioning: 5 percent of the concrete and steel will remain contaminated; 85 percent of the stainless steel will remain contaminated; 5 percent of the decontaminated steel and concrete will be debris; and the evaporators will be entombed in place so no contaminated soil would need to be removed.

Scanlon, P.L., H. Hampt and W.A. Skelly, 1995, *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Study*, WHC-SD-WM-EV-107, Rev. B, Westinghouse Hanford Company, Richland, Washington.

Request Number 47

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Joan Young Date: 3/20/95

Phone Number: 946-7112 Fax Number: 943-6812

Requested Information: Data request for modelling of risk from routine operations Item 6 Priority C.

Need Date: 4/7/95

Response: Confirmation of Assumption attached

Data Source/Accuracy:

Prepared By: Dave Murray Date Sent/Faxed:

Concurrence: Marc C. Nelson
Marc Nelson - Deputy Project Manager

Request No. 018, hazardous and toxic chemical emissions for in-tank sludge washing and retrieval are not provided due to the fact that actual characterization of the air being expelled from the tank ventilation systems has not been performed in sufficient detail to allow comparison to regulatory lists. Given this lack of data, emissions of hazardous air pollutants from the tanks during retrieval and in-tank sludge washing have been assumed to be negligible for the TPA Alternative. Please indicate the following:

a. Is this a valid assumption? If so, please provide the rationale to be used in the TWRS EIS to justify the assumption that hazardous emissions from the tank farms are negligible.

b. Does this same rationale apply to the remaining alternatives? Is so, please state. If not, please describe the situations where different assumptions should be used.

6. CONFIRM THE ASSUMPTION THAT THERE WILL BE NO AIR EMISSIONS FROM LLW DISPOSAL VAULTS DURING DISPOSAL OPERATIONS AND FROM HLW DURING INTERIM STORAGE.

For Cs and Sr Capsules (TPA) Alternative:

For the TPA Alternative, it was assumed that air emissions from the LLW disposal vaults during disposal operations and the HLW casks during interim storage will be controlled such that the dose to remediation workers, nearby workers, and the public does not exceed administrative dose limits and the public dose does not exceed current limits (ASI Engineering Data Request No. 21 1995). A specific risk from these unit operations was not calculated. Is this assumption valid for the Cs and Sr Capsules (TPA) Alternative as well?

References

ASI Engineering Data Request No. 018. Internal memo dated January 27, 1995.

WHC. 1994. Engineering Data Package for the No Separations Alternative, WHC-SD-WM-EV-COLBY, Rev. A.

cc: Alex Nazarali
Mitch Pelton
Andy Stanley
Reed Kaldor
John Shrock
Mike Harker
File 587.2.11.2.2
File 587.2.11.2.5

EIR #47. Air Emissions from LLW Vaults and HLW Interim Storage.

It is assumed that air emissions from these two storage/disposal facilities will be controlled so that the doses to the workers do not exceed administrative limits and the dose to the public does not exceed current limits. This assumption is also valid for the capsules since they will either be stored in overpacks awaiting shipment, or they will have been converted into a portion of the HL glass which is stored in canisters.

Request Number 048

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean, ASI Date: 3/21/95

Phone Number: 509-946-7112 Fax Number: 509-943-6812

Request Information: Complete footprint of the area of physical disturbance associated with the In Situ Vitrification alternative. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities. Priority A

Need Date: 4/7/95

Response: See attached.

Data Source/Accuracy: In situ data package WHC-SD-WM-EV-101. The data is conceptual; minimal engineering has gone into developing this alternative.

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Deputy Project Manager

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6.1.1 48

4/10/95

Larry Dean, ASI

Here are replies to your information requests #48 and #50 dated 3/21/95. As I mentioned to Andy Stanley this morning we do not have CAD files for anything but the TPA alternative, so we cannot provide cad files for ISV, capsule alternatives, or No Action. We are providing drawings where they are available from the data packages. Where no drawings are available, we have provided a written approach to use with the GIS system. EIR #49 is not included since we are waiting for WHC to furnish the location of the drywell storage facility for the capsules. We will complete this request and forward it to you as soon as data becomes available.

If you have any questions, please give me, Colin Henderson or Jim Goodwin a call.

Dave Murray

DATA REQUEST 048

SUBJECT: DISTURBED AREA FOR ISV

Background

1. Detailed engineering has not been done for the ISV alternative and as a result the facility requirements and associated support facility requirements are conceptual.

2. A total of 21 ha of land is estimated for temporary use in assembling the tank farm confinement facility modular section prior to replacement over the tank farm. This 21 ha of land will be spread over the 17 tank farms for an average of 1.23 ha (110 by 110 meters) per tank farm.

Approach

The recommended approach involves using the GIS system to create the following disturbed areas. For the ISV alternative a reasonable approach would be to use the existing tank farms and outline the disturbed area in the following manner:

a. Starting with existing tank farm boundaries add 200 ft (61 m) on all four sides to account for a substation, offgas system, and control room as shown on the attached drawing. Add a 500 by 500 foot (152 m) zone on one side of the farm (any side with available space, or the side with less impact) to account for the frit bulk storage area and frit conveyer building (see attached drawing).

b. Using the area impacted by the procedure outlined in a., add the 50 meter buffer around each farm

For the power lines, the approach should be to use the attached power transmission plan and locate the new transmission line and temporary lines on the GIS system followed by a buffer zone each side of the line. As noted in the notes, the line shall be constructed with single wood poles using vertical construction.

Request Number 48

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean, ASI Date: 21 MAR 1995

Phone Number: 509-946-7112 Fax Number: 509-943-6812

Requested Information:

Complete footprint of the area of physical disturbance associated with the *In-situ* vitrification alternative. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Priority A

Need Date: 7 April 1995

Response:

Data Source/Accuracy:

Prepared By: _____ Date Sent/Faxed: _____

Concurrence: _____

Marc Nelson - Deputy Project Manager

6 / 1

Request Number 049

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Larry Dean (ASI) Date: 3/21/95

Phone Number: (509)946-7112 Fax Number: (509)943-6812

Request Information: Complete footprint of the area of physical disturbance associated with the capsule alternatives. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Need Date: 4/7/95

Response: see attached

Data Source/Accuracy: The data used is from the Cs/Sr capsule data package and additional cc mail messages from WHC.

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Deputy Project Manager

engin\eninfrq.055

DATA REQUEST 049

The three capsule alternatives are: 1)Overpack and ship 2)No Action (drywell storage) 3)Vitrify with Tank Waste

For the overpack and ship alternative: There is no physical disturbance associated with the overpack and ship alternative. It is assumed that the overpacking will take place at WESF and the overpacked casks will be stored on pads with the HLW (presuming the tank waste is treated ex situ). This alternative will yield approx 75 casks out of 1700 estimated for the extensive retrieval ex situ vitrification alternative. If this alternative were to be analyzed along with an in situ tank waste alternative then assume that a pad would be built to accommodate the capsule casks. The pad would be located in the same area as existing HLW storage pads in the ex situ alternatives.

No Action (drywell storage): The dry well storage facility will be located just west of the 200E area (old HWVP area). The NW corner of the facility is E572,336 N136,277 in state coordinates. The facility is 195 meters by 195 meters and this includes a 30 meter buffer zone all around the drywell storage area. Assume that the facility boundaries are parallel with the state coordinate system. No new power lines or roads are expected to be required for this alternative. The 30 meter buffer was included in the numbers received from WHC, the 50 meter buffer could be obtained after locating the facility with the coordinates above by adding an additional 20 meters or by adding an additional 50 meters.

Vitrify with Tank Waste: There is no physical disturbance associated with this alternative. With this alternative the capsules will be transported to the HLW vitrification plant, the capsules will be cut up, the contents will be removed and possibly chemically processed and fed into the vitrification feed stream. The processing cell will be built within the HLW vitrification plant and will not require changing the current vitrification plant footprints.

Request Number 49

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean, ASI Date: 21 MAR 1995

Phone Number: 509-946-7112 Fax Number: 509-943-6812

Requested Information:

Complete footprint of the area of physical disturbance associated with the capsule alternatives (3). Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Priority A

Need Date: 7 April 1995

Response:

Data Source/Accuracy:

Prepared By: _____ Date Sent/Faxed: _____

Concurrence: _____

Marc Nelson - Deputy Project Manager

6.1.1

Request Number 050

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Larry Dean (ASI) Date: March 21, 1995

Phone Number: (509) 946-7112 Fax Number: (509) 943-6812

Request Information: Complete footprint of the area of physical disturbance associated with the No Action alternative. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Priority A

Need Date: April 7, 1995

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc Nelson - Deputy Project Manager

engin\eninfrq.050

DATA REQUEST 50

Foot print and disturbed area for No Action.

Under the No Action alternative the following activities will take place:

SST waste will be left in place.

DST waste be retanked every fifty years or a total of two times in the 100 year institutional control period.

The area where the new tanks will be located has been identified as a 500 m X 1000 m area that will fall within the disturbed area for the TPA vitrification plants and support facilities.

The area will be 500 meters east west and 1000 meters north south. This area represents two 500 m X 500 m areas cooresponding to the two tank farms (26 tanks each) that will be built for the no action alternative.

The 500 m X 1000 m area includes a 100 meter buffer around each tank farm.

Assume no new roads are constructed.

New pipelines will have to be built to connect the existing DSTs to the new DSTs. The routing of these lines has not been determined.

Power lines would have to be run connecting the new tank farms to the existing grid. This routing has not been identified and can be assumed to take place in an existing cooridor.

Request Number 50

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean, ASI Date: 21 MAR 1995

Phone Number: 509-946-7112 Fax Number: 509-943-6812

Requested Information:

Complete footprint of the area of physical disturbance associated with the No Action alternative. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Priority A

Need Date: 7 April 1995

Response:

Data Source/Accuracy:

Prepared By: _____ Date Sent/Faxed: _____

Concurrence: _____

Marc Nelson - Deputy Project Manager

Request Number 51

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean, ASI

Date: 21 MAR 1995

Phone Number: 509-946-7112

Fax Number: 509-943-6812

Requested Information:

Complete footprint of the area of physical disturbance associated with the selective retrival alternatives. Footprint to be in CAD format and to include all facilities associated with the alternative, all roads, pipelines and transmission lines associated with the facility and a 50 meter buffer around all facilities.

Priority B

Need Date: 1 May 1995

Response:

No Response Sent
Sel. Retrieval footprints were ratioed from Ext. Ret. (Ex SituVit) footprints just prior to PDEIS C.H. 8/10/95

Data Source/Accuracy:

Prepared By: C. Henderson

Date Sent/Faxed: 8/10/95

Concurrence: Marc E. Nelson

Marc Nelson - Deputy Project Manager

Request Number 052

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Request By: Arrie Bachrach Date: 3/21/95

Phone Number: 818-568-7114 Fax Number: 818-568-7135

Request Information: Dimensions of facilities associated with TPA, In Situ Vit, Capsules (all 3 Alts.), and No Action (if any). Also need locations & dimensions of caps (Hanford Barrier). Need approximate dimensions and height (and number and height of stacks); also need same data for annexes and other ancillary facilities (concrete batch plant?) including locations. Data needed for Visual Resources Impacts.

Priority A

Need Date: 4/7/95

.....

Response: See attached

Date Source/ Accuracy: See the Assumptions Section of the attached Responses Package for dimensions requiring estimation due to lack of readily available source data. In general, dimensions for TPA are rated "A" in accuracy. For In-Situ, the rating becomes "B". The ratings for No-Action and Capsules are "C" and "D" respectively. This rating is relatively reflecting the concepture nature and the degree of engineering and design for Options.

Prepared By: Michael Chang Date Sent/Faxed:

Concurrence: Mark E. Nelson
Mark Nelson - Deputy Project Manager

REQ_052.DOC

ENGINEERING INFORMATION REQUEST 052

Supplemental Information

WHC has provided confirmation on the stack information as follows:
for Extensive Retrieval - Ex Situ Vitrification

The HLW plant will have 2 stacks each 180' high located within 20-25' of the East side of the plant.

The LLW plant will have 2 stacks each 180' high located within 20-25' of the East side of the plant.

For the Minimal Retrieval - In Situ Vitrification alternative the following stack information replaces the data in the response page 4 section G. The height of the stack associated with the tank farm confinement facility is assumed to be 100'.

Jacobs Engineering Group INC.
251 South Lake Avenue, Pasadena, California 91101-3063
Telephone (818)568-7000 FAX (818)568-7129

FAX COMMUNICATION

TO: Dave Murray
Jacobs Engineering Group Inc.
Hanford, WA

DATE: 11 April 1995

PROJECT NO. 01-K471-01

FAX: (509) 736-7504

FROM: Michael Chang MYC

SUBJECT: Responses (draft) to Request Number 52

Attached are the complete (draft) responses to Request Number 52 for TPA, In-Situ, No-Action and Capsules (3 Options). The complete attachments (drawings) were mailed to you Yesterday. Please replace the previously sent contents with this new set of responses. Please keep the previously sent attachments (drawings).

Should you not receive 12 page(s), please contact the sender.

HAN41195.DOC

Request Number: 52 By: Arrie Bachrach @ (818)568-7114 Date: 3/21/95 TWRS EIS (01-K471-01) Responded By: Michael Chang @ (818)568-7173

Item # - TPA Request Information	Responses	{Location}	Source of Responses
A. Dimensions of facilities associated with TPA (During Operation)	-HLW vitrification plant: 511' x 175' x 100' (above grade) (53m x 156m x 30.48m)	{Fig (Page f2); Fig (Page f1); S. of C-Farm, W. of A-Farm}	Fig 7-3 of Data Package HLW facility layout
	-LLW separation/vitrification plant: 323' x 248' x 63' (above grade) (98.5m x 75.6m x 19.2m)	{Same as Above}	Fig 7-1 of Data Package LLW facility layout
B. Dimensions & locations of caps (Hanford Barrier) associated with TPA (Closure)	-The hanford Barrier would be placed over the top of the stabilized tanks and ancillary equipment and over the LLW vaults. It would be composed of 10 layers with a combined thickness (height) of (4.5 m)14.8 ft. It would cap group of tanks, not individual tanks. Each barrier would include 9m of additional coverage on each side of the barrier.	{Fig (Page f1]; Table on Page t1}	Section 3.3.2 Closure Data Package
	- Barrier over Tank Farm A (SST 6 tanks): 2.13 acres	{Fig[Page f1]; A-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AN (DST 7 tanks): 3.21 acres	{Fig[Page f1]; AN-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AP (DST 8 tanks): 2.89 acres	{Fig[Page f1]; AP-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AW (DST 6 tanks):2.26 acres	{Fig[Page f1]; AW-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AX (SST 4 tanks): 1.55 acres	{Fig[Page f1]; AX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AY (DST 2 tanks): 0.92 acres	{Fig[Page f1]; AY-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AZ (DST 2 tanks): 0.92 acres	{Fig[Page f1]; AZ-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm B (SST 16 tanks): 4.57 acres	{Fig[Page f1]; B -Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm BX (SST 12 tanks): 3.80 acres	{Fig[Page f1]; BX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm BY (SST 12 tanks): 3.84 acres	{Fig[Page f1]; BY-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm C (SST 16 tanks): 4.68 acres	{Fig[Page f1]; C-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm S (SST 12 tanks): 3.89 acres	{Fig[Page f1]; S -Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm SX (SST 15 tanks): 4.72 acres	{Fig[Page f1]; SX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm SY (DST 3 tanks): 1.61 acres	{Fig[Page f1]; SY-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm T (SST 16 tanks): 4.57 acres	{Fig[Page f1]; T-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm TX (SST 18 tanks): 6.09 acres	{Fig[Page f1]; TX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm TY (SST 6 tanks): 2.16 acres	{Fig[Page f1]; TY-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm U (SST 16 tanks): 4.67 acres	{Fig[Page f1]; U -Tanks}	Table A8 (Closure)
	- Barrier LLW vaults: (1110 ft x 760 ft) : 19.37 acres	{Fig.8-1; Fig(Page f3); Fig (P. f1)}	Fig 8-1(TPA)

C. Dimensions and height and numbers of stacks associate with TPA	-HLW vitrification plant: Two (2) stacks each 180' high -LLW separation/vitrification plant: Two (2) stacks each 180' high (54.8 m)	{Fig.8-1; Fig(Page f3); Fig (P. f1); S. of C-Farm, W. of A-Farm}	Fig A-1 (Sheet 14) Fig A-1 (Sheet 15)
D. Dimensions & locations of annexes and other ancillary facilities associated with TPA	-WSSF (Waste staging/sampling facility): 36m x 53m (20510 sq. ft)	{Fig.8-1; Fig(Page f3); Fig (P. f1]; Fig. E-1; E-2; E-3 [Page f5,f6,f7]}	Fig 8-1 of Data Package Appendix E-2
	-BCCB (Bulk handling and cold chemical make up building): 8361 m^2 (89964 sq. ft) (floor space, single story, chemical storage and make-up)	{Same As Above}	Fig 8-1 of Data Package Site Plan Appendix E-2
	-Substation/switch yard: 119m x 149m (390 ft x 489 ft) will bring in the overhead high voltage line	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-MUB (Mechanical utilities building): 8281 m^2 (89103 sq. ft), one story houses utilities such as air, chilled water, steam	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-OCB (Operations control building): 2090 m^2 (22488 sq. ft) floor space	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-REB (Regulated entrance building): 6503 m^2 (69972 sq. ft) floor space, single point entry for maintenance and operations personnel	{Same As Above}	Fig 8-1 of Data Package Site Plan Appendix E-2
	-OSB (Operation support building)(administration building): 5574 m^2 (59976 sq. ft) floor space, 40% office, 60% misc.	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-FAB (Fabrication shop): 46m x 91m (45000 sq. ft) one story floor place	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-Mockup shop: 46m x 91m (45000 sq. ft) one story floor place	{Same As Above}	Fig 8-1 of Data Package
	-Shipping/Receiving building: 12m x 48m (6190 sq. ft)	{Same As Above}	Fig 8-1 of Data Package
	-WHSE (Three warehouses): 41m x 91m (39932 sq. ft) one story for each warehouse	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-Two-case storage pads: 145m x 213m (476 ft x 699 ft = 332724 sq. ft) each	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-46 LLW vaults: 17m x 31m (5665 sq. ft) each vault	{Same As Above}	Fig 8-1 of Data Package
	-FW (Fire water) pump house and tanks: 12380 sq. ft approximately	{Same As Above}	Fig 8-1 of Data Package Appendix E-2
	-Cooling Tower: 61m x 61m (200 ft x 200 ft = 40000 sq. ft)	{Same As Above}	Fig 8-1 of Data Package
	-SERV/STOR (Service/storage) yard: 60m x 145m (93640 sq. ft)		Fig 8-1 of Data Package
	-Switch gear/Generator building: 91m x 91m (89100 sq. ft)	{Same As Above}	Appendix E-2

Request Number: 52 By: Arrie Bachrach @ (818)568-7114 Date: 3/21/95 TWRS EIS (01-K471-01) Responded By: Michael Chang @ (818)568-7173

Item # - In-Situ-Vit Request Information	Responses	{Location}	Source of Responses
E. Dimensions of facilities associated with In-Situ-Vit (During Operation)	Tank Farm TX	{Fig[Page f1]; TX-Tanks}	
	-TFCF 600' x 500' x 150' (apex above grade)		Fig 4-2 of Data Package Facility Layout
	-Within TFCF: Operating floor (20' above grade); Top of roof (20' above floor) Structure of a section (540' x 75')		Fig 4-3 of Data Package Building Support
	-Off-gas treating system: 150' x 75'		Fig 4-2 of Data Package
	- Off-gas hood cooling system: 80' x 50'		Fig 4-2 of Data Package
	Tank Farm SX	{Fig[Page f1]; SX -Tanks}	Table A2, A8
	-TFCF 600' x 400' x 150' (apex above grade) each		
	-Within TFCF: Operating floor (20' above grade); Top of roof (20' above floor)		
	-Off-gas treating system: 150' x 75' each		
	- Off-gas hood cooling system: 80' x 50' each		
	Tank Farms B; C; T; U; BX; BY; S; AN; AP	{Fig[Page f1]; B -Tanks C - Tanks; T - Tanks; U - Tanks, BX - Tanks BY - Tanks; S - Tanks AN - Tanks; AP - Tanks}	Table A2, A8
	-TFCF 500' x 400' x 150' (apex above grade) each		
	-Within TFCF: Operating floor (20' above grade); Top of roof (20' above floor)		
	-Off-gas treating system: 150' x 75' each		
	- Off-gas hood cooling system: 80' x 50' each		
	Tank Farm A;AW; TY	{Fig[Page f1]; A -Tanks AW - Tanks; TY - Tanks}	Table A2, A8
	-TFCF 300' x 300' x 120' (apex above grade) each		
	-Within TFCF: Operating floor (20' above grade); Top of roof (20' above floor)		
	-Off-gas treating system: 150' x 75' each		
	- Off-gas hood cooling system: 80' x 50' each		
	Tank Farm AX; SY; AY AZ	{Fig[Page f1]; AX -Tanks SY - Tanks; AY - Tanks; AZ - Tanks}	Table A2, A8
	-TFCF 200' x 300' x 100' (apex above grade) each		
	-Within TFCF: Operating floor (20' above grade); Top of roof (20' above floor)		
	-Off-gas treating system: 150' x 75' each		
	- Off-gas hood cooling system: 80' x 50' each		

F. Dimensions & locations of caps (Hanford Barrier) associated with TPA (Closure)	-The hanford Barrier would be placed over the top of the stabilized tanks and ancillary after the In Situ Vit process is complete. It would be composed of 10 layers with a combined thickness (height) of (4.5 m)14.8 ft. It would cap group of tanks, not individual tanks. Each barrier would include 9m of additional coverage on each side of the barrier.	{Fig (Page f1]; Table on Page t1}	Section 3.3.2 Closure Data Package
	- Barrier over Tank Farm A (SST 6 tanks): 2.13 acres	{Fig[Page f1]; A-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AN (DST 7 tanks): 3.21 acres	{Fig[Page f1]; AN-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AP (DST 8 tanks): 2.89 acres	{Fig[Page f1]; AP-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AW (DST 6 tanks):2.26 acres	{Fig[Page f1]; AW-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AX (SST 4 tanks): 1.55 acres	{Fig[Page f1]; AX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm AY (DST 2 tanks): 0.92 acres	{Fig[Page f1]; AY-Tanks}	Table A8 (Closure)
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	- Barrier over Tank Farm BY (SST 12 tanks): 3.84 acres	{Fig[Page f1]; BY-Tanks}	Table A8 (Closure)
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	- Barrier over Tank Farm TX (SST 18 tanks): 6.09 acres	{Fig[Page f1]; TX-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm TY (SST 6 tanks): 2.16 acres	{Fig[Page f1]; TY-Tanks}	Table A8 (Closure)
	- Barrier over Tank Farm U (SST 16 tanks): 4.67 acres	{Fig[Page f1]; U -Tanks}	Table A8 (Closure)
G. Dimensions and height and numbers of stacks associate with In-Situ-Vit	<u>One (1) stack for each of the 18 tank farms</u> under in-situ vitrification operation -In-Situ vitrification plant: One (1) stack, 180' high (54.8 m), in operation at a given time	{Fig[Page f1]; Fig 4-2(Page f4]}	Fig 4-2 of Data Package Facility Layout
H. Dimensions & locations ancillary facilities of annexes and other associated with In-Situ-Vit	<u>The following are needed for each of the 18 tank farms</u>		Fig 4-2 of Data Package
	-Frit supply conveyor building: 50' x 50' (2500 sq. ft)	{Fig[Page f1]; Fig 4-2(Page f4]}	Fig 4-2 of Data Package
	-Frit supply conveyor: 345' x 10'	{Same As Above}	Fig 4-2 of Data Package
	-Substation: 60 ft x 60 ft (3600 sq. ft) will bring in the overhead high voltage line	{Same As Above}	Fig 4-2 of Data Package

-Frit bulk storage Area: 260' x 200' (52000 sq. ft)	{Same As Above}	
-Effluent monitor building: 40' x 20' (800 sq. ft)	{Same As Above}	Fig 4-2 of Data Package
-Tank farm retrieval unit annex/Equip Decon & LI/LO/ Crane Maint/Control room/Elec./ Fan house/HVAC: 100' x 75' (7500 sq. ft)	{Same As Above}	Fig 4-2 of Data Package Facility Layout
-4 Container loadout airlocks: 31' x 75' (2325 sq. ft) each	{Same As Above}	Fig 4-2 of Data Package
-2 Trolley/off-gas hood Decon station: 76' x 75' (5700 sq. ft) each	{Same As Above}	Fig 4-2 of Data Package
-2 Trolley/ Trolley/off-gas hood repair & loadout station:	{Same As Above}	Fig 4-2 of Data Package
-8 HVAC exhaust system: 20' x 60' (1200 sq. ft) each	{Same As Above}	Fig 4-2 of Data Package
-Berm for exterior walls: Twenty (20) at 20' x40' (800 sq. ft) each; Two (2) at 40' x50' (2000 sq. ft) each; Two (2) at 40' x 93' (3720 sq. ft) each	{Same As Above}	Fig 4-2 of Data Package Facility Layout

Note: 1.There are 18 tank farms containing 177 tanks to be in-situ vitrified.

2. Sand would be excavated. Existing Pit 30, located between 200 East and 200 West Areas, would be used to excavate 540,000 cubic meter of sand required for filling the tank void spaces. It assumes that excavating and crushing equipment will already be in place from other contracts. As a result, no construction work would be necessary.

Section 8.1 Assumptions

Request Number: 52 By: Arrie Bachrach @ (818)568-7114 Date: 3/21/95 TWRS EIS (01-K471-01) Responded By: Michael Chang @ (818)568-7173

Item # - No Action Request Information	Responses	{Location}	Source of Responses
I. Dimensions of facilities associated with No-Action	-----For the first retanking (2033 to 2037)----- - 26 new tanks (DSTs): 500 ft x 600 ft (300,000 sq. ft) (below grade) -- This is the first retanking - One new Evaporator: 20' x 50' x 38' (above grade)	{Same as TPA HLW/LLW vitrification plant (same vicinity)} {Fig (Page f2); Fig (Page f1); S. of C-Farm, W. of A-Farm}	Fig 2-3 & Fig 2-4 of "No Action" Package Table C-1 of "No Separation" Package Section 2.2.1
	-----For the second retanking (2083 to 2087)----- - 26 new tanks (DSTs): 500 ft x 600 ft (300,000 sq. ft) (below grade) -- This is the second retanking - One new Evaporator: 20' x 50' x 38' (above grade)	{Same As Above}	{Same As Above}
J. Dimensions & locations of caps (Hanford Barrier) associated with No-Action	None		
K. Dimensions and height and and numbers of stacks associated with No-Action	One (1) stack 65' high	{Same as TPA HLW/LLW vitrification plant (same vicinity)}	Fig 2-3 & Fig 2-4 Sections 2.2.1 & 2.2.2
L. Dimensions & locations of annexes and other ancillary facilities associated with No-Action	- (2) Weather enclosures: 2 x 500' x 600' (2 x 300,00 sq. ft) (above grade, above 2 x 26 new tanks), 60' high - Cooling towers: 100' x100' - Administration building/Support facility: 300' x 300' contains offices, a lunchroom, a nonprotective-clothing changeroom, training rooms, and a communications room	{Same as TPA HLW/LLW vitrification plant (same vicinity)} {Dimensions on the left are scaled down from TPA case (estimated)}	Fig 2-3 Section 2.2.1 & 2.2.2
	- Double-ended unit substation: 200' x 200'	{Same As Above}	{Same As Above}
	- Diesel Generator building: 200' x 200' provide backup power	{Same As Above}	{Same As Above}
	-OCB (Operations control building or operating galleries): 150' x150' (22500 sq. ft) contain local control room, and rooms for liquid sampling and control, communications, process cell supply air filter, air compressor, contaminated solid waste, building exhaust, HVAC, normal/backup electrical distribution panels,	{Same As Above}	{Same As Above}

	backup electrical motor control centers, condenser cooling equipment, exhaust sampling, and process cell exhaust. - Earth borrow material: (during construction of processing facilities and ancillary buildings) will be located within 1.9 miles radius of the construction site.	{Same As Above}	{Same As Above}

Request Number: 52 By: Arrie Bachrach @ (818)568-7114 Date: 3/21/95 TWRS EIS (01-K471-01) Responded By: Michael Chang @ (818)568-7173

Item # - **Capsules** Request Information	Responses	{Location}	Source of Responses
M. Dimensions of facilities associated with Capsules--**No-Action**	-WESF (Waste Encapsulation and Storage Facility): It is an existing facility (225-B) next to B Plant (221-B Building) approx. dimensions: 90m x 120m (10,800 sq. meters)	{The northwest corner of site is W54,500,N42,300.Fig[Page f2]}	Fig 2-1& 2-2 of Package Plant Layout/ WESF
	-Capsule Packaging facility-- 43m x 26m (1,100 sq. meter) x 14 m high - stand along facility (note: smaller dimensions, if modified within WESF]	{Either @ HLW vitrifi. facility; or @ modified WESF, refer to above for location}	Section 2.6 Section A1.1
	-On site dry well storage: A total of 672 drywells arranged in a grid 5 m center to center, Total land (w/o buffer): 18,000 sq. meter (194,000 sq. ft) 135m x 135m Total land (w buffer): 38,000 sq. meter (410,000 sq. ft) 195m x 195m	{The northwest corner of site is W57600,N42000. This site is on the western boundary of 200E and is selected tentatively} see Fig[Page f2]}	Fig A2-6 Section A1.1 Update #3 for capsules from Ed(WHC) to Marc 3/22/75 fax
N. Dimensions & locations of caps (Hanford Barrier) associated with Capsules--**No-Action**	-None		
O. Dimensions and height and numbers of stacks associate with Capsules--**No-Action**	- Two (2) stacks each 50' high (15.25 m) conceptual from the capsule packing facility (note: no new stacks if WESF is modified to handle packaging)	{Same as the packaging facility as the above Item #M}	Fig A1-2
P. Dimensions & locations ancillary facilities	-Trucks: small -Shielded transporters: small	{Move among WESF, packaging and Drywells,	Fig A1-2; A2-6 Profile View of the

of annexes and other associated with Capsules- **-No-Action**	-In cell crane/maniplator: small	see above and Fig[Page f2]}	Capsule Packing Operations in Relation to the Drywell Storage
	End of Capsules No-Action Alternative		
Q. Dimensions of facilities associated with Capsules- **-No-Immobilization (Overpack & Ship)**	-WESF (Waste Encapsulation and Storage Facility): It is an existing facility (225-B) next to B Plant (221-B Building) approx. dimensions: 90m x 120m (10,800 sq. meters) -Capsule Packaging facility-- 43m x 26m (1,100 sq. meter) x 14 m high - stand along facility (note: smaller dimensions, if modified within WESF] -On site interim storage: the same as TPA two-case storage pads: 145m x 213m (476 ft x 699 ft = 332724 sq. ft) each	{The northwest corner of site is W54,500,N42,300. Fig[Page f2]} {Either @ HLW vitrifi. facility; or @ modified WESF, refer to above for location} {Same as TPA pads see Item #D}	Fig 2-1& 2-2 of Package Plant Layout/ WESF Section 2.6 Section A1.1 Fig 8-1 of Data Package Appendix E-2
R. Dimensions & locations of caps (Hanford Barrier) associated with Capsules- **-No-Immobilization (Overpack & Ship)**	-None		
S. Dimensions and height and numbers of stacks associate with Capsules- **-No-Immobilization (Overpack & Ship)**	- Two (2) stacks each 50' high (15.25 m) conceptual from the capsule packing facility (note: no new stacks if WESF is modified to handle packaging	{Same as the packaging facility as the above Item #M}	Fig A1-2
T. Dimensions & locations ancillary facilities of annexes and other associated with Capsules- **-No-Immobilization (Overpack & Ship)**	-Trucks: small -Railcars: small -In cell crane/maniplator: small	{Move among WESF, packaging and depository, see above and Fig[Page f2]}	Fig A1-1
	End of Capsules No-Immobilization (Overpack & Ship) Alternative		

U. Dimensions of facilities associated with Capsules- **-Extensive-Immobilization (Vit with TPA-HLW)**	-WESF (Waste Encapsulation and Storage Facility): It is an existing facility (225-B) next to B Plant (221-B Building) approx. dimensions: 90m x 120m (10,800 sq. meters)	{The northwest corner of site is W54,500,N42,300. Fig[Page f2]}	Fig 2-1& 2-2 of Package Plant Layout/ WESF
	-Cesium and Strontium vitrification facility-- 53m x 156m (8268 sq. meter) x 30.4m high - 511' x 175' x 100' (note: under this alternative, the contents of the cesium and strontium capsules are sent to an existing vitrification plant for processing. The mass requiring vitrification from the cesium and strontium is less than 1% of the tank HLW that require vitrification. Therefore the impact by processing of the capsule contents is not significant.)	{@ TPA HLW vitrifi. facility; refer to above Item #A}	Section 2.6 Fig 1.1 Table 4-5 Footnotes
	-On site interim storage: the same as TPA two-case storage pads: 145m x 213m (476 ft x 699 ft = 332724 sq. ft) each	{Same as TPA pads see Item #D}	Fig 8-1 of Data Package
V. Dimensions & locations of caps (Hanford Barrier) associated with Capsules- **-Extensive-Immobilization (Vit with TPA-HLW)**	-None		
W. Dimensions and height and numbers of stacks associate with Capsules- **-Extensive-Immobilization (Vit with TPA-HLW)**	-No separate stacks other than those existing stacks for the existing vitrification plant		
X. Dimensions & locations ancillary facilities of annexes and other associated with Capsules- **-Extensive-Immobilization (Vit with TPA-HLW)**	-Trucks: small -Railcars: small	{Move among WESF, vit facility and depository}	Fig A1-1
	- small impact to other ancillary facilities associated with the existing vitrification facility for processing Tank HLW	{Fig.8-1; Fig(Page f3); Fig (P. f1]; Fig. E-1; E-2; E-3 [Page f5,f6,f7]}	Fig 8-1 of Data Package Appendix E-2 of TPA data package

Assumptions:

1. The Hanford barrier dimensions are the tank farm dimensions plus 9 meter on (4) sides.
2. The stack dimensions are reasonably estimated. WHC was requested to furnish dimensions.
3. The TFCF (Tank Farm Confinement Facility) dimensions are reasonably estimated for the following tank farms (based on the numbers and the arrangement of the tanks): Tanks Farm: SX; B, C, T, U, BX, BY, S AN, AP; A, AW, TY; AX, SY, AY, AZ. Only the dimensions of TFCF for Tank Farm TX are available from the WHC data package.
4. The retanking dimensions for the No-Action Alternative are estimated based on 75' DST diameter plus 20' space between the tanks.
5. The ancillary facilities associated with No-Action Alternative are estimated only based on conceptual drawing Figure 2-3 of the WHC data package.
6. The existing WESF (Waste Encapsulation and Storage Facility) dimensions for the Capsules Alternatives are estimated from Fig[Page f2] (next to B Plant).

Attachments:

1. Page t1: Tank Volumes (Table A1 of Closure Data Package)
2. Page f1: Tank Farm Locations within the Hanford Site (Figure 4-1)
3. Page f2: 200 East Area with WHC coordinates (WHC-SD-WM-EV-097 Rev. B Page 3-15/3-16)
4. Page f3: Site Plan (Figure 8-1 of WHC-SD-WM-EV-104 Rev. B)
5. Page f4: Large Confinement Facility ISV Conditioning Tank Farm Plan (DWG: ES-S17-M01 Rev 0)
6. Page f5: TPA Preferred Alternative Disturbed Area Site Plan (Figure E-1 of WHC-SD-WM-EV-ERIC Rev. A)
7. Page f6: TPA Preferred Alternative Temporary Facilities Site Plan (Figure E-2 of WHC-SD-WM-EV-ERIC Rev. A)
8. Page f7: No Pretreatment/TPA Preferred Alternative Aggregate Pit Site Plan (Figure E-3 of WHC-SD-WM-EV-ERIC Rev. A)

Table A1. Tank Volumes (Backup to Tables 5-2A, 5-2B, 5-3A, 5-8, 5-9, 5-11 and 5-12).

TANK FARM	NUMBER TANKS	TANK CAPACITY (gal/tank)	TANK CAPACITY (cu m/tank)	TOT CAP (cu m)	FACTOR	TOTAL VOLUME (gallons)	TOTAL VOLUME (cu m)
A	6	1000000	3780	22680	1.6	9600000	36288
AN*	7	1160000	4384.8	30694	1.6	12992000	49110
AP*	8	1160000	4384.8	35078	1.6	14848000	56125
AW*	6	1160000	4384.8	26309	1.6	11136000	42094
AX	4	1000000	3780	15120	1.6	6400000	24192
AY*	2	1000000	3780	7560	1.6	3200000	12096
AZ*	2	1000000	3780	7560	1.6	3200000	12096
B	12	530000	2003.4	24041	1.6	10176000	38465
B	4	55000	207.9	832	1.6	352000	1331
BX	12	530000	2003.4	24041	1.6	10176000	38465
BY	12	758000	2865.24	34383	1.6	14553600	55013
C	12	530000	2003.4	24041	1.6	10176000	38465
C	4	55000	207.9	832	1.6	352000	1331
S	12	758000	2865.24	34383	1.6	14553600	55013
SX	15	1000000	3780	56700	1.6	24000000	90720
SY*	3	1160000	4384.8	13154	1.6	5568000	21047
T	12	530000	2003.4	24041	1.6	10176000	38465
T	4	55000	207.9	832	1.6	352000	1331
TX	18	758000	2865.24	51574	1.6	21830400	82519
TY	6	758000	2865.24	17191	1.6	7276800	27506
U	12	530000	2003.4	24041	1.6	10176000	38465
U	4	55000	207.9	832	1.6	352000	1331
TOTALS:	177			475917		201446400	761467

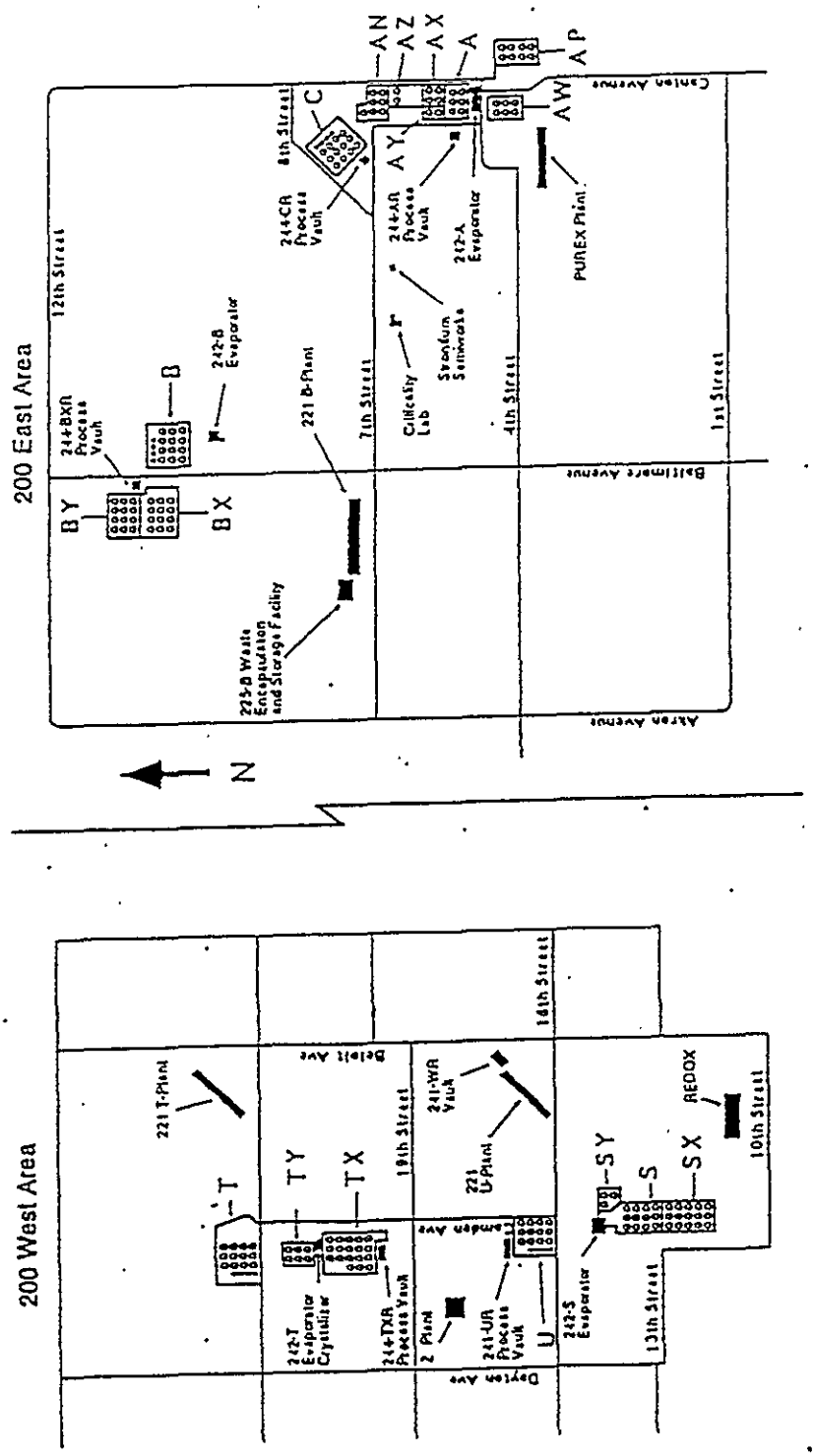
NOTES: (1) Asterisks following the Tank Farm letter designators mean that the tank is a DST.

(2) The column "FACTOR" refers to a scaling factor determined by the calculation of the actual volume of Tank C-106, 530,000 gallon tank. It was assumed that all tanks had the same geometry as Tank C-106.

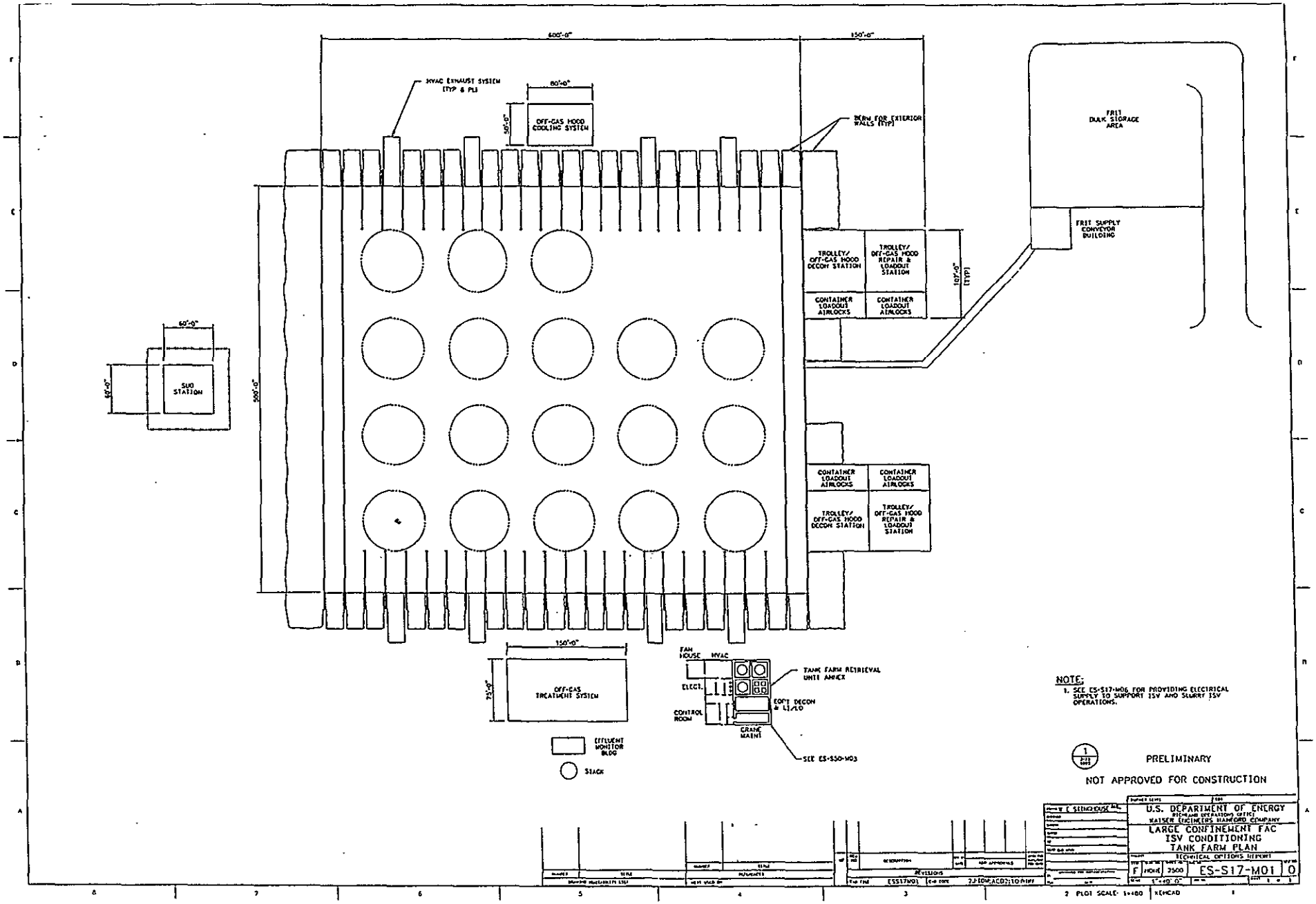
The scaling factor comes from the ratio of the calculated C-106 total tank volume (852,000 gallons) divided by the C-106 tank capacity (530,000 gallons). All tank capacities are from the Updated Monthly Hanford Tank Farm Facilities Report (graphics # 29310073.2C).

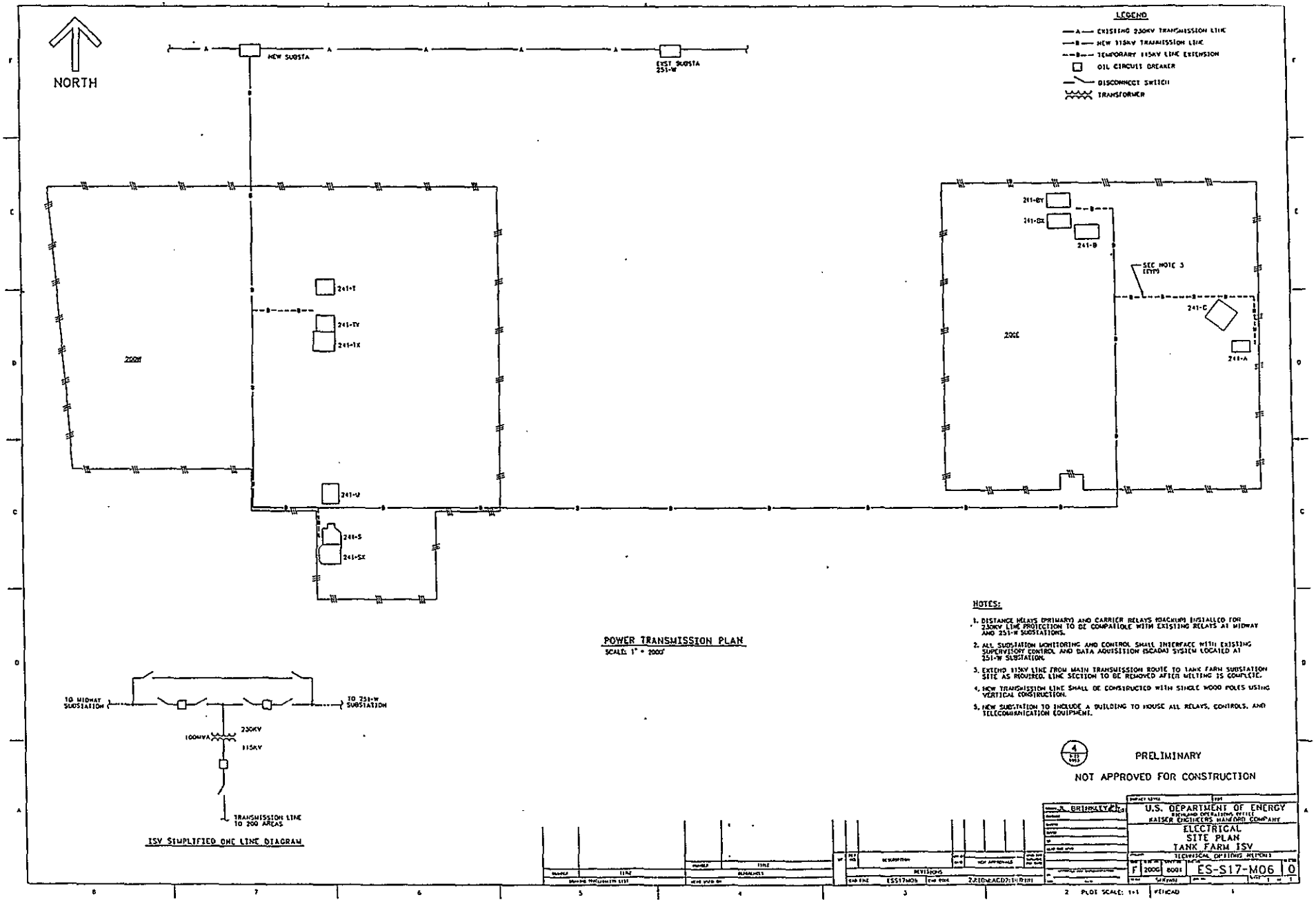
(3) The total capacity is the amount of waste that actually is in the 177 waste tanks. 1% of the waste in the SSTs will remain in the tanks after retrieval operations; the DSTs are considered to be "clean-closed". That is, no waste remains in the DSTs after retrieval. Therefore, there is actually 760,000 m^3 of void volume in the tanks to be stabilized [761,467 cu m - (0.01)(135,475 cu m of SST capacity)].

Figure 4-1. Tank Farm Locations within the Hanford Site. (Brevick et al., 1994a)



Page 51

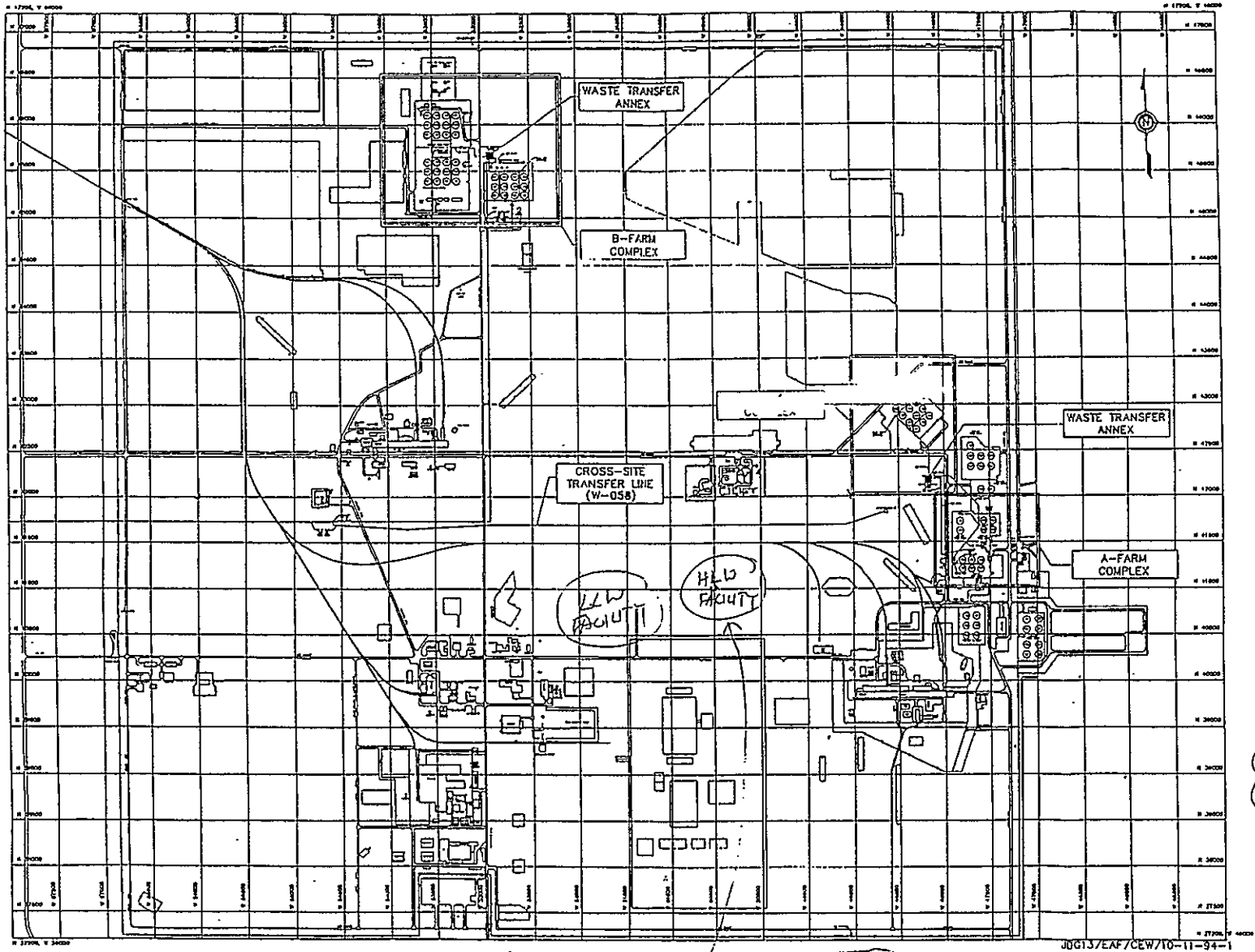

600'-0"
150'-0"
HVAC EXHAUST SYSTEM (TYP & PL)
80'-0"
50'-0"
OFF-GAS HOOD COOLING SYSTEM
BERM FOR EXTERIOR WALLS (TYP)
FRIT BULK STORAGE AREA
FRIT SUPPLY CONVEYOR BUILDING
TROLLEY/ OFF-GAS HOOD DECON STATION
TROLLEY/ OFF-GAS HOOD REPAIR & LOADOUT STATION
CONTAINER LOADOUT AIRLOCKS
CONTAINER LOADOUT AIRLOCKS
107'-0" (TYP)
60'-0"
60'-0"
SUD STATION
500'-0"
CONTAINER LOADOUT AIRLOCKS
CONTAINER LOADOUT AIRLOCKS
TROLLEY/ OFF-GAS HOOD DECON STATION
TROLLEY/ OFF-GAS HOOD REPAIR & LOADOUT STATION
150'-0"
75'-0"
OFF-GAS TREATMENT SYSTEM
FAN HOUSE
HVAC
ELECT.
CONTROL ROOM
TANK FARM RETRIEVAL UNIT ANNEX
EQPT DECON & LI/LO
CRANE MAINT
SEE ES-S50-M03
EFFLUENT MONITOR BLDG
STACK
NOTE:
1. SEE ES-S17-M06 FOR PROVIDING ELECTRICAL SUPPLY TO SUPPORT ISV AND SLURRY ISV OPERATIONS.
PRELIMINARY
NOT APPROVED FOR CONSTRUCTION
U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
WAISER ENGINEERS HANFORD COMPANY
LARGE CONFINEMENT FAC
ISV CONDITIONING
TANK FARM PLAN
TECHNICAL OPTIONS REPORT
F
HOME
2500
ES-S17-M01
0
REVISIONS
ESS17M01
2 PLOT SCALE: 1=480
XEHCAD



POWER TRANSMISSION PLAN
SCALE: 1" = 2000'

NOTES:

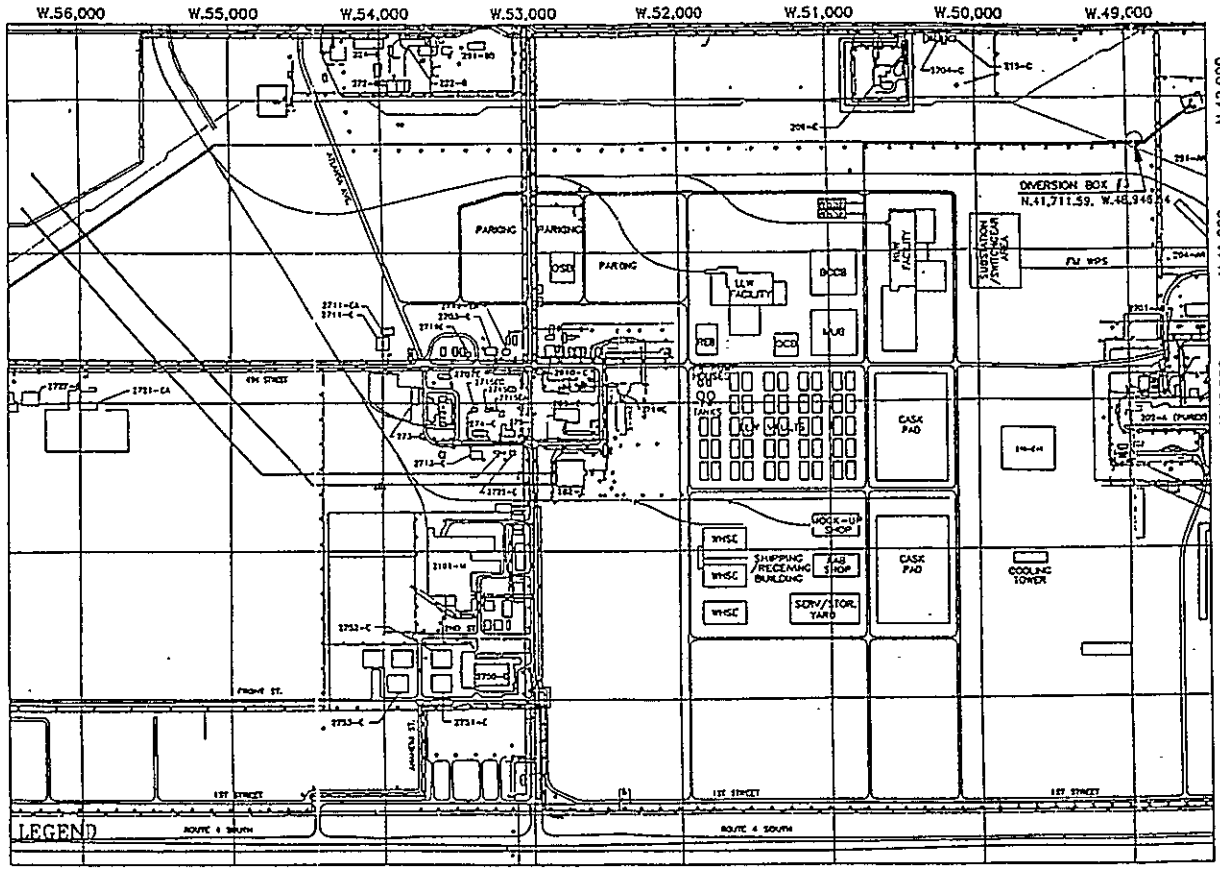
1. DISTANCE RELAYS (PRIMARY) AND CARRIER RELAYS (BACKUP) INSTALLED FOR 230KV LINE PROTECTION TO BE COMPATIBLE WITH EXISTING RELAYS AT MIDWAY AND 251-W SUBSTATIONS.
2. ALL SUBSTATION MONITORING AND CONTROL SHALL INTERFACE WITH EXISTING SUPERVISORY CONTROL AND DATA AQUISITION (SCADA) SYSTEM LOCATED AT 251-W SUBSTATION.
3. EXTEND 115KV LINE FROM MAIN TRANSMISSION ROUTE TO TANK FARM SUBSTATION SITE AS REQUIRED. LINE SECTION TO BE REMOVED AFTER MELTING IS COMPLETE.
4. NEW TRANSMISSION LINE SHALL BE CONSTRUCTED WITH SINGLE WOOD POLES USING VERTICAL CONSTRUCTION.
5. NEW SUBSTATION TO INCLUDE A BUILDING TO HOUSE ALL RELAYS, CONTROLS, AND TELECOMMUNICATION EQUIPMENT.



Page f2

PLE CROSS REFERENCE TO Page f3 FOR COORDINATES

Figure 8-L Site Plan.



200 EAST AREA

PLE CROSS REFERENCE Pages f1 & f2 FOR COORDINATES AND LOCATIONS

LEGEND

DCCB	BULK HANDLING & COLD CHEMICAL MAKE-UP BUILDING
FAB	FABRICATION
FW	FIREWATER
HLW	HIGH LEVEL WASTE VITRIFICATION
LLW	LOW LEVEL WASTE VITRIFICATION
MUB	MECHANICAL UTILITIES BUILDING
OCB	OPERATIONS CONTROL BUILDING
OSB	OPERATIONS SUPPORT BUILDING
REB	REGULATED ENTRANCE BUILDING
WSSF	WASTE STAGING AND SAMPLING FACILITY
SERV/STOR	SERVICE/STORAGE
WHSE	WAREHOUSE

Page f3

CASE 8A EIS

U.S. DEPARTMENT OF ENERGY

FLUOR DANIEL, INC. ADVANCED TECHNOLOGY DIVISION

EIS
TPA PREFERRED ALTERNATIVE
SITE PLAN

ES-ALT8A-03 2 F 0

8-3/8-4

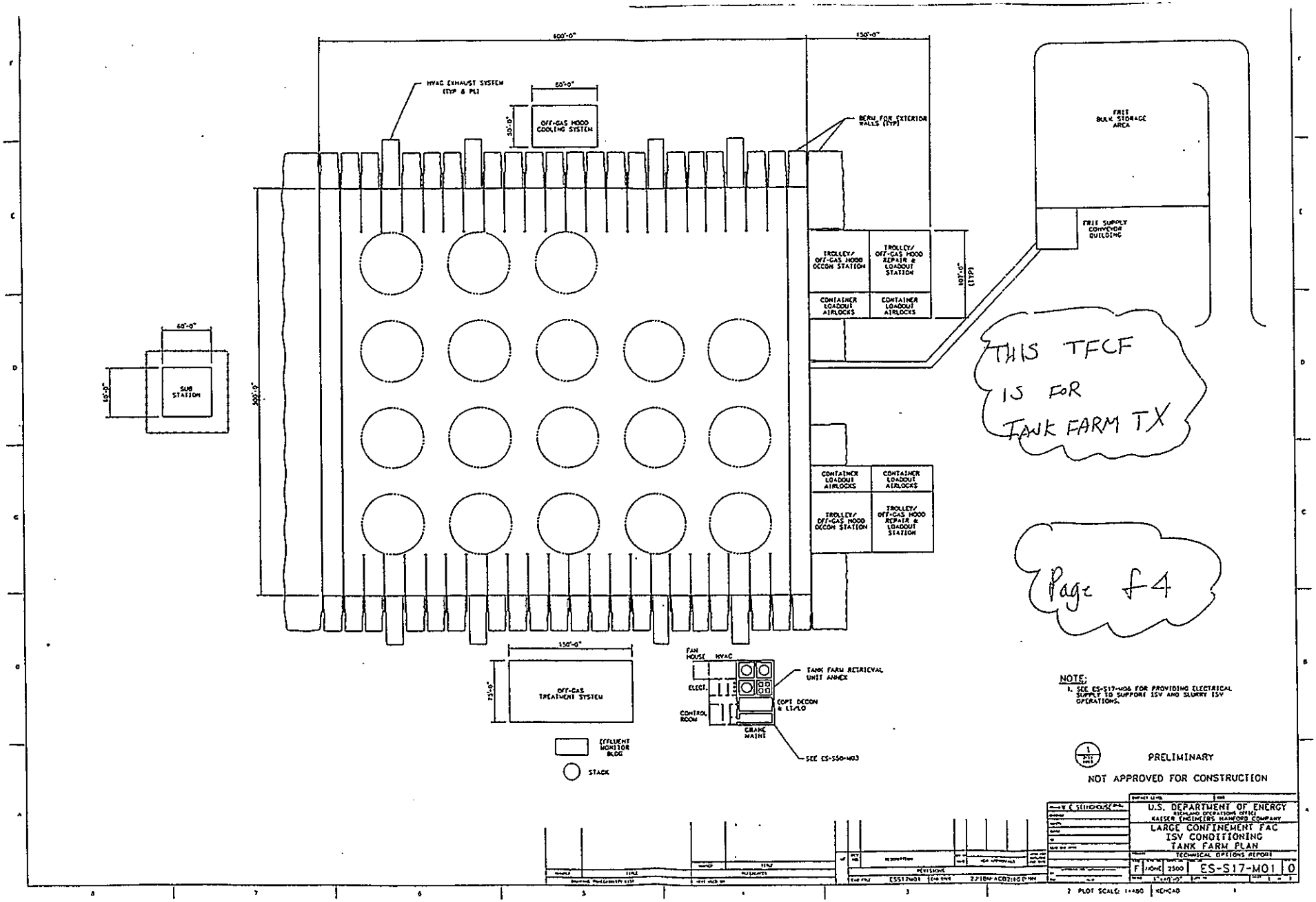
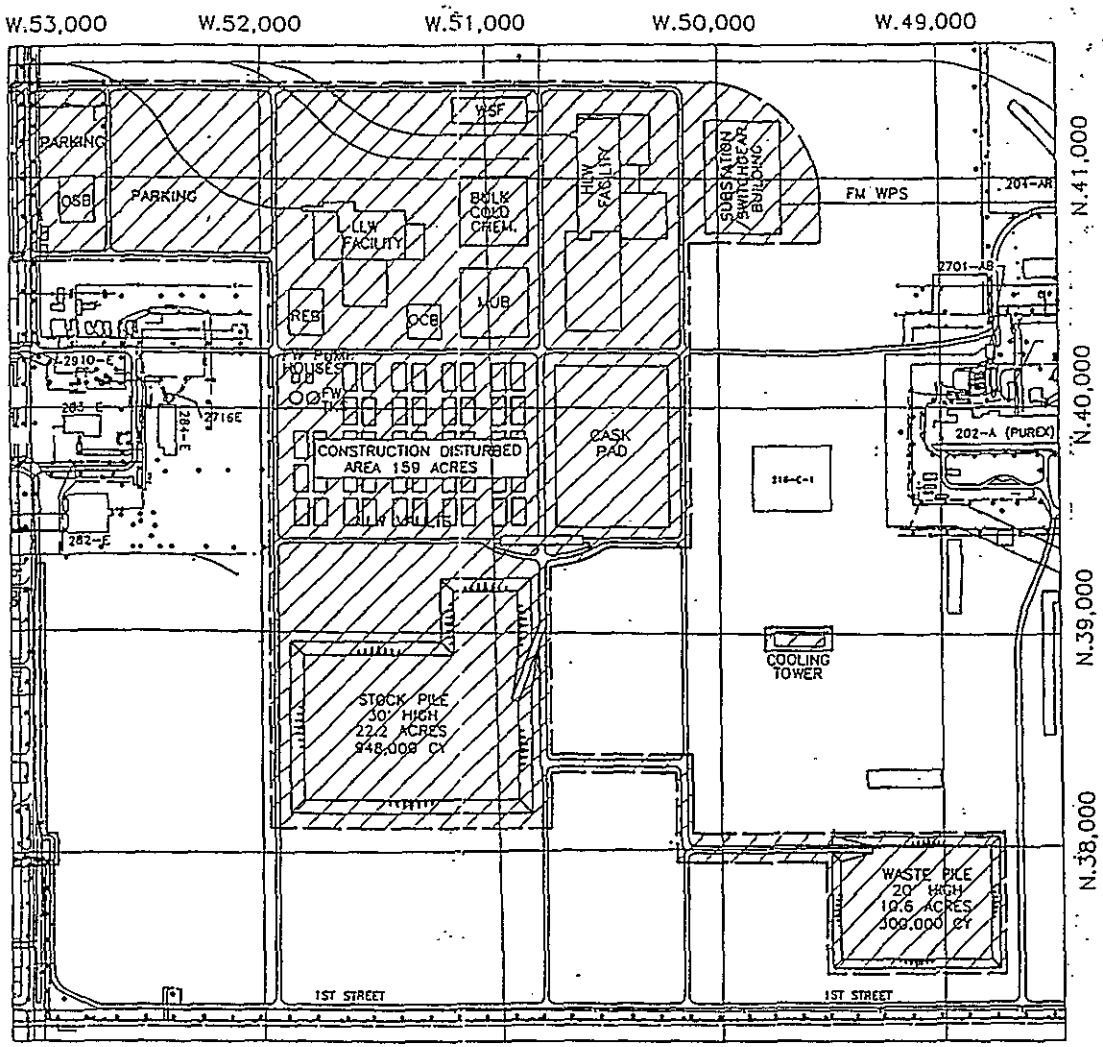

600'-0"
150'-0"
HVAC EXHAUST SYSTEM (TYP & PL)
60'-0"
OFF-GAS HOOD COOLING SYSTEM
BERM FOR EXTERIOR WALLS (TYP)
FREE BULK STORAGE AREA
FREE SUPPLY CONVEYOR BUILDING
TROLLEY/ OFF-GAS HOOD DECON STATION
TROLLEY/ OFF-GAS HOOD REPAIR & LOADOUT STATION
CONTAINER LOADOUT AIRLOCKS
CONTAINER LOADOUT AIRLOCKS
107'-0" (TYP)
60'-0"
SUB STATION
500'-0"
CONTAINER LOADOUT AIRLOCKS
CONTAINER LOADOUT AIRLOCKS
TROLLEY/ OFF-GAS HOOD DECON STATION
TROLLEY/ OFF-GAS HOOD REPAIR & LOADOUT STATION
150'-0"
OFF-GAS TREATMENT SYSTEM
FAN HOUSE
HVAC
ELECT.
CONTROL ROOM
TANK FARM RETRIEVAL UNIT ANNEX
CONT DECON & LT/LO
CRANE MAINT
SEE ES-S50-M03
EFFLUENT MONITOR BLDG
STACK
THIS TFCF IS FOR TANK FARM TX
Page f4
NOTE:
1. SEE ES-S17-M06 FOR PROVIDING ELECTRICAL SUPPLY TO SUPPORT ISV AND SLURRY ISV OPERATIONS.
PRELIMINARY
NOT APPROVED FOR CONSTRUCTION
U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
KAISER ENGINEERS HANFORD COMPANY
LARGE CONFINEMENT FAC
ISV CONDITIONING
TANK FARM PLAN
TECHNICAL OPTIONS REPORT
F
ES-S17-M01
0
PLOT SCALE: 1=480

Figure E-1. Disturbed Areas.



200 EAST AREA

Page f5

PLE CROSS REFERENCE Pages f1 and f2 FR LOCATIONS

CASE 8A EIS

0 100 200 300 400
GRAPHIC SCALE IN METERS

0 200 400 600 800 1000
GRAPHIC SCALE IN FEET

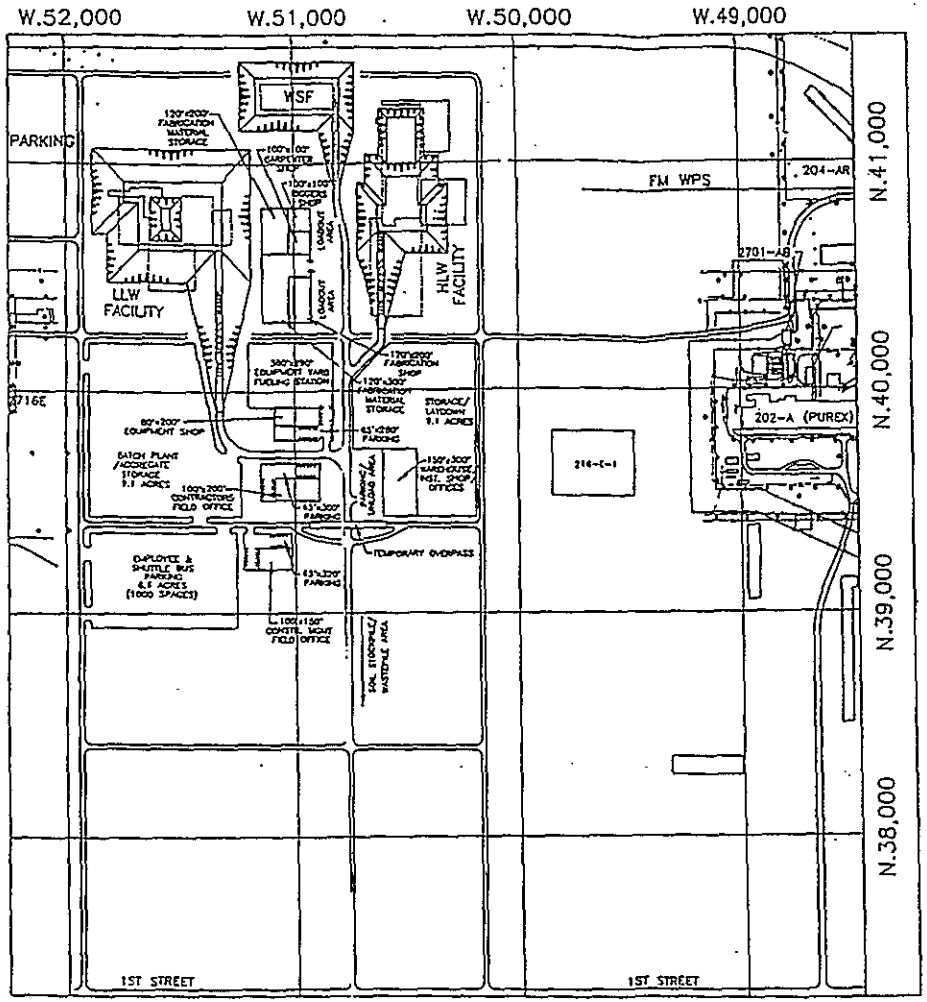
U.S. DEPARTMENT OF ENERGY

FLUOR DANIEL, INC. ADVANCED TECHNOLOGY DIVISION

EIS
TPA PREFERRED ALTERNATIVE
DISTURBED AREA
SITE PLAN

ES-ALT8A-04

Figure E-2 Temporary Facilities.



200 EAST AREA

Page f6

PLE CROSS REFERENCE Page, f1 and f2 FOR LOCATIONS

CASE 8A EIS

0 100 200 300 400
GRAPHIC SCALE IN METERS

0 200 400 600 800 1000
GRAPHIC SCALE IN FEET

U.S. DEPARTMENT OF ENERGY

EIS
TPA PREFERRED ALTERNATIVE
TEMPORARY FACILITIES
SITE PLAN

ES-ALT8A-04

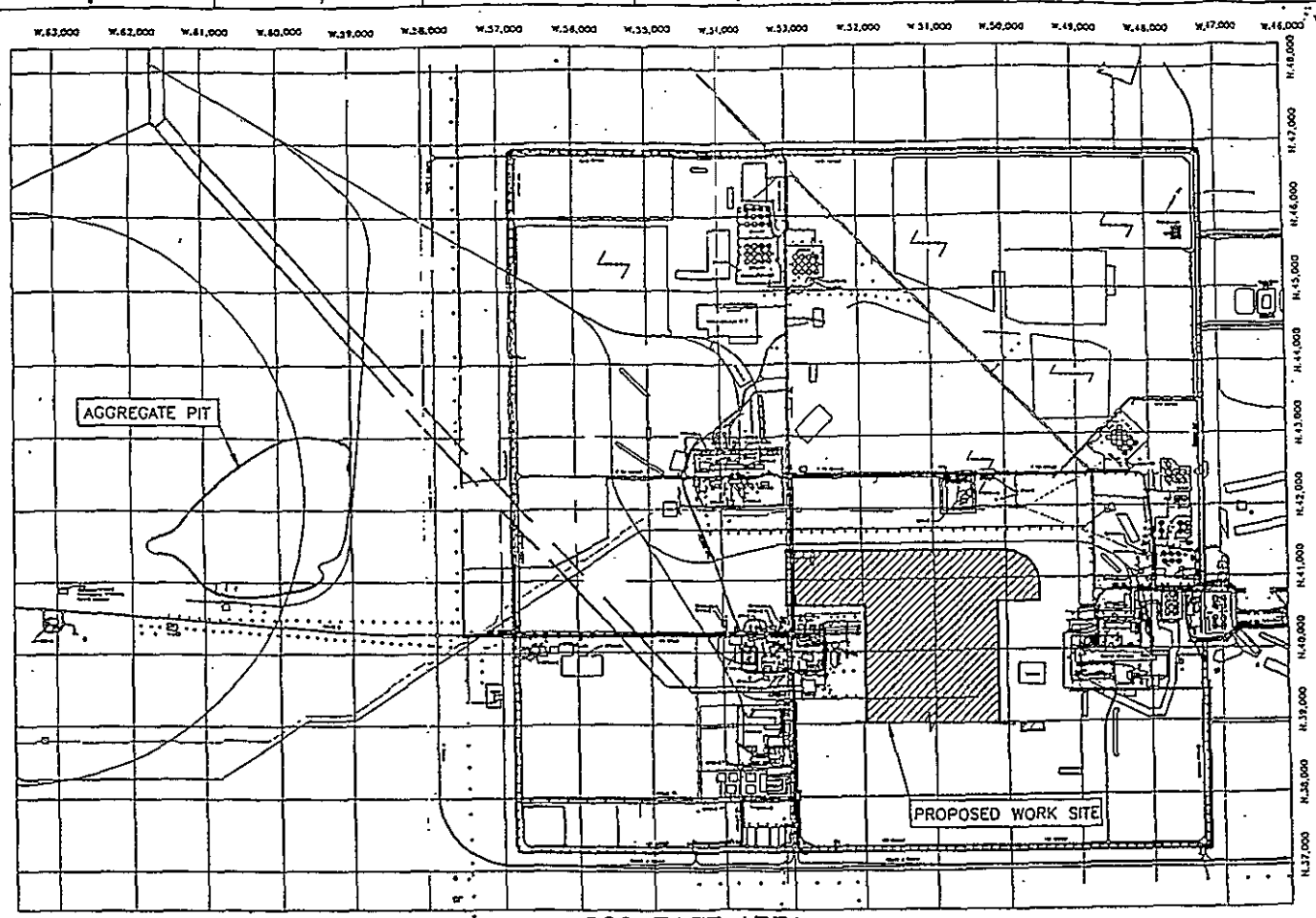


Figure E-3. Aggregate Pit Location.

Page f7

CASE 8A EIS

PLE CROSS REFERENCE Pages f1 and f2 FOR LOCATIONS

0 500 1500 2500 3500 4500
1000 2000 3000 4000 5000
GRAPHIC SCALE IN FEET

180 360 720 1080 1440
GRAPHIC SCALE IN METERS

U.S. DEPARTMENT OF ENERGY

EIS
HO PRETREAT./TPA PREF. ALT.
AGGREGATE PIT
SITE PLAN

ES-ALTBA-04

ENGINEERING INFORMATION REQUEST 052

Supplemental Information

WHC has provided confirmation on the stack information as follows:
for Extensive Retrieval - Ex Situ Vitrification

The HLW plant will have 2 stacks each 180' high located within 20-25' of the East side of the plant.

The LLW plant will have 2 stacks each 180' high located within 20-25' of the East side of the plant.

For the Minimal Retrieval - In Situ Vitrification alternative the following stack information replaces the data in the response page 4 section G. The height of the stack associated with the tank farm confinement facility is assumed to be 100'.

Request Number 053

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Phil Rogers (ESE) Date: 3/21/95

Phone Number: (303)790-0770 Fax Number: (303)790-4411

Request Information: For No Action Capsules please provide: Capsule storage facility location and coordinates. Area (sq meters) of capsule storage facility. Depth of release of contaminates. Contaminant inventory in grams for the year 1995. Ground conditions. When will contaminants be released to the vadose zone.

Need Date: 4/7/95

Response: see attached

Data Source/Accuracy: The data used is from the Cs/Sr capsule data package and additional cc mail messages from WHC.

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

engin\eninfrq.055

Request Information: For No Action Capsules: Please provide:

Capsule storage facility location and coordinates.

Area (M^2) of capsule storage facility.

Depth of release of contaminants.

Contaminant inventory in grams for the year 1995.

Ground conditions, e.g. gravel w/o only,(sic) vegitation.

When will contaminants be released to vadose zone?

Need Date: ASAP (3/23/95)

DATA REQUEST 053

1. The drywell storage facility is approximately 18,000 square meters in area. This is based on 672 drywells on a 5 meter center to center spacing. There is a 30 meter buffer around the drywells so the entire facility is 195 meters x 195 meters or 38,000 square meters in area.

2. Contaminant inventory- see attached calc for details

12/31/95 inventory for cesium and strontium capsules

Cs137= 604,000 grams
Sr90= 162,000 grams

3. Depth of release- The drywells go from the surface of the ground down to a 4.60 meter depth below the surface.

4. The engineering data package indicates that during the period of institutional control there will be vegetation control in the dry well storage facility. So during the 100 year institutional control period the ground in the dry well storage facility will be natural soil with no vegetation. After the 100 year period the area will slowly revert back to being naturally vegitated (assume minimal vegetation).

5. When will contaminates be released- see attached calc for additional detail.
Assume that the capsule storage remains intact for 500 years at which time all remaining inventory is released into the vadose zone 4.6 meters below ground level.

6. At the 500 year mark the remaining inventory per drywell is as follows:

Sr= 0.0044 grams/drywell (200 Sr drywells)
Cs=0.0133 grams/drywell (472 Cs drywells)

7. The decay chains for Cs/Sr are as follows

Cs137-----> Ba137m-------> Ba137(stable)
Sr90--------> Y90----------> Zr90(stable)

the half life of Ba137m is 2.5 minutes
the half life of Y90 is 64 hours

8. The solubility of CsCl and SrF2:

CsCl=1230 g/L

SrF_2=0.11 g/L

9. At the above solubilities the inventory at the 500 year mark get dissolved in the following amount of water.

CsCl=1.35E-5 L of water
SrF_2=0.06 L of water

the estimated volume of water infiltrating a drywell based on 5 cm/yr of water infiltration is 39 liters. At the time of release all of the remaining inventory is released over a very short period.

10. Coordinates of the drywell facility are as follows:

The NW corner of the no action capsule storage facility is at the state coordinates
E 572,336 N 136,277

The drywell storage site will be 195 meters by 195 meters and this includes a 30 meter buffer zone all the way around the dry well area.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 1

BY _____ CHKD. _____ JOB NO. _____

DATA REQ 53

1) CONTAMINANT INVENTORY - TOTAL CURIES

601 Sr CAPSULES @ 23.01 MCi 12/31/94
1328 Cs CAPSULES @ 53.4 MCi 12/31/94

DECAY FROM 1994 TO 1995

$I = I_0 e^{\lambda t}$ $\lambda = \ln \frac{1}{2} / T_{1/2}$ $T_{1/2}$: half life

FOR Cs $I = 53.4\ MCi\ e^{(\ln 1/2 / 30.2)1} = 52.2\ MCi$

FOR Sr $I = 23.01\ MCi\ e^{(\ln 1/2 / 28.6)1} = 22.46\ MCi$

SPECIFIC ACTIVITY OF Cs = 8.64E1 Ci/g
Sr = 1.39E2 Ci/g

CONVERTING TO GRAMS.

$Cs\ 137 = 52.2\ MCi \left(\frac{1 \times 10^6\ Ci}{MCi}\right)\left(\frac{1}{8.64E1\ Ci/g}\right) = 604167\ g$

$Sr\ 90 = 22.46\ MCi \left(\frac{1 \times 10^6\ Ci}{MCi}\right)\left(\frac{1}{1.39E2\ Ci/g}\right) = 161583\ g$

INVENTORY AS OF 12/31/95 IS

Cs137 = 604,000 grams
Sr90 = 162,000 grams

FORM 31-005-1 (4/87)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 2

BY _____ CHKD. _____ JOB NO. _____

- THE DRYWELLS GO FROM the SURFACE OF THE GROUND DOWN TO 4.60 m below ground.

- THE CANISTERS, which are 0.3 m in diameter, will be surrounded by 0.76 m diameter of sand backfill, which is surrounded by natural soil at the storage site. There will be minimal vegetation at the storage site.

- Assume the Capsule Storage remains intact for 500 years at which time all remaining inventory is RELEASED into the vadose zone.

- After 500 yrs.

Inventory is:

$Cs\,137 = 6.27\,g$

$Sr\,90 = 0.88\,g$

- Take a 1 m dia zone of influence for infiltration. a 5.0 cm/yr infiltration Rate.

$$Q = \frac{\pi (1)^2}{4} m^2 \times 0.05\,m = 0.03927\,m^3 \text{ water/yr. per Drywell}$$

which is 39 l of water per year.

There are 672 drywells say 200 Sr Drywells & 472 Cs drywells.

So for Sr 0.88 g / 200 wells = 0.0044 g/drywell

for Cs 6.27 g / 472 drywells = 0.0133 g/drywell

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 3

BY _____ CHKD. _____ JOB NO. _____

Decay Chains

$^{137}Cs \rightarrow {}^{137m}Ba \rightarrow {}^{137}Ba$ (STABLE)

$Sr \rightarrow {}^{90}Y \rightarrow {}^{90}Zr$ (STABLE)

half life ^{90}Y = 64 hours
half life ^{137m}Ba = 2.5 minutes

FROM LANGES Handbook of Chemistry.

SOLUBILITY of CsCl & SrF_2 is as follows.

From Lange CsCl @ 20°C = 186.5 g/100g water = 65%.

SrF_2 @ = 0.011 g/100g = 0.01%.

From Lange pg 10-130 Sp Gr CsCl @ 65% by interpolation = 1.89.

$$\frac{186.5\text{ g CsCl}}{286.5\text{ g soln} \times \frac{\text{ml soln}}{1.89\text{ g soln}} \times \frac{\text{L soln}}{1000\text{ ml soln}}} = 1230\text{ g/L}$$

Since only 0.011 g/100g water is so small for SrF_2 use 0.11 g/L for SOLUBILITY of SrF_2.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 4.

BY _____ CHKD. _____ JOB NO. _____

Remaining inventory per drywell is:

Cs = 0.0133 g/drywell

$CsCl = .0133\ g\ Cs/drywell \times \frac{172\ CsCl}{137\ Cs} = .0167\ g\ CsCl/drywell$

$Sr = 0.0044\ g/drywell \times \frac{128}{90} = 0.0063\ g\ SrF_2/drywell.$

For CsCl $0.0167\ g\ CsCl / 1230\ g/L = 1.35 \times 10^{-5}\ L$ water

SrF_2 $.0063\ g\ SrF_2 / 0.11\ g/L = .06\ L$ water

So at time of release all of the remaining inventory is released over very short period of time.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 5

BY _____ CHKD. _____ JOB NO. _____

THE Remaining inventory of Cs decays to Stable Ba-137.

at the 500 yr mark the inventory of Ba is equal to:

604,000 grams − 6.27 = 604,000 g using 3 sig fig.

Ba: 604 kg.

at the 500 yr mark the inventory of Zr:

162,000 · 0.588 g = 162 kg. Zr.

Zr = 162 kg.

The Ba = 604 kg/472 wells = 1.27 kg/well

Zr = 162 kg/200 = 0.81 kg/well

SOLUBILITY OF Ba $\frac{36\ g\ BaCl_2}{136\ g\ soln \times \frac{ml\ soln}{1.2531} \times \frac{L\ soln}{1000\ mL\ soln}} = 332\ g/L$

infiltration = 39 l/yr.

The Barium at 1.27 kg/well dissolves in the first:

$\frac{1270\ g}{332\ g/L} = 3.8\ L$ of Water

ALL OF the Ba (1.27 kg/drywell) dissolves in ← Ba.
FIRST Year of inventory release (500 yr)

FORM 91-005-1 (4/81)

Request Number 054

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Phil Rogers (ESE) Date: 3/22/95

Phone Number: (303)790-0770 Fax Number: (303)790-4411

Request Information: For No Action Tanks please provide: Date tank domes collapse. Check and verify the time over which mass dissolves and infiltrates the vadose zone.

Need Date: ASAP (3/23/95)

Response: The release concentration will be the same as the post remediation tank flux estimated in EIR 025. The release time will be controled by infiltration rate, release concentration, and inventory. See attached sheet for tank dome collapse dates.

Data Source/Accuracy:

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

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F.3.0 PREDICTED CONTAMINANT CONCENTRATIONS

This section describes the potential impacts to the groundwater aquifer from the TWRS alternatives and subalternatives. The discussion includes the calculated movement of contaminants through the vadose zone and groundwater aquifer. Results are presented for five time periods; 300, 500, 2500, 5000, and 10,000 years from the present for the primary contributor to human health risk, C14, I-129, Tc-99, U-238, and nitrate. Maps are provided for each alternative and subalternative for the periods where the Federal drinking water standards is exceeded.

F.3.1 TANK WASTE - NO ACTION

The No Action alternative would result in the release of the total waste inventory from the 177 tanks into the vadose zone. The contaminants in K_d groups one and two, modeled as K_d equals zero and one, respectively, ultimately pass through the vadose zone and reach the groundwater in the underlying unconfined aquifer within the 10,000-year period of interest. Once in the aquifer, the contaminants in K_d group one move relatively quickly through the aquifer and discharge to the Columbia River. The results of contaminant transport modeling through the vadose zone and groundwater are discussed in the following sections.

F.3.1.1 Vadose Zone

The scenario for this alternative includes the following major assumptions:

- Infiltration is 5.0 cm/year initially and throughout the period of interest.
- Contaminant release for the five SST source areas is assumed to begin at the end of institutional control in the year 2095.
- Contaminant releases from the three DST source areas are assumed to begin 100 years after the end of institutional control in the year 2195.
- The initial unit concentration assumed in modeling for K_d groups one and two (K_d equals zero and one) is 400,000 g/m^3.

For K_d equals zero the vadose modeling results predict contaminant first arrival at the vadose zone/groundwater interface at times varying from 51,000 to 56,000 days (140 to 153 years) for the SSTs and from 85,000 to 93,000 days (233 to 254 years) for the DSTs (Figure F.14). The difference between the first arrival times for the two tank types correspond well to the release scenario assumed for SSTs and DSTs. Peak concentration at the vadose zone/groundwater interface is reached at times varying from 76,000 to 128,000 days (207 to 351 years). Contaminant concentrations from four of the five SST source areas (1WSS, 2WSS, 1ESS, and 4ESS) reach or nearly reach steady-state and the maximum possible (400,000 g/m^3) concentration. The vadose zone in the 200 West Area is generally thinner by 5 to 20 m (16 to 66 ft), compared to that in the 200 East Area. The flatter shape of the peak of the time and concentration curves for the 200 West Area sites compared to the 200 East sites indicate that peak concentrations predicted at the groundwater-vadose zone interface are relatively sensitive to vadose zone thickness. The fifth SST source area, 2ESS, is located in the 200 East Area. First arrival of contaminants from this source area is similar to that from the other SST sources but the peak concentration is much lower at approximately 27,900 g/m^3. This occurs because the contaminant mass and corresponding release period (Table F.12) for the 2ESS source area is generally one or more orders of magnitude less than the other source areas.

Request Information: For No Action Tanks, please provide:

Date tank domes collapse (Marc suggested at end of instit(utional) control.

Check and verify my estimate of time over which mass dissolves and infiltrates vadose zone given an infiltration rate that I will develope.

Need Date: ASAP (3/23/95)

Request Number 055

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 3/20/95

Phone Number: (904) 332-3318 Fax Number: (904) 333-6631

Request Information: Process information and emission rates for the Tanks - Extensive Retrieval TWRS alternative. Please refer to the attached sheet for additional information.

Priority B.

Need Date: 4/7/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

engin\eninfrq.055

6.1.1 55

4/10/95

John Kuhn, ESE

Here are the Engineering Information Requests #55 to #59 which comply with your letter of 3/20/95. In the interests of timeliness we are providing this package on an informal basis. With this in mind, please note that EIR #59 provides a partial answer. The remainder of the reply is dependent on WHC providing in writing the location of the drywell storage facility for the capsules, and clarifying the quantites for SOx. In the same manner, EIR #60 cannot be started until we receive the drywell storage location.

If you have any questions, please give me, Colin Henderson or Jim Goodwin a call.

Dave Murray

DATA REQUEST 055

The attached calculation estimates the concentration and volume of gas released from a selected number of tanks. These VOC emissions are a result of storing the waste in the tanks and are not specifically related to extensive retrieval operations. These emissions can be viewed as on going until the wastes are removed from the tanks.

During the retrieval process an exhauster will be hooked up to the ventilation system of the tank being retrieved. Those tanks that will have waste retrieval operations going on will have active ventilation. This will tend to increase the overall mass of VOC emitted, from both the increased air flow and stirring the wastes up with the sluicer. The increase in mass will be at a significantly lower concentration than that seen in the head space data for tank C-103.

An actively ventilated tank has a ventilation flow rate of 500-1600 cubic meters per hour. The passively vented tank estimate for ventilation flow is 0.33 cubic meters per hour. This represents a 1500-4800 fold increase in air flow from the tank.

Another point is that the wastes have been sitting in the tanks for a number of years and most of the wastes have been through an evaporator, thus the majority of the volatiles have already left the tanks. The VOCs coming out of the tanks now may be decay products of the heavier organics in the tanks.

The following method to estimate the VOC emissions from a tank during retrieval is as follows:

- assume that the mass of VOC emitted from a tank remains constant
- the ventilation flow rate goes from 0.33 cu meter/hr to 4000 cu. meters/hr
- two of the organic tanks get retrieved per year once retrieval operations begin
- to maintain a constant mass emission per tank the concentration of the organic from the C-103 head space data should be ratioed by (0.083/4000) 2.1E-5. This is the annual average volumetric flow from a passively ventilated tank divided by the volumetric flow of an actively ventilated tank.

To estimate organic emissions during evaporator operations, we asked WHC for organic emissions data from 242A evaporator operations (currently operating). WHC replied that organic emissions from the evaporator are not measured but instead are reported based on calculations using the feed stream concentrations. The calculations for recent evaporator runs ar not yet completed, but should be done in the next few weeks.

Using the attached calculation the following table is developed for organic emissions.

Pollutant	Source	Peak Hourly Volume Released (m3/hr)	Annual Average volume of release (m3/yr)	Chronological Phase
see note 1	TF9E (1 tank)	0.33	720	see note 2
"	TF8E (1 tank)	0.33	720	"
"	TF3E (1 tank)	0.33	720	"
"	TF4E (2 tank)	0.66	1450	"
"	TF5W (2 tanks)	0.66	1450	"
"	TF6W (2 tanks)	0.66	1450	"
"	TF1W (1 tank)	0.33	720	"
"	TF3W (2 tanks)	0.66	1450	"
"	TF2W (1 tank)	0.33	720	"
"	TF4W (7 tanks)	2.31	5060	"
see note 3	any source	4000		during retrieval
see note 3	any source	4000		during retrieval

Note 1: The organic compounds and their concentrations are assumed to be those for the mid point data from Tank C-103 head space analysis. (see attached table)

Note 2: These emissions should remain constant until retrieval operations begin in 2003. These emissions should decline approximately 6-7% per year between 2003 and 2015 due to tank retrieval. After 2018 VOC emissions from the tanks should go to zero.

Note 3: At any time during retrieval operations two organic tanks may be subject to retrieval operations. These tanks could come from any two source areas. These tanks will have organic compounds identified in the Tank C-103 headspace analysis. The concentration of these compounds will be ratioed down from the mid point concentrations identified for Tank C-103 by the factor 2.07E-5.

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

TANK FARM	SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
		x coord.	y coord.		
BY	TF1E	573556	137442	200	AREA
BX	TF2E	573556	137282	200	AREA
B	TF3E	573771	137252	200	AREA
C	TF4E	575075	136493	200	AREA
AN	TF5E	575332	136378	205	AREA
AZ	TF6E	575365	136279	205	AREA
AY	TF7E	575281	136157	205	AREA
AX	TF8E	575380	136159	205	AREA
A	TF9E	575310	136015	210	AREA
AW	TF10E	575304	135806	210	AREA
AP	TF11E	575481	135747	210	AREA
T	TF1W	566738	136662	210	AREA
TY	TF2W	566715	136373	210	AREA
TX	TF3W	566689	136146	210	AREA
U	TF4W	566744	135000	205	AREA
S&SY	TF5W	566750	134399	205	AREA
SX	TF6W	566746	134162	205	AREA
	TA1W	566833	136570	210	AREA
	TA2W	566886	134878	205	AREA
	TA3W	566930	134444	205	AREA
	TA1E	573755	137383	200	AREA
	TA2E	575163	136336	200	AREA
SITE C	PROC	573879	135229	215	AREA
	BTCH	571332	135953	225	AREA
	SMIN	574425	135978	215	AREA
	ST-L	574120	135901	215	AREA
	ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. pg 1

BY _____ CHKD. _____ JOB NO. _____

METHOD FOR ESTIMATING VOC Releases:

- Assume all organic emissions come from the 20 organic watch list tanks (>3% TOC)

- Assume that the CONCENTRATION ON ACTIVELY Vented tanks is small and will therefore be neglected. The actual mass of VOC from active ventilated tanks may be higher but concentration should be much lower than passive
- The following are the organic watch list tanks:

A101 (A)	SX103 (A)	U105 (P)
AX102 (P)	SX106 (A)	U106 (P)
B103 (P)	T111 (P)	U107 (P)
C102 (P)	TX105 (P)	U111 (P)
C103 (P)	TX118 (P)	U203 (P)
S102 (P)	TY104 (P)	U204 (P)
S111 (P)	U103 (P)	

(P) = PASSIVELY Vented (A) = ACTIVE VENT

- 17 OUT OF 20 TANKS ARE PASSIVELY VENTED.

- TANK C103 IS ON THE ABOVE LIST AND IS THOUGHT to be an organic tank with some of the highest vapor concentrations (WHC-SD-WM-SARR-011)
- ASSUME OTHER TANKS DO NOT HAVE ANY VOC EMISSIONS.

Approach: Calculate the headspace volume in a typical tank. Assume an atmospheric pressure change and calculate the volume of air exchanged between the tank and the atmosphere. Assume the air coming out of the tanks contains organics at a concentration equal to the midpoint data collected for tank C103 (Ref WHC-SD-WM-SARR-011)

FORM 91-005-1 (4/61)

Volume of Release.

- Tank breaths as a function of atmospheric pressure changes.

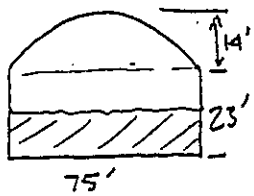
Volume of RELEASE:

$$PV = nRT \quad \text{or} \quad \frac{P_1V_1}{RT_1} = \frac{P_2V_2}{RT_2}$$

- Assume Temp inside the tank remains Constant

$$P_1V_1 = P_2V_2$$

$$V_2 = \frac{P_1V_1}{P_2}$$



Assume tank is ½ full of waste.

Vapor space = ½ tank Capacity + dome Volume.

$$\text{Vapor Space} = \frac{\pi d^2}{4}h + \frac{1}{6}\pi h\left(3(r^2) + h^2\right)$$

$$= \frac{\pi\, 75^2}{4}(11.5) + \frac{1}{6}\pi(14)\left(3(37.5)^2 + 14^2\right)$$

$$\text{Vapor Space} = 50805 + 32360 = 83165\ ft^3$$

$$\text{Vapor Space} = 83165\ ft^3\left(.02832\ m^3/ft^3\right) = 2355\ m^3$$

$$\text{Vapor Space} = 2355\ m^3.$$

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 3

BY _____ CHKD. _____ JOB NO. _____

if $\Delta P = 1/10$ in of Hg $= \frac{1}{10}'' \left(\frac{.4912 \text{ psi}}{\text{in Hg}}\right) = .05$ psi

$$V_2 = \frac{14.7 \text{ psi}}{14.65 \text{ psi}} (V_1) = 1.0034\ V_1$$

$$V_2 = 1.0034 (2355\ m^3) = 2363\ m^3$$

$$\Delta V = 2363 m^3 - 2355 m^3 = 8\ m^3$$

if the ΔP occurs in a 24 hr period

the hourly flow rate is:

$$8\ m^3/24 hr = 0.33\ m^3/hr.$$

this $0.33\ m^3/hr$ should be peak hourly in light of the following.

The hourly emission is:

17 tanks X $0.33\ m^3/hr = 5.6\ m^3/hr$.

Release Volume = $5.6\ m^3/hr$

Release Concentration = mid pt data from attached table

This method estimates an hourly emission rate of .017 Kg VOC/hr. OR 0.4 Kg VOC/24 hr.

WHC OPS DATA ESTIMATES 0.68 Kg VOC emissions for 1995.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 4.

BY _____ CHKD. _____ JOB NO. _____

AT 0.4 kg VOC/day the ANNUAL Emission would be 146 kg VOC/yr.

Since the pressure change will not occur every day conservatively assume that the pressure changes 50% of the time, and half the time air must be going into the tank.

Annual release per tank = 0.33 m^3/hr x 24 hr/day x 365 day/yr x 0.5x0

Annual Release per tank. = 723 m^3/yr/tank

Annual Average Volume flow from tank = .083 m^3/hr.

AS A CHECK OF THE METHOD ESTIMATE ANNUAL VOC EMISSIONS.

$$20 \text{ tanks} \times 723 \frac{m^3 \text{ Headspace gas}}{yr/tank} \times 3080 \, mg/m^3 \times \frac{1 g}{1000 mg} \times \frac{1 kg}{1000 g}$$

= 44.5 kg VOC/yr.

This is Higher than the 0.68 kg VOC/yr emission estimate in the WHC Current Operations data tables.

FORM 91-005-1 (4/81)

TABLE 1. PRELIMINARY DATA FOR C-103 HEADSPACE

CHEMICAL	MAXIMUM DATA POINT (mg/m^3)	MID DATA POINT (mg/m^3)	MINIMUM DATA POINT (mg/m^3)
Acetone	299	77	0.44
Acetonitrile	182	30	0.20
Ammonia	202	202	202
Benzene	21	4.1	0.05
1,3-Butadiene	0.32	0.30	0.22
Butanal	176	7.4*	7.4*
Butanol (n-butyl alcohol)	597	198	0.64
Hexane	187	12	0.50
2-Hexanone (methyl n-butyl ketone)	32	10	0.03
Methylene chloride (dichloromethane)	318	33	0.02
Dodecane	3713	1376	16
Tridecane	4500	1090	82
Propane nitrile	132	29	0.06
Tributylphosphate	302	12	1.3

* The mid and minimum data points for butanal are the same because of the nature of the data and the method used to determine these points.

As new data become available, they should be incorporated into the release consequence calculations. Current Tri-Party Agreement milestones for characterization are as follows (Osborne 1994):

- o M-40-06 Complete vapor sampling and characterization of tank 241-C-103 by August 30, 1994.
- o M-40-08 Complete vapor sampling and characterization of all Organic Watch List tanks by November 1995.
- o M-40-03 Complete vapor sampling and characterization of all Ferrocyanide Watch List tanks by November 1995.

Supp. to EIR
55 & 56.

SUBJECT: IN SITU VITRIFICATION DATA (For 55 see pg 3)

REFERENCE: TELECON WITH JOHN KUHN 4/19/95

In order to model the emissions from the ISV process the following information is needed:

1. Stack height
2. Volumetric flow rate
3. Exit area or exit velocity
4. Temperature
5. Release characteristics (release straight up into the atmosphere)

Information regarding emission of hazardous organics was not included in the reply to the data request. Does this mean that the estimate has not been completed or are the organics destroyed?

In reviewing the In Situ data package I found the following information:

The volumetric flow rate used in calculating the operating radiological emissions in the notes of table 7-6 is 7.6E6 cubic meters/yr/tank.

Page 4-17 of the data package notes that "Routinely, the high temperature in the melt zone would destroy chemical constituents. As backup, the offgas system would remove any organic compounds by two stage combustion. I think it is safe to say that there will be minimal organic emissions.

With regards to the stack information the data package doesn't have any.

I propose the following parameters to use for modeling purposes:

stack height=100'
The TPA stack is 180' high with a 100' vitrification building (stack=1.8 height building)
The tank farm confinement facility is 150' high trusses supporting a 40 foot high solid roof line. Stack could be 1.8*40'=72' which seems short recognizing that there will be some interference from the supporting trusses. Using 100' seems reasonable.

exit velocity=15 meters/second
A recommended range is 14-28 m/sec.

exit temperature=200 deg F (this is a WAG)

volumetric flow rate=4.33 standard cubic meters/second (=9125 scfm). Calculated as

follows- stack flow=(5E5 mt/2.74E5mt)*5000 scfm=9125 scfm, where the 2.74E5 and 5E5 mt are total mass flows from the material balance and 5000scfm is the supply air volumetric flow rate. This flow rate and the exit velocity of 15 m/sec and a temperature of 100 C gives a stack diameter of approx 26".

The above noted number of 7.6E6 cu meters/yr/tank equals 0.24 cu meters/sec(8.5 cfm) which seems to small for gas flow during operation.

release characteristics= release will be straight up into atmosphere

With respect to the peak factor for VOC emissions during retrieval operations:

It would be reasonable to use a peaking factor of 3 for the annual mass emission of VOCs during retrieval operations. This increase will be from mixing the waste up and the resultant aerosol production from operations. If the organic emissions during retrieval will represent a problem from either a regulatory or worker safety standpoint then some type of control device should be used.

The retrieval emissions would then be 3 times the estimated emission during current conditions ie passive ventilation. These emissions will still be diluted by the increased ventilation air as noted in the previous response to data request 55. The ratio used to factor the C103 headspace data would be 3*2.1E-5=6.3E-5. This factor when applied to the concentrations on the C103 table would give concentrations of exhaust during retrieval when the volumetric flow rate will be 4000 std. cubic meters per hour.

The following are specific data requests for the Tanks - Extensive Retrieval TWRS alternative.

1. Analysis of this alternative is nearly complete. However, as requested previously, data concerning the release of volatile organic compounds is required to complete the analysis.

Ideally, the data would be presented in the following format:

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
TF1E	573556	137442	200	AREA
TF2E	573556	137282	200	AREA
TF3E	573771	137252	200	AREA
TF4E	575075	136493	200	AREA
TF5E	575332	136378	205	AREA
TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

Request Number 056

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Request By: John Kuhn Date: 3/20/95

Phone Number: 904-332-3318 Fax Number: 904-333-6631

Request Information: Process information and emission rates for the tanks - Minimal Retrieval TWRS alternative. Please refer to attached sheet for additional information.

Priority A

Need Date: 4/7/95

Response: See attached

Date Source/ Accuracy: In Situ Data Package WHC - SD - WM - EV - 101. Minimal engineering has gone into developing this alternative. Assumption is made to derive some data (peak hourly emission rate).

Prepared By: Michael Chang Date Sent/Faxed:

Concurrence: Mark C. Nelson
Mark Nelson - Deputy Project Manager

REQ_056.DOC

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

ATTACHMENT TO DATA REQUEST 056.

The method used by WHC to calculate Rad emissions during ISV OPERATIONS TREATS ALL RADIONUCLIDES THE SAME. The C14 and I129 WILL GO UP THE STACK During OPERATIONS.

The TPA DATA PACKAGE ASSUMES THE Entire inventory of C14 AND I129 WILL Go up the VITRIFICATION PLANT STACKS. (See TABLE 9-6 attached)

Using this methodology the ISV operating air emissions for C14 and I129 should be as follows:

I129 Inventory = 16 Ci
Annual Emission = 16 ci/9 = 1.8 ci/yr
Peak Emission = 5.7×10^{-4} ci/hr

C14 Inventory 5.3E3 Ci
Annual Emission = 590 Ci/yr
Peak Emission = 0.19 ci/hr

These Emissions for C14 and I129 replace the emissions noted in the body of the response.

FORM 91-005-1 (4/81)

Table 9-6. Radiological Operating Emissions. (Ci)

Radionuclide[1]	Tri-Party Agreement Preferred Alternative	
	Air[2]	Water[3]
^{241}Am	5.3E-02	4.2E-4
^{14}C	5.3E+03	n/a[4]
^{137}Cs	2.5E+01	6.9E-2
^{129}I	1.6E+01	3.5E-4
$^{239,240}Pu$	1.7E-02	4.2E-4
^{106}Ru	1.9E-08	1.0E-2
^{151}Sm	3.2E-01	NA
^{90}Sr	2.7E+01	2.8E-3
^{99}Tc	1.6E-02	n/a
^{93}Zr	1.8E-01	n/a
%PM-10[5]	2.67E-01	- -[6]

Notes:

[1]All values in Ci except for % PM-10 which is in metric tonnes

[2]Air values taken from material balances (Streams 907 and 917 in Appendix A)

[3]Water values are based on effluent streams from both Pretreatment/low-level waste (LLW) and high-level waste (HLW) flowsheets (Streams 807 and 802 respectively) and design basis for Liquid Effluent Treatment Facility (LETF) C-018. Yearly flowrates of these streams were calculated. Engineering judgement set the total amount of effluent to be processed by the LETF equal to 20% of the flow for all but one year of operation. For the last year, 100% was to be processed. The composition of the effluent was assumed to be comparable to the feed set in the design basis. Therefore the concentrations of radionuclides/chemicals in the discharge in the design sheet equals what the discharge would be for the process effluent.

Request Number: 56 By: John Kuhn (ESE) @ (904)332-3318 Date: 3/20/95 TWRS EIS (01-K471-01) Responded By: Michael Chang @ (818)568-7173

Item # Request Information	Alternative- Minimal Retrieval (In-Situ Vitrification) Responses	Source of Responses
1. Description of the processes (including construction activities) indicating their nature/location	In situ disposal is defined as disposal of tank waste within existing SSTs and DSTs, it would leave all waste in place. All salt well pumping will be completed by the year 2000 before in-situ disposal would begin. Approximately 20,000 cubic meters of liquid will be jet pumped from the SSTs and placed in the DSTs during the salt well pumping process. In situ vitrification (ISV) would use joule heating to melt waste in place into a single block of glass. Hanford sand would serve as the glass former. The stability of the melt would reduce the rate of radionuclide release to the environment. The hazardous waste is immobilized in the tank system at closure. The ISV consist of:	Section 2.0 Section 3.0 Section 4.1 Fig. 4-1 Section 4.2
	Process / Location	
	a. Send all pumpable liquid from DSTs to the 242-A Evaporator @ vicinity of A-Tanks	
	b. Construct tank farm confinement facilities @ vicinity of 18 tank farms	Fig. 4-3
	c. Fill tank voids with Hanford Site sand sand excavated from Pit 30(200E-200W)	
	d. Vitrification @ 177 underground tanks	Fig. 4-2
	e. Install Barriers @ 18 tank farms	
	Assuming (4) ISV systems would be used with at least (2) in continuous operation, vitrification of all 177 tanks would be completed within 5 years.	Section 4.2.3.2
	The final step of in situ would be the installation of infiltration barriers to mark the vitrified site and prevent intrusion. The closure barrier would be horizontal, slightly abovegrade, engineered structures whose function would be to provide isolation of the waste site from the accessible environment.	Section 4.2.4
2. Emissions of all regulated pollutants from each of the processes in: peak hourly and average annual emissions. Also assign emissions to 27 identified sources locations per Washington State Coordinates grid system used by ASI.	See Table 56-A listed below.	
3. A chronological description of the processes and emissions and numbers of stacks	a. The only construction required for ISV would be that of TFCF.	Section: 4.2.3.1
	b. No construction would be necessary for sand excavation because it was assumed that excavating and crushing equipment would already be in place from other contracts.	
	c. Construction would run from Year 1998 to Year 2016. Operation: Year 2005 to 2016	

d. Vitrification process is in sequence: from tanks to tanks within a tank farm; then from tank farm to tank farm.
e. Construction of TFCF adjacent to a tank farm would precede operation of that tank farm.
f. Emissions from Construction/Operation are listed below: Table 56-A.
g. One stack for each TFCF. One TFCF for each tank farm. There will be a total of eighteen (18) stacks. However, only one stack will release pollutant at a given time. Fig. 4-2

Table 56-A Emissions from In-Situ Vitrification Alternative

Pollutant	Type Pollutant	Grand Total Pollutant	Source ID (Note 1)*	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronological Phase	Source of Data (Note 2)* (Note 3)*
Particulate (kg)	Nonradiological	6.1 E7	TF(1-10)E, TF(1-6)W	2.2 E3	3.4 E6	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Sox (kg)	Nonradiological	7.8 E7	TF(1-10)E, TF(1-6)W	2.8 E3	4.3 E6	Construction	Table 7-10 Table 7-26 (1998 - 2016)
CO (kg)	Nonradiological	3.4 E9	TF(1-10)E, TF(1-6)W	1.2 E5	1.9 E8	Construction	Table 7-10 Table 7-26 (1998 - 2016)
HCs (kg)	Nonradiological	2.5 E8	TF(1-10)E, TF(1-6)W	9.0 E3	1.4 E7	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Nox (kg)	Nonradiological	6.2 E8	TF(1-10)E, TF(1-6)W	2.2 E4	3.4 E7	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Aldehydes (kg)	Nonradiological	1.8 E7	TF(1-10)E, TF(1-6)W	6.5 E2	1.0 E6	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Organic acids (kg)	Nonradiological	4.0 E6	TF(1-10)E, TF(1-6)W	1.4 E2	2.2 E5	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Thermal release (J)	Nonradiological	1.2 E18	TF(1-10)E, TF(1-6)W	4.3 E13	6.7 E16	Construction	Table 7-10 Table 7-26 (1998 - 2016)
Particulate (kg)	Nonradiological	< 1 E3	TF(1-10)E, TF(1-6)W	4.5 E-2	< 1.1 E2	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
Sox (kg)	Nonradiological	0	TF(1-10)E, TF(1-6)W	0	0	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
CO (kg)	Nonradiological	0	TF(1-10)E, TF(1-6)W	0	0	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
HCs (kg)	Nonradiological	< 1.1 E1	TF(1-10)E, TF(1-6)W	5.0 E-4	< 1.2	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)

Nox (kg)	Nonradiological	< 3.6 E5	TF(1-10)E, TF(1-6)W	1.6 E1	< 4 E4	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
Aldehydes (kg)	Nonradiological	0	TF(1-10)E, TF(1-6)W	0	0	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
Organic (kg) Acids	Nonradiological	0	TF(1-10)E, TF(1-6)W	0	0	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
Thermal releases (J)	Nonradiological	1.6 E16	TF(1-10)E, TF(1-6)W	7.2 E11	1.7 E15	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
NH3 (kg)	Nonradiological	5.6 E4	TF(1-10)E, TF(1-6)W	2.5	6.2 E3	Operation	Table 7-5 (Footnote 1,4)* Table 7-25 (2005 - 2016)
241 Am (Ci)	Radiological	9.4 E-6	TF(1-10)E, TF(1-6)W	4.3 E-10	1.04 E-6	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
14 C (Ci)	Radiological	4.8 E-7	TF(1-10)E, TF(1-6)W	2.2 E-11	5.3 E-8	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
137 Cs (Ci)	Radiological	3.1 E-3	TF(1-10)E, TF(1-6)W	1.4 E-7	3.4 E-4	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
129 I (Ci)	Radiological	1.4 E-9	TF(1-10)E, TF(1-6)W	6.3 E-14	1.6 E-10	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
239, 240 Pu (Ci)	Radiological	3.0 E-6	TF(1-10)E, TF(1-6)W	1.4 E-10	3.3 E-7	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
106 Ru (Ci)	Radiological	3.4 E -12	TF(1-10)E, TF(1-6)W	1.5 E-16	3.8 E-13	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
151 Sm (Ci)	Radiological	5.7 E-5	TF(1-10)E, TF(1-6)W	2.6 E-9	6.3 E-6	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
90 Sr (Ci)	Radiological	4.8 E-3	TF(1-10)E, TF(1-6)W	2.2 E-7	5.3 E-4	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
99 Tc (Ci)	Radiological	2.9 E-6	TF(1-10)E, TF(1-6)W	1.3 E-10	3.2 E-7	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
241 Zr (Ci)	Radiological	3.5 E-7	TF(1-10)E, TF(1-6)W	1.6 E-11	3.9 E-8	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)
% PM-10^5	Radiological	100%	TF(1-10)E, TF(1-6)W	100%	100%	Operation	Table 7-6 (Footnote 1,4)* Table 7-25 (2005 - 2016)

***Notes:**

1. Those presented under "Source ID" represent the 18 tank farms at 200 E and 200 W. The sequence of the tank farm operation/construction (chronologic phase) is not determined at this time. The tank farm area as a whole is the emission source. See the attached Table 5.3.1 and the map for the tank farm locations/coordinates/and elevations.
2. The operating life including startup and decontamination/decommissioning used to derive annual average emission rate is based on 9 years. [startup = 3 yrs (2005-2008) = 2 equivalent operating years; decontamination/decommissioning = 3 years (2013-2016) = 2 equivalent operating years)
3. Construction phase (1998-2016) and operation phase (2005-2016) are chronologically overlapping (2005-2016). The emission rates are additive for the annual average emission rates during the overlapping years.

Assumptions:

1. The peak hourly emission rate is based on the following assumptions:
   a. Construction hours are based on 10 average hours/day ,5 days/week, six(6) holidays/year. Construction hours = 1550 hours/year.
   b. Operation hours are based on 60 % operating efficiency. Also the additional 40% margin applicable to the "No Separation Alternative" will be assumed. In addition, the nine (9) operating years will be shorten to seven (7) years because the startup and decontamination/decommissioning are assumed half of the full operation emission rate. Operation hours = 24 x 365 x 60% x 60% = 3154 (hours/year)

Attachments:

1. "Tank Farm Locations within the Hanford Site" on Page 5 -- from WHC-SD-WM-TI-648 REV 0 Figure 4-1
2. "Source Types and Locations" on Page 6 -- Table 5.3.1
3. "In Situ Vitrification Flow Diagram" on Page 7 -- from WHC-SD-WM-EV-101 Rev. B Figure 4-1
4. "In Situ Vitrification Facility Layout (1 of 5)" on Page 8 -- from WHC-SD-WM-EV-101 Rev. B Figure 4-2
5. "Tank Farm Confinement Facility (Sheet 1 of 3)" on Page 9 -- from WHC-SD-WM-EV-101 Rev. B Figure 4-3

Figure 4-1. Tank Farm Locations within the Hanford Site. (Brevick et al., 1994a)

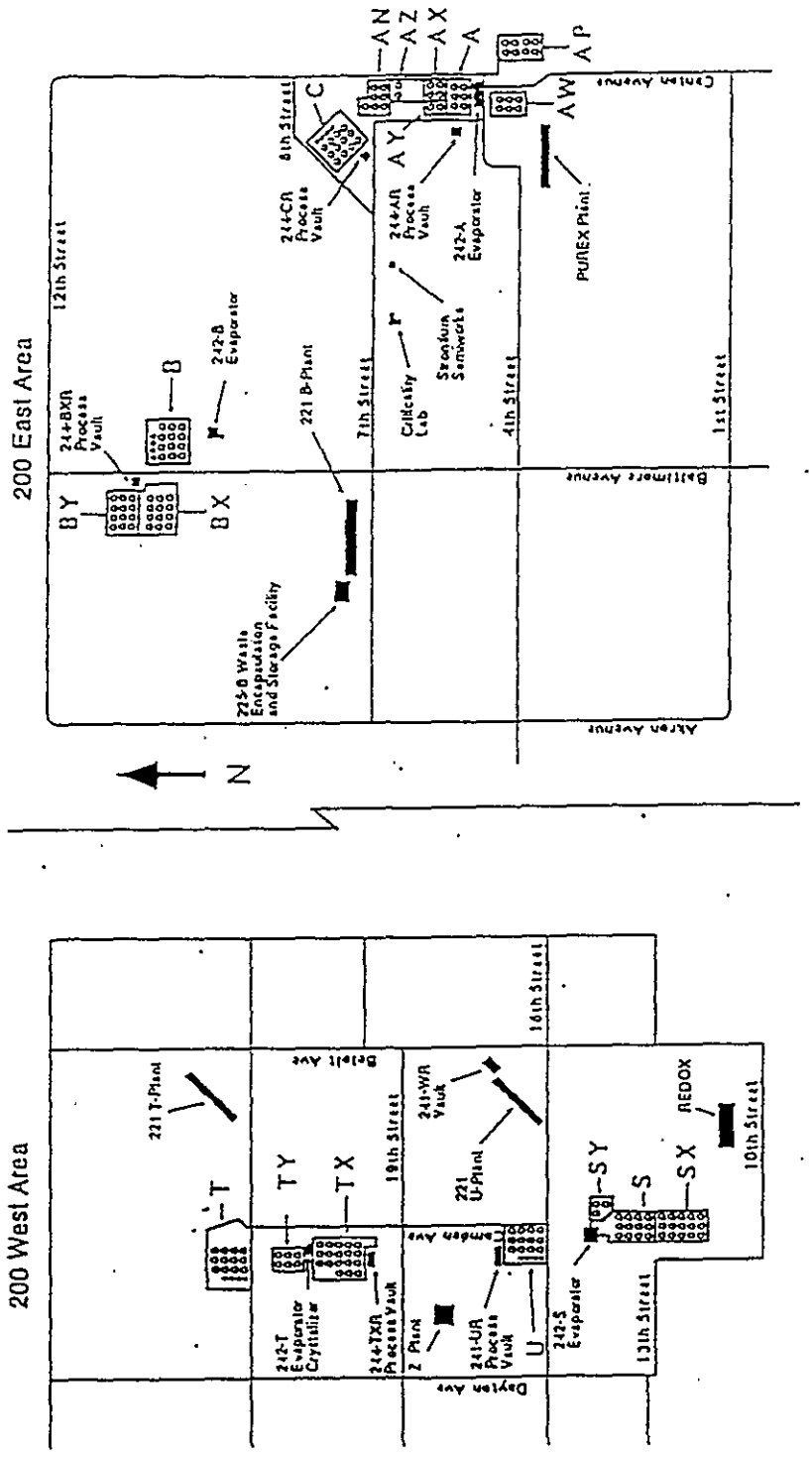


TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

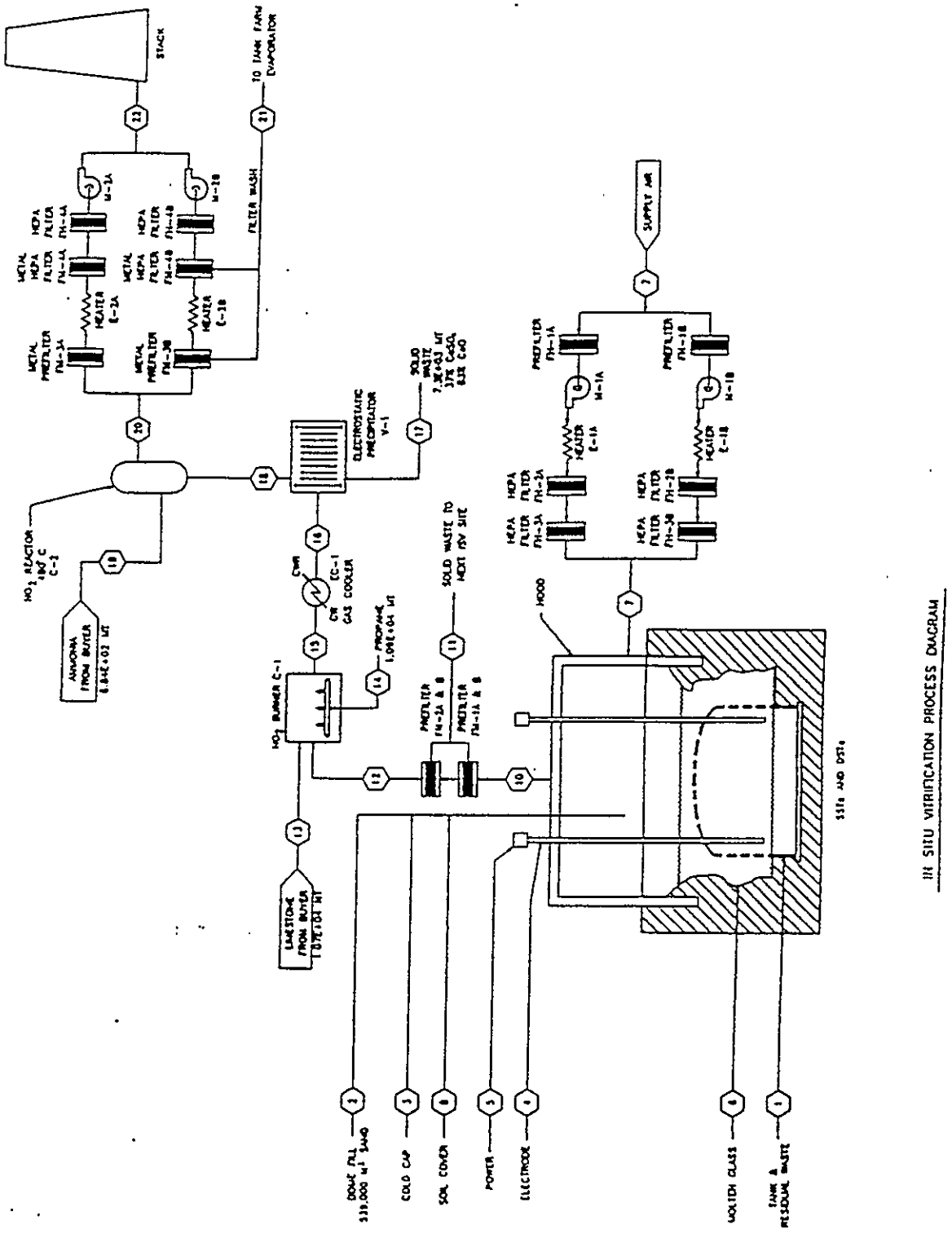
TANK FARM	SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
		x coord.	y coord.		
BY	TF1E	573556	137442	200	AREA
BX	TF2E	573556	137282	200	AREA
B	TF3E	573771	137252	200	AREA
C	TF4E	575075	136493	200	AREA
AN	TF5E	575332	136378	205	AREA
AZ	TF6E	575365	136279	205	AREA
AY	TF7E	575281	136157	205	AREA
AX	TF8E	575380	136159	205	AREA
A	TF9E	575310	136015	210	AREA
AW	TF10E	575304	135806	210	AREA
AP	TF11E	575481	135747	210	AREA
T	TF1W	566738	136662	210	AREA
TY	TF2W	566715	136373	210	AREA
TX	TF3W	566689	136146	210	AREA
U	TF4W	566744	135000	205	AREA
S&SY	TF5W	566750	134399	205	AREA
SX	TF6W	566746	134162	205	AREA
	TA1W	566833	136570	210	AREA
	TA2W	566886	134878	205	AREA
	TA3W	566930	134444	205	AREA
	TA1E	573755	137383	200	AREA
	TA2E	575163	136336	200	AREA
SITE C	PROC	573879	135229	215	AREA
	BTCH	571332	135953	225	AREA
	SMIN	574425	135978	215	AREA
	ST-L	574120	135901	215	AREA
	ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

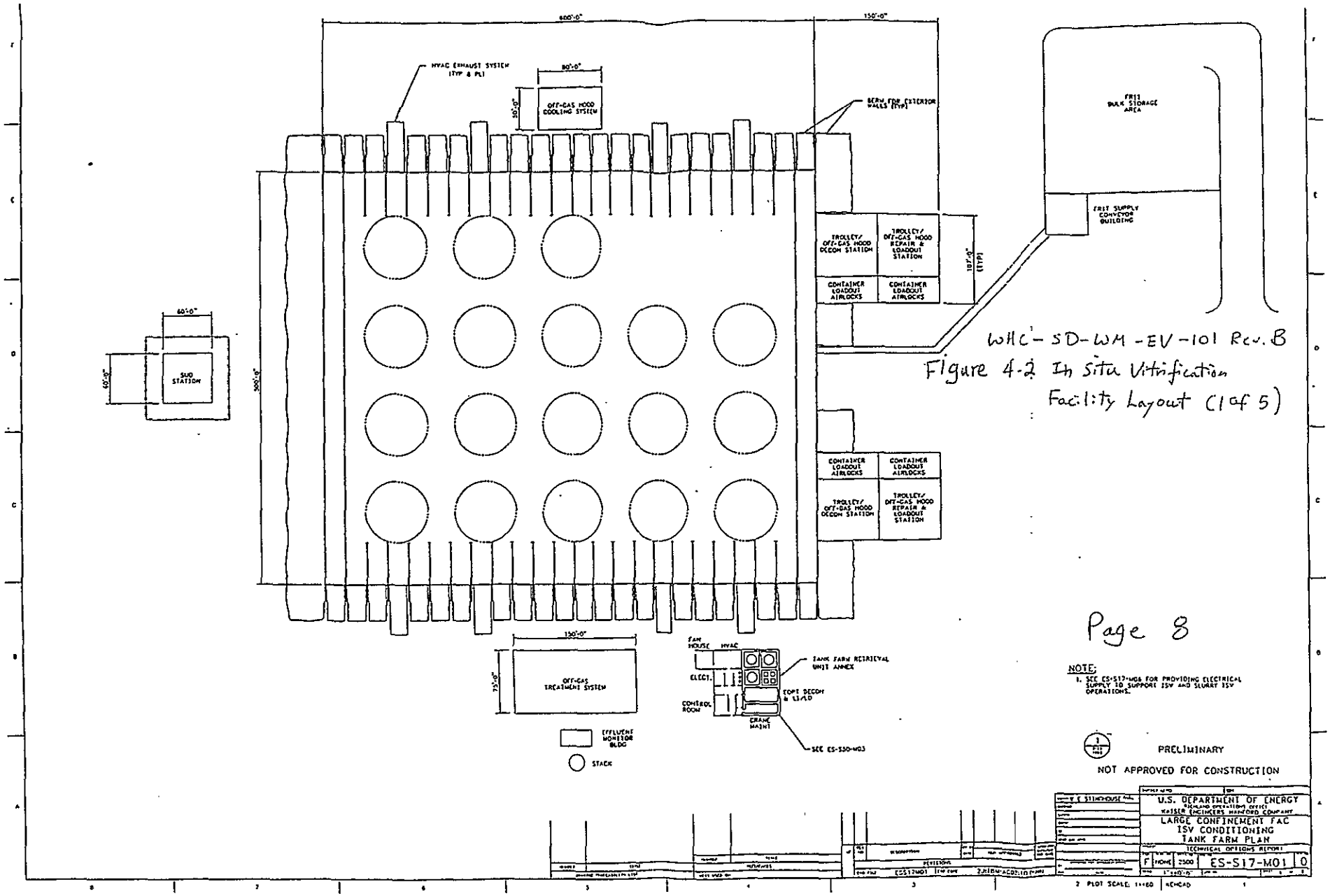
PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

Figure 4-1. In Situ Vitrification Flow Diagram.



Page 7

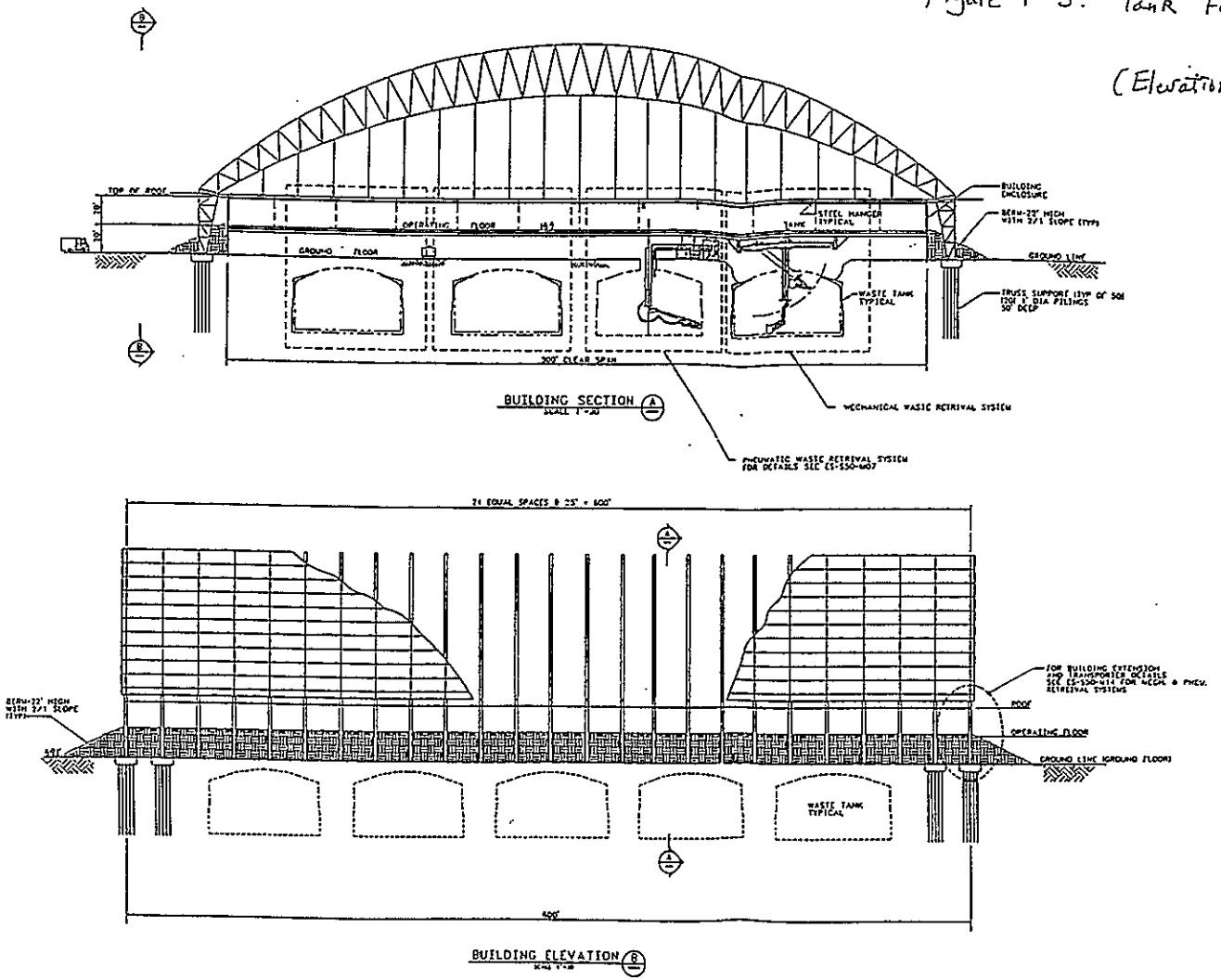


WHC-SD-WM-EV-101 Rev. B

Figure 4-2 In Situ Vitrification Facility Layout (1 of 5)

Page 8

Figure 4-3. Tank Farm Confinement Facility
(Sheet 1 of 3)
(Elevation and Section)



Page 9

PRELIMINARY
NOT APPROVED FOR CONSTRUCTION

U.S. DEPARTMENT OF ENERGY
KAISER CONTRACTORS MANAGED COMPANIES
LARGE CONFINEMENT FAC
STRUCTURAL
ELEVATION & SECTION
TECHNICAL OPTIONS REPORT
ES-S50-M02 0

Supp. to EIR
55 & 56.
(For 55 see pg 3)

SUBJECT: IN SITU VITRIFICATION DATA

REFERENCE: TELECON WITH JOHN KUHN 4/19/95

In order to model the emissions from the ISV process the following information is needed:

1. Stack height
2. Volumetric flow rate
3. Exit area or exit velocity
4. Temperature
5. Release characteristics (release straight up into the atmosphere)

Information regarding emission of hazardous organics was not included in the reply to the data request. Does this mean that the estimate has not been completed or are the organics destroyed?

In reviewing the In Situ data package I found the following information:

The volumetric flow rate used in calculating the operating radiological emissions in the notes of table 7-6 is 7.6E6 cubic meters/yr/tank.

Page 4-17 of the data package notes that "Routinely, the high temperature in the melt zone would destroy chemical constituents. As backup, the offgas system would remove any organic compounds by two stage combustion. I think it is safe to say that there will be minimal organic emissions.

With regards to the stack information the data package doesn't have any.

I propose the following parameters to use for modeling purposes:

stack height=100'
The TPA stack is 180' high with a 100' vitrification building (stack=1.8 height building)
The tank farm confinement facility is 150' high trusses supporting a 40 foot high solid roof line. Stack could be 1.8*40'=72' which seems short recognizing that there will be some interference from the supporting trusses. Using 100' seems reasonable.

exit velocity=15 meters/second
A recommended range is 14-28 m/sec.

exit temperature=200 deg F (this is a WAG)

volumetric flow rate=4.33 standard cubic meters/second (=9125 scfm). Calculated as

follows- stack flow=(5E5 mt/2.74E5mt)*5000 scfm=9125 scfm, where the 2.74E5 and 5E5 mt are total mass flows from the material balance and 5000scfm is the supply air volumetric flow rate. This flow rate and the exit velocity of 15 m/sec and a temperature of 100 C gives a stack diameter of approx 26".

The above noted number of 7.6E6 cu meters/yr/tank equals 0.24 cu meters/sec(8.5 cfm) which seems to small for gas flow during operation.

release characteristics= release will be straight up into atmosphere

With respect to the peak factor for VOC emissions during retrieval operations:

It would be reasonable to use a peaking factor of 3 for the annual mass emission of VOCs during retrieval operations. This increase will be from mixing the waste up and the resultant aerosol production from operations. If the organic emissions during retrieval will represent a problem from either a regulatory or worker safety standpoint then some type of control device should be used.

The retrieval emissions would then be 3 times the estimated emission during current conditions ie passive ventilation. These emissions will still be diluted by the increased ventilation air as noted in the previous response to data request 55. The ratio used to factor the C103 headspace data would be 3*2.1E-5=6.3E-5. This factor when applied to the concentrations on the C103 table would give concentrations of exhaust during retrieval when the volumetric flow rate will be 4000 std. cubic meters per hour.

SUPPLEMENT TO ENGINEERING INFORMATION REQUEST 56

Revised data from WHC for the In Situ alternative relative to construction emissions was received 5/3/95. The revised data replaces earlier construction emission data for the ISV alternative. The new data is as follows:

Nonradiological Construction Emissions

Pollutant	Total Emission	Source ID	Peak hourly emission	Annual Average Emission
Particulate (kg)	6.2E4	see note 1	3.4 kg/hr	3.4E3 kg/yr
SOx (kg)	7.9E4	"	4.4 kg/hr	4.4E3 kg/yr
CO (kg)	3.5E6	"	190 kg/hr	1.9E5 kg/yr
Hydrocarbons (kg)	2.9E5	"	16 kg/hr	1.6E4 kg/yr
Nox (kg)	6.3E5	"	35 kg/hr	3.5E4 kg/yr
Aldehydes (kg)	1.8E4	"	1 kg/hr	1E3 kg/yr
Organic acids (kg)	4.0E3	"	.22 kg/hr	2.2E2 kg/yr
Thermal releases (J)	1.5E15	"	8.3E10 J/hr	8.3E13 J/yr

Note the source for the construction emissions is from any one of the tank farm source areas TF(1-10)East, and/or TF(1-6)West.

Peak hourly emission rates are based on 1yr/365days X 1day/8hours X 3 (peak factor). Annual emission rates are based on a construction duration of 18 years.

To: John Kuhn

From: Colin Henderson

Subject: Extensive Retrieval - Ex Situ Vitrification Alternative Stack Emission Estimates

Date: 5/1/95

Reference: Engineering Information Request 9, Engineering Information Request 42 (ASI)

Attached are the operating emissions from the HLW and LLW vitrification plants. Differences between the current emission estimates and previous estimates are due to updated model runs from WHC using the latest inventory, changes in some of the flow rates of the streams going up the stack (affects concentration), addition of C14 and I129 into the spread sheet per the material balance for separations. The C14 does not show up in the material balance streams exiting the stack.

The gas flow rates for the stacks will be higher than current estimates due to the lack of detail in the data available. For example, streams 903 and 911 for both the HLW and LLW plant are not modeled in the material balance. A review of the equipment list in the data package shows:

LLW Stream 903 blower with 1000 scfm capacity
LLW Stream 911 blower with 22,000 scfm capacity

The gas flow rates for the HLW plant will be lower because the flow sheet and material balance in the Rev B data package continues to show a fuel fired melter with combustion air supplied by 100% oxygen.

TPA STACK STREAMS

SEPARATIONS AND LLW VITRIFICATION

STREAMS
907=702+706+434+522+645+903
917=911+914
factor=(200 mt/day/3.87E5)*91.8583lb/hr=4.747E-2

	702	706	434	522	645	903	sum of streams	907
MT gas	1.39E+04	0	2.78E+06	0	2.61E+05	0		3.05E+06
MT solid	0	0	1.94E-03	0	1.55E-04	0		1.05E-06
Total MT	1.39E+04	0.00E+00	2.78E+06	0.00E+00	2.61E+05	0.00E+00	3.05E+06	3.05E+06
Factor	4.75E-02	4.75E-02	4.75E-02	4.75E-02	4.75E-02	4.75E-02		4.75E-02
mass flow rate (lb/hr)	659.833	0	131966.6	0	12389.67	0		144783.5
molecular weight	27.63	28.26	28.76	28.76	37.61			29.5
temperature deg F	177	130	438	442	150			420.4278
flow scfm	153.187		29433.64	0	2113.125		31699.95	31482.25

HLW STREAMS

TPA HLW STREAMS	702	706	340	522	645	903		907
MT gas	7.19E+02	0	1.80E+05	0	2.09E+04	0		2.02E+05
MT solid	0	0	1.26E-04	0	9.89E-06	0		6.78E-08
Total MT	7.19E+02	0.00E+00	1.80E+05	0.00E+00	2.09E+04	0.00E+00	2.02E+05	2.02E+05
Factor	7.32E-02	7.32E-02	7.32E-02	7.32E-02	7.32E-02	7.32E-02		7.32E-02
mass flow rate (lb/hr)	52.6308	0	13176	0	1529.88	0		14786.4
molecular weight	27.63	28.26	28.75	28.75	38.13			29.66229
Temperature deg F	180	130	447	447	150			423.7172
flow scfm	12.21878	0	2939.778	0	257.3708		3209.367	3197.618

Note: the 150 deg F temp for streams 917 (both HLW and LLW) is a best estimate, no data was provided

TPA STACK STREAMS

SEPARATIONS AND LLW VITRIFICATION

STREAMS
907=702+706+434+522+645+903
917=911+914
factor=(200 mt/day/3.87E5)*91.8583lb/hr=4.747E-2

	911	914	917	total flow 907+917 scfm	total flow acfm
MT gas	0	4.87E+05	4.87E+05		
MT solid	0	3.92E+02	1.96E-01		
Total MT	0.00E+00	4.87E+05	4.87E+05		
Factor	4.75E-02	4.75E-02	4.75E-02		
mass flow rate (lb/hr)	0	23136.5	23117.9	167901.40	
molecular weight	29	29	29		
temperature deg F			150	382.64	
flow scfm		5117.624	5113.51	36595.76	58404

TPA HLW STREAMS	911	914	917		
MT gas	0	3.16E+04	3.16E+04		
MT solid	0	2.54E+01	1.27E-02		
Total MT	0.00E+00	3.16E+04	3.16E+04		
Factor	7.32E-02	7.32E-02	7.32E-02		
mass flow rate (lb/hr)	0	2314.979	2313.121	17099.52	
molecular weight	29	29	29		
Temperature deg F			150	385.96	
flow scfm	0	512.06	511.65	3709.26	5943

HIGH LEVEL Emissions

TPA HLW stack flows								
LIQUID COMPONENTS								
	Regulated	stream						
		907	917	totals mt	ANNUAL AVE	24 hour avg.	peak hourly	peak conc.
VOLUME					TOTAL/23 year	ann ave/219	(daily ave/24)x2.6	peak hrly/stack flow
SP. GRAVITY				metric tons	kg/year	kg/ 24 hr	kg/hr	grams / cubic meter
Cs and Ba,(MCi)								
Sr and Y, (MCi)								
Tc, (MCi)								
Am, (MCi)								
Np, (MCi)								
Pu-239, (MCi)								
Pu-240, (MCi)								
Pu-241, (MCi)								
TRU, (MCi)								
Total MCi								
Total Mass Flow,(MT)		2.02E+05	3.16E+04	233600	1.02E+07	4.64E+04	5.02E+03	4.98E+02
Total Cr, (MT)								
Total Na, (MT)	WAC-460-160							
Total Si,(MT)	PP							
Total P, (MT)								
Total NO2-, (MT)								
Total NO3-, (MT)								
Ag+	WAC-460-130							
Al(OH)4-	WAC-460							
Am+3								
As+5	WAC-460							
B+3								
Ba+2	WAC-460 ?							
Be+2	40CFR/WAC460							
Bi+3								
C 14				4.54E-04	1.97E-02	9.01E-05	9.76E-06	9.67E-07
Ca+2								
Cd+2	WAC-460-130							
Ce+3								

Cl-								
Cl2	WAC-460-160	4.17E+00		4.17	1.81E+02	8.28E-01	8.97E-02	8.88E-03
CO	WAC-460-160	2.03E+02		203	8.83E+03	4.03E+01	4.37E+00	4.32E-01
CO2	WAC-460-160	1.69E+04		16900	7.35E+05	3.36E+03	3.63E+02	3.60E+01
CO3-2	WAC-460-160							
Cr(OH)4-	WAC-460-160							
Cs+								
Cu+2	WAC-460-160							
F-								
F2	WAC-460-160	6.21E+01		62.1	2.70E+03	1.23E+01	1.34E+00	1.32E-01
Fe+3								
H2								
H2O		3.14E+03		3140	1.37E+05	6.23E+02	6.75E+01	6.69E+00
H2S	WAC							
Hg	WAC-460-160							
Hg+2	WAC							
I-								
I2	WAC-460	2.14E+01		21.4	9.30E+02	4.25E+00	4.60E-01	4.56E-02
K+								
Kerosene								
La+3								
Li+								
Mg+2								
MnO2	WAC-460-160							
Mo+6								
N2		1.42E+05	2.50E+04	167000	7.26E+06	3.32E+04	3.59E+03	3.56E+02
Na+								
NH3	WAC-460-160	1.83E+01		18.3	7.96E+02	3.63E+00	3.94E-01	3.90E-02
Ni+3	WAC-460-130							
NO	PP	9.98E-02		0.0998	4.34E+00	1.98E-02	2.15E-03	2.13E-04
NO2	PP	4.28E+00		4.28	1.86E+02	8.50E-01	9.21E-02	9.12E-03
NO2-								
NO3-								
Np+4								
O2		3.95E+04	6.63E+03	46130	2.01E+06	9.16E+03	9.92E+02	9.82E+01
OH-								
Pb+4	WAC/40CFR							

PO4-3								
POLY								
Pu+4								
S								
Si+4								
SO2	PP	4.60E+00		4.6	2.00E+02	9.13E-01	9.89E-02	9.80E-03
SO4-2								
Sr+2								
S								
TcO2								
TcO4-								
TOC								
UO2+2	WAC-460							
V+5								
W+6	WAC460							
ZN+2								
Zr=4								
ZRO2:2H2O								
SOLIDS COMPONENTS								
Cs and Ba,(MCi)		1.69E-10	3.41E-05	3.41E-05	1.48E-03	6.77E-06	7.33E-07	7.26E-08
Sr and Y, (MCi)		2.64E-10	5.33E-05	5.33E-05	2.32E-03	1.06E-05	1.15E-06	1.14E-07
Tc, (MCi)		1.48E-14	2.99E-09	2.99E-09	1.30E-07	5.94E-10	6.43E-11	6.37E-12
Am, (MCi)		2.38E-13	4.81E-08	4.81E-08	2.09E-06	9.55E-09	1.03E-09	1.02E-10
Np, (MCi)		2.32E-16	4.70E-11	4.7E-11	2.04E-09	9.33E-12	1.01E-12	1.00E-13
Pu-239, (MCi)		6.17E-14	1.25E-08	1.25E-08	5.43E-07	2.48E-09	2.69E-10	2.66E-11
Pu-240, (MCi)		1.57E-14	3.18E-09	3.18E-09	1.38E-07	6.31E-10	6.84E-11	6.77E-12
Pu-241, (MCi)		1.83E-13	3.71E-08	3.71E-08	1.61E-06	7.37E-09	7.98E-10	7.90E-11
TRU, (MCi)		4.99E-13	1.01E-07	1.01E-07	4.39E-06	2.01E-08	2.17E-09	2.15E-10
Total MCi		4.33E-10	8.75E-05	8.75E-05	3.80E-03	1.74E-05	1.88E-06	1.86E-07
Total Mass Flow,(MT)		6.78E-08	1.27E-02	0.0127	5.52E-01	2.52E-03	2.73E-04	2.70E-05
Total Cr, (MT)		9.91E-11	2.00E-05	2E-05	8.70E-04	3.97E-06	4.30E-07	4.26E-08
Total Na, (MT)	WAC-460-160	6.29E-09	1.18E-03	0.00118	5.13E-02	2.34E-04	2.54E-05	2.51E-06
Total Si,(MT)	PP	1.57E-08	2.95E-03	0.00295	1.28E-01	5.86E-04	6.34E-05	6.28E-06
Total P, (MT)		7.33E-10	1.37E-04	0.000137	5.96E-03	2.72E-05	2.95E-06	2.92E-07
Total NO2-, (MT)								
Total NO3-, (MT)								

Ag+								
Ag2O		3.70E-12	7.48E-07	7.48E-07	3.25E-05	1.49E-07	1.61E-08	1.59E-09
Al+3								
Al2O3		4.68E-09	8.76E-04	0.000876	3.81E-02	1.74E-04	1.88E-05	1.87E-06
Am+3								
Am2O3		7.62E-14	1.54E-08	1.54E-08	6.70E-07	3.06E-09	3.31E-10	3.28E-11
As+5	WAC							
As2O5		1.92E-12	3.88E-07	3.88E-07	1.69E-05	7.70E-08	8.34E-09	8.26E-10
B+3								
B2O3	WAC-460-160	4.75E-09	8.89E-04	0.000889	3.87E-02	1.76E-04	1.91E-05	1.89E-06
Ba+2	?							
BaO	WAC	8.63E-12	1.76E-06	1.76E-06	7.65E-05	3.49E-07	3.79E-08	3.75E-09
Be+2	40CFR/WAC							
BeO		5.40E-14	1.09E-08	1.09E-08	4.74E-07	2.16E-09	2.34E-10	2.32E-11
Bi+3								
Bi2O3		5.47E-10	1.11E-04	0.000111	4.83E-03	2.20E-05	2.39E-06	2.36E-07
C 14								
Ca+2								
CANCRINITE								
CaO	WAC-460-160	5.11E-10	9.57E-05	9.57E-05	4.16E-03	1.90E-05	2.06E-06	2.04E-07
Cd+2	WAC-460-130							
CdO		2.27E-11	4.58E-06	4.58E-06	1.99E-04	9.09E-07	9.85E-08	9.75E-09
Ce+3								
Ce2O3		7.44E-10	1.39E-04	0.000139	6.04E-03	2.76E-05	2.99E-06	2.96E-07
Cl-								
CO3-2								
Cr+3	WAC-460-160							
Cr2O3		1.45E-10	2.93E-05	2.93E-05	1.27E-03	5.82E-06	6.30E-07	6.24E-08
Cs+								
Cs2O		2.40E-12	4.84E-07	4.84E-07	2.10E-05	9.61E-08	1.04E-08	1.03E-09
Cu	WAC-460-160							
Cu+2	WAC-460-160							
CuO		2.34E-12	4.72E-07	4.72E-07	2.05E-05	9.37E-08	1.02E-08	1.01E-09
CuSO4								
F-	WAC							
Fe+3								
Fe2O3	WAC-460-160	3.27E-09	6.13E-04	0.000613	2.67E-02	1.22E-04	1.32E-05	1.31E-06

Hg+2	WAC-460-160							
I-	WAC ?							
K+								
K2O		6.32E-11	1.28E-05	1.28E-05	5.57E-04	2.54E-06	2.75E-07	2.73E-08
La+3								
La2O3		6.16E-11	1.25E-05	1.25E-05	5.43E-04	2.48E-06	2.69E-07	2.66E-08
Li+								
Li2O		1.36E-09	2.54E-04	0.000254	1.10E-02	5.04E-05	5.46E-06	5.41E-07
Mg+2								
MgO	WAC-460-160	4.70E-11	9.51E-06	9.51E-06	4.13E-04	1.89E-06	2.05E-07	2.03E-08
MnO2	WAC-460-160	5.64E-10	1.06E-04	0.000106	4.61E-03	2.10E-05	2.28E-06	2.26E-07
Mo+6								
MoO3		3.04E-12	6.16E-07	6.16E-07	2.68E-05	1.22E-07	1.32E-08	1.31E-09
Na+								
Na20.		8.48E-09	1.59E-03	0.00159	6.91E-02	3.16E-04	3.42E-05	3.39E-06
Ni+3	WAC-460-160							
Ni2FeCN6								
Ni2O3		2.32E-11	4.69E-06	4.69E-06	2.04E-04	9.31E-07	1.01E-07	9.99E-09
NiO		6.12E-10	1.15E-04	0.000115	5.00E-03	2.28E-05	2.47E-06	2.45E-07
NO2-								
NO3-								
Np+4								
NpO2		3.74E-13	7.56E-08	7.56E-08	3.29E-06	1.50E-08	1.63E-09	1.61E-10
OH-								
P2O5		1.68E-09	3.14E-04	0.000314	1.37E-02	6.23E-05	6.75E-06	6.69E-07
P2O5:24H2O								
Pb+4	PP/WAC							
Pb02	WAC	9.48E-12	1.92E-06	1.92E-06	8.35E-05	3.81E-07	4.13E-08	4.09E-09
PO4-3								
Pu+4								
PuO2		1.21E-12	2.45E-06	2.45E-06	1.07E-04	4.86E-07	5.27E-08	5.22E-09
Si+4								
SiO2		3.37E-08	6.31E-03	0.00631	2.74E-01	1.25E-03	1.36E-04	1.34E-05
SO4-2								
Sr+2								
SrO		1.07E-10	2.17E-05	2.17E-05	9.43E-04	4.31E-06	4.67E-07	4.62E-08
Tc2O7		1.36E-12	2.76E-07	2.76E-07	1.20E-05	5.48E-08	5.94E-09	5.88E-10

TcO4-								
TOC								
UO2+2	WAC-460							
UO3	WAC-460	4.52E-09	8.46E-04	0.000846	3.68E-02	1.68E-04	1.82E-05	1.80E-06
V+5								
V2O5	WAC-460-160	8.39E-13	1.70E-07	1.7E-07	7.39E-06	3.38E-08	3.66E-09	3.62E-10
WO2		1.10E-12	2.23E-07	2.23E-07	9.70E-06	4.43E-08	4.80E-09	4.75E-10
WO3		5.16E-15	1.04E-09	1.04E-09	4.52E-08	2.06E-10	2.24E-11	2.22E-12
ZN+2	WAC-460-160							
ZNO	WAC-460-160	2.97E-12	6.00E-07	6E-07	2.61E-05	1.19E-07	1.29E-08	1.28E-09
Zr+4								
ZRO2	WAC-460-160	1.86E-09	3.49E-04	0.000349	1.52E-02	6.93E-05	7.51E-06	7.43E-07
ZRO2;2H2O								
material balance based on TPA data package Rev B revcd. 3/16/95								
annual ave based on 23 year operations period								
24 hour ave. based on annual ave/number of operating days per year (365 days@60% OE=219 days)								
peak hourly rate based on plant capacity of 20 mt/operating day								

TPA LLW stack flows								
LIQUID COMPONENTS								
	Regulated	stream						
		907	917	totals mt	ANNUAL AVE	24 hour avg.	peak hourly	peak conc.
VOLUME					TOTAL/19	ann ave/219	(daily ave/24)x1.3	peak hourly/stack flow
SP. GRAVITY				metric tons	kg/year	kg/ 24 hr	kg/hr	grams/cubic meter
MASS FLOW MT		3.05E+06	4.87E+05	3.54E+06	1.86E+08	8.50E+05	4.60E+04	4.64E+02
Total Cr	WAC-460							
Total Na								
Total Si								
Total P	WAC-460-160							
Total NO2-,(MT)	PP							
Total NO3-, (MT)		2.05E+01		2.05E+01	1.08E+03	4.93E+00	2.67E-01	2.69E-03
Cs and Ba, (MCi)								
Sr and Y, (MCi)								
Tc, (MCi)								
Am, (MCi)								
Np, (MCi)								
Pu-239,(MCi)								
Pu-240,(MCi)								
Pu-241,(MCi)								
Total TRU, (MCi)								
Total (MCi)								
Ag+	WAC-460-130							
Al+3	WAC-460							
Am+3								
As+5	WAC-460							
B+3								
Ba+2	WAC-460 ?							
Be+2	40CFR/WAC460							
Bi+3								
C 14				7.46E-04	3.93E-02	1.79E-04	9.71E-06	9.79E-08
Ca+2								
Cd+2	WAC-460-130							
Ce+3								

Cl-								
Cl2	WAC-460-160	3.10E+02		3.10E+02	1.63E+04	7.45E+01	4.04E+00	4.07E-02
Cm+3								
CO	WAC-460-160	2.35E+03		2.35E+03	1.24E+05	5.65E+02	3.06E+01	3.08E-01
CO2		1.89E+05		1.89E+05	9.95E+06	4.54E+04	2.46E+03	2.48E+01
CO3-2	WAC-460-160							
Cr(OH)4-	?							
Cs+								
Cu+2	WAC-460-160							
DPCD								
F-								
F2	WAC-460-160	1.12E+03		1.12E+03	5.89E+04	2.69E+02	1.46E+01	1.47E-01
Fe+3								
H+		3.33E-01		3.33E-01	1.75E+01	8.00E-02	4.33E-03	4.37E-05
H2								
H2O		5.83E+04		5.83E+04	3.07E+06	1.40E+04	7.59E+02	7.65E+00
H2S	WAC							
Hg	WAC-460-160							
Hg+2	WAC							
I-								
I2	WAC-460	5.45E+02		5.45E+02	2.87E+04	1.31E+02	7.09E+00	7.15E-02
K+								
Kerosene								
La+3								
Li+								
Mg+2								
MnO2	WAC-460-160							
Mo+6								
N2		2.21E+06	3.85E+05	2.60E+06	1.37E+08	6.24E+05	3.38E+04	3.40E+02
Na+								
Nb+5								
NH3	WAC-460-160	1.63E+01		1.63E+01	8.58E+02	3.92E+00	2.12E-01	2.14E-03
Ni+3	WAC-460-130	9.66E-02		9.66E-02	5.08E+00	2.32E-02	1.26E-03	1.27E-05
NO	PP	3.11E+00		3.11E+00	1.64E+02	7.47E-01	4.05E-02	4.08E-04
NO2	PP	1.39E+02		1.39E+02	7.32E+03	3.34E+01	1.81E+00	1.82E-02
NO2-								
NO3-		2.05E+01		2.05E+01	1.08E+03	4.93E+00	2.67E-01	2.69E-03

Np+4								
O2		5.95E+05	1.02E+05	6.97E+05	3.67E+07	1.68E+05	9.07E+03	9.14E+01
OH-								
OLIGIMER								
Pb+4	WAC/40CFR							
PO4-3								
POLY								
Pu+4								
Si+4								
SO2	PP	2.09E+02		2.09E+02	1.10E+04	5.02E+01	2.72E+00	2.74E-02
SO4-2								
Sr+2								
S								
TcO2								
TcO4-								
TOC								
UO2+2	WAC-460							
V+5								
W+6	WAC460							
ZN+2								
Zr+4								
ZRO2:2H2O								
SOLIDS COMPONENTS								
Cs and Ba, (MCi)		1.23E-12	2.49E-07	2.49E-07	1.31E-05	5.98E-08	3.24E-09	3.27E-11
Sr and Y, (MCi)		4.74E-12	9.59E-07	9.59E-07	5.05E-05	2.30E-07	1.25E-08	1.26E-10
Tc, (MCi)		6.48E-14	1.31E-08	1.31E-08	6.89E-07	3.15E-09	1.71E-10	1.72E-12
Am, (MCi)		2.15E-14	4.35E-09	4.35E-09	2.29E-07	1.05E-09	5.66E-11	5.71E-13
Np, (MCi)		2.58E-17	5.21E-12	5.21E-12	2.74E-10	1.25E-12	6.78E-14	6.83E-16
Pu-239, (MCi)		4.17E-17	8.43E-10	8.43E-10	4.44E-08	2.03E-10	1.10E-11	1.11E-13
Pu-240, (MCi)		1.03E-15	2.09E-10	2.09E-10	1.10E-08	5.02E-11	2.72E-12	2.74E-14
Pu-241,(MCi)		3.71E-15		3.71E-15	1.95E-13	8.92E-16	4.83E-17	4.87E-19
Total TRU,(MCi)		3.04E-14	5.41E-09	5.41E-09	2.85E-07	1.30E-09	7.04E-11	7.10E-13
Total MCi		6.07E-12	1.23E-06	1.23E-06	6.47E-05	2.96E-07	1.60E-08	1.61E-10
Total Mass Flow (MT)		1.05E-06	1.96E-01	1.96E-01	1.03E+01	4.71E-02	2.55E-03	2.57E-05
Total Cr (MT)	WAC460-160	3.89E-10	7.28E-05	7.28E-05	3.83E-03	1.75E-05	9.48E-07	9.55E-09
Total Na (MT)		1.94E-07	3.63E-02	3.63E-02	1.91E+00	8.72E-03	4.73E-04	4.76E-06

Total Si (MT)		2.89E-07	5.41E-02	5.41E-02	2.85E+00	1.30E-02	7.04E-04	7.10E-06
Total P (MT)	WAC460-160	3.65E-09	6.83E-04	6.83E-04	3.59E-02	1.64E-04	8.89E-06	8.96E-08
Total NO2-, (MT)	PP							
Total NO3-, (MT)								
Ag+	WAC460-160							
Ag2O	WAC460-160	8.79E-13	1.78E-07	1.78E-07	9.37E-06	4.28E-08	2.32E-09	2.33E-11
Al+3								
Al2O3		5.23E-08	9.79E-03	9.79E-03	5.15E-01	2.35E-03	1.27E-04	1.28E-06
Am+3								
Am2O3		6.89E-15	1.39E-09	1.39E-09	7.32E-08	3.34E-10	1.81E-11	1.82E-13
As+5	WAC							
As2O5		2.95E-12	5.96E-07	5.96E-07	3.14E-05	1.43E-07	7.76E-09	7.82E-11
B+3								
B2O3	WAC-460-160	4.17E-12	8.43E-07	8.43E-07	4.44E-05	2.03E-07	1.10E-08	1.11E-10
Ba+2	?							
BaO	WAC	2.20E-12	4.46E-07	4.46E-07	2.35E-05	1.07E-07	5.81E-09	5.85E-11
Be+2	40CFR/WAC							
BeO		5.67E-13	1.15E-07	1.15E-07	6.05E-06	2.76E-08	1.50E-09	1.51E-11
Bi+3								
Bi2O3		1.88E-10	3.80E-05	3.80E-05	2.00E-03	9.13E-06	4.95E-07	4.98E-09
C 14								
Ca+2								
CANCRINITE								
CaO	WAC-460-160	1.05E-07	1.96E-02	1.96E-02	1.03E+00	4.71E-03	2.55E-04	2.57E-06
Cd+2	WAC-460-130							
CdO		5.95E-12	1.20E-06	1.20E-06	6.32E-05	2.88E-07	1.56E-08	1.57E-10
Ce+3								
Ce2O3		6.97E-12	1.41E-06	1.41E-06	7.42E-05	3.39E-07	1.84E-08	1.85E-10
Cl-								
Co3-2								
Cr+3	WAC-460-160							
Cr2O3		5.68E-10	1.06E-04	1.06E-04	5.58E-03	2.55E-05	1.38E-06	1.39E-08
Cs+								
Cs2O		1.71E-14	3.45E-09	3.45E-09	1.82E-07	8.29E-10	4.49E-11	4.53E-13
Cu	WAC-460-160							
Cu+2	WAC-460-160							
CuO		5.53E-13	1.12E-07	1.12E-07	5.89E-06	2.69E-08	1.46E-09	1.47E-11

CuSO4								
F-	WAC							
Fe+3								
Fe2O3	WAC-460-160	5.14E-11	1.04E-05	1.04E-05	5.47E-04	2.50E-06	1.35E-07	1.36E-09
Hg+2	WAC-460-160							
I-	WAC ?							
K+								
K2O		6.62E-13	1.43E-07	1.43E-07	7.53E-06	3.44E-08	1.86E-09	1.88E-11
La+3								
La2O3		6.45E-13	1.30E-07	1.30E-07	6.84E-06	3.12E-08	1.69E-09	1.71E-11
Li+								
Li2O		3.10E-14	6.27E-09	6.27E-09	3.30E-07	1.51E-09	8.16E-11	8.22E-13
Mg+2								
MgO	WAC-460-160	4.00E-12	8.08E-07	8.08E-07	4.25E-05	1.94E-07	1.05E-08	1.06E-10
MnO2	WAC-460-160	5.41E-11	1.09E-05	1.09E-05	5.74E-04	2.62E-06	1.42E-07	1.43E-09
Mo+6								
MoO3		1.82E-11	3.69E-06	3.69E-06	1.94E-04	8.87E-07	4.80E-08	4.84E-10
Na+								
Na20		2.62E-07	4.90E-02	4.90E-02	2.58E+00	1.18E-02	6.38E-04	6.43E-06
Ni+3	WAC-460-160							
Ni2FeCN6								
Ni2O3		1.43E-11	2.89E-06	2.89E-06	1.52E-04	6.95E-07	3.76E-08	3.79E-10
NiO		3.74E-14	7.57E-09	7.57E-09	3.98E-07	1.82E-09	9.85E-11	9.93E-13
NO2-								
NO3-								
Np+4								
NpO2		4.15E-14	8.38E-09	8.38E-09	4.41E-07	2.01E-09	1.09E-10	1.10E-12
OH-								
P2O5		8.35E-09	1.56E-03	1.56E-03	8.21E-02	3.75E-04	2.03E-05	2.05E-07
P2O5:24H2O								
Pb+4	PP/WAC							
Pb02	WAC	5.65E-12	1.14E-06	1.14E-06	6.00E-05	2.74E-07	1.48E-08	1.50E-10
PO4-3								
Pu+4								
PuO2		8.15E-14	1.65E-08	1.65E-08	8.68E-07	3.97E-09	2.15E-10	2.16E-12
S								
Si+4								

SiO2		6.18E-07	1.16E-01	1.16E-01	6.11E+00	2.79E-02	1.51E-03	1.52E-05
SO4-2								
Sr+2								
SrO		1.00E-12	2.02E-07	2.02E-07	1.06E-05	4.85E-08	2.63E-09	2.65E-11
Tc2O7		5.98E-12	1.21E-06	1.21E-06	6.37E-05	2.91E-07	1.58E-08	1.59E-10
TcO4-								
TOC								
UO2+2	WAC-460							
UO3	WAC-460	2.26E-10	4.56E-05	4.56E-05	2.40E-03	1.10E-05	5.94E-07	5.98E-09
V+5								
V2O5	WAC-460-160	2.76E-13	5.59E-08	5.59E-08	2.94E-06	1.34E-08	7.28E-10	7.33E-12
WO2		7.27E-17		7.27E-17	3.83E-15	1.75E-17	9.46E-19	9.54E-21
WO3		2.35E-12	4.75E-07	4.75E-07	2.50E-05	1.14E-07	6.18E-09	6.23E-11
ZN+2	WAC-460-160							
ZNO	WAC-460-160	1.12E-11	2.25E-06	2.25E-06	1.18E-04	5.41E-07	2.93E-08	2.95E-10
Zr+4								
ZRO2	WAC-460-160	3.25E-09	3.28E-07	3.31E-07	1.74E-05	7.96E-08	4.31E-09	4.35E-11
ZRO2:2H2O								
material balance based on TPA data package Rev B recvd 3/16/95								
annual average based on 19 year operations period								
24 hour ave. based on annual ave/number of operationg days per year (365 days @ 60% OE=219 days)								
peak hourly rate based on plant capacity of 200 mt /operating day								

Table F-26. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline (1 year).

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_2		Aldehydes as HCHO		Sulfur Oxides as SO_2*		Particulate Matter	
					units	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss
¾ ton pickup	250	LDGT1	1	64800 mi	g/mi	10.25	664.2	0.81	52.488	0.59	38.232	1.06	68.688	-	-	-	-	-	-
D8 dozer	335	wheeled dozer D	4	3770 hr	g/hr	816.8	3079.37	86.84	327.387	-	0	1889	7122.13	29.5	111.215	-	-	75	282.75
Cat 966 loader	200	wheeled loader D	1	120 hr	g/hr	259.6	31.1496	113.2	13.5804	-	0	858.2	102.983	18.8	2.256	-	-	77.9	9.348
10 cy dump truck	250	off-highway truck D	8	960 hr	g/hr	816.8	784.138	[illegible]			0	1889	1813.59	51	48.96	-	-	116	[illegible]
Cat D9 dozer	460	wheeled dozer D	2	[illegible]							0	1889	5289.65	29.5	82.6	-	-	75	210
Cat 637E [illegible]											0	1741	13543	65	505.7	-	-	184	1431.52
(Tw[illegible]											0	1741	13543	65	505.7	-	-	184	1431.52
Towe[illegible] roller											18	164	229.6	7.57	10.598	-	-	11.8	16.52
Cat 14C Grader												324.4	1417.76	5.54	24.2098	-	-	27.7	121.049
Cat 235B Backhoe												767.3	61.384	13.9	1.112	-	-	63.2	5.056
Cat 623E Elevating S[illegible]												1741	10914.4	65	407.55	-	-	184	1153.68
Cat 815B Compactor										-	0	767.3	1204.66	13.9	21.823	-	-	63.2	99.224
5000 gal Wate[illegible] Tanker						816.8	1282.39	86.84	136.339	-	0	1889	2965.98	51	80.07	-	-	116	182.12

Lotus FYI here is the construction emissions estimate for the TPA data package.

Table F-26. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline (1 year).

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor units	Carbon Monoxide fact	Carbon Monoxide emiss	Exhaust Hydrocarbons fact	Exhaust Hydrocarbons emiss	Fugitive Hydrocarbons fact	Fugitive Hydrocarbons emiss	Nitrogen Oxides as NO_x fact	Nitrogen Oxides as NO_x emiss	Aldehydes as HCHO fact	Aldehydes as HCHO emiss	Sulfur Oxides as SO_x* fact	Sulfur Oxides as SO_x* emiss	Particulate Matter fact	Particulate Matter emiss
Mechanics Truck	250	off-highway truck D	1	1650 hr	g/hr	816.8	1347.74	86.84	143.286	-	0	1889	3117.11	51	84.15	-	-	116	191.4
Fuel/Lube Truck	250	off-highway truck D	1	2480 hr	g/hr	816.8	2025.69	86.84	215.363	-	0	1889	4685.12	51	126.48	-	-	116	287.68
Totals			40	No Separations Baseline			33222		4593.7		155.4		66079		2012.4		2025		5533.2
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							46511		6431.1		217.6		92511		2817.4		2835		7746.5

Notes:

LDG = light duty gasoline
HDG = heavy duty gasoline
LDD = light duty diesel
HDD = heavy duty diesel
D = diesel
G = gasoline

Emissions are estimated using U.S. Environmental Protection Agency "AP-42" emission factors. The equipment list and usage estimates were obtained from Bob Campbell, Fluor Daniel Inc.

*SOx emissions are estimated using a fuel specific emission factor of 3.23 grams(SOx)/gallon of diesel burned (0.00712 lbs(SOx)/gal). This factor is based upon "Clean Air Act" maximum permissible diesel fuel sulfur content of 0.05% (by weight). Diesel fuel usage for this equipment is estimated to be 626,911 gallons.

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

Table F-27. Years 2-4 of Construction. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline.

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor Units	Carbon Monoxide		Exhaust Hydrocarbons		Evaporative Hydrocarbons		Nitrogen Oxides as NO_x		Aldehydes as HCHO		Sulfur Oxides as SO_x		Particulate Matter	
						fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
D8 dozer	335	wheeled dozer D	1	920 hr	g/hr	816.8	751.465	86.84	79.8928	-	0	1889	1738.03	29.5	27.14	-	-	75	69
966 FE loader	200	wheeled loader D	4	8160 hr	g/hr	259.6	2118.17	113.2	923.467	-	0	858.2	7002.83	18.8	153.408	-	-	77.9	635.66
10 cy dump truck	250	off-highway truck D	10	12730 hr	g/hr	816.8	10398	86.84	1105.47	-	0	1889	24049	51	649.23	-	-	116	1476.7
Cat 623E scraper	330	scraper D	4	610 hr	g/hr	568.2	346.596	128.2	78.1715	-	0	1741	1061.85	65	39.65	-	-	184	112.24
Cat 14G motor grader	200	motor grader D	1	150 hr	g/hr	68.46	10.269	18.07	2.7105	-	0	324.4	48.6645	5.54	0.831	-	-	27.7	4.155
¾ ton pickup	250	LDGT1	1	3000 mi	g/mi	10.25	30.75	0.81	2.43	0.59	1.77	1.06	3.18	-	-	-	-	-	-
Cat D6 dozer	165	wheeled dozer D	1	1810 hr	g/hr	816.8	1478.43	86.84	157.18	-	0	1889	3419.38	29.5	53.395	-	-	75	135.75
8 cy concrete mixer trucks	250	off-highway truck D	4	16800 hr	g/hr	816.8	13722.4	86.84	1458.91	-	0	1889	31737.9	51	856.8	-	-	116	1948.8
Totals			26	No Separations Baseline			28856.1		3808.24		1.77		69060.8		1780.5		1252		4382.3
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							40398.5		5331.53		2.478		96685.2		2492.6		1753		6135.2

Table F-27. Years 2-4 of Construction. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline.

Notes:

LDG	=	light duty gasoline
HDG	=	heavy duty gasoline
LDD	=	light duty diesel
HDD	=	heavy duty diesel
D	=	diesel
G	=	gasoline

Emissions are estimated using U.S. Environmental Protection Agency "AP-42" emission factors. The equipment list and usage estimates were obtained from Bob Campbell, Fluor Daniel Inc.

*SOx emissions are estimated using a fuel specific emission factor of 3.23 grams(SOx)/gallon of diesel burned (0.00712 lbs(SOx)/gal). This factor is based upon "Clean Air Act" maximum permissible diesel fuel sulfur content of 0.05% (by weight). Diesel fuel usage for this equipment is estimated to be 626,911 gallons.

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

Table F-28. 5-Year Duration of Construction. Equipment Nonradiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline.

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission factor	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_2		Aldehydes as HCHO		Sulfur Oxides as SO_2†		Particulate Matter	
					units	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
Utility dozer	65	wheeled dozer D	5	16000 hr	g/hr	816.8	13069	86.84	1389.44	-	0	1889	30226.6	29.5	472	-	-	75	1200
Utility loader/ backhoe	65	wheeled loader D	6	19000 hr	g/hr	259.6	4932.02	113.2	2150.23	-	0	858.2	16305.6	18.8	357.2	-	-	77.9	1480.1
Backhoe-1 cy	65	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Backhoe-2 cy	120	wheeled loader D	2	3000 hr	g/hr	259.6	778.74	113.2	339.51	-	0	858.2	2574.57	18.8	56.4	-	-	77.9	233.7
Loader-2 cy	120	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Loader-4 cy	200	wheeled loader D	2	3000 hr	g/hr	259.6	778.74	113.2	339.51	-	0	858.2	2574.57	18.8	56.4	-	-	77.9	233.7
Crane-15 ton	150	misc. D	10	64000 hr	g/hr	306.4	19607.7	69.35	4438.4	-	0	767.3	49107.2	13.9	889.6	-	-	63.2	4044.8
Crane-25 ton	185	misc. D	10	48000 hr	g/hr	306.4	14705.8	69.35	3328.8	-	0	767.3	36830.4	13.9	667.2	-	-	63.2	3033.6
Crane-50 ton	200	misc. D	5	16000 hr	g/hr	306.4	4901.92	69.35	1109.6	-	0	767.3	12276.8	13.9	222.4	-	-	63.2	1011.2
Crane-100 ton	300	misc. D	2	6000 hr	g/hr	306.4	1838.22	69.35	416.1	-	0	767.3	4603.8	13.9	83.4	-	-	63.2	379.2
Forklift-2 ton	60	wheeled loader D	10	56000 hr	g/hr	259.6	14536.5	113.2	6337.52	-	0	858.2	48058.6	18.8	1052.8	-	-	77.9	4362.4
Forklift-4 ton	70	wheeled loader D	6	29000 hr	g/hr	259.6	7527.82	113.2	3281.93	-	0	858.2	24887.5	18.8	545.2	-	-	77.9	2259.1
Forklift-6 ton	100	wheeled loader D	4	16000 hr	g/hr	259.6	4153.28	113.2	1810.72	-	0	858.2	13731	18.8	300.8	-	-	77.9	1246.4
Forklift-10 ton	130	wheeled loader D	4	13000 hr	g/hr	259.6	3374.54	113.2	1471.21	-	0	858.2	11156.5	18.8	244.4	-	-	77.9	1012.7
Forklift-15 ton	150	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Motor grader	125	motor grader D	4	22000 hr	g/hr	68.46	1506.12	18.07	397.54	-	0	324.4	7137.46	5.54	121.88	-	-	27.7	609.4
Pumps-1 in.	2	IC gasoline	40	128000 hr	g/hp * hr	199	50944	6.68	1710.08	2.99	765.44	5.16	1320.96	0.22	56.32	-	-	0.327	83.712
Pumps-2 in.	5	IC gasoline	20	64000 hr	g/hp * hr	199	63680	6.68	2137.6	2.99	956.8	5.16	1651.2	0.22	70.4	-	-	0.327	104.64

Table F-28. 5-Year Duration of Construction. Equipment Nonradiological Emissions Estimates Tri-Party Agreement Alternative Linearly Scaled Against No Separations Alternative Baseline.

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission factor	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_2		Aldehydes as HCHO		Sulfur Oxides as SO_x†		Particulate Matter	
					units	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
Pumps-6 in.	10	IC gasoline	10	16000 hr	g/hp * hr	199	31840	6.68	1068.8	2.99	478.4	5.16	825.6	0.22	35.2	-	-	0.327	52.32
Totals			152	No Separations Baseline			245962		35122.1		2200.64		289014		5795.6		3379.0		23684
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							344346		49170.9		3080.9		404620		8113.84		4730.6		33158

Notes:

LDG = light duty gasoline
HDG = heavy duty gasoline
LDD = light duty diesel
HDD = heavy duty diesel
D = diesel
G = gasoline

Emissions are estimated using U.S. Environmental Protection Agency "AP-42" emission factors. The equipment list and usage estimates were obtained from Bob Campbell, Fluor Daniel Inc.

*SOx emissions are estimated using a fuel specific emission factor of 3.23 grams(SOx)/gallon of diesel burned (0.00712 lbs(SOx)/gal). This factor is based upon "Clean Air Act" maximum permissible diesel fuel sulfur content of 0.05% (by weight). Diesel fuel usage for this equipment is estimated to be 626,911 gallons.

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

Table F-29. 5-Year Duration of Construction. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative linearly scaled against No Separations Alternative Baseline.

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor units	Carbon Monoxide fact	Carbon Monoxide emiss (kg)	Exhaust Hydrocarbons fact	Exhaust Hydrocarbons emiss (kg)	Fugitive Hydrocarbons fact	Fugitive Hydrocarbons emiss (kg)	Nitrogen Oxides as NO2 fact	Nitrogen Oxides as NO2 emiss (kg)	Aldehydes as HCHO fact	Aldehydes as HCHO emiss (kg)	Sulfur Oxides as SO2 fact	Sulfur Oxides as SO2 emiss (kg)	Particulate Matter fact	Particulate Matter emiss (kg)
Air Comp - 100 cfm	50	IC gasoline	20	112000	g/hp/hr	199	1114400	6.68	37408	2.99	16744	5.16	28896	0.22	1232	-	-	0.327	1831.2
Air Comp - 250 cfm	90	IC diesel	20	80000	g/hp/hr	3.03	21816	1.12	8064	0.02	144	14	100800	0.21	1512	-	-	1	7200
Air Comp - 600 cfm	180	IC diesel	10	24000	g/hp/hr	3.03	13089.6	1.12	4838.4	0.02	86.4	14	60480	0.21	907.2	-	-	1	4320
Welders - 200 amp	100	IC gasoline	60	336000	g/hp/hr	199	6686400	6.68	224448	2.99	100464	5.16	173376	0.22	7392	-	-	0.327	10987.2
Welders - 400 amp	200	IC gasoline	80	320000	g/hp/hr	199	12736000	6.68	427520	2.99	191360	5.16	330240	0.22	14080	-	-	0.327	20928
Generators - 0.5 kW	5	IC gasoline	20	96000	g/hp/hr	199	95520	6.68	3206.4	2.99	1435.2	5.16	2476.8	0.22	105.6	-	-	0.327	156.96
Generators - 5 kW	10	IC gasoline	20	64000	g/hp/hr	199	127360	6.68	4275.2	2.99	1913.6	5.16	3302.4	0.22	140.8	-	-	0.327	209.28
Generators - 10 kW	20	IC gasoline	15	36000	g/hp/hr	199	143280	6.68	4809.6	2.99	2152.8	5.16	3715.2	0.22	158.4	-	-	0.327	235.44
Generators - 100 kW	75	IC diesel	10	16000	g/hp/hr	3.03	3636	1.12	1344	0.02	24	14	16800	0.21	252	-	-	1	1200
Generators - 250 kW	150	IC diesel	10	16000	g/hp/hr	3.03	7272	1.12	2688	0.02	48	14	33600	0.21	504	-	-	1	2400
Light Plants - 10 kW	20	IC gasoline	50	280000	g/hp/hr	199	1114400	6.68	37408	2.99	16744	5.16	28896	0.22	1232	-	-	0.327	1831.2
Compactors - Walk	5	IC gasoline	60	192000	g/hp/hr	199	191040	6.68	6412.8	2.99	2870.4	5.16	4953.6	0.22	211.2	-	-	0.327	313.92
Compactors - Ride	40	IC gasoline	20	64000	g/hp/hr	199	509440	6.68	17100.8	2.99	7654.4	5.16	13209.6	0.22	563.2	-	-	0.327	837.12
Totals			395	No Separations Baseline			22763654		779523		341641		800746		28290.4		1220.9		52450.3
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							31869115		1091332		478297		1121044		39606.6		1709.3		73430.4

Table F-29. 5-Year Duration of Construction. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement Alternative linearly scaled against No Separations Alternative Baseline.

Notes:

LDG	=	light duty gasoline
HDG	=	heavy duty gasoline
LDD	=	light duty diesel
HDD	=	heavy duty diesel
D	=	diesel
G	=	gasoline

Emissions are estimated using U.S. Environmental Protection Agency "AP-42" emission factors. The equipment list and usage estimates were obtained from Bob Campbell, Fluor Daniel Inc.

*SOx emissions are estimated using a fuel specific emission factor of 3.23 grams(SOx)/gallon of diesel burned (0.00712 lbs(SOx)/gal). This factor is based upon "Clean Air Act" maximum permissible diesel fuel sulfur content of 0.05% (by weight). Diesel fuel usage for this equipment is estimated to be 626,911 gallons.

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

Table F-30. 5-Year Duration of Construction. Construction Equipment Non-Radiological Emissions Estimates Tri-Party Agreement alternative linearly scaled against No Separations Alternative Baseline.

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor Units	Carbon Monoxide		Exhaust Hydrocarbon		Fugitive Hydrocarbon		Nitrogen Oxides as NO2		Aldehydes as HCHO		Sulfur Oxides as SO2+		Particulate Matter	
						fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
½ ton Pickup	200	LDGT1	50	1600000	g/mi	10.25	16400	0.81	1296	0.59	944	1.06	1696	-	-	-	-	-	-
¾ ton Pickup	250	LDGT1	25	800000	g/mi	10.25	8200	0.81	648	0.59	472	1.06	848	-	-	-	-	-	-
3 ton Flat bed	300	HDGV	20	800000	g/mi	16.16	12928	1.42	1136	1.59	1272	5.1	4080	-	-	-	-	-	-
5 ton Flat bed	350	HDGV	10	320000	g/mi	16.16	5171.2	1.42	454.4	1.59	508.8	5.1	1632	-	-	-	-	-	-
40' Float and Tractor	350	HDDV	10	320000	g/mi	8.67	2774.4	2.53	809.6	-	0	11.44	3660.8	-	-	-	-	-	-
Low Boy with Tractor	400	HDDV	2	15000	g/mi	8.67	130.05	2.53	37.95	-	0	11.44	171.6	-	-	-	-	-	-
Shuttle Bus	250	LDGT1	10	480000	g/mi	10.25	4920	0.81	388.8	0.59	283.2	1.06	508.8	-	-	-	-	-	-
Van	200	LDGT1	10	720000	g/mi	10.25	7380	0.81	583.2	0.59	424.8	1.06	763.2	-	-	-	-	-	-
Fuel/Service Truck	250	LDDT	5	400000	g/mi	1.53	612	0.63	252	-	0	1.09	436	-	-	-	-	-	-
Mechanic's Truck	250	LDDT	5	400000	g/mi	1.53	612	0.63	252	-	0	1.09	436	-	-	-	-	-	-
Water Trucks	300	HDDV	2	80000	g/mi	8.67	693.6	2.53	202.4	-	0	11.44	915.2	-	-	-	-	-	-
Totals			149	No Separations Baseline			59821.3		6060.35		3904.8		15147.6		0		2196.4		0
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							83749.8		8484.49		5466.7		21206.6		0		3075.0		0

d[5] From: Cari M McConville at ~KEH5 4/20/95 12:42PM (987 bytes: 1 ln)
To: ^Jacobs Engineering Group at ~DOE_HANFORD_1
Subject: ATTN Colin Henderson - ISV Data
---------- Message Contents ----------

Text item 1: Text_1

I have received the FAX you sent this morning. The exit velocity, exit temperature, and volumetric flow rate estimates look fine. However, I have the following comments:

1. It is assumed that all organics are destroyed during ISV, (as you noted from page 4-17) so there are no emissions of hazardous organics during the ISV process.

2. In estimating the stack height, the building height should be 40 feet, which is the actual roof height. Everything above the 40 foot roof height is just structural support. The stack height would therefore be 1.8 * 40ft = 72 feet.

The following are specific data requests for the Tanks - Minimal Retrieval TWRS alternative.

1. A description of the processes involved in the Minimal Retrieval alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
TF1E	573556	137442	200	AREA
TF2E	573556	137282	200	AREA
TF3E	573771	137252	200	AREA
TF4E	575075	136493	200	AREA
TF5E	575332	136378	205	AREA
TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

6.1.1

Request Number 57

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE)

Date: March 20, 1995

Phone Number: (904) 332-3318

Fax Number: (904) 333-6631

Request Information: Process information and emission rates for the Tanks - No Action TWRS alternative. Please refer to attached sheet for additional information.

Priority A

Need Date: April 7, 1995

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed:

Concurrence: Marc Nelson - Deputy Project Manager

forms\engin\engreq.057

DATA REQUEST 57

No Action Alternative - Tanks

For No Action the following activities will take place:

SST wastes will be left in place following the completion of salt well pumping.

DST wastes will be retrieved and transferred into new DSTs twice during the 100 year period where institutional control will be maintained.

The following activities will be completed for DST wastes:

Construction

Note: The following will be constructed for each retrieval campaign. (Each construction activity will take place twice)

Build DST transfer piping

- connect existing DST facilities to new tank farms and new evaporator
- Build replacement evaporator
- Build tank retrieval systems
- Build new tanks
  - 26 new DSTs will replace existing 28 DSTs
  - Diesel generator building
  - Gas sampling and stack monitoring facilities
  - Administration building
  - Possible weather enclosure over tank farm
  - Tank ventilation systems

Operation

Retrieve DST wastes

- Direct transfer supernate to new DSTs
- Add dilution liquids to remaining wastes, run mixer pumps and slurry pump to evaporator
- Process slurry through evaporator
- Retrieve 99% of DST waste

Monitor SSTs

Operate Evaporator

- Evaporate all slurry transfer to maintain waste volume
- Treat condensate of liquid effluent treatment facility

From the No Action Data Package the following emissions estimated are made:

Non Radiological Operating Emissions: (For additional tank emission data see Request No. 55)

- Table 5-5 attached
- These emissions were taken from the HDW EIS and represent an estimate for emissions associated with tank farm surveillance during the 100 year institutional control period
- These emissions appear to be vehicle emissions
- If these are to be modeled, they can be divided by 100 to get an average annual emission. A peak emission could be estimated using the following factor:

$$\frac{\text{Non Rad Operating Emission}}{\text{18 (tank farms)}} \times \frac{1}{\text{100 yrs}} \times \frac{\text{1 yr}}{\text{2,000 hrs}} \times \text{2 (peak factor)}$$

Emission quantity X 5.6×10^{-7} (peak hourly emission) kg/hr - tank farm

Thus the peak hourly emission for any of the pollutants in table 5-5 can be calculated using the above factor.

Emissions will be very small. For example: The CO estimate is for 710 kg.

The CO peak hourly emission rate per tank farm is:

$$710 \text{ kg} \times 5.6 \times 10^{-7} = 4 \times 10^{-4} \text{ kg/hr}$$

Radiological Operating Emissions:

- Table 5-6 attached
- Memo and attached hand calculation from Chris Memg (WHC) to Dave Murray (attached)
- Engineering data package Appendix B (attached)

The following points should be made for the radiological operating emissions:

- The radiological emissions are estimated using measured emission data for the tank farms in 1993. Emission data was obtained only for areas 3EDS and 5EDS (3DS = tank farms AN, AY, AZ, sources TF5E, TF6E, TF7E), (5EDS = tank farms AP, AW, sources TF10E, TF11E)

The memo noted above states that the emissions from other tank farms were either below detection or below reportable amounts.

- The quantities reported in table 5-6 are for the 100 year institutional control period
- Appendix B summarizes the calculations for determining the emissions based on the measured 1993 data

- Annual emissions can be calculated for any year using the following expression:

$$N = No e^{-\lambda t}; \qquad \lambda = \frac{\ell n 2}{t^{1/2}}$$

For Cs, $N = 5.3 \times 10^{-5}$ Ci $\times e^{-.0231t}$ (t in years from 1995)

Sr, $N = 8.4 \times 10^{-6}$ Ci $\times e^{-.0247t}$ (t in years from 1995)

I, $N = 4.6 \times 10^{-5} \times e^{-4.08 \times 10^{-8}t}$ (t in years from 1995)

- The air emission from tank farms are not a result of any processing activities and should remain constant throughout the 100 year period without any peaks.

- The radiological air emissions from tank farms can be identified as follows:

Pollutant	Source ID	Peak Hourly	Annual Average (Ci)	Phase
Cs 137	TF5E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF6E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF7E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF10E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Cs 137	TF11E	-	$1.06 \times 10^{-5} e^{-.0231t}$	Yrs 1995-2042
Sr 90	TF5E	-	$1.68 \times 10^{-6} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF6E	-	$1.68 \times 10^{-6} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF7E	-	$1.68 \times 10^{-6} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF10E	-	$1.68 \times 10^{-6} e^{-.0247t}$	Yrs 1995-2042
Sr 90	TF11E	-	$1.68 \times 10^{-6} e^{-.0247t}$	Yrs 1995-2042
I 129	TF5E	-	$9.2 \times 10^{-4} e^{-4.08E-8t}$	Yrs 1995-2042
I 129	TF6E	-	$9.2 \times 10^{-4} e^{-4.08E-8t}$	Yrs 1995-2042
I 129	TF7E	-	$9.2 \times 10^{-4} e^{-4.08E-8t}$	Yrs 1995-2042
I 129	TF10E	-	$9.2 \times 10^{-4} e^{-4.08E-8t}$	Yrs 1995-2042
I 129	TF11E		$9.2 \times 10^{-4} e^{-4.08E-8t}$	Yrs 1995-2042

After the year 2042 all DST wastes will have been retanked into new DSTs located in the same area as the TPA vitrification facilities.

Making the assumption that all releases from the new DST tank farms will occur from the TPA HLW vitrification stack source location the following table is developed.

Pollutant	Source	Peak Hourly	Annual Average (Ci)	Phase
Cs 137	ST-H	-	$5.3 \times 10^{-5} e^{-.02231t}$	Yrs 2042-2095
Sr 90	ST-H	-	$8.4 \times 10^{-4} e^{-.02476t}$	Yrs 2042-2095
I 129	ST-H	-	$4.6 \times 10^{-5} e^{-4.04E-4t}$	Yrs 2042-2095

Note the emissions for any given year falling in the phase noted can be calculated by subtracting the year from 1995 and using the result ~~as~~ to evaluate the expression in the annual average column for the pollutant of interest. This was done because of the continuously changing emissions resulting from the short half life of Cs & Sr.

For evaporator emissions the following breakdown applies:

	Pollutant	Source	Peak Hourly* Ci/Hr	Annual Average** Ci/Yr	Phase
Water	Cs 137	ST-H	6.3×10^{-7}	2.76×10^{-3}	Yrs 2037-2042
	H 3	ST-H	9×10^{-3}	39	Yrs 2037-2042
	Sr 90	ST-H	7×10^{-7}	3.1×10^{-3}	Yrs 2037-2042
	I 129	ST-H	6×10^{-7}	2.72×10^{-3}	Yrs 2037-2042
Air	Total Beta	ST-H	4×10^{-10}	1.9×10^{-6}	Yrs 2037-2042
	Total Alpha	ST-H	4.6×10^{-10}	2×10^{-6}	Yrs 2037-2042
Water	Cs 137	ST-H	2×10^{-7}	8.7×10^{-4}	Yrs 2087-2092
	H 3	ST-H	5.3×10^{-4}	2.3	Yrs 2087-2092
	Sr 90		2×10^{-7}	9×10^{-4}	Yrs 2087-2092
	I 129		6.2×10^{-7}	2.7×10^{-3}	Yrs 2087-2092
Air	Total Beta		1.2×10^{-10}	5.4×10^{-7}	Yrs 2087-2092
	Total Alpha		4.7×10^{-10}	2.08×10^{-6}	Yrs 2087-2092

***Peak Hourly**: Annual Average X 1 yr/365 days X 1 day/24 hrs X 2 (peak factor).
**** Annual Average**: Evaporator estimate (10 yr)/5 yrs operation period. These evaporator emissions were annualized without using the decay equations.

<u>For Construction Emissions:</u>

The new tanks will be located in the same area as the TPA facilities so the source for No Action should correspond to PROC (ESE source area for TPA construction emissions).

The construction duration is 6/2033 - 6/2037 and 6/2083 - 6/2087.

Pollutant	Source	Peak Hourly	Annual Average	Phase
Particulate	PROC	16.25 kg/hr	16,250 kg	Construction
SO_x	PROC	2 kg/hr	2,000 kg	Construction
CO	PROC	4,500 kg/hr	4,500,000kg	Construction
Hydrocarbons	PROC	225 kg/hr	225,000 kg	Construction
NO_x	PROC	237 kg/hr	237,500 kg	Construction
Aldehydes-(HCHO)	PROC	7.4 kg/hr	7,375 kg	Construction
Organic Acids	PROC	0	0	Construction
Thermal (J)	PROC	9.5×10^{10} J/hr	9.5×10^{13} (J)	Construction
Fugitive dust	PROC	.07 mt/hr	68.75 metric ton	Construction

Peak Hourly: Annual Average X 1/365 days X 1 day/8 hrs X 3 peak factor.
Peak Hourly: Annual Average X .001.
Annual Average: Total estimate/8 years.

NOTE: SEE TABLE 5-11 attached.

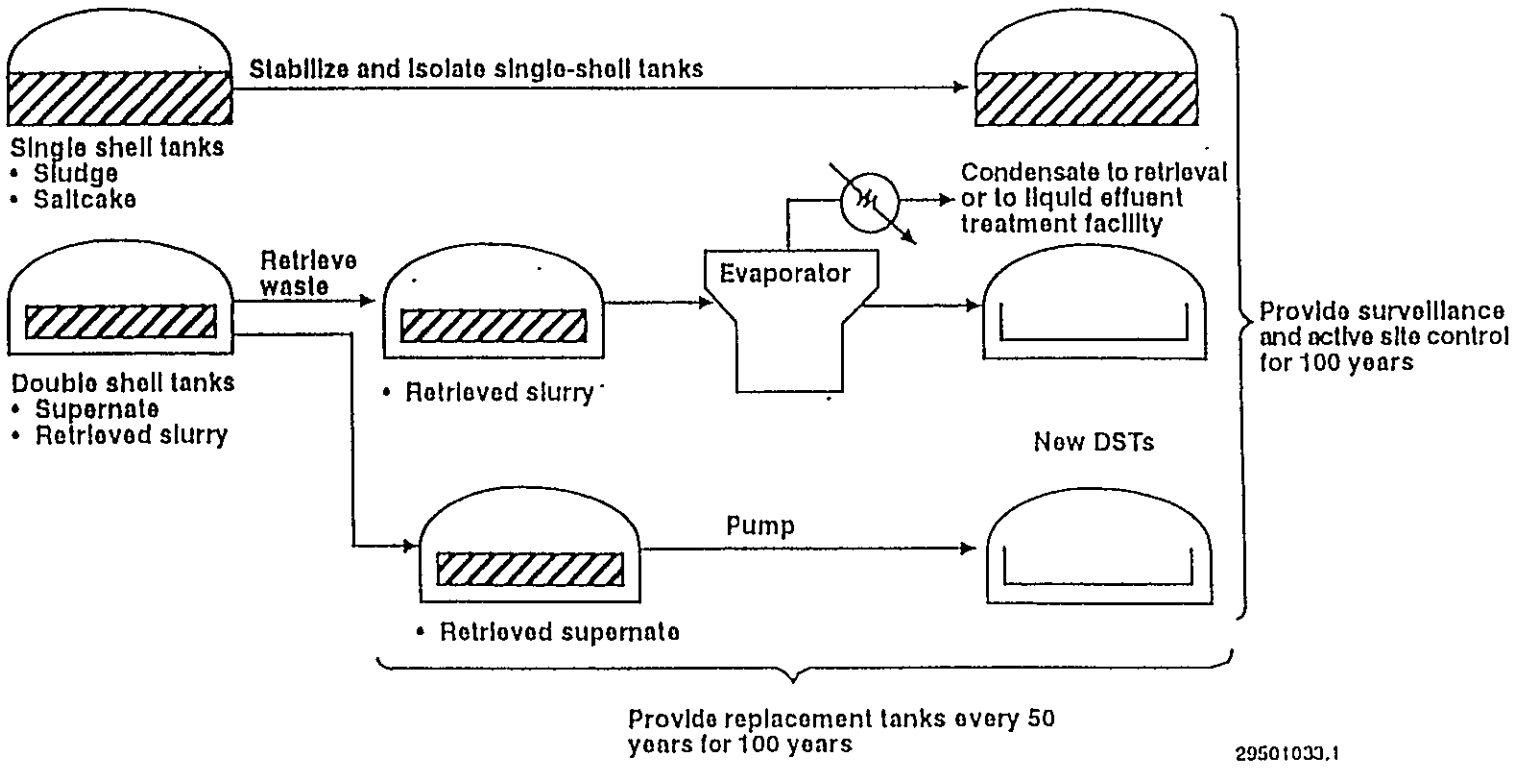


Figure 1-5. No Disposal Action Alternative Flowsheet.

Table 5-5. Nonradiological Operating Emissions
(Units as Indicated).

Item	No Disposal Action[1]
Thermal releases	1.1×10^{13} J
Particulate	20 kg
Volatile organic compounds	68 kg
Fugitive dust	n/a
Toxic Air Pollutants[2]	not available
NOx (as nitrogen dioxide)	77 kg
SOx (as sulfur dioxide)	12 kg
Carbon Monoxide	710 kg

Notes:

J = joule
kg = kilogram

[1]The values for these emissions (over the 100-year period) were taken from RHO-RE-ST-30 P, Table 4-17, pages 4-24 and 4-25 (*Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS.*

[2]The list of Toxic Air Pollutants present in the tank farms has not been completed yet. The final list will include only those species that are present in sufficient quantities to be regulated. Vapor characterization of Tank 241-C-103 head space is being used as a worst case to estimate the amount of Toxic Air Pollutants given off by the tank farms. The data for the Toxic Air Pollutants will be in the soon to be released Draft Tank Farms Air Operating Permit.

RHO, 1985, *Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS*, RHO-RE-ST-30 P, Rockwell Hanford Operations, Richland, Washington.

Table 5-10. Nonradiological Construction Emissions (units as indicated).

Construction Emission Pollutant	No Disposal Action[1]
Particulate (kg)	130,000
SO_x as sulfur dioxide (SO_2) (kg)	16,000
Carbon monoxide (kg)	36,000,000
Hydrocarbons (kg) (exhaust and fugitive)	1,800,000
NO_x as nitrogen dioxide (NO_2) (kg)	1,900,000
Aldehydes (kg) (as HCHO)	59,000
Organic acids (kg)	0
Thermal releases (J)	7.60×10^{14}
Fugitive dust (t)	550

Notes:

J = joule
kg = kilogram
NO_x = Nitrous oxides
SO_x = Sulfurous oxides
t = metric ton

[1]The values in this table were factored from the No Separations alternative by using a ratio of the construction costs.

Table 5-11. Transportation of Earthen Borrow Construction Material (Units as Indicated).

Item	No Disposal Action
Borrow source location (state)	3 km NW of site
Route location (state mileage)	Route 3 to Route 4 (5 Km)
Road type (gravel or asphalt)	Gravel, level
Total number of trips Truck[1] Train Barge	 31,000 0 0
New road construction (miles)	0
Load volumes (m^3)	6.1

Notes:

km = kilometer
m^3 = cubic meter
NW = northwest

[1]The values in this table were factored from the No Separations alternative by using a ratio of the construction costs.

NOTE: The 31,000 trips indicated above should result in fugitive dust emissions that are split Between the borrow site and the Construction site. This is NOT shown on the Response to the Engineering Information Request page 4 "Construction Emissions by source". Since the fugitive dust estimate is factored from the No Separations data package, the fugitive dust estimate can be split between the borrow site & Construction site in a similar manner to the TPA or No Separations data. Using No Separations data pkg 32% fugitive dust comes from borrow pit and batch plant operations.

Table 5-21. Overall Schedule (Calendar Year Start/Completion Date).

Activity	No Disposal Action[1]
Construction	06/2033 - 06/2037 06/2083 - 06/2087
Tank retrieval and re-evaporation	06/2037 - 06/2042 06/2087 - 06/2092
Decontamination and decommissioning	06/2042 - 06/2047 06/2092 - 06/2097
Monitoring and maintenance	01/1995 - 01/2095
Research and development	n/a

Notes:

[1]Figure 2-2 is a representation of the above schedule.

Table 5-6. Radiological Operating Emissions (Ci). for 100 yr's

Radionuclide[1]	No Disposal Action		
	Air Emissions from Tank Farms[2]	Air Emissions from Evaporator[3]	Water Emissions from Evaporator[4]
^{241}Am	0	n/a	0
^{14}C	0	n/a	0
^{137}Cs	2.1E-03	n/a	1.8E-02
^{3}H	Below Detection[5]	n/a[6]	2.1E02
^{129}I	4.6E-03	n/a	2.7E-02
^{239}Pu, ^{240}Pu	0	n/a	0
^{106}Ru	0	n/a	0
^{151}Sm	0	n/a	0
^{90}Sr	3.1E-04	n/a	2.0E-02
^{99}Tc	0	n/a	0
^{93}Zr	0	n/a	0
Total Alpha	n/a	2.1E-05	n/a
Total Beta	n/a	1.2E-05	n/a
Percent PM-10[7]	100	n/a	n/a

Notes:

[1]All values in Ci except for percent PM-10.

[2]Starting air releases for tank farms were taken from WHC-EP-0527-3, *Environmental Releases for Calendar Year 1993* (Thomas and Curn 1994). The release values were then decayed and summed over the 100-year period (see Appendix B).

[3]These releases were below the trip point for reporting individual radionuclides so total alpha and beta were reported in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas* (Coony et al.).

[4]These releases were based on the yearly releases of the evaporator while processing approximately 41,600 m^3 (11 million gal) of waste in a year as reported in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas* (Coony et al.). To evaporate 416,000 m^3 (110 million gal) of waste (at a 3-to-1 dilution) at 41,600 m^3 (11 million gal) a year, requires the equivalent of 10 years of operation for each retanking or 20 years of emissions at this level. The releases were calculated by decaying the 1987 releases to the point of evaporation and summing the releases over the evaporator operation while decaying the radionuclide during the evaporation (see Appendix B). The actual evaporation for retanking is scheduled for 5 years each time so the emissions may be more concentrated while remaining within release limits.

Table 5-6. Radiological Operating Emissions (Ci).

Notes: (Continued)

[5]Table 2-1 of the *Environment Releases for Calendar Year 1993* (Thomas and Curn 1994) indicates that air sampling was not done for tritium in the 200 Areas based on its known absence or extremely low concentrations and dose impact.

[6]No separate air emissions were compiled for different radionuclides in the *Westinghouse Hanford Company Effluent Releases and Solid Waste Management report for 1987: 200/600/1100 Areas* (Coony et al.); therefore, the tritium releases are contained in the total Beta entry in this column.

[7]Percent PM-10 is 100 percent as all released particulates are less than 10 microns.

Coony, F. M., D. B. Howe, and L. J. Voigt, 1988, *Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas*, WHC-EP-0141, Westinghouse Hanford Compant, Richland, Washington.

Thomas S. J. and B. L. Curn, 1994, *Environmental Releases for Calendar Year 1993*, WHC-EP-0527-3, Westinghouse Hanford Company, Richland, Washington.

APPENDIX B

CALCULATION OF RADIOLOGICAL RELEASES TO AIR AND WATER FROM THE TANK FARMS AND EVAPORATOR OVER THE FIRST 100 YEARS

The amount of a radionuclide at a given time in its decay life is represented by:

$$N = N^o \, e^{-\lambda t}$$

where:

N = the amount of the radionuclide at time t
N° = the amount of the radionuclide at time zero
λ = the decay constant

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

$t_{1/2}$ = the half life or the amount of time before half the original amount of radionuclides decay

To find the amount of environmental releases over a 100-year period the decay equation is integrated over 100 years.

$$\int_0^{100} N^o \, e^{-\lambda t} \, dt = N^o \int_0^{100} e^{-\lambda t} \, dt =$$

$$= N^o \left[\frac{-e^{-\lambda t}}{\lambda}\right]_0^{100} =$$

$$= - N^o \left[\frac{e^{-\lambda 100}}{\lambda} - \frac{e^0}{\lambda}\right] =$$

$$= N^{o}\,[\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 100}}{\lambda}]$$

$$for\ ^{137}Cs\quad t_{1/2} = 30\ years\quad so\quad \lambda = \frac{\ln 2}{30\ y} = 0.0231\ y^{-1}$$

$$for\ ^{90}Sr\quad t_{1/2} = 28.1\ years\quad so\quad \lambda = \frac{\ln 2}{28.1\ y} = 0.0247\ y^{-1}$$

$$for\ ^{129}I\quad t_{1/2} = 1.7X10^{7}\ years\quad so\quad \lambda = \frac{\ln 2}{1.7X10^{7}\ y} = 4.08X10^{-8}\ y^{-1}$$

Current yearly tank farm air releases are:

$^{137}Cs = 5.3 \text{ X } 10^{-5}$ Ci

$^{90}Sr = 8.4 \text{ X } 10^{-6}$ Ci

$^{129}I = 4.6 \text{ X } 10^{-5}$ Ci

Tank Farm releases for 100 years for each of these radionuclides are:

for ^{137}Cs

$$5.3X10^{-5}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(100)}}{0.0231}] = 2.1X10^{-3}\ Ci$$

for ^{90}Sr

$$8.4X10^{-6}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(100)}}{0.0247}] = 3.1X10^{-4}\ Ci$$

for ^{129}I

$$4.6X10^{-5}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(100)}}{4.1X10^{-8}}] = 4.6X10^{-3}\ Ci$$

Yearly evaporator liquid releases for 1987 are:

$^{3}H = 4.30 \times 10^{2}$ Ci

$^{137}Cs = <4.91 \times 10^{-3}$ Ci

$^{90}Sr = <6.07 \times 10^{-3}$ Ci

$^{129}I = <1.36 \times 10^{-3}$ Ci

Yearly evaporator air releases for 1987 are:

Total Alpha = 1.04×10^{-6} Ci

Total Beta = 3.63×10^{-6} Ci

The first evaporation connected to retanking occurs in 2037. The releases above will be decayed to that time (50 years). The decayed releases then will be summed and decayed over the first ten year operation of the evaporator. The releases then will be decayed to the beginning of the second evaporation which starts in 2087 (another 50 years). The decayed releases then will be summed and decayed over the second ten year operation of the evaporator.

$$N = N^{o}\ e^{-\lambda t}$$

where:

N = the amount of the radionuclide at time t
N° = the amount of the radionuclide at time zero
λ = the decay constant

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

$t_{1/2}$ = the half life or the amount of time before half the original amount of radionuclides decay

$$\text{for } ^{137}Cs \quad t_{1/2} = 30 \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{30 \text{ y}} = 0.0231 \text{ y}^{-1}$$

$$\text{for } ^{90}Sr \quad t_{1/2} = 28.1 \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{28.1 \text{ y}} = 0.0247 \text{ y}^{-1}$$

$$\text{for } ^{129}I \quad t_{1/2} = 1.7X10^{7} \text{ years} \quad \text{so} \quad \lambda = \frac{\ln 2}{1.7X10^{7} \text{ y}} = 4.08X10^{-8} \text{ y}^{-1}$$

$$\text{for } ^{3}H \quad t_{1/2} = 12.3 \text{ years so } \lambda = \frac{\ln 2}{12.3 \text{ y}} = 0.0564 \text{ y}^{-1}$$

Therefore, the amount of the radionuclides after 50 years is:

for ^{3}H

$$N = 4.3X10^{2} \text{ Ci } e^{-0.0564(50)} = 25.7 \text{ Ci}$$

for ^{137}Cs

$$N = 4.91X10^{-3} \ Ci \ e^{-0.0231(50)} = 1.55X10^{-3} \ Ci$$

for ^{90}Sr

$$N = 6.07X10^{-3} \ Ci \ e^{-0.0247(50)} = 1.77X10^{-3} \ Ci$$

for ^{129}I

$$N = 1.36X10^{-3} \ Ci \ e^{-4.1X10^{-8}(50)} = 1.36X10^{-3} \ Ci$$

for Total Beta (decay the same as ^{90}Sr)

$$N = 3.63X10^{-6} \ Ci \ e^{-0.0247(50)} = 1.06X10^{-6} \ Ci$$

for Total Alpha (decay the same as Pu $t_{1/2}$ = 24,400 y $\lambda = 2.84 \times 10^{-5}$)

$$N = 1.04X10^{-6}\ Ci\ \ e^{-2.84X10^{-5}(50)} = 1.04X10^{-6}\ Ci$$

First evaporator releases over a 10 year period are calculated below:

$$N = N^{o}\ [\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 10}}{\lambda}]$$

Evaporator releases for 10 years for each of these radionuclides are:

for ^{137}Cs

$$Total = 1.55X10^{-3}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(10)}}{0.0231}] = 1.38X10^{-2}\ Ci$$

for ^{3}H

$$25.7\ \text{Ci}\ [\frac{1}{0.0564} - \frac{e^{-0.0564(10)}}{0.0564}] = 196.4\ \text{Ci}$$

for ^{90}Sr

$$1.77X10^{-3}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 1.56X10^{-2}\ Ci$$

for ^{129}I

$$1.36X10^{-3}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(10)}}{4.1X10^{-8}}] = 1.36X10^{-2}\ Ci$$

for Total Beta

$$1.06X10^{-6}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 9.36X10^{-6}\ Ci$$

for Total Alpha

$$1.04X10^{-6}\ Ci[\frac{1}{2.84X10^{-5}} - \frac{e^{-2.84X10^{-5}(10)}}{2.84X10^{-5}}] = 1.04X10^{-5}\ Ci$$

The second evaporation will occur after another 50 years of decay. Release concentrations after the second 50 years are:

$$N = N^{o}\ e^{-\lambda t}$$

for ^{137}Cs

$$N = 1.55X10^{-3}\ Ci\ e^{-0.0231(50)} = 4.87X10^{-4}\ Ci$$

for ^{3}H

$$N = 25.7\ e^{-0.0564(50)} = 1.53\ Ci$$

for ^{90}Sr

$$N = 1.77X10^{-3}\ Ci\ \ e^{-0.0247(50)} = 5.14X10^{-4}\ Ci$$

for ^{129}I

$$N = 1.36X10^{-3}\ Ci\ e^{-4.1X10^{-4}(50)} = 1.36X10^{-3}\ Ci$$

for Total Beta (decay the same as ^{90}Sr)

$$N = 1.06X10^{-6}\ Ci\ \ e^{-0.0247(50)} = 3.08X10^{-7}\ Ci$$

for Total Alpha (decay the same as Pu $t^{1/2}$ = 24,400 y $\lambda = 2.84\ X\ 10^{-5}$)

$$N = 1.04X10^{-6}\ Ci\ \ e^{-2.84X10^{-5}(50)} = 1.04X10^{-6}\ Ci$$

Second evaporator releases over a 10 year period are calculated below:

$$N = N^{o} \cdot [\frac{e^{0}}{\lambda} - \frac{e^{-\lambda 10}}{\lambda}]$$

Evaporator releases for 10 years for each of these radionuclides are:

for ^{137}Cs

$$4.87X10^{-4}\ Ci[\frac{1}{0.0231} - \frac{e^{-0.0231(10)}}{0.0231}] = 4.35X10^{-3}\ Ci$$

for ^{3}H

$$1.53\ \text{Ci}\ [\frac{1}{0.0564} - \frac{E^{-0.0564(10)}}{0.0564}] = 11.7\ \text{Ci}$$

for ^{90}Sr

$$5.14X10^{-4}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 4.56X10^{-3}\ Ci$$

for ^{129}I

$$1.36X10^{-3}\ Ci[\frac{1}{4.1X10^{-8}} - \frac{e^{-4.1X10^{-8}(10)}}{4.1X10^{-8}}] = 1.36X10^{-2}\ Ci$$

for Total Beta

$$3.08X10^{-7}\ Ci[\frac{1}{0.0247} - \frac{e^{-0.0247(10)}}{0.0247}] = 2.72X10^{-6}\ Ci$$

for Total Alpha

$$1.04X10^{-6}\ Ci[\frac{1}{2.84X10^{-5}} - \frac{e^{-2.84X10^{-5}(10)}}{2.84X10^{-5}}] = 1.04X10^{-5}\ Ci$$

Total releases for the evaporator is a sum of the first and second evaporator operation releases:

for ^{137}Cs

$$<1.38 \times 10^{-2} + <4.35 \times 10^{-3} = <1.8 \times 10^{-2} \text{ Ci}$$

for ^{3}H

$$196 \text{ Ci} + 12 \text{ Ci} = 210 \text{ Ci}$$

for ^{90}Sr

$$<1.56 \times 10^{-2} + <4.56 \times 10^{-3} = <2.0 \times 10^{-2} \text{ Ci}$$

for ^{129}I

$$<1.36 \times 10^{-2} + <1.36 \times 10^{-2} = <2.7 \times 10^{-2} \text{ Ci}$$

for Total Beta

$$9.36 \times 10^{-6} + 2.72 \times 10^{-6} = 1.2 \times 10^{-5} \text{ Ci}$$

for Total Alpha

$$1.04 \times 10^{-5} + 1.04 \times 10^{-5} = 2.1 \times 10^{-5} \text{ Ci}$$

DON'T SAY IT --- *Write It!*

DATE: 3/31/95

TO: Dave Murray

FROM: Chris Meng H5-27

Telephone: 376-2947

cc: Ed Fredenburg

SUBJECT: No Disposal Action - Open item - radioactive emissions

The air operating emissions from 1993 for the tank farms (Table 5-6) had data for areas 3EDS and 5EDS. No emission data was given for the other areas. This indicates that the amounts released may have been so low they were not detectable or the releases were below reportable amounts.

The releases of tritium are associated with the operation of the evaporator. The evaporator releases and calculations remain the same and were not identified in the areas given. The tank farm releases and evaporator releases are separate in Table 5-6.

Please find attached the calculations for the releases from the areas where data was available.

Also, find attached the updated tables discussed earlier.

3EDS -

^{137}Cs	5.3 E - 5	Ci	Released in 1993
^{129}I	4.6 E - 5	Ci	
^{90}Sr	8.32 E - 6	Ci	

See Appendix B of WHC-SD-WM-EV-099 Ref. B for deffinitions. and equations (decay + integration).

Tank Farm releases for 100 years for each of these radionuclides are:

for ^{137}Cs

$$5.3\,E-5\ Ci\left[\frac{1}{0.0231} - \frac{e^{-0.0231(100)}}{0.0231}\right] = 2.1\,E-3\ Ci$$

for ^{129}I

$$4.6\,E-5\ Ci\left[\frac{1}{4.1\times10^{-8}} - \frac{e^{-4.1\times10^{-8}(100)}}{4.1\times10^{-8}}\right] = 4.6\,E-3\ Ci$$

for ^{90}Sr

$$8.32\,E-6\ Ci\left[\frac{1}{0.0247} - \frac{e^{-0.0247(100)}}{0.0247}\right] = 3.08\,E-4\ Ci$$

5EOS

^{137}Cs	1.6 E -7	Ci	Released in 1993
^{129}I	Not Detected		
^{90}Sr	9.3 E -8	Ci	

Tank Farm releases for 100 yrs for each of these radionuclides are:

for ^{137}Cs

$$1.6\,E-7\ Ci\left[\frac{1}{0.0231}-\frac{e^{-0.0231(100)}}{0.0231}\right]=6.2\,E-6\ Ci$$

for ^{90}Sr

$$9.3\,E-8\ Ci\left[\frac{1}{0.0247}-\frac{e^{-0.0247(100)}}{0.0247}\right]=3.4\,E-6\ Ci$$

Table 5-9. Construction Resource Requirements (Units As Indicated).

Construction Resource	No Disposal Action
Land (m^2)[1]	
Surface committed	
Temporarily	360,000[2]
Permanently	190,000
Water (m^3)[3]	17,000
Energy[3]	
Electrical (GWh)	0.4
Propane (m^3)	7,500
Diesel fuel (m^3)	63
Gasoline (m^3)	86
Materials[4]	
Concrete (m^3)	120,000
Steel:	
Carbon steel (t)	12,000
Stainless steel (t)	22
Hastelloy (t)	0
Excavation (m^3)	3,700,000
Riprap (m^3)	0
Structure backfill (m^3)	3,500,000[5]
Total Contaminated Material (m^3)	0

Table 5-15. Decommissioning of Contaminated Treatment/Storage Facilities (Units as Indicated).

Item	No Disposal Action
Steel Quantity Disposition	20 t Low-level waste burial ground
Concrete Quantity Disposition	150 m^3 Low-level waste burial ground
Soil Quantity Disposition	0
Debris Quantity Disposition	140 m^3 Low-level waste burial ground

Notes:

m^3 = cubic meters
t = metric tons

As a part of this alternative, the current double-shell tanks and the new double-shell tanks would be left in place; therefore, no decontamination and decommissioning work would be done on them. The abandoned double-shell tanks may be filled with grout or gravel. Details of the closure of the double-shell tanks are in the *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Study* (Scanlon et al. 1995)

The two high-level waste evaporators built as part of this alternative would be decommissioned. The entries in this table are for those evaporators. The following assumptions were made for decommissioning: 5 percent of the concrete and steel will remain contaminated; 85 percent of the stainless steel will remain contaminated; 5 percent of the decontaminated steel and concrete will be debris; and the evaporators will be entombed in place so no contaminated soil would need to be removed.

Scanlon, P.L., H. Hampt and W.A. Skelly, 1995, *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Study*, WHC-SD-WM-EV-107, Rev. B, Westinghouse Hanford Company, Richland, Washington.

The following are specific data requests for the Tanks - No Action TWRS alternative.

1. A description of the processes involved in the No Action alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	**Source ID**	**Peak Hourly Emission Rate**	**Annual Average Emission Rate**	**Chronologic Phase**

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
TF1E	573556	137442	200	AREA
TF2E	573556	137282	200	AREA
TF3E	573771	137252	200	AREA
TF4E	575075	136493	200	AREA
TF5E	575332	136378	205	AREA
TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

6.1.1

Request Number 058

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 3/20/95

Phone Number: (904) 332-3318 Fax Number: (904) 333-6631

Request Information: Process information and emission rates for the Cs and Sr capsules - Extensive Immobilization TWRS alternative. Please refer to attached sheet for additional information. Priority A.

Need Date: 4/7/95

Response: See attached.

Data Source/Accuracy:

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

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DATA REQUEST 058

The Extensive Immobilization alternative for the cesium and strontium capsules involves the following activities:

- Retrieve capsules from WESF;
- Build or modify a cell in the HLW vitrification facility to provide equipment to cut up capsules, remove contents, chemically treat contents if required, and feed capsule materials into the HLW melter food stream;
- Put capsules in a transportation cask and transport from WESF to the HLW plant;
- Cut up capsules, chemically treat if required, and feed into HLW melter feed; and
- Vitrify capsule contents with tank wastes.

No emissions for the construction or operations phases are provided in this data request. The construction emissions will be less than the uncertainty associated with the TPA construction emissions. The operating emissions will be treated and released with the HLW offgas system and should not significantly increase the stack emissions.

The cesium and strontium capsules engineering data package does not provide estimates for construction related emissions or operating emissions. The rationale provided in the data package is that the additional volume from the capsules is so small compared to the tank wastes that the additional impacts are insignificant.

The following are specific data requests for the Cs and Sr Capsules - Extensive Mobilization TWRS alternative.

1. A description of the processes involved in the Extensive Mobilization alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
TF1E	573556	137442	200	AREA
TF2E	573556	137282	200	AREA
TF3E	573771	137252	200	AREA
TF4E	575075	136493	200	AREA
TF5E	575332	136378	205	AREA
TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

6.11

Request Number 059

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE)

Date: March 20, 1995

Phone Number: (904) 332-3318

Fax Number: (904) 333-6631

Request Information: Process information and emission rates for the Cs and Sr Capsules - Overpacked and ship to federal repository. No Immobilization TWRS alternative. Please refer to the attached sheet for additional information.

Priority A

Need Date: April 7, 1995

Response:

Data Source/Accuracy:

Prepared By: Jim Goodwin

Date Sent/Faxed:

Concurrence: Marc C Nelson
Marc Nelson - Deputy Project Manager

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The following are specific data requests for the Cs and Sr Capsules - No Immobilization TWRS alternative.

1. A description of the processes involved in the No Immobilization alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
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TF4E	575075	136493	200	AREA
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TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

DATA REQUEST 59

Construction Activities

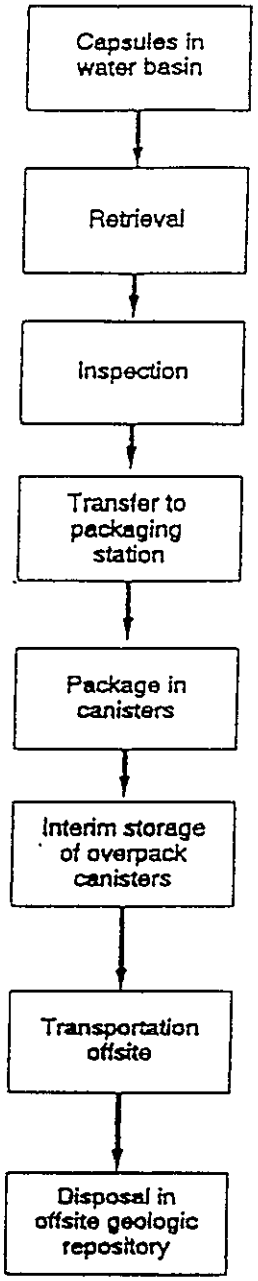
The only construction activity for Cesium and Strontium Capsules - No Immobilization TWRS alternative is the construction of capsule packaging facility. This will be a modification of the existing waste encapsulation storage facility (WESF). The duration of construction is for a period of seven years.

The capsule packaging facility is envisioned as a series of three hot cells, each 4.9-m wide and 3-m, 14-m, and 7-m long, respectively. The cells will be housed in a facility that is 43-m long, 14-m high, and occupies approximately 1,100 m^2 of surface area. The thick high density, concrete shielding wall of the hot cells will have an estimated eight viewing windows. Four manipulator pairs will be required. See attached Figure A1-1. Process flowsheet for the capsule packing facility.

For construction and location of capsule packaging facility see attached: Figure 4-1 and Figure D-5.

See the attached Figure 3-3 for the process flowsheet.

Figure 3-3. Flowsheet for Tri-Party Agreement Alternative for Storing and Disposing of Cesium Strontium Capsules (Preferred Alternative).



SPC87\FIG-3-3
JEB (10/4/94)

Table 59-A. Nonradioactive Emissions for the Construction Phase for Cesium and Strontium Capsules

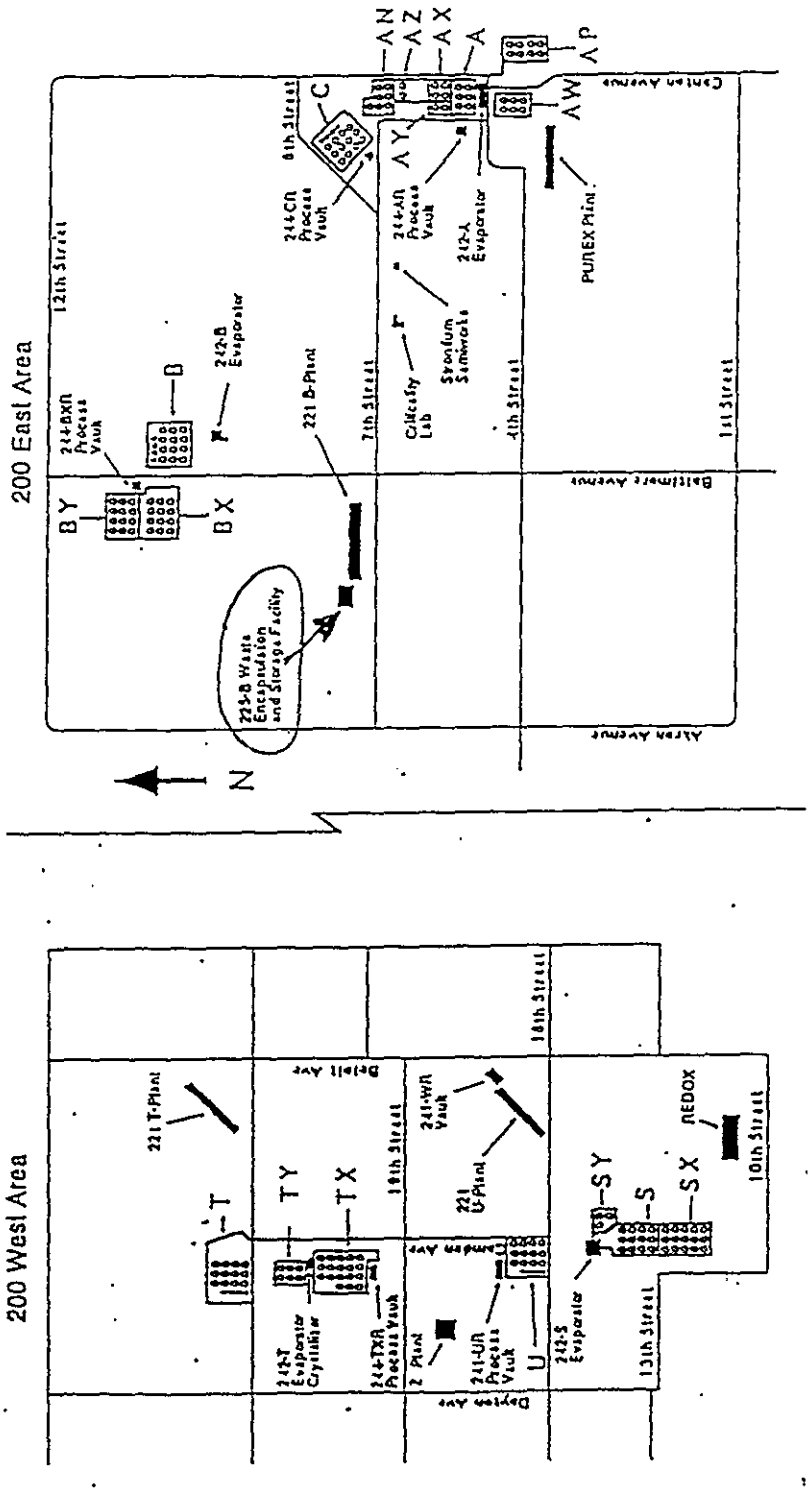
Pollutant	Source ID[1]	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase
Carbon Monoxide	W 573400 N 136400	5.0 kg	3,428.5 kg	Construction
Hydrocarbons	W 573400 N 136400	0.19 kg	128.6 kg	Construction
NO_x	W 573400 N 136400	0.19 kg	128.6 kg	Construction
SO_x	W 573400 N 136400	0.0 kg	0.0 kg	Construction
Particulates	W 573400 N 136400	0.02 kg	14.3 kg	Construction
Thermal	W 573400 N 136400	1.15E-3 TJ	0.78 TJ	Construction

[1]See attached 200 East Area map.

Table 59-B. Nonradioactive Emissions for the Operational Phase for Cesium and Strontium Capsules

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase
Carbon Monoxide	W 573400 N 136400	0.16 kg	489.0 kg	Operation
Hydrocarbons	W 573400 N 136400	0.05 kg	144.4 kg	Operation
NO_x	W 573400 N 136400	0.79 kg	2,445.4 kg	Operation
SO_x	W 573400 N 136400	HOLDING FOR INFORMATION FROM WHC		
Particulates	W 573400 N 136400	0.12 kg	372.2 kg	Operation
Thermal	W 573400 N 136400	1.09E-2 TJ	33.9 TJ	Operation

Figure 4-1. Tank Farm Locations within the Hanford Site. (Brevick et al., 1994a)



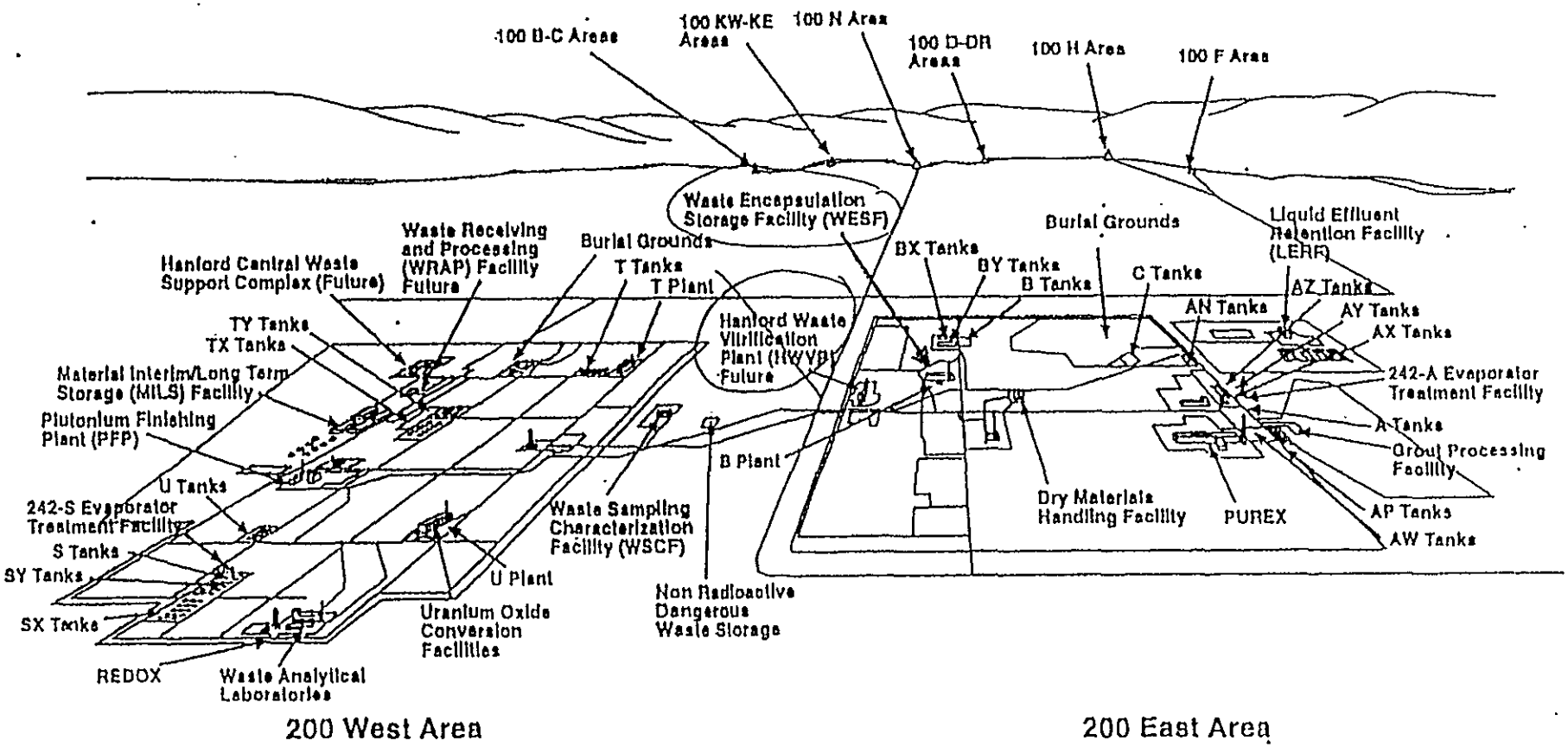


Figure D-4. Storage and Disposal Operations - 200 Area Facilities

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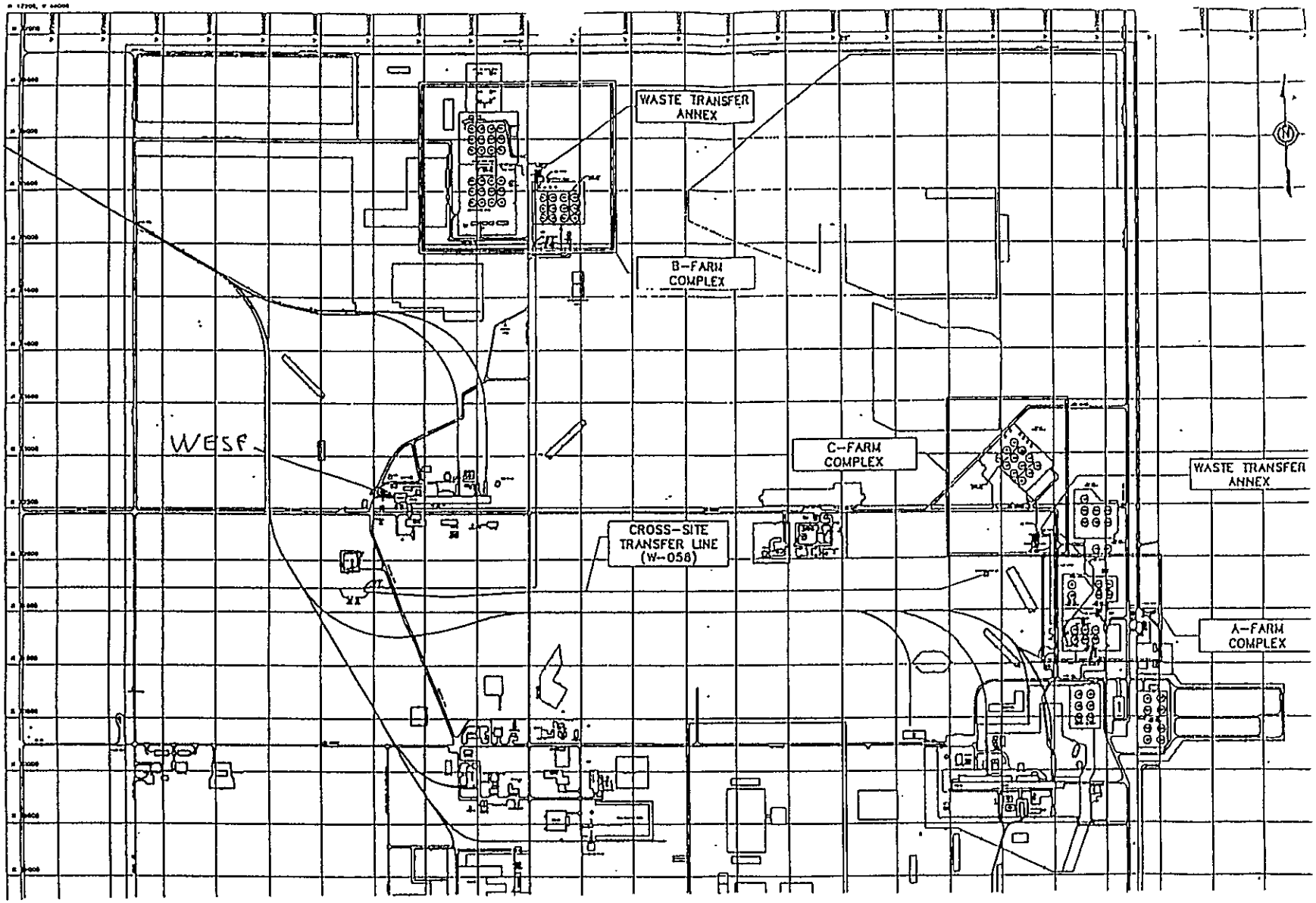
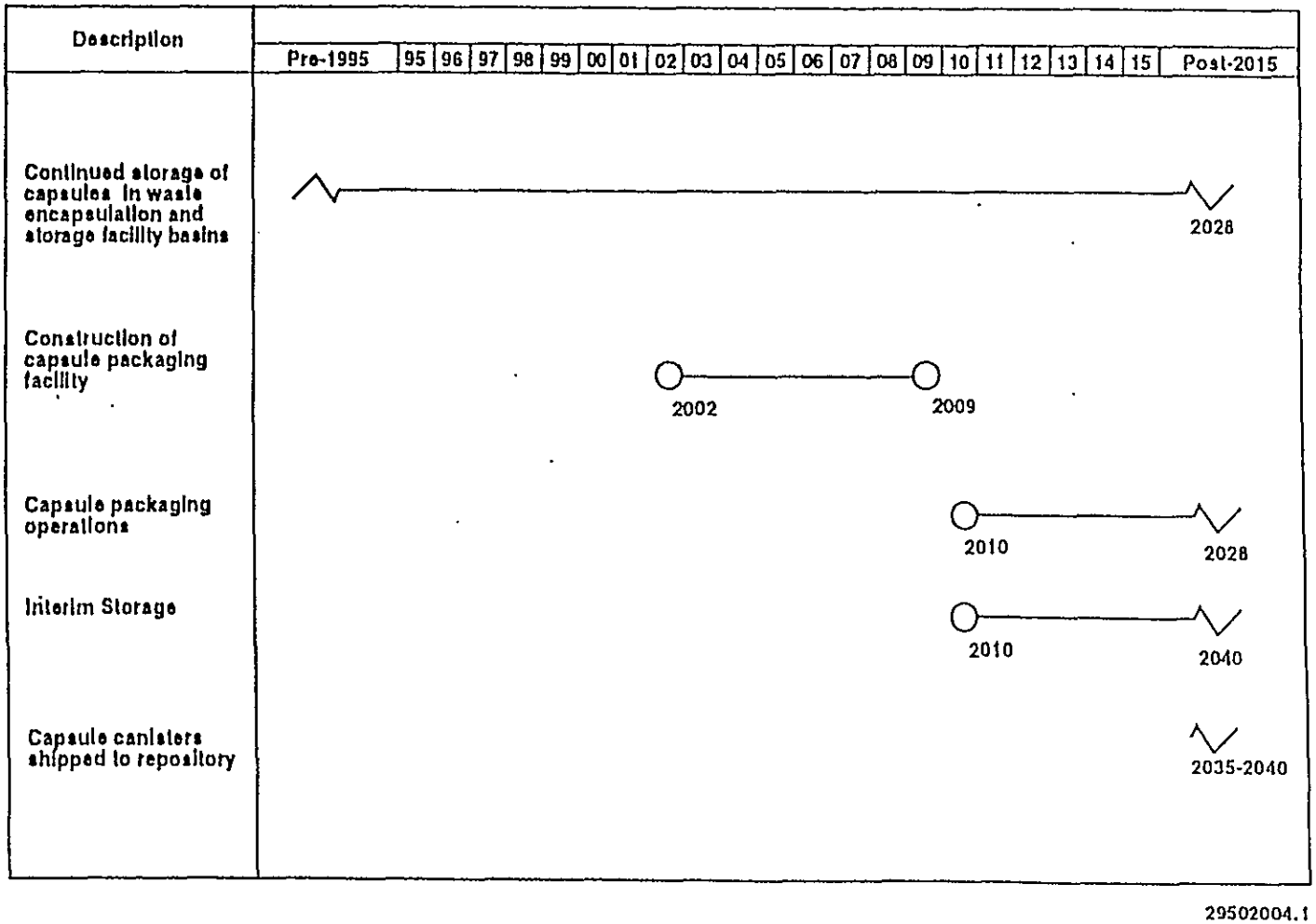

WASTE TRANSFER ANNEX
B-FARM COMPLEX
WESF
C-FARM COMPLEX
WASTE TRANSFER ANNEX
CROSS-SITE TRANSFER LINE (W-058)
A-FARM COMPLEX
N

Figure 3-4. Schedule of Activities for the Tri-Party Agreement Alternative: Storage and Disposal of Cesium Strontium Capsules (Preferred Alternative).



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SUPPLEMENT TO ENGINEERING INFORMATION REQUEST 59

SUBJECT: Emissions from Capsule Overpack and Ship Alternative

The operational phase emissions for this capsule alternative are tied to the estimated 18,000 metric tons of coal identified in the operational resource requirements table. This coal is assumed to be used to generate process steam.

The operating resource requirements table does not identify any gasoline or diesel requirements for this alternative.

Since the WESF is assumed to be modified to accommodate capsule packaging activities it is reasonable to assume that an electric steam generator will be utilized to provide any required process steam (this is the same assumption used in the other data packages).

Using the above information the nonradiological operating emissions for this capsule alternative for CO, Hydrocarbons, Nox, Sox, and particulates should be reduced to zero.

The following are specific data requests for the Cs and Sr Capsules - No Immobilization TWRS alternative.

1. A description of the processes involved in the No Immobilization alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	**Source ID**	**Peak Hourly Emission Rate**	**Annual Average Emission Rate**	**Chronologic Phase**

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
TF1E	573556	137442	200	AREA
TF2E	573556	137282	200	AREA
TF3E	573771	137252	200	AREA
TF4E	575075	136493	200	AREA
TF5E	575332	136378	205	AREA
TF6E	575365	136279	205	AREA
TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
TF9E	575310	136015	210	AREA
TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
TA1W	566833	136570	210	AREA
TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

Request Number 060

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 3/20/95

Phone Number: (904) 332-3318 Fax Number: (904) 333-6631

Request Information: Process information and emission rates for the Cs and Sr capsules - No Action Alternative. Please refer to the attached sheet for additional information.

Need Date: 4/7/95

Response: See attached response

Data Source/Accuracy: Data developed from the Capsule and No Separtions data packages using the assumptions outlined in this data request. Location of the drywell storage facility provided by WHC on CC mail message.

Prepared By: Colin Henderson Date Sent/Faxed:

Concurrence: Marc C Nelson
Marc Nelson - Deputy Project Manager

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DATA REQUEST 060

The Capsules No Action Alternative involves the following steps:

1. Build a dry well storage facility for the capsules
2. Retrieve capsules from current storage
3. Overpack capsules into canisters
4. Transport overpacked capsules to the drywell storage facility
5. Place canisters into drywells
6. Monitor drywell storage facility until the year 2090

The drywell storage facility will be located at the following coordinates:

The NW corner of the no action capsule storage facility is at the state coordinates
E 572,336 N 136,277

The drywell storage site will be 195 meters by 195 meters and this includes a 30 meter buffer zone all the way around the dry well area.

It is assumed that the construction emissions for the drywell storage facility can be estimated in the following manner:

1. Scale the construction emission data for clearing and grubbing estimated for the No Separations alternative. Clearing and grubbing consists of leveling and site preperation.

2. The fugitive dust emissions for the No Separations data package clearing and grubbing was estimated to be:

bulldozer grading = 5.1 mt
paved road traffic= 7.8 mt

12.9 metric tons

3. The No Separations disturbed area = 189 acres (765,000 square meters)
1 acre=4047 ssquare meters

4. The drywell storage facility = 38,000 square meters

5. The area ratio is = 38,000/765,000= 0.05

6. The fugitive dust emission for the drywell storage facility is
=0.05*12.9 mt = .65 metric tons fugitive dust

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7. The construction period in the data package is 2002-2009
This includes a proposed capsule packaging facility (which is assumed to be modifications to WESF). No new capsule packaging facilities will be built. Assume the drywell facility will be constructed in a 3 month period in the year 2009.

8. Using the .05 factor the attached No Separations vehicle emissions for year one of construction yeilds the following:

CO=1660 kg
Exhaust hydrocarbons = 230 kg
Fugitive hydrocarbons = 8 kg
NO2 = 3300 kg
Aldehydes HCHO = 100 kg
SO2 = 100 kg
Particulate matter PM10 = 277 kg (from vehicle exhaust)

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Ave Emission Rate (see note 1)	Chronologic Phase
CO	see note2	8.3 kg/hr	1660 kg	construction
Exhaust hydrocarbons	see note 2	1.15 kg/hr	230 kg	construction
Fugitive hydrocarbons	see note 2	0.04 kg/hr	8 kg	construction
NO2	see note 2	16.5 kg/hr	3300 kg	construction
Aldehydes HCHO	see note 2	0.5 kg/hr	100 kg	construction
SO2	see note 2	0.5 kg/hr	100 kg	construction
Particulate Matter PM10 (exhaust particulate)	see note 2	1.4 kg/hr	277 kg	construction
Fugitive dust	see note 2	3.25 kg/hr	650 kg	construction

Note 1: The construction phase is assumed to occur in a 3 month time period and the emissions noted are the total over the three month time period.

Peak hourly emissions are based on 10 hours/day, 5 days/week, peak factor of 3, 3 months

is 60 work days =600 hours. Peak hourly = (total/600)*3 =.005

Note 2. This source is not represented by one of the 27 existing source areas. It is nearest to the BTCH location.

Year 1 of Construction

Hanford Waste Vitrification Project - Environmental Impact Statement
Construction Equipment Non-Radiological Emissions Estimates
"Tri-Party Agreement" alternative linearly scaled against "No Pretreatment" alternative baseline

Fluor Daniel Environmental Services
contract #04-436303-2013-052

Equipment Description	Rated Power (hp)	AP-42 Category	No. of Units	Total Usage		emiss. factor units	Carbon Monoxide CO fact	Carbon Monoxide CO emiss (kg)	Exhaust Hydrocarbons Exh HC fact	Exhaust Hydrocarbons Exh HC emiss (kg)	Fugitive Hydrocarbons Fug HC fact	Fugitive Hydrocarbons Fug HC emiss (kg)	Nitrogen Oxides as NO2 NOx fact	Nitrogen Oxides as NO2 NOx emiss (kg)	Aldehydes as HCHO Aldehydes fact	Aldehydes as HCHO Aldehydes emiss (kg)	Sulfur Oxides as SO2† SOx fact	Sulfur Oxides as SO2† SOx emiss (kg)	Particulate Matter Particulate fact	Particulate Matter Particulate emiss (kg)
3/4 ton Pickup	250	LDGT1	1	64800	mi	g/mi	10.25	664.2	0.81	52.488	0.59	38.232	1.06	68.688	-	-	-	-	-	-
D8 Dozer	335	wheeled dozers D	4	1280	hr	g/hr	816.8	1079.17	86.84	127.387	-	0	1889	7122.13	29.5	111.215	-	-	75	282.75
Cat 966 Loader	200	wheeled loader D	1	120	hr	g/hr	259.6	31.1496	113.2	13.5804	-	0	858.2	102.983	18.8	2.256	-	-	77.9	9.348
10 cy Dump Truck	250	off highway truck D	8	4680	hr	g/hr	816.8	284.118	86.84	31.3664	-	0	1889	1813.59	51	48.96	-	-	116	111.36
Cat D9 Dozer	460	wheeled dozers D	2	5000	hr	g/hr	816.8	2287.02	86.84	241.152	-	0	1889	5289.65	29.5	82.6	-	-	75	210
Cat 637E Scraper	450	scraper D	6	7280	hr	g/hr	568.2	4420.52	128.2	997.007	-	0	1741	13543	65	505.7	-	-	184	1431.52
(twin engine)	250	scraper D	6	7280	hr	g/hr	568.2	4420.52	128.2	997.007	-	0	1741	13543	65	505.7	-	-	184	1431.52
Towed Vibratory Roller	50	roller G	1	1400	hr	g/hr	6080	8512	277	387.8	83.7	117.18	164	229.6	7.57	10.598	-	-	11.8	16.52
Cat 14G Motor Grader	200	motor grader D	2	4370	hr	g/hr	68.46	299.17	18.07	78.9659	-	0	324.4	1417.76	5.54	24.2098	-	-	27.7	121.049
Cat 235B Backhoe	215	misc D	1	80	hr	g/hr	306.4	24.5096	69.35	5.548	-	0	767.3	61.384	13.9	1.112	-	-	63.2	5.056
Cat 623E Elevating Scraper	330	scraper D	4	6270	hr	g/hr	568.2	3562.55	128.2	803.501	-	0	1741	10914.4	65	407.55	-	-	184	1153.68
Cat 815B Compactor	210	misc D	1	1570	hr	g/hr	306.4	481.001	69.35	108.88	-	0	767.3	1204.66	13.9	21.823	-	-	63.2	99.224
5000 gal Water Tanker	300	off-highway truck D	1	1570	hr	g/hr	816.8	1282.39	86.84	136.339	-	0	1889	2965.98	51	80.07	-	-	116	182.12
Mechanics Truck	250	off-highway truck D	1	1650	hr	g/hr	816.8	1347.74	86.84	143.286	-	0	1889	3117.11	51	84.15	-	-	116	191.4
Fuel/Lube Truck	250	off-highway truck D	1	2480	hr	g/hr	816.8	2025.69	86.84	215.363	-	0	1889	4685.12	51	126.48	-	-	116	287.68
Totals			40			No Pretreatment Baseline		33222		4593.7		155.4		66079		2012.4		2025		5533.2

Figure A1-2. Profile View of the Capsule Packing Operations in Relation to the Drywell Storage.

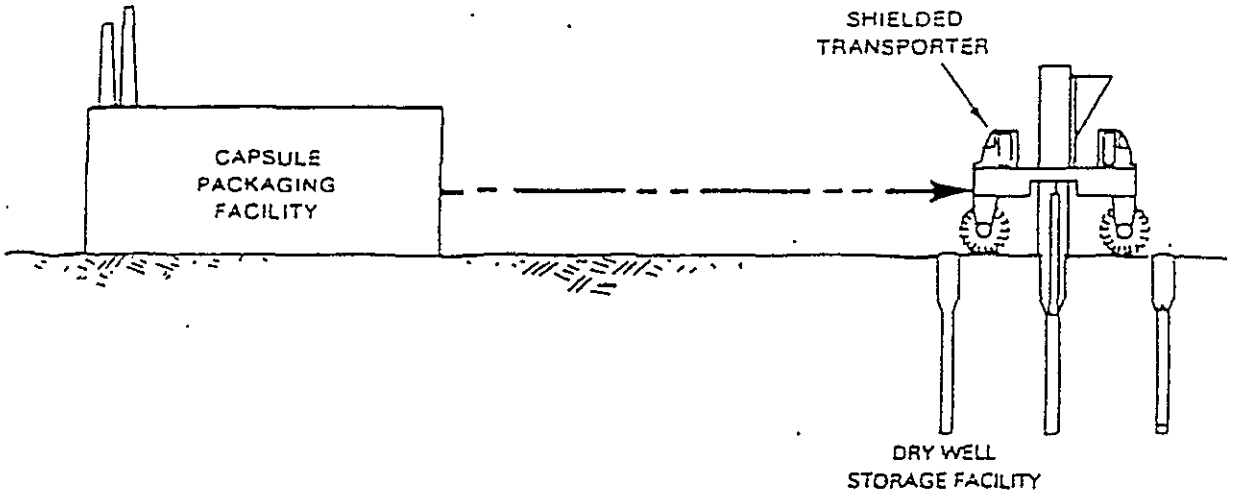


Figure A2-7. Typical Drywell Assembly.

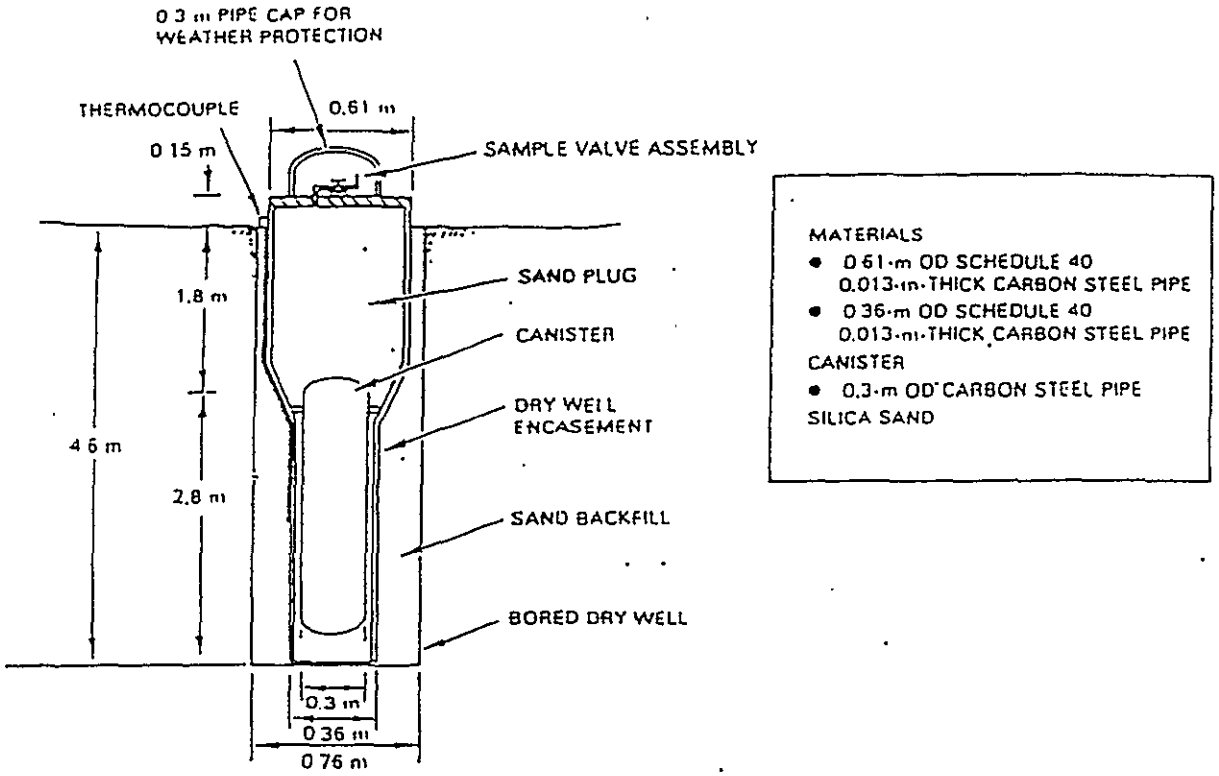
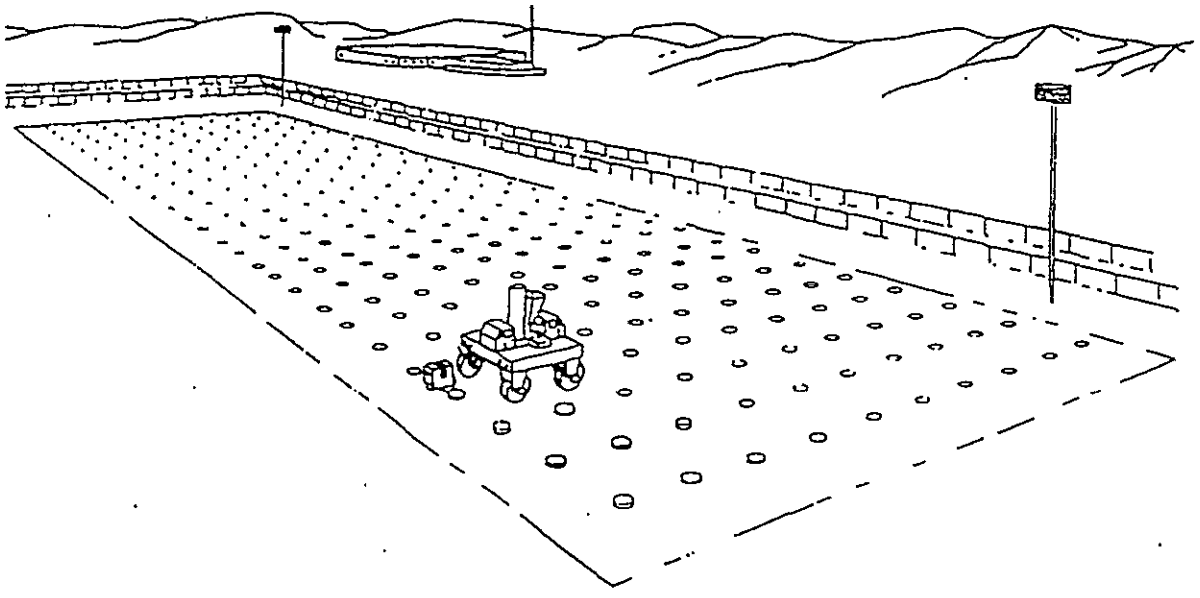


Figure A2-6. Assumed Drywell Storage Array.



RCP8006-217A

The following are specific data requests for the Cs and Sr Capsules - No Action TWRS alternative.

1. A description of the processes involved in the No Action alternative (including construction activities), indicating their nature and location. We feel that it would be useful to include applicable descriptive text and figures from the Engineering Data Package for this alternative.

2. Emissions of all regulated pollutants from each of the processes identified in item 1. Peak hourly and average annual emissions are required. These emissions should be assigned, if possible, to one of the 27 sources identified in the attached sheet and description. If a process occurs at a location other than the 27 identified source locations, please indicate the location of these sources. The preferred format for source locations is the coordinate grid system used by ASI (Washington State Coordinates).

3. A chronological description of the processes and emissions listed in items 1 and 2. For example, at how many tank farm locations will processes occur at one time? Will the duration of the project involve phases in which distinctly different emissions sources will be involved? If so, emissions from each phase should be given separately.

Ideally, the data would be presented in the following format:

Pollutant	Source ID	Peak Hourly Emission Rate	Annual Average Emission Rate	Chronologic Phase

TABLE 5.3.1 SOURCE TYPES AND LOCATIONS.

SOURCE NAME **	SOURCE LOCATION*		ELEVATION OF CENTER (m)	SOURCE TYPE
	x coord.	y coord.		
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TF2E	573556	137282	200	AREA
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TF7E	575281	136157	205	AREA
TF8E	575380	136159	205	AREA
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TF10E	575304	135806	210	AREA
TF11E	575481	135747	210	AREA
TF1W	566738	136662	210	AREA
TF2W	566715	136373	210	AREA
TF3W	566689	136146	210	AREA
TF4W	566744	135000	205	AREA
TF5W	566750	134399	205	AREA
TF6W	566746	134162	205	AREA
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TA2W	566886	134878	205	AREA
TA3W	566930	134444	205	AREA
TA1E	573755	137383	200	AREA
TA2E	575163	136336	200	AREA
PROC	573879	135229	215	AREA
BTCH	571332	135953	225	AREA
SMIN	574425	135978	215	AREA
ST-L	574120	135901	215	AREA
ST-H	574410	135978	215	AREA

Notes: * Location of area sources represents southwest corner of area (coordinates in meters)
** Tank farm sources have the prefix "TF", transfer annex areas have the prefix "TA"; source IDs ending in "E" are located in the 200 East area, while those ending in "W" are located in the 200 West area. Other sources are defined as follows:

PROC = Vitrification process facility construction emissions
BTCH = Concrete batch plant emissions
SMIN = Minimal pretreatment process stack
ST-L = TPA low level waste process stack
ST-H = TPA high level waste process stack

Coordinate locations are given consistent with ASI coordinate system.

Request Number 062

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: William Elizinga

Date: 03/28/95

Phone Number: (314) 567-4600

Fax Number: (314) 567-5030

Request Information: List of construction equipment for each alternative

1) Capsules

2) TPA

3) In Situ Vitrification

4) No Action

Need Date: 04/07/95 A Priority

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson C.H.

Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

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To: Chris Erickson - FAX No. 314/567-5030

From: Jim Goodwin

Date: April 11, 1995

Subject: William Elzinga's request for a list of construction equipment for each Alternative.

Construction equipment for the TPA Alternative was provided in detail, but this detail is lacking in the other WHC packages. We (Jacobs) can estimate what equipment will be required for construction by interpreting other information in the package - the fuel burned, the type of construction that will be done, etc.

We think that our original reply to your TPA question may be more than you needed. We have attached tables from the WHC packages to illustrate the information that we have. Please call Dave Murray to discuss how we can respond to your data needs.

Table 5-22. Construction Equipment Schedule (units).

Construction Equipment Type	No Disposal Action[1]
Heavy duty diesel equipment	100
Light-duty[2] diesel equipment	230
Light-duty gasoline vehicles	220
Small gasoline engines	650
Construction[3] noise (dcbls)	85

Notes:

[1]The values in this table were factored from the No Separations alternative by using a ratio of the construction costs.

[2]Light-duty diesel equipment has been added to this chart. It represents diesel engine equipment that runs at idle speed for a major portion of its time (e.g., lift cranes). The number of equipment units is based on a tabulation of "expected" types and numbers of equipment.

[3]Represents noise near a twin-engine scraper with 2 push dozers. The construction noise is based upon the noise at a twin-engine scraper with (2) Dg push cats. The combination produces "border line" ear protection noise levels for the equipment operators. The borderline threshold is 85 decibels. At distances away from the operating equipment, the noise level will decrease.

No Disposal

Table 5-25. Operating Schedule (Calendar Year Start/Completion Date) by Unit Process.

Unit Process	No Disposal Action[1]
Tank retrieval and re-evaporation	06/2037 - 06/2042 06/2087 - 06/2092

Note:

[1]The schedule was taken Figure 3-22, p. 3-30 *Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS*, (RHO 1985).

RHO, 1985, *Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the HDW-EIS*, RHO-RE-ST-30 P, Rockwell Hanford Operations, Richland, Washington.

Table 5-26. Duration (percent) by Construction Type.

Unit Process	Typical[1]
Clearing	1.6
Grubbing	1.6
Earthwork	4.9
Foundations	7.8
Structure	26
Mechanical and Electrical	29
Piping	29

Note:

[1]The source of this table is the *No Separations Data Package for the Tank Waste Remediation System Environmental Impact Statement*, (Colby 1995).

Colby, S. A., 1995, *No Separations Data Package for the Tank Waste Remediation System Environmental Impact Statement*, WHC-SD-WM-EV-103, Rev. B, Westinghouse Hanford Compant, Richland, Washington.

Table 7-23. Comparison of Alternatives by Construction Equipment Schedule.

Construction Equipment Type	In Situ Chemical Stabilization	Drying and Gravel Fill	In Situ Vitrification
Heavy Duty Diesel[1] Equipment	320	11	350
Light Duty Gasoline[2] Vehicles	1,300	47	1,400
Construction Noise[3] (decibels)	85	85	85

Notes:

[1]The *Tri-Party Agreement Alternative Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement* (Slaathaug 1995) reports 5.7 E4 liters diesel per piece of diesel equipment. This ratio was applied to each In Situ option using the diesel fuel requirement listed in Table 7-9.

[2]The ratio 9.0 E3 liters gasoline per vehicle was calculated from the *Tri-Party Agreement Alternative Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement* (Slaathaug 1995). This ratio was applied to each in situ option using the gasoline requirement listed in Table 7-9.

[3]Represents noise near a twin-engine scraper with 2 push dozers.

Slaathaug, E., 1995, *Tri-Party Agreement Alternative Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement*, Draft, Westinghouse Hanford Company, Richland, Washington.

Hanford Cs/Sr

Table 4-7. Nonradioactive Emissions for the Construction Phase for Cesium and Strontium Capsules.

Emission	Units	No Action	Onsite stabilization and disposal		Geologic disposal	Vitrification and disposal[2]
			Barrier	Total[1]	Storage and containerization	
CO	t	96	46	140	24	
Hydrocarbons	t	3.5	5.6	9.1	0.9	
NOx	t	3.6	23	27	0.9	
SOx	t	0.1	5.4	5.5	.0	
Particulates	t	0.3	3.0	3.3	0.1	
Thermal	TJ	23	59	82	5.5	
Aldehydes	t	-	0.76	0.8	-	
Dust	t	-	120	120	-	
Organic acids	t	-	0.5	0.5	-	

Notes:

t = ton
TJ = Terajoules (1E + 12 joules)

[1]Total equals barrier values plus continued storage value.

[2]Resource usage, costs, and personnel requirements for the vitrification and disposal option.

Under this alternative, the contents of the cesium and strontium capsules are sent to an existing vitrification plant for processing. The mass requiring vitrification from the cesium and strontium capsules is less than 1% of the tank materials that require vitrification. Therefore, the processing of the capsule contents does not impose any significant additional resource (both usage and personnel) requirements on the vitrification plant. Thus no separate estimate of impacts is provided.

MEMORANDUM

TO: William Elzinga

FROM: Dave Murray

SUBJECT: ENGINEERING INFORMATION REQUEST

February 15,1995
95-DM-005

In response to your inquiry we are enclosing the completed Engineering Information Request Number 031. Should you have any questions, please contact me at (509) 736-0616.

cc: Project File

Attachments: Engineering Information Request Number 031

DM:CCM:ns

Request Number 031

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: William Elzinga Date: 12/21/94

Phone Number: 314-567-4600 Fax Number: 314-567-5030

Request Information: 1) List of construction equipment used for each alternative, and measured noise levels @ 50 feet (each piece of machinery). 2) See attached sheet.

Need Date: 01/15/95

Response: See attached.

Data Source/Accuracy:

Construction equipment list from Min. Pretreat and TPA data packages (appendix) transportation table from Mike Harker.

Prepared By: Colin Henderson Date Sent/Faxed: 01/16/95

Concurrence: Marc E. Nelson
Marc Nelson - Deputy Project Manager

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ENGINEERING DATA REQUEST 31

REQUESTED BY: WILLIAM ELZINGA/ESE

SUBJECT: NOISE

For No Pretreatment Alternative the construction equipment schedule is as follows:

No Pretreatment Alternative
Five-Year Construction Schedule
Construction Equipment List

YEAR ONE OF CONSTRUCTION
The following equipment will be used during the first year of construction:

1. 3/4 ton pickup: 1 unit, total usage: 64,800 mi.
2. D8 dozer: 335 hp, 4 units, total usage: 3,770 hours.
3 Cat 966 loader: 200 hp, 1 unit, total use 120 hours.
4. Ten-cy dump truck: 250 hp, 8 units, total use 960 hours.
5. Cat D9 dozer: 460 hp, 2 units, usage: 2,800 hours.
6. Cat 637E scraper: 460 hp, 6 units, usage: 7,780 hours.
7. Scraper twin engine: 250 hp, 6 units, usage: 7,780 hours.
8. Towed vibratory roller:50 hp, 1 unit, usage: 1,400 hours.
9. Cat 14G motor grader:200 hp, 2 units, usage: 4,370 hours.
10. Cat 235B backhoe: 215 hp, 1 unit, usage: 80 hours.
11. Cat 623E elevating scraper:330 hp, 4 units, usage: 6,270 hours.
12. Cat 815B compactor: 210 hp, 1 unit, usage: 1,570 hours.
13. 5,000 gallon water tanker:300 hp, 1 unit, usage:1,570 hours.
14. Mechanics truck: 250 hp, 1 unit, usage: 1,650 hours.
15. Fuel/lube truck: 250 hp, 1 unit, usage: 2,480 hours.

YEAR TWO-FOUR OF CONSTRUCTION
The following equipment and usage will take place in years two-four of the construction period:

1. D8 dozer: 335 hp, 1 unit, usage: 920 hours.
2. 966 Front-end loader: 200 hp, 4 units, usage: 8,160 hours.
3. Ten-cy dump truck: 250 hp, 10 units, usage: 12,730 hours.
4. Cat 623E scraper: 330 hp, 4 units, usage: 610 hours.
5. Cat 14G motor grader:200 hp, 1 unit, usage: 150 hours.
6. 3/4 ton pickup: 250 hp, 1 unit, usage: 3,000 miles.
7. Cat D6 dozer: 165 hp, 1 unit, usage:1,810 hours.

8. Eight-cy concrete mixer trucks:250 hp, 4 units, usage: 16,800 hours.

Five-year duration. The following will be used throughout the five-year construction period:

1.	Utility dozer:	65 hp, 5 units, total usage: 16,000 hours.
2.	Utility loader/backhoe:	65 hp, 6 units, usage: 19,000 hours total.
3.	Backhoe:	65 hp, 4 units, usage: 10,000 hours.
4.	Backhoe:	120 hp, 4 units, 3,000 hours total use.
5.	Loader:	120 hp, 4 units, 10,000 hours total use.
6.	Loader:	200 hp, 2 units, 3,000 hours.
7.	Crane:	15 ton, 10 units, 64,000 hours.
8.	Crane:	25 ton, 10 units, 48,000 hours.
9.	Crane:	50 ton, 5 units, 16,000 hours.
10.	Crane:	100 ton, 2 units, 6,000 hours.
11.	Forklift:	2 ton, 10 units, 36,000 hours.
12.	Forklift:	4 ton, 6 units, 29,000 hours.
13.	Forklift:	6 ton, 4 units, 16,000 hours.
14.	Forklift:	10 ton, 4 units, 13,000 hours.
15.	Forklift:	15 ton, 4 units, 10,000 hours.
16.	Motor grader:	125 hp, 4 units, 22,000 hours.
17.	Pumps:	1", 2 hp, gas, 40 units, 128,000 hours.
18.	Pumps:	2", 5 hp, gas, 20 units, 64,000 hours.
19.	Pumps:	6", 10 hp, gas, 10 units, 16,000 hours.
20.	Air comp:	100 cfm, 50 hp, gas, 20 units, 112,000 hours.
21.	Air comp:	250 cfm, 90 hp, diesel, 20 units, 80,000 hours.
22.	Air comp:	600 cfm, diesel, 10 units.
23.	Welder:	90 hp, 60 units, 336,000 hours, gas power.
24.	Welder:	200 hp, gas, 80 units, 320,000 hours.
25.	Generators:	0.5 kW, gas, 20 units, 96,000 hours
		5 kW, 10 hp, gas, 20 units, 64,000 hours
		10 kW, 20 hp, Gas, 15 units, 36,000 hours
		100 kW, 75 hp, diesel, 10 units, 16,000 hours
		250 kW, 150 hp, diesel, 10 units, 16,000 hours.
26.	Light plant:	10 kW, 20 hp, gas, 50 units, 280,000 hours.
27.	Compactors:	5 hp, gas, 60 units, 192,000 hours
		40 hp, gas, 20 units, 64,000 hours.
28.	Trucks:	1/2 ton P.U., 50 units, 1,600,000 miles.
		3/4 ton P.U., 25 units, 800,000 miles.
		3 ton flat bed, 20 units, 800,000 miles.
		5 ton flat bed, 10 units, 320,000 miles.
		40 foot float and tractor, 10 units, 320,000 miles.
		Low boy with tractor, 2 units, 15,000 miles.
		Shuttle bus, 10 units, 480,000 miles.
		Van, 10 units, 720,000 miles.
		Fuel truck, 5 units, 400,000 miles.

Mechanics truck, 5 units, 400,000 miles.
Water truck, 2 units, 80,000 miles.

For equipment usage see attached breakdown which gives by year a list of equipment size, number of units available (this will be peak usage), and operating units (this is the average usage for the year).

For TPA Alternative, the equipment list during construction is the same.

The TPA case used a factor of 1.4 to estimate the emissions during construction from the minimal pretreatment construction equipment list. Therefore the TPA case will use a combination of increased equipment numbers and utilization to get the 40%. For TPA multiply the numbers of available numbers and available numbers by 1.4 to get TPA usage.

The above lists do not account for construction equipment required for waste retrieval and transfer. The same general type of equipment should be used. The number of units/year for construction equipment for retrieval and transfer is shown on table 6-24 attached.

Noise emissions for all operations within the processing facilities will be very minimal just outside the facilities due to the amount of radiation shielding required.

CONST4EQ

CONST EQUIP - DIESEL UNLESS OTHERWISE NOTED

		YR 1		YR 2		YR 3		YR 4		YR 5	
		AVAIL UNITS	OPR UNITS	AVAIL UNITS	OPR UNITS	AVAIL UNITS	OPR UNITS	AVAIL UNITS	OPR UNITS	AVAIL UNITS	OPR UNITS
1 DOZER, CAT D9	460 HP	2	1.30								
3 DOZER, CAT D8	335 HP	4	1.75	1	.40	1	.40				
3 DOZER, CAT D6	165 HP			1	.28	1	.28	1	.28		
5 DOZER, UTILITY	65 HP	5	1.48	5	1.48	5	1.48	5	1.48	5	1.48
3 LOADER, CAT 966	200 HP	3	.34	6	1.54	6	1.54	6	1.54	2	.28
5 LOADER, 2CY	120 HP	4	.93	4	.93	4	.93	4	.93	4	.93
1 BACKHOE, CAT 235B	215 HP	1	.50								
5 BACKHOE, 4CY	120 HP	4	.28	4	.28	4	.28	4	.28	4	.28
5 LOADER/BACKHOE, UTILITY	65 HP	6	1.76	6	1.76	6	1.76	6	1.76	6	1.76
5 BACKHOE, UTILITY	65 HP	4	.93	4	.93	4	.93	4	.93	4	.93
1 SCRAPER, CAT 637E	460 HP	6	3.60								
3 ELEVATING SCRAPER, CAT 623E	330 HP	4	2.90	2	.60						
1 SCRAPER, TWIN ENGINE	250 HP	6	3.60								
1 TOWED VIBTATING ROLLER, GAS	50 HP	1	.65								
3 MOTOR GRADER, CAT 14G	200 HP	2	2.02	1	.60						
5 MOTOR GRADER	125 HP	4	2.04	4	2.04	4	2.04	4	2.04	4	2.04
1 COMPACTOR, CAT 815B	210 HP	1	.73								
5 COMPACTOR, GAS	40 HP	20	5.93	20	5.93	20	5.93	20	5.93	20	5.93
5 COMPACTOR, WALKING, GAS	5 HP	60	17.78	60	17.78	60	17.78	60	17.78	60	17.78
3 DUMP TRUCK, 10 YD	250 HP	8	6.50	10	8.96	10	8.96	5	1.96		
3 CONCRETE MIX TRUCKS	250 HP			4	2.59	4	2.59	4	2.59		
5 CRANE	100 TO	2	.56	2	.56	2	.56				
5 CRANE	50 TO	5	1.48	5	1.48	5	1.48	5	1.48	5	1.48
5 CRANE	25 TO	10	4.44	10	4.44	10	4.44	10	4.44	10	4.44
5 CRANE	15 TO	10	5.93	10	5.93	10	5.93	10	5.93	10	5.93
5 FORKLIFT	15 TO	4	.93	4	.93	4	.93	4	.93	4	.93
5 FORKLIFT	10 TO	4	1.20	4	1.20	4	1.20	4	1.20	4	1.20
5 FORKLIFT	6 TO	4	1.48	4	1.48	4	1.48	4	1.48	4	1.48
5 FORKLIFT	4 TO	6	2.69	6	2.69	6	2.69	6	2.69	6	2.69
5 FORKLIFT	2 TO	10	3.33	10	3.33	10	3.33	10	3.33	10	3.33
5 PUMPS, 6", ELECT	10 HP	10	1.48	10	1.48	10	1.48	10	1.48	10	1.48
5 PUMPS, 2", ELECT	5 HP	20	5.93	20	5.93	20	5.93	20	5.93	20	5.93
5 PUMPS, 1", ELECT	2 HP	40	11.85	40	11.85	40	11.85	40	11.85	40	11.85
5 AIR COMPRESSOR	600 CF	10	2.22	10	2.22	10	2.22	10	2.22	10	2.22
5 AIR COMPRESSOR	250 CF	20	7.41	20	7.41	20	7.41	20	7.41	20	7.41
5 AIR COMPRESSOR, GAS	100 CF	20	10.37	20	10.37	20	10.37	20	10.37	20	10.37
5 WELDER, GASOLINE	200 HP	80	29.63	80	29.63	80	29.63	80	29.63	80	29.63
5 WELDER, GASOLINE	90 HP	60	31.11	60	31.11	60	31.11	60	31.11	60	31.11
5 GENERATORS	250 KW	10	1.48	10	1.48	10	1.48	10	1.48	10	1.48
5 GENERATORS	100 KW	10	1.48	10	1.48	10	1.48	10	1.48	10	1.48
5 GENERATORS, GAS	10 KW	15	3.33	15	3.33	15	3.33	15	3.33	15	3.33
5 GENERATORS, GAS	5 KW	20	5.93	20	5.93	20	5.93	20	5.93	20	5.93
5 GENERATORS, GAS	.50 KW	20	8.89	20	8.89	20	8.89	20	8.89	20	8.89
5 LIGHT PLANT, GAS	10 KW	50	25.93	50	25.93	50	25.93	50	25.93	50	25.93
5 LOW BOY WITH TRACTOR	400 HP	2	1.39	2	1.39	2	1.39	2	1.39	2	1.39
5 40' FLOAT AND TRACTOR	350 HP	10	29.63	10	29.63	10	29.63	10	29.63	10	29.63
5 MECHANICS TRUCK	250 HP	6	37.82	5	37.04	5	37.04	5	37.04	5	37.04
5 FUEL/LUB TRUCK	250 HP	5	37.04	5	37.04	5	37.04	5	37.04	5	37.04
			MILES		MILES		MILES		MILES		MILES
5 PICKUP, 3/4 TON, GAS	250 HP	26	30,000	25	30,000	25	30,000	25	30,000	25	30,000
5 PICKUP, 1/2 TON, GAS	200 HP	50	30,000	50	30,000	50	30,000	50	30,000	50	30,000
5 FLATBED, 5 TON,GAS	350 HP	10	30,000	10	30,000	10	30,000	10	30,000	10	30,000
5 FLATBED, 3 TON, GAS	300 HP	20	40,000	20	40,000	20	40,000	20	40,000	20	40,000
5 WATER TANKER, 5000 GAL	300 HP	3	40,000	2	40,000	2	40,000	2	40,000	2	40,000
5 SHUTTLE BUS, GAS	250 HP	10	48,000	10	48,000	10	48,000	10	48,000	10	48,000
5 VAN, GAS	200 HP	10	72,000	10	72,000	10	72,000	10	72,000	10	72,000

Table 6-24. Comparison of Alternatives by Construction Equipment Schedule for Retrieval and Transfer: (units/year).

Construction Equipment Type	Continued Storage	In Situ Disposal	Extensive Pretreatment	Minimal Pretreatment	DPA Preferred Alternative
Diesel construction equipment.	4[1]	0	12[1]	12[1]	12[1]
Heavy-duty diesel equipment	0	0	0	0	0
Light-duty gasoline vehicles	10[2]	0	40[2]	40[2]	40[2]
Small gasoline engines	12[3]	0	36[3]	36[3]	36[3]

Notes:

[1]Two diesel-powered cranes are assumed in 200E and 200W areas (4 total) for installation of mixer pumps and miscellaneous service for DST retrieval construction. In addition, an equal number of diesel-powered cranes are assumed needed in 200E and 200W for installation of SST retrieval systems. For construction of SST transfer lines, two diesel-powered back hoes are assumed required for trenching in 200E and 200W areas (4 total).

[2]One light-duty gasoline vehicle is assumed required for each 20 construction persons. An average of 200 construction persons are assumed for DST retrieval construction based on an estimated $940 million capital cost (see Table 6-17), 18-year construction period (see Table 6-23), 7350 construction manhours per $1 million total estimated cost (see Appendix B, Backup to Table 6-7), and 1836 manhours per full-time equivalent. An average of 600 construction persons are assumed required for SST and MUST retrieval and transfer construction based on $3,250 - $940 = $2,310 million capital cost (see Appendix B, Backup to Table 6-7), 7350 construction manhours per $1 Million total estimated cost (see Appendix B, Backup to Table 6-7 Construction Personnel Manhours), and 1836 manhours per full-time equivalent.

[3]Small gasoline engines are estimated to be required at a ratio of 3 for each diesel-powered construction equipment unit.

Table XXXX. Comparison of Anticipated Transportation (km) Between Alternatives

Transportation Activity	Alternative			
	TPA		No Pretreatment	
	Onsite	Offsite	Onsite	Offsite
Construction	3.0E+5 km truck 30,400 trips (3.5 yr)	4.5E+6 km truck 27,000 trips (3.5 yr)	2.0E+5 km truck 20,200 trips (3.5 yr)	3.8E+6 km truck 18,000 trips (3.5 yr)
Waste Transport	3.4E+4 km truck 1,060 trips (14 yr)	7.3E+5 km rail 171 trips (14 yr)	3.4E+4 km truck 1,060 trips (14 yr)	9.6E+6 km rail 2,249 trips (44 yr)
Process Chemical/Material Shipments	2.6E+5 km truck 21,000 trips (14 yr)	1.62E+8 km truck 208,428 trips (14 yr) or 3.34E+6 km rail 4,169 trips (14 yr)	-	1.6E+8 km truck 201,103 TRIPS 3.2E+6 km rail 4,022 TRIPS (14 yr)

Request Number 063

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Tirzo Gonzales Date: 5/6/95

Phone Number: 619-560-8552 Fax Number: 619-560-8538

Request Information: Need to know if any of the remaining EIS alternatives will cause ground disturbing activities (i.e., construction) outside of the areas that have already been surveyed for cultural resources for the existing TWRS project area. If so, where and how much? Will need foot. Priority A.

Need Date: 5/14/95

Response:

Data Source/Accuracy:

Prepared By: Date Sent/Faxed:

Concurrence: Marc Nelson - Deputy Project Manager

Cancelled

engin\eninfrq.063

Request Number 064

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Phil Rogers

Date: 4/18/95

Phone Number: 303-790-0770

Fax Number: 303-790-4411

Request Information: For in situ vitrification, please provide 1) elapse time for contaminants to first enter vadose zone, 2) the duration of releases, 3) the concentration of releases, 4) the water flux, and 5) the specific contaminants and isotopes.

Need Date: 4/21/95

Response: Priority A

Data Source/Accuracy:

Prepared By:

Date Sent/Faxed:

Concurrence: Marc R. Nelson
Marc Nelson - Deputy Project Manager

enginleninfrq.064

1/18
Pg 19 & 20 Added 8/18
(ISOTOPIC Fractions)

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering - Flux From ISV Waste Forms

ORIGINATOR D. Murray DATE 4/19/95

REVISION NO. 0

OBJECTIVE Estimate the concentration of radionuclides released from ISV waste forms

METHODOLOGY See p 2

ASSUMPTIONS See p 3

(Continue on another sheet if necessary)

David J Murray
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV FTUX SHEET NO. 2/18

BY DFM CHKD. JOB NO. OIK47101

Methodology

A. Calculate available leach area for the waste form

B. Use mass loss rate in g/m²/day to calculate amount leached

C. Determine change in area as a function of time

D. Calculate water available for leaching

E. Calculate total solution concentration

F. Calculate concentration of ions in solution

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV Flux SHEET NO. 3/18

BY NJM CHKD. JOB NO. 01K47101

Assumptions

1 Waste form is a right circular cylinder with the dimensions equal to those of the original tank

2 Surface area increases by 20% due to cracks & irregularities

3 Mass Loss Rate (MLR) = 10^{-3} g/m²/day (Reference 1)

4 Composition of waste form is the same as for No Separations (Reference 2). This means that proper proportions of glass formers are added prior to ISV

5 Recharge rate for intact barrier is 0.05 cm³/cm²/yr = 0.05 cm/yr. When barrier is not intact, this increases to 0.1 cm/yr.

6 The solution available for leaching comes from directly over the tank.

7 Leaching takes place evenly on all tank surfaces.

Note: Assumptions 1 & 4 may differ from In Situ Data Pkg

References

1. J W Shade, et al Preliminary Low Level Waste Definition Guidance, Low Level Waste Pretreatment Interface, WHC-SD-WM-RD-052 Rev 0

2. No Separations Engineering Data Package WHC-SD-WM-EV-103 Rev B

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV Flux SHEET NO. 4/18

BY [illegible] CHKD. _____ JOB NO. 01K47101

Calculation

① Right Circular Cylinder

$$\text{Area} = 2 \times \pi/4\, D^2 (\text{top} + \text{bottom}) + \pi D H (\text{sides})$$
$$= \pi D \left(\frac{D}{2} + H \right)$$

② Mass Loss Rate (MLR) = 10^{-3} g/m²/day

If density of glass is 2.6 g/cm³

$$\text{Corrosion Rate (CR)} = \frac{MLR \frac{g}{m^2} \times \frac{cm^3}{2.6g} \times \frac{m^2}{10^4 cm^2}}{day \times \frac{yr}{365.25\, day}}$$

$$= MLR \times \frac{365.25}{2.6 \times 10^4} \text{ cm/yr}$$

So CR = .0140 MLR

or CR × 71.2 = MLR

If MLR = 10^{-3} g/m²/day, CR = 1.4×10^{-5} cm/yr

③ Start with a tank 75 ft (22.9m) × 31 ft (9.45) and increase area by 20% to account for surface irregularities.

$$\text{Area} = 1.2 \times \left[2 \frac{\pi}{4} (22.9)^2 + \pi (22.9)(9.45) \right]$$

$$= 1800 \text{ m}^2$$

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV Flux SHEET NO. 5/18

BY [illegible] CHKD. _____ JOB NO. D1K47101

(4) Amount leached

$$1800\,m^2 \times \frac{10^{-3}\,g/day}{m^2} = 1.8\,g/day$$

(5) If tank retains its proportions, and leaches evenly, how big is it when its surface (irregular) becomes $1700\,m^2$

Initially $H = \frac{9.45}{22.9} D$, this factor remains constant

$$1700 = 1.2\left[\frac{\pi D^2}{2} + \pi D \times \frac{9.45 D}{22.9}\right]$$

$$1700 = 1.88 D^2 + 1.56 D^2 = 3.44 D^2$$

$$D^2 = 1700/3.44 = 494$$

$$D = 22.2\,m$$

(6) Amount leached = 1.7 g/day now

How long did this take to decrease D from 22.9 to 22.2 m (0.7 m)?

$$.7\,m \times \frac{100\,cm}{m} \times \frac{yr}{1.4 \times 10^{-5}\,cm} = 5 \times 10^6\,yrs.$$

So leach rate only varies by 5% over the first 5 million yrs.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 4/19/85 SUBJECT ISV Flux SHEET NO. 6/17

BY [illegible] CHKD. JOB NO. 01K47101

(7) For 10,000 yrs, amount leached is $10^4 \text{ yrs} \times \frac{365.25 \text{ day}}{\text{yr}} \times \frac{1.8 \text{ g}}{\text{day}} = 6.57 \times 10^6 \text{ g}$

Composition of leachate is proportional to composition of vitrified waste form

(8) Now make a table for the various tank dimensions

D, ft (m)	H, ft (m)	$A = 1.2\pi D(D/2 + H)$ (m^2)	Amt Leached $= A/10^3$ (g/day)	Soln Conc (g/L)
75 (22.9)	16 (4.88)	1400	1.4	1.2
20 (6.10)	24.9 (7.59)	240	0.24	3.0
75 (22.9)	23 (7.01)	1600	1.6	1.4
75 (22.9)	31 (9.45)	1800	1.8	1.6
75 (22.9)	35 (10.7)	1900	1.9	1.7

Soln Flow
for 75' ϕ tanks = 1.13 L/day
for 20' ϕ tanks = 0.08 L/day

Calculated on following page

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV Flux SHEET NO. 7/18

BY [illegible] CHKD. _____ JOB NO. 01K47101

(9) Water available for leaching is that which directly overlays the vitrified mass. Recharge rate = 0.1 $cm^3/cm^2/yr$ after 1000 yrs (0.05 $cm^3/cm^2/yr$ before 1000 yrs)

For a 75 ft (22.9 m) dia tank, this is

$$\frac{\pi}{4} \times \left(22.9m \times \frac{100cm}{m}\right)^2 \times \frac{0.1 cm^3/yr}{cm^2} \times \frac{L}{1000 cm^3} \times \frac{yr}{365.25 days}$$

= 1.13 L/day (0.565 L/day at 0.05 cm/yr)

Soln conc for 31 ft (9.45 m) high tank

$$= \frac{1.8 g/day}{1.13 L/day} = 1.6 g/L$$

(10) For a 20 ft (6.1 m) dia tank

$$\text{Soln rate} = \frac{\pi}{4}(610)^2 \times 0.1 \times \frac{1}{1000} \times \frac{1}{365.25}$$

= 0.08 L/day

$$\text{Soln conc} = \frac{0.24 g/day}{0.08 L/day} = 3.0 g/L$$

(11) Now calculate a representative flow & conc for IWSS (Tank dimensions on following page)

Tank Size	No	L/day	g/L	g/day
75x16	12	13.6	1.2	16.3
75x23	24	27.1	1.4	37.9
20x24.9	4	0.3	3.0	0.9
		41.0		55.1

$$\frac{55.1 \frac{g}{day}}{41.0 \frac{L}{day}} = 1.3 \frac{g}{L}$$

Summary 41.0 L/day at [illegible]

FORM 91-005-1 (4/81)

8/18

ENGINEERING DATA REQUEST ~~X~~ 64

REQUESTED BY: PHIL ROGERS

SUBJECT: TANK DIAMETERS

The following table provides the tank inner diameter listed by tank group.
Attached are sketches of the different tank types.

TANK GROUP	CAPACITY (KGAL)	NUMBER OF TANKS	INSIDE DIAMETER & Height (Ft)
1WSS	530	12	75 x 16
	758	24	75 x 23
	55	4	20 x 24.9
2WSS	530	12	75 x 16
	55	4	20 x 24.9
	758	12	75 x 23
	1,000	15	75 x 31
1ESS	758	12	75 x 23
	55	4	20 x 24.9
	530	24	75 x 16
2ESS	530	12	75 x 16
	55	4	20 x 24.9
4ESS	1,000	10	75 x 31
3WDS	1,160	3	75 x 35
3EDS	1,160	7	75 x 35
	1,000	4	75 x 31
5EDS	1,160	14	75 x 35

JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISV Flux SHEET NO. 9/18

BY [illegible] CHKD. _____ JOB NO. 01K47101

Repeat calcs for remaining tank groups

Group	Tank Size	No	L/day	g/L	g/day	Summary
2WSS	75x16	12	13.6	1.2	16.3	63.4 g/day / 44.5 L/day = 1.4 g/L
	20x24.9	4	0.3	3.0	0.9	
	75x23	12	13.6	1.4	19.0	
	75x31	15	17.0	1.6	27.2	
1ESS	75x23	12	13.6	1.4	19.0	52.4 g/day / 41.0 L/day = 1.3 g/L
	20x24.9	4	0.3	3.0	0.9	
	75x16	24	27.1	1.2	32.5	
2ESS	75x16	12	13.6	1.2	16.3	17.2 g/day / 13.9 L/day = 1.2 g/L
	20x24.9	4	0.3	3.0	0.9	
4ESS	75x31	10	11.3	1.6	18.1	18.1 g/day / 11.3 L/day = 1.6 g/L
3WDS	75x35	3	3.4	1.7	5.8	5.8 g/day / 3.4 L/day = 1.7 g/L
3EDS	75x35	7	7.9	1.7	13.4	20.6 g/day / 12.4 L/day = 1.7 g/L
	75x31	4	4.5	1.6	7.2	
5EDS	75x35	14	15.8	1.7	26.9	26.9 g/day / 15.8 L/day = 1.7 g/L
1WSS	(Recap)					41.0 L/day @ 1.3 g/L

(12) So summary tables need to be made for the following concentrations (g/L)

1.2, 1.3, 1.4, 1.6 & 1.7

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JACOBS ENGINEERING GROUP INC.

DATE 4/19/95 SUBJECT ISVF Flux SHEET NO. 10/18

BY AFM CHKD. JOB NO. 01K47101

Using Al as an example, from the No Separations Data Pkg. Rev B, App A, pA-20

$$\frac{1.2\ g\ total}{L\ soln} \times \frac{1.79\times10^{4}\ MT\ Al_2O_3}{3.57\times10^{5}\ MT\ Total} \times \frac{(2\times27)}{(2\times27)+(3\times16)},\ \frac{g\ Al^{+3}}{L\ soln}$$

Subscript of Al

At Wt of Al

Subscript of O

At Wt of O

$= 0.0318\ g/L\ Al^{+3}$

$= \text{Soln Conc} \times 2.80\times10^{-6} \times \text{MT Oxide} \times \text{Conversion}$

(13) Summary Table

Tank Group	Flow (L/yr) at 0.1 cm/yr	Flow (L/yr) at 0.05 cm/yr	Concentrations from Table
1W SS	15,000	7,500	2
2W SS	16,200	8,100	3
1E SS	15,000	7,500	2
2E SS	5,000	2,500	1
4E SS	4,100	2,000	4
3W DS	1,200	600	5
3E DS	4,500	2,200	5
5E DS	5,800	2,900	5

FORM 91-005-1 (4/81)

11/18

		TABLE 1				
		Estimated ISV Release Concentrations, g/L				
		Total Solution Concentratic		1.2		
Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	5.72E-06	Ag+1	2	108	1
Al2O3	1.79E+04	3.18E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.02E-07	Am+3	2	243	3
As2O5	1.95E+00	4.27E-06	As+5	2	75	5
B2O3	4.87E+00	1.47E-05	B+3	2	209	3
BaO	4.33E+00	1.30E-05	Ba+2	1	137	1
BeO	2.48E-01	3.00E-07	Be+2	1	9	1
Bi2O3	2.94E+02	8.86E-04	Bi+3	2	209	3
CaO	3.58E+04	8.59E-02	Ca+2	1	40	1
CdO	1.14E+01	3.35E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	8.23E-04	Ce+3	2	140	3
Cr2O3	2.68E+02	6.16E-04	Cr+3	2	52	3
Cs2O	9.65E-01	3.06E-06	Cs+1	2	133	1
CuO	1.16E+00	3.12E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	2.89E-03	Fe+3	2	56	3
K2O	2.56E+01	7.14E-05	K+1	2	39	1
La2O3	2.49E+01	7.13E-05	La+3	2	139	3
Li2O	6.53E-02	1.02E-07	Li+1	2	7	1
MgO	1.98E+01	3.99E-05	Mg+2	1	24	1
MnO2	2.31E+02	4.91E-04	Mn+4	1	55	2
MoO3	8.51E+00	1.91E-05	Mo+6	1	96	3
Na2O	8.94E+04	2.23E-01	Na+1	2	23	1
Ni2O3	1.50E+01	3.58E-05	Ni+3	2	59	3
NiO	2.27E+02	6.00E-04	Ni+3	1	59	1
NpO2	1.66E-01	4.91E-07	Np+4	1	237	2
P2O5	3.71E+03	8.34E-03	PO4-3	2	31	5
PbO2	6.05E+00	1.76E-05	Pb+4	1	207	2
PuO2	5.16E-01	1.53E-06	Pu+4	1	242	2
SiO2	2.06E+05	3.23E-01	Si+4	1	28	2
SrO	4.33E+01	1.23E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	5.19E-06	TcO4-1	2	99	7
UO3	1.76E+03	5.58E-03	UO2+2	1	238	3
V2O5	4.46E-01	8.40E-07	V+5	2	51	5
WO2	4.41E-01	1.70E-06	WO4-2	1	184	2
WO3	9.42E-01	3.38E-06	WO4-2	1	184	3
ZnO	5.56E+00	1.50E-05	Zn+2	1	65	1
ZrO2	7.07E+02	1.76E-03	ZrO+2	1	91	2
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		TABLE 2				
		Estimated ISV Release Concentrations, g/L				
		Total Solution Concentratic		1.3		
Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	6.20E-06	Ag+1	2	108	1
Al2O3	1.79E+04	3.45E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.10E-07	Am+3	2	243	3
As2O5	1.95E+00	4.63E-06	As+5	2	75	5
B2O3	4.87E+00	1.59E-05	B+3	2	209	3
BaO	4.33E+00	1.41E-05	Ba+2	1	137	1
BeO	2.48E-01	3.25E-07	Be+2	1	9	1
Bi2O3	2.94E+02	9.60E-04	Bi+3	2	209	3
CaO	3.58E+04	9.31E-02	Ca+2	1	40	1
CdO	1.14E+01	3.63E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	8.92E-04	Ce+3	2	140	3
Cr2O3	2.68E+02	6.67E-04	Cr+3	2	52	3
Cs2O	9.65E-01	3.31E-06	Cs+1	2	133	1
CuO	1.16E+00	3.38E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	3.13E-03	Fe+3	2	56	3
K2O	2.56E+01	7.73E-05	K+1	2	39	1
La2O3	2.49E+01	7.73E-05	La+3	2	139	3
Li2O	6.53E-02	1.11E-07	Li+1	2	7	1
MgO	1.98E+01	4.32E-05	Mg+2	1	24	1
MnO2	2.31E+02	5.32E-04	Mn+4	1	55	2
MoO3	8.51E+00	2.07E-05	Mo+6	1	96	3
Na2O	8.94E+04	2.41E-01	Na+1	2	23	1
Ni2O3	1.50E+01	3.88E-05	Ni+3	2	59	3
NiO	2.27E+02	6.50E-04	Ni+3	1	59	1
NpO2	1.66E-01	5.32E-07	Np+4	1	237	2
P2O5	3.71E+03	9.03E-03	PO4-3	2	31	5
PbO2	6.05E+00	1.91E-05	Pb+4	1	207	2
PuO2	5.16E-01	1.66E-06	Pu+4	1	242	2
SiO2	2.06E+05	3.50E-01	Si+4	1	28	2
SrO	4.33E+01	1.33E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	5.63E-06	TcO4-1	2	99	7
UO3	1.76E+03	6.05E-03	UO2+2	1	238	3
V2O5	4.46E-01	9.10E-07	V+5	2	51	5
WO2	4.41E-01	1.84E-06	WO4-2	1	184	2
WO3	9.42E-01	3.67E-06	WO4-2	1	184	3
ZnO	5.56E+00	1.62E-05	Zn+2	1	65	1
ZrO2	7.07E+02	1.90E-03	ZrO+2	1	91	2
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TABLE 3

Estimated ISV Release Concentrations, g/L

Total Solution Concentratic 1.4

Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	6.68E-06	Ag+1	2	108	1
Al2O3	1.79E+04	3.71E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.18E-07	Am+3	2	243	3
As2O5	1.95E+00	4.99E-06	As+5	2	75	5
B2O3	4.87E+00	1.71E-05	B+3	2	209	3
BaO	4.33E+00	1.52E-05	Ba+2	1	137	1
BeO	2.48E-01	3.50E-07	Be+2	1	9	1
Bi2O3	2.94E+02	1.03E-03	Bi+3	2	209	3
CaO	3.58E+04	1.00E-01	Ca+2	1	40	1
CdO	1.14E+01	3.91E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	9.60E-04	Ce+3	2	140	3
Cr2O3	2.68E+02	7.19E-04	Cr+3	2	52	3
Cs2O	9.65E-01	3.57E-06	Cs+1	2	133	1
CuO	1.16E+00	3.64E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	3.38E-03	Fe+3	2	56	3
K2O	2.56E+01	8.33E-05	K+1	2	39	1
La2O3	2.49E+01	8.32E-05	La+3	2	139	3
Li2O	6.53E-02	1.19E-07	Li+1	2	7	1
MgO	1.98E+01	4.66E-05	Mg+2	1	24	1
MnO2	2.31E+02	5.72E-04	Mn+4	1	55	2
MoO3	8.51E+00	2.22E-05	Mo+6	1	96	3
Na2O	8.94E+04	2.60E-01	Na+1	2	23	1
Ni2O3	1.50E+01	4.18E-05	Ni+3	2	59	3
NiO	2.27E+02	7.00E-04	Ni+3	1	59	1
NpO2	1.66E-01	5.73E-07	Np+4	1	237	2
P2O5	3.71E+03	9.73E-03	PO4-3	2	31	5
PbO2	6.05E+00	2.05E-05	Pb+4	1	207	2
PuO2	5.16E-01	1.79E-06	Pu+4	1	242	2
SiO2	2.06E+05	3.77E-01	Si+4	1	28	2
SrO	4.33E+01	1.44E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	6.06E-06	TcO4-1	2	99	7
UO3	1.76E+03	6.51E-03	UO2+2	1	238	3
V2O5	4.46E-01	9.80E-07	V+5	2	51	5
WO2	4.41E-01	1.98E-06	WO4-2	1	184	2
WO3	9.42E-01	3.95E-06	WO4-2	1	184	3
ZnO	5.56E+00	1.75E-05	Zn+2	1	65	1
ZrO2	7.07E+02	2.05E-03	ZrO+2	1	91	2

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		TABLE 4				
		Estimated ISV Release Concentrations, g/L				
		Total Solution Concentratic		1.6		
Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	7.63E-06	Ag+1	2	108	1
Al2O3	1.79E+04	4.25E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.35E-07	Am+3	2	243	3
As2O5	1.95E+00	5.70E-06	As+5	2	75	5
B2O3	4.87E+00	1.96E-05	B+3	2	209	3
BaO	4.33E+00	1.74E-05	Ba+2	1	137	1
BeO	2.48E-01	4.00E-07	Be+2	1	9	1
Bi2O3	2.94E+02	1.18E-03	Bi+3	2	209	3
CaO	3.58E+04	1.15E-01	Ca+2	1	40	1
CdO	1.14E+01	4.47E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	1.10E-03	Ce+3	2	140	3
Cr2O3	2.68E+02	8.21E-04	Cr+3	2	52	3
Cs2O	9.65E-01	4.08E-06	Cs+1	2	133	1
CuO	1.16E+00	4.16E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	3.86E-03	Fe+3	2	56	3
K2O	2.56E+01	9.52E-05	K+1	2	39	1
La2O3	2.49E+01	9.51E-05	La+3	2	139	3
Li2O	6.53E-02	1.37E-07	Li+1	2	7	1
MgO	1.98E+01	5.32E-05	Mg+2	1	24	1
MnO2	2.31E+02	6.54E-04	Mn+4	1	55	2
MoO3	8.51E+00	2.54E-05	Mo+6	1	96	3
Na2O	8.94E+04	2.97E-01	Na+1	2	23	1
Ni2O3	1.50E+01	4.78E-05	Ni+3	2	59	3
NiO	2.27E+02	8.00E-04	Ni+3	1	59	1
NpO2	1.66E-01	6.55E-07	Np+4	1	237	2
P2O5	3.71E+03	1.11E-02	PO4-3	2	31	5
PbO2	6.05E+00	2.35E-05	Pb+4	1	207	2
PuO2	5.16E-01	2.04E-06	Pu+4	1	242	2
SiO2	2.06E+05	4.31E-01	Si+4	1	28	2
SrO	4.33E+01	1.64E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	6.93E-06	TcO4-1	2	99	7
UO3	1.76E+03	7.44E-03	UO2+2	1	238	3
V2O5	4.46E-01	1.12E-06	V+5	2	51	5
WO2	4.41E-01	2.27E-06	WO4-2	1	184	2
WO3	9.42E-01	4.51E-06	WO4-2	1	184	3
ZnO	5.56E+00	2.00E-05	Zn+2	1	65	1
ZrO2	7.07E+02	2.34E-03	ZrO+2	1	91	2
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TABLE 5

Estimated ISV Release Concentrations, g/L

Total Solution Concentratic 1.7

Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	8.11E-06	Ag+1	2	108	1
Al2O3	1.79E+04	4.51E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.44E-07	Am+3	2	243	3
As2O5	1.95E+00	6.05E-06	As+5	2	75	5
B2O3	4.87E+00	2.08E-05	B+3	2	209	3
BaO	4.33E+00	1.85E-05	Ba+2	1	137	1
BeO	2.48E-01	4.25E-07	Be+2	1	9	1
Bi2O3	2.94E+02	1.26E-03	Bi+3	2	209	3
CaO	3.58E+04	1.22E-01	Ca+2	1	40	1
CdO	1.14E+01	4.75E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	1.17E-03	Ce+3	2	140	3
Cr2O3	2.68E+02	8.73E-04	Cr+3	2	52	3
Cs2O	9.65E-01	4.33E-06	Cs+1	2	133	1
CuO	1.16E+00	4.42E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	4.10E-03	Fe+3	2	56	3
K2O	2.56E+01	1.01E-04	K+1	2	39	1
La2O3	2.49E+01	1.01E-04	La+3	2	139	3
Li2O	6.53E-02	1.45E-07	Li+1	2	7	1
MgO	1.98E+01	5.65E-05	Mg+2	1	24	1
MnO2	2.31E+02	6.95E-04	Mn+4	1	55	2
MoO3	8.51E+00	2.70E-05	Mo+6	1	96	3
Na2O	8.94E+04	3.16E-01	Na+1	2	23	1
Ni2O3	1.50E+01	5.08E-05	Ni+3	2	59	3
NiO	2.27E+02	8.50E-04	Ni+3	1	59	1
NpO2	1.66E-01	6.96E-07	Np+4	1	237	2
P2O5	3.71E+03	1.18E-02	PO4-3	2	31	5
PbO2	6.05E+00	2.49E-05	Pb+4	1	207	2
PuO2	5.16E-01	2.17E-06	Pu+4	1	242	2
SiO2	2.06E+05	4.58E-01	Si+4	1	28	2
SrO	4.33E+01	1.74E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	7.36E-06	TcO4-1	2	99	7
UO3	1.76E+03	7.91E-03	UO2+2	1	238	3
V2O5	4.46E-01	1.19E-06	V+5	2	51	5
WO2	4.41E-01	2.41E-06	WO4-2	1	184	2
WO3	9.42E-01	4.79E-06	WO4-2	1	184	3
ZnO	5.56E+00	2.12E-05	Zn+2	1	65	1
ZrO2	7.07E+02	2.49E-03	ZrO+2	1	91	2

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TABLE 5

Estimated ISV Release Concentrations, g/L

Total Solution Concentratic 1.7

Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	1.83E+00	8.11E-06	Ag+1	2	108	1
Al2O3	1.79E+04	4.51E-02	Al+3	2	27	3
Am2O3	3.32E-02	1.44E-07	Am+3	2	243	3
As2O5	1.95E+00	6.05E-06	As+5	2	75	5
B2O3	4.87E+00	2.08E-05	B+3	2	209	3
BaO	4.33E+00	1.85E-05	Ba+2	1	137	1
BeO	2.48E-01	4.25E-07	Be+2	1	9	1
Bi2O3	2.94E+02	1.26E-03	Bi+3	2	209	3
CaO	3.58E+04	1.22E-01	Ca+2	1	40	1
CdO	1.14E+01	4.75E-05	Cd+2	1	112	1
Ce2O3	2.87E+02	1.17E-03	Ce+3	2	140	3
Cr2O3	2.68E+02	8.73E-04	Cr+3	2	52	3
Cs2O	9.65E-01	4.33E-06	Cs+1	2	133	1
CuO	1.16E+00	4.42E-06	Cu+2	1	64	1
Fe2O3	1.23E+03	4.10E-03	Fe+3	2	56	3
K2O	2.56E+01	1.01E-04	K+1	2	39	1
La2O3	2.49E+01	1.01E-04	La+3	2	139	3
Li2O	6.53E-02	1.45E-07	Li+1	2	7	1
MgO	1.98E+01	5.65E-05	Mg+2	1	24	1
MnO2	2.31E+02	6.95E-04	Mn+4	1	55	2
MoO3	8.51E+00	2.70E-05	Mo+6	1	96	3
Na2O	8.94E+04	3.16E-01	Na+1	2	23	1
Ni2O3	1.50E+01	5.08E-05	Ni+3	2	59	3
NiO	2.27E+02	8.50E-04	Ni+3	1	59	1
NpO2	1.66E-01	6.96E-07	Np+4	1	237	2
P2O5	3.71E+03	1.18E-02	PO4-3	2	31	5
PbO2	6.05E+00	2.49E-05	Pb+4	1	207	2
PuO2	5.16E-01	2.17E-06	Pu+4	1	242	2
SiO2	2.06E+05	4.58E-01	Si+4	1	28	2
SrO	4.33E+01	1.74E-04	Sr+2	1	88	1
Tc2O7	2.94E+00	7.36E-06	TcO4-1	2	99	7
UO3	1.76E+03	7.91E-03	UO2+2	1	238	3
V2O5	4.46E-01	1.19E-06	V+5	2	51	5
WO2	4.41E-01	2.41E-06	WO4-2	1	184	2
WO3	9.42E-01	4.79E-06	WO4-2	1	184	3
ZnO	5.56E+00	2.12E-05	Zn+2	1	65	1
ZrO2	7.07E+02	2.49E-03	ZrO+2	1	91	2

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Stream Name Solid Components	425	426	431	432	433	434	435	436	437	438
Cs and Ba, (MCi)	6.86E+01	6.86E-01	6.79E+01	6.79E-04		3.40E-07	6.79E-04	6.79E-04	6.79E+01	
Sr and Y, (MCi)	1.08E+02	1.08E+00	1.07E+02	1.07E-03		5.37E-07	1.07E-03	1.07E-03	1.07E+02	
Tc, (MCi)	3.22E-02	3.22E-04	3.18E-02	3.18E-07		1.59E-10	3.18E-07	3.18E-07	3.18E-02	
Am, (MCi)	1.05E-01	1.05E-03	1.04E-01	1.04E-06		5.19E-10	1.04E-06	1.04E-06	1.04E-01	
Np, (MCi)	1.04E-04	1.04E-06	1.03E-04	1.03E-09		5.16E-13	1.03E-09	1.03E-09	1.03E-04	
Pu-239, (MCi)	2.66E-02	2.66E-04	2.64E-02	2.64E-07		1.32E-10	2.64E-07	2.64E-07	2.64E-02	
Pu-240, (MCi)	6.76E-03	6.76E-05	6.70E-03	6.70E-08		3.35E-11	6.69E-08	6.69E-08	6.70E-03	
Pu-241, (MCi)	7.56E-02	7.56E-04	7.48E-02	7.48E-07		3.74E-10	7.48E-07	7.48E-07	7.48E-02	
Total TRU, (MCi)	2.14E-01	2.14E-03	2.12E-01	2.12E-06		1.06E-09	2.12E-06	2.12E-06	2.12E-01	
Total MCi	1.77E+02	1.77E+00	1.76E+02	1.76E-03		8.77E-07	1.75E-03	1.75E-03	1.76E+02	
Total Mass Flow, (MT)	3.61E+05	3.61E+03	3.58E+05	3.58E+00		1.79E-03	3.57E+00	3.57E+00	3.57E+05	
Total Cr, (MT)	1.86E+02	1.86E+00	1.84E+02	1.84E-03		9.18E-07	1.84E-03	1.84E-03	1.84E+02	
Total Na, (MT)	6.70E+04	6.70E+02	6.63E+04	6.63E-01		3.32E-04	6.63E-01	6.63E-01	6.63E+04	
Total Si, (MT)	9.71E+04	9.71E+02	9.61E+04	9.61E-01		4.81E-04	9.60E-01	9.60E-01	9.61E+04	
Total P, (MT)	1.64E+03	1.64E+01	1.62E+03	1.62E-02		8.11E-06	1.62E-02	1.62E-02	1.62E+03	
Total NO2-, (MT)										
Total NO3-, (MT)										
AG+										
AG2O	1.85E+00	1.85E-02	1.83E+00	1.83E-05		9.15E-09	1.83E-05	1.83E-05	1.83E+00	
AL+3										
AL2O3	1.81E+04	1.81E+02	1.79E+04	1.79E-01		8.94E-05	1.79E-01	1.79E-01	1.79E+04	
AM+3										
AM2O3	3.36E-02	3.36E-04	3.32E-02	3.32E-07		1.66E-10	3.32E-07	3.32E-07	3.32E-02	
AS+5										
AS2O5	1.97E+00	1.97E-02	1.95E+00	1.95E-05		9.73E-09	1.94E-05	1.94E-05	1.95E+00	
B+3										
B2O3	4.92E+00	4.92E-02	4.87E+00	4.87E-05		2.44E-08	4.87E-05	4.87E-05	4.87E+00	
BA+2										
BAO	4.38E+00	4.38E-02	4.33E+00	4.33E-05		2.17E-08	4.33E-05	4.33E-05	4.33E+00	
BE+2										
BEO	2.51E-01	2.51E-03	2.48E-01	2.48E-06		1.24E-09	2.48E-06	2.48E-06	2.48E-01	
BI+3										
BI2O3	2.97E+02	2.97E+00	2.94E+02	2.94E-03		1.47E-06	2.94E-03	2.94E-03	2.94E+02	2
C14										
CA+2										
CANCRIN1										
CAO	3.61E+04	3.61E+02	3.58E+04	3.58E-01		1.79E-04	3.57E-01	3.57E-01	3.58E+04	
CD+2										
CDO	1.16E+01	1.16E-01	1.14E+01	1.14E-04		5.72E-08	1.14E-04	1.14E-04	1.14E+01	
CE+3										
CE2O3	2.81E+02	2.81E+00	2.78E+02	2.78E-03		1.39E-06	2.78E-03	2.78E-03	2.78E+02	2
CL-										
CO3-2										
CR+3										
CR2O3	2.71E+02	2.71E+00	2.68E+02	2.68E-03		1.34E-06	2.68E-03	2.68E-03	2.68E+02	2
CS+										
CS2O	9.75E-01	9.75E-03	9.65E-01	9.65E-06		4.83E-09	9.65E-06	9.65E-06	9.65E-01	

17/18

Stream Name / Solid Component	429	430	431	432	433	434	435	436	437	438
CU										
CU+2										
CUO	1.17E+00	1.17E-02	1.16E+00	1.16E-05		5.78E-09	1.16E-05	1.16E-05	1.16E+00	
CUSO4										
F-										
FE+3										
FE2O3	1.25E+03	1.25E+01	1.23E+03	1.23E-02		6.16E-06	1.23E-02	1.23E-02	1.23E+03	
HG+2										
I-										
K+										
K2O	2.58E+01	2.58E-01	2.56E+01	2.56E-04		1.28E-07	2.56E-04	2.56E-04	2.56E+01	
LA+3										
LA2O3	2.51E+01	2.51E-01	2.49E+01	2.49E-04		1.24E-07	2.49E-04	2.49E-04	2.49E+01	
LI+										
LI2O	6.60E-02	6.60E-04	6.53E-02	6.53E-07		3.27E-10	6.53E-07	6.53E-07	6.53E-02	
MG+2										
MGO	2.00E+01	2.00E-01	1.98E+01	1.98E-04		9.92E-08	1.98E-04	1.98E-04	1.98E+01	
MNO2	2.33E+02	2.33E+00	2.31E+02	2.31E-03		1.15E-06	2.31E-03	2.31E-03	2.31E+02	2
MO+6										
MOO3	8.59E+00	8.59E-02	8.51E+00	8.51E-05		4.25E-08	8.50E-05	8.50E-05	8.51E+00	
NA+										
NA2O	9.03E+04	9.03E+02	8.94E+04	8.94E-01		4.47E-04	8.93E-01	8.93E-01	8.94E+04	
NI+3										
NI2FECN6										
NI2O3	1.51E-01	1.51E-01	1.50E-01	1.50E-04		7.50E-08	1.50E-04	1.50E-04	1.50E+01	
NIO	2.29E-02	2.29E+00	2.27E+02	2.27E-03		1.13E-06	2.27E-03	2.27E-03	2.27E+02	2
NO2-										
NO3-										
NP+4										
NPO2	1.68E-01	1.68E-03	1.66E-01	1.66E-06		8.30E-10	1.66E-06	1.66E-06	1.66E-01	
OH-										
P2O5	3.75E-03	3.75E-01	3.71E-03	3.71E-02		1.86E-05	3.71E-02	3.71E-02	3.71E+03	
P2O5:24W										
PB+4										
PBO2	6.11E-00	6.11E-02	6.05E-00	6.05E-05		3.03E-08	6.05E-05	6.05E-05	6.05E-00	
PO4-3										
PU+4										
PUO2	5.22E-01	5.22E-03	5.16E-01	5.16E-06		2.58E-09	5.16E-06	5.16E-06	5.16E-01	
SI+4										
SIO2	2.08E-05	2.08E+03	2.06E+05	2.06E+00		1.03E-03	2.06E+00	2.06E+00	2.06E+05	
SO4-2										
SR+2										
SRO	4.38E-01	4.38E-01	4.33E-01	4.33E-04		2.17E-07	4.33E-04	4.33E-04	4.33E+01	
TC2O7	2.97E+00	2.97E-02	2.94E+00	2.94E-05		1.47E-08	2.94E-05	2.94E-05	2.94E+00	
TCO4-										
TOC										
UO2+2										

Stream Name Solid Compounds	425	434	431	432	433	434	435	436	437	438
UO3	1.78E+03	1.78E+01	1.76E+03	1.76E-02		8.81E-06	1.76E-02	1.76E-02	1.76E+03	
V+5										
V2O5	4.51E-01	4.51E-03	4.46E-01	4.46E-06		2.23E-09	4.46E-06	4.46E-06	4.46E-01	
WO2	4.46E-01	4.46E-03	4.41E-01	4.41E-06		2.21E-09	4.41E-06	4.41E-06	4.41E-01	
WO3	9.52E-01	9.52E-03	9.42E-01	9.42E-06		4.71E-09	9.42E-06	9.42E-06	9.42E-01	
ZN+2										
ZNO	5.70E+00	5.70E-02	5.65E+00	5.65E-05		2.82E-08	5.64E-05	5.64E-05	5.65E+00	
ZR+4										
ZRO2	7.14E+02	7.14E+00	7.07E+02	7.07E-03		3.54E-06	7.07E-03	7.07E-03	7.07E+02	
ZRO2:2H2										

No separations glass is material balance Stream 437

Consitutents of Concern

			sream 437		stream 437
			Inventory		inventory in grams
			Rev B		
			MT		
	Tc2O7		2.94	Tc	1877806
	UO3		1.76E+03	U	1.46E+09
	PuO2		5.16E-01	Pu	456173.9
	NpO2		1.66E-01	Np	146252.8

Inventory in the in situ glass form based on mass fraction in feed

	grams	metric tons
Tc99	1877806	1.877806
Pu238	147.9373	0.000148
Pu239	425724.8	0.425725
Pu240	29498.84	0.029499
Pu241	802.2187	0.000802
Pu242	0.086975	8.7E-08
U233	1.144606	1.14E-06
U234	31.56059	3.16E-05
U235	9694346	9.694346
U236	35.76257	3.58E-05
U237	1.31E-05	1.31E-11
U238	1.45E+09	1454.921
Np237	146252.8	0.146253
Np238	1.14E-06	1.14E-12
Np239	0.000128	1.28E-10

FROM THE INVENTORY DATA

MASS OF RADIONUCLIDES (grams)

from inventory by tank grouping

	SSTs	DSTs	TOTAL	Fraction
Pu238	65.1	82.88	147.98	0.000324
Pu239	290791.6	135056	425847.6	0.933251
Pu240	18960.35	10547	29507.35	0.064666
Pu241	417.5	384.95	802.45	0.001759
Pu242	0.087		0.087	1.91E-07
total Pu			456305.5	
U233	1.125		1.125	7.82E-10
U234	31.02		31.02	2.15E-08
U235	9528294		9528294	0.006619
U236	35.15		35.15	2.44E-08
U237	1.29E-05		1.29E-05	8.96E-15
U238	1.43E+09		1.43E+09	0.993381
total U			1.44E+09	
Np237	98913	64729	163642	1
Np238	1.28E-06		1.28E-06	7.82E-12
Np239	1.43E-04		0.000143	8.74E-10
total Np			163642	

The material balance is based on WHC inventory which is 12/31/99

The breakdown by isotope using tank by tank grouping data is decayed to 12/31/95

This estimate uses the No Separations data pkg stream 437 as representative of the ISV glass

The following fractions can be used to estimate the release concentrations
of specific isotopes using the release concentrtions shown in table 1-5 of the Engineering
Calculation - Flux from ISV Waste Forms

Example: Table 1 for uranium release conc. =5.58E-3 g/l, release conc. for U234=5.58E-3*2.15E-8=1.2E-10 g/L

		Fraction
Plutonium	Pu238	0.000324
	Pu239	0.933251
	Pu240	0.064666
	Pu241	0.001759
	Pu242	1.91E-07
Uranium	U233	7.82E-10
	U234	2.15E-08
	U235	0.006619
	U236	2.44E-08
	U237	8.96E-15
	U238	0.993381
Neptuniu	Np237	1
	Np238	7.82E-12
	Np239	8.74E-10

No separations glass is material balance Stream 437

Consitutents of Concern

			sream 437		stream 437
			Inventory		Inventory in grams
			Rev B		
			MT		
	Tc2O7		2.94	Tc	1877806
	UO3		1.76E+03	U	1.46E+09
	PuO2		5.16E-01	Pu	456173.9
	NpO2		1.66E-01	Np	146252.8
	Am2O3		3.32E-02	Am	30215.73
	Bi2O3		2.94E+02	Bi	2.64E+08
	Cs2O		9.65E-01	Cs	910248.2
	Ni2O3		1.50E+01	Ni	10662651
	NiO		2.27E+02	Ni	1.79E+08
	PbO2		6.05	Pb	5239958

FROM THE INVENTORY DATA

MASS OF RADIONUCLIDES (grams)

from inventory by tank grouping

	SSTs	DSTs	TOTAL	Fraction
Pu238	65.1	82.88	147.98	0.000324
Pu239	290791.6	135056	425847.6	0.933251
Pu240	18960.35	10547	29507.35	0.064666
Pu241	417.5	384.95	802.45	0.001759
Pu242	0.087		0.087	1.91E-07
total Pu			456305.5	
U233	1.125		1.125	7.82E-10
U234	31.02		31.02	2.15E-08
U235	9528294		9528294	0.006619
U236	35.15		35.15	2.44E-08
U237	1.29E-05		1.29E-05	8.96E-15
U238	1.43E+09		1.43E+09	0.993381
total U			1.44E+09	
Np237	98913	64729	163642	1
Np238	1.28E-06		1.28E-06	7.82E-12
Np239	1.43E-04		0.000143	8.74E-10
total Np			163642	
Am241	9623.9	2.07E+04	30323.9	0.994298
Am242	0.0086		0.0086	2.82E-07
Am242M	7.192		7.192	0.000236
Am243	166.705		166.705	0.005466
total Am			30497.81	

Inventory in the in situ glass form

based on mass fraction in feed

	grams	metric tons
Tc99	1877806.5	1.877806
Pu238	147.93734	0.000148
Pu239	425724.83	0.425725
Pu240	29498.843	0.029499
Pu241	802.21865	0.000802
Pu242	0.0869749	8.7E-08
U233	1.1446057	1.14E-06
U234	31.560593	3.16E-05
U235	9694346	9.694346
U236	35.762568	3.58E-05
U237	1.312E-05	1.31E-11
U238	1.455E+09	1454.921
Np237	146252.79	0.146253
Np238	1.144E-06	1.14E-12
Np239	0.0001278	1.28E-10
Am241	30043.433	
Am242	0.0085205	
Am242M	7.1254809	
Am243	165.16314	
Bi210	4.02E-13	
Bi211	4.81E-11	
Bi212	0	
Bi213	1.14E-09	
Bi214	4.73E-15	
Cs135	126104.3	
Cs137	443029.8	
Ni59	62360.92	
Ni63	4698.096	
Pb209	3.42E-10	
Pb210	6.53E-10	
Pb211	8.14E-10	
Pb212	0	
Pb214	6.36E-15	

need to make sure the fractions account for the non-rad components so for those isotopes that have a stable isotope all of the inventory doesn't show up as a rad component.

CH. 8/18/95

The material balance is based on WHC inventory which is 12/31/99
The breakdown by isolope using tank by tank grouping data is decayed to 12/31/95
This estimate uses the No Separations data pkg stream 437 as representative of the ISV glass

Bi210	4.02E-13		4.02E-13	0.000338
Bi211	4.81E-11		4.81E-11	0.040471
Bi212	0		0	0
Bi213	1.14E-09		1.14E-09	0.959187
Bi214	4.73E-15		4.73E-15	3.98E-06
total Bi			1.19E-09	
Cs135	126104.3		126104.3	0.221572
Cs137	103029.8	3.40E+05	443029.8	0.778428
total Cs			569134.1	
Ni59	62360.92		62360.92	0.929941
Ni63	4698.096		4698.096	0.070059
total Ni			67059.02	
Pb209	3.42E-10		3.42E-10	0.189054
Pb210	6.53E-10		6.53E-10	0.360972
Pb211	8.14E-10		8.14E-10	0.449971
Pb212	0		0	0
Pb214	6.36E-15		6.36E-15	3.52E-06
total Pb			1.81E-09	

The following fractions can be used to estimate the release concentrations
of specific isotopes using the release concentrtions shown in table 1-5 of the Engineering
Calculation - Flux from ISV Waste Forms

Example: Table 1 for uranium release conc. =5.58E-3 g/l, release conc. for U234=5.58E-3*2.15E-8=1.2E-10 g/L

		Fraction			Fraction			Fraction
Plutonium	Pu238	0.000324		Am241	0.994298		Pb209	0.189054
	Pu239	0.933251		Am242	2.82E-07		Pb210	0.360972
	Pu240	0.064666		Am242M	0.000236		Pb211	0.449971
	Pu241	0.001759		Am243	0.005466		Pb212	0
	Pu242	1.91E-07					Pb214	3.52E-06
				Bi210	0.000338			
Uranium	U233	7.82E-10		Bi211	0.040471			
	U234	2.15E-08		Bi212	0			
	U235	0.006619		Bi213	0.959187			
	U236	2.44E-08		Bi214	3.98E-06			
	U237	8.96E-15						
	U238	0.993381		Cs135	0.221572			
				Cs137	0.778428			
Neptuniu	Np237	1						
	Np238	7.82E-12		Ni59	0.929941			
	Np239	8.74E-10		Ni63	0.070059			

6.1.1

Request Number 065

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Kieth Lusk (ASI) Date: 3/20/95

Phone Number: (619) 560-8552 Fax Number: (619) 560-8538

Request Information: Request the following information for the remaining alternatives:

Estimated utility usage (gas, water, etc.)

Need Date: ASAP

Response: See attached response

Data Source/Accuracy: Engineering Data Packages

Prepared By: Colin Henderson CH. Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Deputy Project Manager

PRELIMINARY

engin\eninfrq.065

DATA REQUEST 065

UTILITY CONSUMPTION

NO ACTION TANKS

Operating Resource	No Action Tanks	Schedule
Water (cubic meters) Raw Sanitary	 0 1.5E6	1995-2095 peak water usage during DST retrieval campaigns 2037-2042 and 2087-2092
Energy Electrical (Gwh) Diesel fuel (m^3)	 1,100 22	1995-2095
Construction Resources Water (m^3) Electricity (GWH) Propane (m^3) Diesel (m^3) Gasoline (m^3)	 17,000 0.4 7,500 63 86	usage split between the two construction periods 2033-2037 and 2083-2087

MINIMAL RETRIEVAL- IN SITU VITRIFICATION

Resource	ISV	Schedule
Water Potable (liters) Process water	 1.2E9 -----	2005-2016
Electrical (Gwh)	4.4E3	2005-2016 actual operation of the ISV 2007-2012
Diesel fuel (m^3)	6.1E3	2005-2016

Construction Requirements Water (m^3) Electrical (Gwh) Diesel fuel (liters) Gasoline (liters)	 1.7E8 5.6E1 2E10 1.3E10	1998-2016

EXTENSIVE RETRIEVAL - EX SITU VITRIFICATION (was the TPA)

Resource	EXT. RET.- EX SITU VIT	Schedule
Water Raw Water (m^3) Sanitary Water (m^3)	 1.1E7 1.1E6	2004-2023
Electrical (Gwh) Kerosene (m^3)	9E3 5.8E4	2004-2023
Construction Resources Water (m^3) Electrical (Gwh) Diesel (liters) Gasoline (liters)	 4.9E5 7.3E7 2.1E7 7.6E6	1997-2007

CURRENT ROUTINE OPERATIONS

Resource	Routine Operations	Schedule
Water (m^3)	2.09E4/year	see note 1
Diesel Fuel (m^3)	0.22/year	
Electrical (Gwh)	11/year	

Note 1: Routine operations resource usage is the same for all alternatives in 1995 but differ somewhat as time goes on depending on the schedule of the treatment alternative.

Request Number 66

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: ESE, Elzinga Date: 4/21/95

Phone Number: (314) 567-4600 Fax Number:

Request Information: Attached - Peak traffic volume & percentage of truck traffic traveling to Site

Need Date: 4/28/95
Priority A

Response:

Data Source/Accuracy:

Prepared By: Murray/Harker Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Deputy Project Manager

MEMORANDUM

To: Phil Rogers

From: William Elzinga (314-567-4600)

Date: April 21, 1995

Subject: TWRS EIS--Noise

Recently I have had some difficulty reaching Arrie to inquire as to the status of the traffic data he was to provide on April 7. Yesterday I found out that he had been ill for about two weeks. As a result I expect that we will be delayed in our ability to meet the schedule for the revised report write-up. Information that Arrie had indicated that he would provide to me consisted of peak hour traffic volume (broken down by vehicle type) for each project alternative. He was going to then select with me, the following for inclusion in the analysis:

- No-Action Alternative,
- Worst Case Alternative during full construction, and
- A third alternative scenario based upon intermediate traffic volume.

Post-it® Fax Note 7671

To Phil ROGERS	Date 4/21 # of pages ▸ 1
Co./Dept.	From W. ELZINGA
Phone #	Co.
Fax #	Phone #
	Fax # 897-6007-6

Environmental Science & Engineering, Inc.

A GILCORP Company

FACSIMILE

DATE: 4/21/95 TIME:

TO: Marc Nelson FROM: Mark Rogers

FAX#: JOB#: 8946001-G-6150-8160

SUBJECT: Notes

Number of Pages
(Including this Cover Sheet)
2

ADDITIONAL MESSAGE:

Memo from Elzinga, as we discussed

If you have any questions, please call us immediately at (303) 790-0770.

2 Inverness Drive East, Suite 201 Englewood, CO 80112 Phone (303) 790-0770 Fax (303) 790-4411

4/10/95

Mike Harker, Arrie Bachrach

Attached is the information you requested in EIR #61, dated 3/21/95.

If you have any questions, please give me, Colin Henderson or Jim Goodwin a call.

Dave Murray

The construction schedule is a ten-hour day, five days per week for both TPA and No Separation alternative.

The operating schedule is three shifts, seven days a week. Operating personnel schedules are attached. Assume that half of the non-exempt workers are on shiftwork and the other half are on day shift, five days a week.

NO ACTION
MANPOWER ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE NO DISPOSAL ACTION ENGINEERING PACKAGE
REV 0 Apr 8, 1995 JWG

YEAR (NOTE 1)			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% MH EXPENDED PER YR, DESIGN (NOTE 2)																						
% MH EXPENDED PER YR, CONST. (NOTE 2)																						
	TOTAL MH	EQUIV TOTAL MAN*YR (NOTE 4)	EQUIVALENT MEN (NOTE 7)																			
375 - DESIGN & ENGR (NOTE 5) 4yr	750,000	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3,375 - CONSTRUCTION (NOTE 5) 10yr																						
NONEXEMPT	1,875,000	937.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXEMPT	3,750,000	1875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUPERVISION	1,125,000	562.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3,750																				
04,287 - OPERATION (NOTE 6) 103yr																						
EXEMPT																						
RAD WORKER			89	90	92	89	90	88	97	97	97	96	95	95	95	95	95	95	95	95	95	95
NONRAD WORKER			354	358	366	358	358	352	388	388	386	384	379	379	379	379	379	379	379	379	379	379
NON-EXEMPT																						
RAD WORKER			416	422	431	421	422	414	457	456	455	452	446	446	446	446	446	446	446	446	446	446
NONRAD WORKER			89	90	92	90	90	89	98	97	97	97	95	95	95	95	95	95	95	95	95	95
08,037 - TOTAL	7,500,000	3,750	948	960	981	958	960	943	1,040	1,038	1,035	1,029	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015

NOTES:
1. SCHEDULE FROM TABLE 5-21
2. THE MANHOUR DISTRIBUTION WAS ESTIMATED BY JACOBS
3.
4. JACOBS ASSUMES 2000 WORKING MANHOURS PER YEAR
5. TOTAL MANHOURS FROM TABLE 5-8. JACOBS ASSUMES 10% OF THE TOTAL HOURS ARE ENGINEERING, 25% ARE EXEMPT, 50% ARE NON-EXEMPT AND 15% ARE SUPERVISI
6. MANHOURS FROM TANK WASTE OPERATIONS DATA (SPREADSHEET) -- NO DISPOSAL ACTION IN THE ROUTINE OPERATIONS DATA PACKAGE.
7. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
																30%	40%	10%	10%	10%	10%	10%			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	150	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	94	94	94	94	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	188	188	188	188	188	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	56	56	56	56	0	0	0
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379
446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,128	1,165	1,353	1,353	1,353	1,353	1,353	1,015	1,015	1,015

2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379
446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015

2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086
																		10%	20%			
																			10%	10%	10%	10%
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	75	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94 now exempt 47	94	94	94
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	188	188	188	188
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	56	56	56
																			413			
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379
446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446	446 now exempt	446	446	446
95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,053	1,015 1,428	1,353	1,353	1,353

2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097		
											100%	
10%											100%	
											TOTAL	
0	0	0	0	0	0	0	0	0	0	0	375	
94	0	0	0	0	0	0	0	0	0	0	938	construction
188	0	0	0	0	0	0	0	0	0	0	1,875	
56	0	0	0	0	0	0	0	0	0	0	563	
											3,751	
95	95	95	95	95	95	95	95	95	95	95	9,760	
379	379	379	379	379	379	379	379	379	379	379	38,939	operations
446	446	446	446	446	446	446	446	446	446	446	45,824	
95	95	95	95	95	95	95	95	95	95	95	9,764	104,287
1,353	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	108,037	
											18	

9,760 - exempt rad
45,824 - nonexempt rad
55,584

ISV, INCLUDING CLOSURE
IN SITU VITRIFICATION PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE IN SITU VITRIFICATION TECHNICAL DATA PACKAGE DATED FEB 1995 AND FROM REV B DRAFT OF THE CLOSURE TECHNICAL DATA PACKAGE DATED MARCH 1995
REV 0 Apr 8, 1995 JWG

YEAR	1998	1999	2000	2001	2002	2003	2004	2005
% MANHOURS EXPENDED PER YR FOR R & D (NOTE 1)	5%	10%	15%	20%	20%	15%	15%	
% MANHOURS EXPENDED PER YR FOR CONST DESIGN (NOTE 2)	5%	10%	15%	20%	20%	15%	15%	
% MANHOURS EXPENDED PER YR FOR CONST (NOTE 2)	2%	4%	6%	6%	6%	6%	8%	10%
% MANHOURS EXPENDED PER YR FOR OPR (NOTE 3)			6%	6%	6%	6%	6%	6%
% MANHOURS EXPENDED PER YR FOR CLOSURE DESIGN (NOTE 4)								
% MANHOURS EXPENDED PER YR FOR CLOSURE (D&D) (NOTE 4)								
% MANHOURS EXPENDED PER YR FOR MON & MAINT (NOTE 2)								

	TOTAL MH	EQUIV TOTAL MAN*YR (NOTE 8)	EQUIVALENT MEN (NOTE 9)							
RESEARCH AND DEVELOPMENT (NOTE 1)	785,000	393	20	39	59	79	79	59	59	0
CONSTRUCTION (NOTE 5)										
DESIGN & ENGR	8,800,000	4400	220	440	660	880	880	660	660	0
NONEXEMPT NONRAD W'KR	26,400,000	13200	264	528	792	792	792	792	1056	1320
EXEMPT NONRAD WORKER	2,200,000	1100	22	44	66	66	66	66	88	110
SUPERVISION	6,600,000	3300	66	132	198	198	198	198	264	330
VITRIFICATION OPERATION (NOTE 6)		22,000							2,127	
EXEMPT RAD	3,600,000	1800	0	0	108	108	108	108	108	108
EXEMPT NONRAD	2,200,000	1100	0	0	66	66	66	66	66	66
NONEXEMPT RAD	8,900,000	4450	0	0	267	267	267	267	267	267
NON EXEMPT NONRAD	1,400,000	700	0	0	42	42	42	42	42	42
ROUTINE OPERATION (NOTE 12)		8,050								558
EXEMPT RAD			89	90	88	97	97	97	96	95
EXEMPT NONRAD			358	358	352	388	388	386	384	379
NONEXEMPT RAD			421	422	414	457	456	455	452	446
NON EXEMPT NONRAD		18,262	90	90	89	98	97	97	97	95
CLOSURE (NOTE 7)						1,523			1,512	
DESIGN/ENGINEERING	208,000	104	0	0	0	0	0	0	0	0
NONEXEMPT RAD	364,000	182	0	0	0	0	0	0	0	0
SUPERVISION	65,000	33	0	0	0	0	0	0	0	0
MONITORING AND MAINTENANCE (NOTE 11)		6	0	0	0	0	0	0	0	0
TOTAL			1,550	2,143	3,201	3,538	3,536	3,293	3,639	3,258

22,000
319
22,319

add closure to construction

NOTES:

1. SCHEDULE AND MANHOURS FROM SECTION 4.2.3, IN SITU. JACOBS ASSUMES AN AVERAGE WAGE OF $85 PER HOUR.
2. SCHEDULE FROM TABLE 7-21, IN SITU. DISTRIBUTION ESTIMATED BY JACOBS
3. MANHOUR DISTRIBUTION FROM FIG 8-1, IN SITU.
4. BARRIER CONSTRUCTION SCHEDULE FROM TABLE 5-12, CLOSURE DATA PACKAGE, IN SITU DISPOSAL. MANHOUR DIST. ASSUMED BY JACOBS
5. DATA FROM FIGURE 7-8, IN SITU. JACOBS ASSUMES 20% OF THE TOTAL HOURS ARE ENGINEERING, 60% ARE RAD WORKERS, 5% ARE NON RAD WORKERS AND 15% ARE SUPERVISION.
6. OPERATIONAL MANHOURS FROM TABLE 7-3, IN SITU.
7. DATA FROM FIGURE 5-2D, CLOSURE DATA PACKAGE, IN SITU DISPOSAL.
8. JACOBS ASSUMES 2000 MANHOURS PER YEAR
9. GENERAL CALCULATION: (EQUIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)
10.
11. SEE TABLE 5-7 IN THE CLOSURE DATA PACKAGE
12. DATA FROM TANK FARM OPTIONS DATA -- IN SITU VITRIFICATION; ROUTINE OPERATIONS DATA PACKAGE.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2024 TO 2124	
																100%
																100%
	10%	10%	7%	4%	3%	3%	3%	3%	3%	3%	3%					100%
	6%	7%	6%	6%	6%	6%	6%	6%	5%	5%	5%					100%
					20%	30%	30%	20%								100%
								5%	10%	15%	20%	20%	15%	15%		100%
															100	

																TOTAL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0		393
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4,400
	1320	1320	924	528	396	396	396	396	396	396	396	0	0	0		13,200
	110	110	77	44	33	33	33	33	33	33	33	0	0	0		1,100
	330	330	231	132	99	99	99	99	99	99	99	0	0	0		3,300
																22,000
Operations Vit	108	126	108	108	108	108	108	108	90	90	90	0	0	0		1,800
	66	77	66	66	66	66	66	66	55	55	55	0	0	0		1,100
	267	312	267	267	267	267	267	267	223	223	223	0	0	0		4,450
	42	49	42	42	42	42	42	42	35	35	35	0	0	0		700
routine	89	87	77	76	75	74	71	70	70	66	67	67	44	22		1,704
	357	348	308	306	300	296	285	281	279	266	266	266	177	89		6,817
	420	410	363	360	353	348	335	331	329	313	313	313	209	105		8,025
	90	88	78	77	75	74	72	71	70	67	67	67	45	22		1,716
																26,312
closure	0	0	0	0	21	31	31	21	0	0	0	0	0	0		104
	0	0	0	0	0	0	0	9	18	27	36	36	27	27		182
	0	0	0	0	0	0	0	2	3	5	7	7	5	5		319 33
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600
	3,199	3,257	2,541	2,006	1,835	1,834	1,805	1,796	1,700	1,675	1,686	756	507	270	600	49,623

const.

operations

18

closure

Construction 22,000 19yr

Closure 319 +3yr

22,319 22yrs

Operations · 26,312 - 22yrs

TPA; WASTE RETRIEVAL AND TRANSFER
CONSTRUCTION PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE TPA SECTION OF THE REV B DRAFT OF THE WASTE RETRIEVAL AND TRANSFER PACKAGE DATED JANUARY 1995
REV 1 Mar 22, 1995 JWG

YEAR (NOTE 1)			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
% MH EXPENDED PER YR, DESIGN (NOTE 5)			5%	10%	10%	10%	10%	10%	10%	10%	5%	4%	3%	2%	2%	2%	2%	1%	1%	1%	1%	1%	100%
% MH EXPENDED PER YR, CONST. (NOTE 5)			3%	4%	5%	6%	7%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	5%	4%	3%	2%	1%	100%
	TOTAL MH (NOTE 2)	EQUIV TOTAL MAN*YR (NOTE 3)	EQUIVALENT MEN (NOTE 5)																				TOTAL
DESIGN & ENGR	6,000,000	3,000	150	300	300	300	300	300	300	300	150	120	90	60	60	60	60	30	30	30	30	30	3,000
CONSTRUCTION																							
RAD WORKER	600,000	300	9	12	15	18	21	18	18	18	18	18	18	18	18	18	18	15	12	9	6	3	300
NONRADIATION WORKER	12,600,000	6,300	189	252	315	378	441	378	378	378	378	378	378	378	378	378	378	315	252	189	126	63	6,300
SUPERVISORY	2,000,000	1,000	30	40	50	60	70	60	60	60	60	60	60	60	60	60	60	50	40	30	20	10	1,000
TOTAL	21,200,000	10,600	378	604	680	756	832	756	756	756	606	576	546	516	516	516	516	410	334	258	182	106	10,600
					2970	2624	325											2,600					

NOTES:
1. SCHEDULE FROM TABLE 5-21
2. TOTAL MANHOURS FROM TABLE 5-6. USED THE WORK DISTRIBUTION FROM FEVISION A FOR DESIGN, RAD & NONRAD WORKER AND SUPERVISION ADJUSTED TOTAL TO REV B TOTALS BY ADJUSTING NONRAD WORKERS AND BY DELETING SUBSURFACE BARRIERS
3. THE NUMBER OF MAN HOURS PER YEARS ARE ASSUMED TO BE 2000.
4. THE MANHOUR DISTRIBUTION IS BY JEG
5. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)
6. EXCLUDES UNDERGROUND BARRIERS

TPA; WASTE RETRIEVAL AND TRANSFER
OPERATING PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE TPA SECTION OF THE REV B DRAFT OF THE WASTE RETRIEVAL AND TRANSFER PACKAGE DATED JANUARY 1995
REV 1 Mar 22, 1995 JWG

YEAR (NOTE 1)			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
% MH EXPENDED PER YR (NOTE 1)			1%	2%	2%	2%	2%	2%	2%	2%	7%	8%	8%	8%	8%	8%	8%	8%	8%	7%	2%	1%	1%	1%
	TOTAL MH (NOTE 2)	EQUIV TOTAL MAN*YR (NOTE 3)	EQUIVALENT MEN (NOTE 4)																					
NONEXEMPT																								
RAD WORKER	34,000,000	17,000	170	340	340	340	340	340	340	340	1190	1360	1360	1360	1360	1360	1360	1360	1360	1190	340	170	170	170
NONRAD WORKER	12,000,000	6,000	60	120	120	120	120	120	120	120	420	480	480	480	480	480	480	480	480	420	120	60	60	60
				460																				
EXEMPT																								
RAD WORKER	6,000,000	3,000	30	60	60	60	60	60	60	60	210	240	240	240	240	240	240	240	240	210	60	30	30	30
NONRAD WORKER	13,000,000	6,500	65	130	130	130	130	130	130	130	455	520	520	520	520	520	520	520	520	455	130	65	65	65
TOTAL	65,000,000	32,500	325	650	650	650	650	650	650	650	2,275	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,275	650	325	325	325

NOTES:
1. SCHEDULE FROM TABLE 5.1 BACKUP, PAGE A11.
2. TOTAL MANHOURS FROM TABLE 5-2
3. THE NUMBER OF MAN HOURS PER YEARS ARE ASSUMED TO BE 2000.
4. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

2023	2024	
1%	1%	100%
		TOTAL
170	170	17,000
60	60	6,000
30	30	3,000
65	65	6,500
325	325	32,500

TPA WRT OPR MH

TPA; WASTE RETRIEVAL AND TRANSFER
DECONTAMINATING AND DECOMISSIONING PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE TPA SECTION OF THE REV B DRAFT OF THE WASTE RETRIEVAL AND TRANSFER PACKAGE DATED JANUARY 1995
REV 1 Mar 23, 1995 JWG

YEAR (NOTE 1)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
% MH EXPENDED PER YEAR (NOTE 4)		5%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	6%	5%	100%	
	TOTAL MH	EQUIV MEN*YR (NOTE 2)	EQUIVALENT MEN (NOTE 5)														TOTAL	
D&D LABOR	9,810,000	4,905	245	343	343	343	343	343	343	343	343	343	343	343	294	245	4,905	

NOTES:
1. SCHEDULE FROM TABLE 5-17
2. THE NUMBER OF MAN HOURS PER YEARS ARE ASSUMED TO BE 2000.
3. FOOTNOTES FOR TABLE 6-21 (OF REV A) SPECIFY THE FOLLOWING LABOR COSTS FOR D&D:
   30 % OF CAPITAL (EX CONTINGENCY); TABLE 5-14
   NOTE THE BASIS IS DIFFERENT THAN THE TPA PROCESS ASSUMPTION. THREE YEARS OF OPERATING LABOR IS NOT INCLUDED
   JACOBS ASSUMES THAT CAPITAL IS 60% LABOR AND THAT THE LABOR RATE IS 60 $/HR.

   30% OF CAPITAL AT 60% LABOR, MILLIONS 30% X 3,270 X 60% = $589
   TOTAL LABOR HOURS AT 60 $/HR 9810000

4. MANHOUR DISTRIBURIION ESTIMATED BY JACOBS.
5. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)
6. D&D IS NOT DISCUSSED IN THE TEXT, THE SCOPE IS UNDEFINED AND COST ESTIMATES ARE VERY ROUGH.

TPA; WASTE RETRIEVAL AND TRANSFER
MONITORING AND MAINTENANCE PERSONNEL ESTIMATE

M&M ARE DECLARED "NA" IN TABLE 5-17 AND ARE NOT DEISCUSSED IN THE TEXT. PRESUMABLY THE CLOSURE ACTION IS STARTED IMMEDIATELY AFTER OPERATIONS CEASE.

TPA WRT M&M MH

TPA
CONSTRUCTION PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE TPA ENGINEERING PACKAGE DATED MARCH 1995
REV 1 Mar 23, 1995 JWG

YEAR (NOTE 1)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
% MH EXPENDED PER YR, DESIGN (NOTE 4)	8%	12%	15%	15%	15%	15%	10%	5%	2%	1%	1%	1%	1%	1%	102%
% MH EXPENDED PER YR, CONST. (NOTE 1)	3%	6%	9%	9%	15%	13%	12%	11%	11%	5%	3%	2%	1%	0%	100%

	TOTAL MH (NOTE 2)	EQUIV TOTAL MAN*YR (NOTE 3)	EQUIVALENT MEN (NOTE 5)														TOTAL
DESIGN & ENGR	10,000,000	5000	400	600	750	750	750	750	500	250	100	50	50	50	50	50	5,100
CONSTRUCTION																	
NONRADIATION WORKER	24,000,000	12000	360	720	1080	1080	1800	1560	1440	1320	1320	600	360	240	120	0	12,000
SUPERVISORY	5,600,000	2800	84	168	252	252	420	364	336	308	308	140	84	56	28	0	2,800
TOTAL	39,600,000	19,800	844	1,488	2,082	2,082	2,970	2,674	2,276	1,878	1,728	790	494	346	198	50	19,900

Peak

NOTES:
1. SCHEDULE AND DISTRIBUTION FROM FIGURE 10-1
2. TOTAL MANHOURS FROM TABLE 9-9
3. ASSUMED 2000 MAN HOURS PER YEAR
4. THE DESIGN MANHOUR DISTRIBUTION IS BY JEG.
5. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

TPA
OPERATING PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE REV B DRAFT OF THE TPA PACKAGE DATED MARCH 1995

REV 1 Mar 23, 1995 JWG

2-7

	TOTAL MH (NOTE 2)	EQUIV MEN/YR (NOTE 3)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
YEAR (NOTE 1)			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
% MH EXPENDED PER YEAR (NOTE 4)			1%	1%	1%	2%	2%	4%	4%	5%	5%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	6%	5%	5%	4%	4%	2%	1%
			EQUIVALENT MEN (NOTE 4)																										
NONEXEMPT																													
RAD WORKER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NONRAD WORKER	3,500,000	1,750	18	18	18	35	35	70	70	88	88	70	70	70	70	70	70	70	70	70	70	70	105	88	88	70	70	35	18
							35																						
EXEMPT																													
RAD WORKER	27,000,000	13,500	135	135	135	270	270	540	540	675	675	540	540	540	540	540	540	540	540	540	540	540	810	675	675	540	540	270	135
NONRAD WORKER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	30,500,000	15,250	153	153	153	305	305	610	610	763	763	610	610	610	610	610	610	610	610	610	610	610	915	763	763	610	610	305	153

NOTES: 1. SCHEDULE FROM FIGURE 10-2
2. TOTAL MANHOURS FROM TABLE 9-3
3. ASSUMED 2000 MAN HOURS PER YEAR FOR OPERTIONS
4. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

figure 10-3

304v.

2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
1%	1%	1%								.20%	.20%	.20%	.20%	.20%	.20%	100%
																TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	18	18	0	0	0	0	0	0	0	4	4	4	4	4	4	1,754
135	135	135	0	0	0	0	0	0	0	27	27	27	27	27	27	13,527
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
153	153	153	0	0	0	0	0	0	0	31	31	31	31	31	31	15,281

14,900

transport to offsite repository

Jim Goodwin
818-449-2171
V2uts

TPA OPR MH

TPA
DECONTAMINATION AND DECOMISSIONING PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE REV B DRAFT OF THE TPA PACKAGE DATED MARCH 1995

REV 1 Mar 22, 1995 JWG

	YEAR (NOTE 1)		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
% MH EXPENDED PER YEAR (NOTE 6)			4%	8%	12%	13%	13%	13%	13%	12%	8%	4%	100%
	TOTAL MH (NOTE 2)	EQUIV MEN/YR (NOTE 3)	EQUIVALENT MEN (NOTE 5)										TOTAL
NONEXEMPT													
RAD WORKER	2,226,000	1,113	45	89	134	145	145	145	145	134	89	45	1,113
NONRAD WORKER	226,200	113	5	9	14	15	15	15	15	14	9	5	113
EXEMPT													
RAD WORKER	1,484,000	742	30	59	89	96	96	96	96	89	59	30	742
NONRAD WORKER	150,800	75	3	6	9	10	10	10	10	9	6	3	75
TOTAL	4,087,000	2,044	82	163	245	266	266	266	266	245	163	82	2,044

NOTES:
1. SCHEDULE FROM TABLE 9-20
2. TOTAL MANHOURS FROM TABLE F-8. JACOBS ASSUMES THAT 40% ARE EXEMPT.
3. ASSUMED 2000 WORKING MAN HOURS PER YEAR.
4. THE MANHOUR DISTRIBUTION IS BY JEG.
5. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

GENERAL NOTE: TABLE 9-20 ASSUMES 5 YEARS FOE D&D (NOTE 4) WHILE TABLE F-6 ASSUMES 2 YEARS
WE MADE NO ASSUMPTIONS AND USED THE RAW DATA.

TPA
MONITORING AND MAINTENANCE PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING MANHOURS AND SCHEDULE FROM THE REV B DRAFT OF THE TPA PACKAGE DATED MARCH 1995

REV 1 Mar 22, 1995 JWG

	TOTAL MH (NOTE 2)	EQUIV MEN/YR (NOTE 3)	EQUIVALENT MEN (NOTE 5)													TOTAL
YEAR (NOTE 1)			2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
% MH EXPENDED PER YEAR (NOTE 6)			8%	8%	8%	8%	8%	8%	8%	8%	8%	7%	7%	7%	7%	100%
NONEXEMPT																
RAD WORKER	26,100	13	1	1	1	1	1	1	1	1	1	1	1	1	1	13
NONRAD WORKER	104,400	52	4	4	4	4	4	4	4	4	4	4	4	4	4	52
EXEMPT																
RAD WORKER	17,400	9	1	1	1	1	1	1	1	1	1	1	1	1	1	9
NONRAD WORKER	69,600	35	3	3	3	3	3	3	3	3	3	2	2	2	2	35
TOTAL	217,500	109	9	9	9	9	9	9	9	9	9	8	8	8	8	109

NOTES:
1. SCHEDULE FROM TABLE 9-20
2. TOTAL MANHOURS FROM TABLE F-8. JACOBS ASSUMES THAT 40% ARE EXEMPT.
3. ASSUMED 2000 WORKING MAN HOURS PER YEAR.
4. THE MANHOUR DISTRIBUTION IS BY JEG.
5. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

TPA CLOSURE
TANK FARM CLOSURE PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE CLOSURE TECHNICAL DATA PACKAGE DATED MARCH 1995
REV 0 Apr 8, 1995 JWG

YEAR (NOTE 1)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
% MH EXPEND PER YR, TK STAB DSGN (NOTE 6)	5%	6%	7%	8%	8%	8%	8%	8%	8%	8%	8%	7%	6%	5%		
% MH EXPENDED PER YR, TANK STAB (NOTE 6)	3%	4%	5%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
% MH EXPEND PER YR, BARRIER DSGN (NOTE 6)					5%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
% MH EXPENDED PER YR, BARRIER (NOTE 6)																
% MH EXPENDED PER YR, M&M (NOTE 6)			1	1	1	1	1	1	1	1	1	1	1	1	1	1

	TOTAL MH	EQUIV TOTAL MAN*YR	EQUIVALENT MEN (NOTE 7)															
TANK STABILIZATION WITH CONCRETE (NOTE 2)																		
DESIGN & ENGR	96,000	48	2	3	3	4	4	4	4	4	4	4	4	3	3	2	0	0
RAD WORKER	18,000	9	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
NONRADIATION WORKER	1,300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUPERVISION	23,000	12	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BARRIER CONSTRUCTION (NOTE 3)																		
DESIGN	266,000	133	0	0	0	0	7	9	9	9	9	9	9	9	9	9	9	9
RAD WORKER	488,000	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUPERVISION	86,000	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&M (NOTE 4)																		
RAD WORKER	11,000	6	0	0	6	6	6	6	6	6	6	6	6	6	6	6	6	6
TOTAL	989,300		3	4	10	11	17	20	20	20	20	20	20	19	19	18	16	16

NOTES:
1. SCHEDULE FROM FIGURES 5-11 and 5-12
2. TOTAL MANHOURS FROM TABLE 5-2B. GROUT STABILIZATION OF BOTH TANKS AND EQUIPMENT IS ASSUMED.
3. TOTAL MANHOURS FROM 5-2D
4. MANHOURS FROM 5-7. THIS TABLE IS IN STAFF HOURS PER YEAR
5. ASSUMED 2000 MAN HOURS PER YEAR
6. THE DESIGN MANHOUR DISTRIBUTION IS BY JEG.
7. GENERAL CALCULATION: (EQUIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

25 yrs

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035 TO 2134	
										100%
5%	5%									100%
7%	6%	5%								100%
		5%	10%	20%	30%	20%	10%	5%		100%
1	1	1	1	1	1	1	1	1	100	
										TOTAL
0	0	0	0	0	0	0	0	0	0	48
0	0	0	0	0	0	0	0	0	0	9
0	0	0	0	0	0	0	0	0	0	1
1	1	0	0	0	0	0	0	0	0	12
9	8	7	0	0	0	0	0	0	0	133
0	0	12	24	49	73	49	24	12	0	244
0	0	2	4	9	13	9	4	2	0	43
										490
6	6	6	6	6	6	6	6	6	550	677
16	15	27	34	63	92	63	34	20	550	1,166

CAPSULE DRY STORAGE (NO ACTION)
PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE CAPSULE ENGINEERING PACKAGE DATED FEBRUARY 1995
REV 0 Apr 6, 1995 JWG

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
% MH EXPENDED PER YR, DESIGN (NOTE 1)		40%	60%															
% MH EXPENDED PER YR, CONST. (NOTE 1)		5%	20%	20%	20%	10%	10%	10%	5%									
% MH EXPENDED PER YR, PKG (NOTE 1)										5%	5%	5%	5%	5%	5%	5%	5%	5%
% MH EXPENDED PER YR, STORAGE (NOTE 1)										2%	2%	2%	2%	2%	2%	2%	2%	2%
	EQUIV TOTAL MAN*YR	EQUIVALENT MEN (NOTE 4)																
DESIGN & ENGR (NOTE 2)	15	6	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION (NOTE 2)																		
NONRADIATION WORKER	70	[illegible]	14	14	14	7	7	7	4	0	0	0	0	0	0	0	0	0
SUPERVISORY	15	1	3	3	3	2	2	2	1	0	0	0	0	0	0	0	0	0
PACKAGING OPERATIONS (NOTE 3)																		
RAD	140	0	0	0	0	0	0	0	0	7	7	7	7	7	7	7	7	7
NONRAD	54	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3
DRY STORAGE (NOTE 3)																		
RAD	700	0	0	0	0	0	0	0	0	14	14	14	14	14	14	14	14	14
NONRAD	190	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4
TOTAL	1,184	10	26	17	17	9	9	9	4	28	28	28	28	28	28	28	28	28

100 West modification
110 Dry well construction
810 total
~~1,089~~
1294

NOTES:

1. SCHEDULE TAKEN FROM FIGURE 3-2. MANHOUR DISTRIBUTION ESTIMATED BY JACOBS
2. CONSTRUCTION MANYEARS FROM TABLE 4-2. JACOBS ASSUMES THAT 15% OF CONSTRUCTION MANHOURS WILL BE DESIGN AND THAT 15% WILL BE SUPERVISION AND STAFF.
3. OPERATIONAL AND STORAGE/DISPOSAL MAN YEARS FROM TABLE 4-5
4. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)

Pool storage time = from 1997 – 2024 = 33 yrs.

CAPSULE DRY STORAGE MANHOURS

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 TO 2090	
												100%
												100%
5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%		100%
2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	60%	100%
												TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	15
0	0	0	0	0	0	0	0	0	0	0	0	70
0	0	0	0	0	0	0	0	0	0	0	0	15
7	7	7	7	7	7	7	7	7	7	7	0	140
3	3	3	3	3	3	3	3	3	3	3	0	54
14	14	14	14	14	14	14	14	14	14	14	420	700
4	4	4	4	4	4	4	4	4	4	4	114	190
28	28	28	28	28	28	28	28	28	28	28	534	1,184

CAPSULE DRY STORAGE MANHOURS

CAPSULE OVERPACK AND SHIP MANHOURS (AKA NO IMMOBILIZATION OR CAPSULE TPA)
PERSONNEL ESTIMATE
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF THE CAPSULE ENGINEERING PACKAGE DATED FEBRUARY 1995
REV 0 Apr 6, 1995 JWG

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
% MH EXPENDED PER YR, DESIGN (NOTE 1)	40%	60%																
% MH EXPENDED PER YR, CONST. (NOTE 1)	5%	20%	20%	20%	10%	10%	10%	5%										
% MH EXPENDED PER YR, PKG (NOTE 1)									6%	6%	6%	6%	6%	5%	5%	5%	5%	5%
% MH EXPENDED PER YR, STORAGE (NOTE 1)									4%	4%	4%	4%	4%	4%	4%	3%	3%	3%
% MH EXPENDED PER YR, SHIPPING (NOTE 1)																		

	EQUIV TOTAL MAN*YR	EQUIVALENT MEN (NOTE 4)																	
DESIGN & ENGR (NOTE 2)	15	6	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION (NOTE 2)																			
NONRADIATION WORKER	70	4	14	14	14	7	7	7	4	0	0	0	0	0	0	0	0	0	0
SUPERVISORY	15	1	3	3	3	2	2	2	1	0	0	0	0	0	0	0	0	0	0
PACKAGING OPERATIONS (NOTE 3)	700																		
RAD	17 140	0	0	0	0	0	0	0	0	8	8	8	8	8	7	7	7	7	7
NONRAD	34 ~~349~~ 51	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3
DRY STORAGE (NOTE 3)																			
RAD	65 700	0	0	0	0	0	0	0	0	28	28	28	28	28	28	28	21	21	21
NONRAD	25 190	0	0	0	0	0	0	0	0	8	8	8	8	8	8	8	6	6	6
SHIPPING (NOTE 5)	~~80~~ 40 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1,184	10	26	17	17	9	9	9	4	47	47	47	47	47	45	45	36	36	36

NOTES:

1. SCHEDULE TAKEN FROM FIGURE 3-2. MANHOUR DISTRIBUTION ESTIMATED BY JACOBS
2. CONSTRUCTION MANYEARS FROM TABLE 4-2. JACOBS ASSUMES THAT 15% OF CONSTRUCTION MANHOURS WILL BE DESIGN AND THAT 15% WILL BE SUPERVISION AND STAFF.
3. OPERATIONAL AND STORAGE/DISPOSAL MAN YEARS FROM TABLE 4-5
4. GENERAL CALCULATION: (EQIVALENT TOTAL MAN YR) X (% EXPENDED PER YEAR)
5.
6. THERE ARE NO D&D MANHOURS OR SCHEDULE BECAUSE THE WESF FACILITY WILL BE RETROFIT FOR THE OVERPACK OPERATION.

VITRIFY WITH TANK WASTE IS SAME AS OVERPACK & SHIP
IT WILL LAST 24 YRS (SAME AS EASILY VIT.)

OVERPACK & SHIP MANHOURS

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
																					100%
																					100%
5%	5%	5%	5%	5%	5%	5%	5%	5%													100%
3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	100%
															16%	17%	17%	17%	17%	16%	100%
																					TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
7	7	7	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	140
3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	54
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	700
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	190
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
36	36	36	36	36	36	36	36	36												27	1,184

OVERPACK & SHIP MANHOURS

Request Number 067

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Mike Harker

Date: April 26,1995

Phone Number: (509) 736-0616

Fax Number: (509) 736-7504

Request Information: For all 3 capsule alternatives the number of trips for truck/rail - Breake it down into construction & processing. Further break it down into onsite/offsite. Indicate origin of transport (example: Portland/Seattle or Tri-Cities).

Need Date: 04/28/95

Response: Attached

Data Source/Accuracy: Engineering Data Packages for Capsules, TPA & Closure. Letter from Fredenburg to Randkle, 04/07/95

Prepared By: D. Murray

Date Sent/Faxed: 04/28/95

Concurrence: Marc E Nelson
Marc Nelson - Deputy Project Manager

engin\eninfrq.067

CAPSULE TRANSPORTATION			
Construction	Truck Trips		
	No Action	Overpack & Ship	Vitrification
Portland/Seattle	72 trips	19 trips	*
Tri-Cities	139 trips	139 trips	*
Operations	Truck Trips		
	No Action	O'pack & Ship	Vitrification
Portland/Seattle	18 trips	13 trips	*
Pit 30 - 4 km r.t.	87 trips	——	*
WESF- 4 km r.t.	98 trips	98 trips	98 trips
Rail (To Repository) 5 trips for 20-car train			

*Included in vitrification plant data

Assumptions:

1 Concrete: 29000 trips= 480,000m^3 - TPA Pkg
2 Steel: 9500 trips= 114,300 mt - TPA Pkg
3 Sand: 1 trip= 6.1m^3 - Closure Pkg
4 Capsules: 98 multi purpose canisters- Letter from Fredenburg to Randkle, 04/07/95.

JACOBS ENGINEERING GROUP INC.

DATE 4/28/95 SUBJECT Capsule Transportation SHEET NO. 1/1

BY [illegible] CHKD. _____ JOB NO. 01K47101

Construction: Truck Trips

	No Action	Overpack + Ship	Vitrification
Portland/Seattle	72 trips	19 trips	*
Tri-Cities	139 "	139 "	*

Operations: Truck Trips

	No Action	O'pack + Ship	V.t
Portland/Seattle	18 trips	13 trips	*
PFP 30-4Km r.t.	87 trips	—	*
WESF-4Km r.t.	98 trips	98 trips	98 trips

Rail (To Repository) 5 trips for 20-car train

* Included in vitrification plant data

Assumptions
1. Concrete: 29000 trips = 480,000 m^3-TPA Pkg
2. Steel: 9500 trips = 114,300 mt-TPA Pkg
3. Sand: 1 trip = 6.1 m^3-Closure Pkg
4. Capsules: 98 multi-purpose canisters-Letter from Fredenburg to Rand Klev, 4/7/95

FORM 91-005-1 (4/81)

Table 4-1. Resource Usage for Each Disposal Mode: Construction Phase for Cesium and Strontium Capsule. Overpack & Ship

Resource	Units	No Action	Onsite stabilization and disposal		~~Geologic disposal~~	Vitrification and disposal[2]
			Barrier	Total[1]	Storage and containerization	
Land						
Surface committed	ha	3.3	--	5.3	1.5	
Temporarily	ha	1.5	--	1.5	1.5	
Permanently	ha	1.8	--	3.8	--	
Subsurface committed	ha	--	2.0	--	--	
Water	m^3	390	170,000	170,000	390	
Energy						
Electrical	GWh	0.08	-	0.08	0.01	
Propane	m^3	580	-	580	140	
Diesel fuel	m^3	-	1,500	1,500	0.0	
Gasoline	m^3	200	17	220	50	
Materials						
Concrete	m^3	2,300	-	2,300	2,300	
Steel + Other Metals	t	~~860~~ 810	-	810	~~180~~ 230	
Stainless steel						
Iron	t	17	-	17	15	
Chromium	t	3.6	-	3.6	3.2	
Nickel	t	1.6	-	1.6	1.4	
Copper	t	Σ=52.6 4.1	-	4.1	4	Σ=49.9
Aluminum	t	Call it 50 0.7	-	0.7	0.7	Call it 50
Zinc	t	0.6	-	0.6	0.6	
Lead	t	25	-	25	25	
Lumber	m^3	290	-	290	290	
Argon	m^3	90	-	90	80	
Silica sand	m^3	-	-	-	-	
Soil	m^3	-	56,000	56,000	-	
Basalt riprap	m^3	-	170,000	170,000	-	
Rock filter	m^3	-	12,000	12,000	-	

Notes: ha = hectare GWh = gigawatt hour t = ~~ton~~

Concrete Tri-Cities $2{,}300\,m^3 \times \frac{29000 \text{ trips}}{480{,}000\,m^3} = 139$ trips (truck)

[1]Total equals barrier values plus continued storage values except land.

[2]Resource usage, costs, and personnel requirements for the vitrification and disposal option. Under this alternative, the contents of the cesium and strontium capsules will be sent to an existing vitrification plant for processing. The mass requiring vitrification from the cesium and strontium capsules is less than 1% of the tank materials that require vitrification. Therefore, the processing of the capsule contents do not impose any significant additional resource (both usage and personnel) requirements on the vitrification plant. Thus no separate estimate of impacts is provided.

Steel $860\,mt \times \frac{9500 \text{ trips}}{114{,}300\,mt} = 72$ trips (truck)

Portland Bottle $230\,mt = 19$ trips (truck)

Table 4-4. Resource Usage for Each Disposal Mode: Operational Phase for Cesium and Strontium Capsules.

Overpack & Ship

Resource	Units	No Action = Continued Storage	Onsite stabilization and disposal		~~Geologic disposal~~	Vitrification and disposal[2]
			Barrier	Total[1]	Storage and containerization	
Water	m^3	6,000,000	-	6,000,000	15,000,000	
Energy						
Electrical	GWh	120	-	110	43	
Diesel fuel	m^3	2.6		2.6	0	
Coal	t	~~43,000~~		43,000	~~18,000~~	
Materials						
Steel	t	220	-	220	160	
Silica sand	m^3	530	-	530	-	

Notes:

GWh = gigawatt hour

[1]Total equals barrier values plus continued storage values except land.

[2]Resource usage, costs, and personnel requirements for vitrification and disposal option.

Under this alternative, the contents of the cesium and strontium capsules are sent to an existing Vitrification Plant for processing. The mass requiring vitrification from the cesium and strontium capsules is less than 1% of the tank materials that require vitrification. Therefore, the processing of the capsule contents does not impose any significant additional resource (both usage and personnel) requirements on the vitrification plant. Thus no separate estimate of impacts is provided.

Sand - On-Site - Assume this is borrow material

$530 m^3 \times \frac{trip}{6.1 m^3} = 87$ trips (load = 11T) Call it Pt30

4 Km round trip

Steel - Portland/Seattle

$220 mt \times \frac{9500 \text{ trips}}{114,300 mt} = 18$ trips

$160 mt = 13$ trips

Table 9-10. Construction Resource Requirements.[1] (Units As Indicated)

Construction Resource	Tri-Party Agreement Preferred Alternative
Land (m^2)	
Surface committed	
Temporarily	8.1E+5
Water (m^3)	
Source of water	4.9E+5
Energy	
Electrical (Gwh)[2]	7.3E+7
Propane (m^3)	0
Diesel fuel (L)	2.1E+7
Gasoline (L)	7.6E+6
Materials	
Concrete (m^3)	4.8E+5 480,000 m^3
Steel	
Carbon Steel (Mg)	9.7E+4
Stainless Steel (Mg)	1.5E+4
Hastelloy/Inconnel (Mg)	2.3E+3
	114,300 mt
Excavation (m^3)	1.7E+6[3]
Riprap (m^3)	0
Structure backfill (m^3)	1.2E+6[4]

Notes:

[1]Includes construction of the low-level waste (LLW) vaults.

[2]Electrical service will require approximately 2.5 kilometers of 13.8 kilovolt overhead power line.

[3]Excavation represents structural excavation for building and vault construction.

[4]Structure backfill is at the buildings and vaults.

Table 9-13. Transportation of Other Construction Material.
(Units as Indicated)

Item	Tri-Party Agreement Preferred Alternative
Concrete	
Route location (state mileage)	Tri-Cities (70 Km)
Total number of trips Truck Train Barge	 2.9E+4 0 0
Steel	
Route location (state mileage)	Portland/Seattle (400 Km)
Total number of trips (average/peak) Truck Train Barge	 9.5E+3 0 0

To: Ed Randklev April 7, 1995
From: Ed Fredenburg
Subject: Information needed from DOE-RW/Yucca Mountain for the TWRS-EIS

Ed,

I've reviewed your draft file OTL_TWRS.ND4 dated 3/9/95, relative to need dates for input from DOE-RW for the TWRS-EIS, and in support of other HLW program needs. I assume this is to be presented at your meeting next week with DOE-RW and Yucca Mountain. I'd like to update you on our need dates for information supporting the TWRS-EIS, specifically (a) acceptability of overpacked Cs and Sr capsules for shipment and disposal at the geologic repository, (b) repository fee for disposal of overpacked Cs and Sr capsules[1], if acceptable waste forms, (c) acceptability of vitrified HLW canisters in the quantity and form described for each of the TWRS-EIS ex-tank waste disposal options (TPA Preferred Alternative[2], Extensive Separations Alternative[3], and No Separations Alternative[4]), and (d) repository fee for disposal of vitrified HLW canisters for each of the described alternatives.

Table V.A-1, item a. "Acceptability Decisions for HLW Product Options" indicates 8/31/95 for a preliminary decision, and 6/30/96 for a final decision. These dates will support the current schedule dates of 11/28/95 for publication of the draft TWRS-EIS, and 10/4/96 for publication of a final EIS.

Table V.A-2, item a. "Disposal Cost Estimates for HLW Product Options" indicates final information on repository disposal fee is needed by 6/30/96, following preliminary cost estimates provided to WHC on 2/1/95. It is essential that the draft EIS, scheduled for publication on 11/28/95, reflect the latest (at that time) best estimate of repository disposal fees. Therefore an updated estimate, or at least formal confirmation that the data provided on 2/1/95 is the current best estimate, is needed at the same time preliminary input on waste form acceptability is needed, i.e. 8/31/95. Please pursue this objective in your discussions with DOE-RW and Yucca Mountain next week.

Notes: (1) 601 strontium flouride capsules would be placed in one hundred twenty one (121) 0.3 m diameter x 3 m long canisters (at 5 capsules per canister) or sixty-seven (67) 0.68 m diameter x 4.67 m long canisters (at 9 capsules per canister). 1,328 cesium chloride capsules would be placed in two hundred sixty six (266) 0.3 m diameter x 3 m long canisters (at 5 capsules per canister) or one hundred forty eight (148) 0.68 m diameter x 4.67 m long canisters (at 9 capsules per canister). Four such canisters (either size) would be placed in the Hanford Multi-Purpose Canister (HMPC) and shipped to the repository. Using the smaller canister size of 0.3 m x 3.0 m, ninety eight (98) HMPCs would be shipped. Using the larger canister size of 0.68 m x 4.67 m, fifty four (54) HMPCs would be shipped.

(2) For the TPA Alternative, four 0.68 m ID x 4.57 m long cylindrical glass monoliths, are placed in a Hanford Multipurpose Canister (HMPC). 1705 HMPCs are shipped to the repository (6820 glass logs).

(3) For the Extensive Separations Alternative, 116 HMPCs, containing 462 glass logs of the same size as in the TPA Preferred Alternative are shipped to the repository.

(4) For the No Separations Alternative, 21,400 canisters, each 1.67 m OD x 4.57 m long (nominally 10 cubic meters) of glass cullet, inside a 2.06 m OD x 4.95 m long shielding cask are shipped to the repository.

Request Number 068

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: M. Harker

Date: 05/16/95

Phone Number: 509-736-0616

Fax Number: 509 736-7504

Request Information: Truck or rail trips to transport construction material in support of WESF modification (for overpacking capsules). Also number of truck trips of sand/fill to support dry well facility.

Need Date: ASAP

Response:

Data Source/Accuracy:

Prepared By: Dave Murray

Date Sent/Faxed: 5/16/95

Concurrence:
Marc Nelson - Deputy Project Manager

RECEIVED
MAY 16 1995

[10] From: George W Jr Reddick at ~WHC16 5/17/95 3:12PM (899 bytes: 17 ln)
To: ^Jacobs Engineering Group at ~DOE_HANFORD_1
cc: Edward A Fredenburg at ~WHC352
Subject: FOR DAVE MURRAY
---------- Message Contents ----------

Dave:

This message is to respond to your questions, May 16, 1995, about the Cs/Sr capsule data package.

1. My estimate of the number of truck trips to transport construction material in support of the overpacking facility for the repository option is 500 trips.

2. My estimate of the number of truck trips with sand and fill to support the on site disposal option is 16,000 trips.

Please let me know if I may be of further assistance.

Thanks

GWR Table 4-1 Data Package

Request Number 069

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Cliff Duke (ASI consult) Date: 5/23/95

Phone Number: (513)985-9229 Fax Number:

Request Information: No Action concentration of radionuclides and chemicals in the tanks

Need Date: 5/25/95

Response: see attached

Data Source/Accuracy: Data taken from inventory spreadsheets, Tank Waste Technical Options Report, Waste Tank Summary Report for Month Ending 12/31/94. (Cover pages for these documents attached)

Prepared By: Colin Henderson

Date Sent/Faxed: 5/25/95

Concurrence:
Marc Nelson - Project Manager

RECEIVED
MAY 24 1995

Preliminary

engin\eninfrq.069

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering/ No Action Concentration of Radionuclides and Chemicals in the tanks

ORIGINATOR Colin Henderoson DATE 12/5/95

REVISION NO. 0

OBJECTIVE Use existing tank by tank inventory to estimate radioisotope and Chemical Concentrations

METHODOLOGY Spreadsheet Calculations based on tank by tank inventory

ASSUMPTIONS None

(Continue on another sheet if necessary)

Col Henderoson
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

ENGINEERING INFORMATION REQUEST 69

The following notes support the calculations made in the attached spreadsheets.

Density: From the Technical Options Report Appendix D Table D-3 (attached) the density of the wastes in the SST farms varies considerably. I used 1.5 kg/L as a representative density (this is closer to the numbers being reported in current SST characterization reports). From Table D-8 the overall density of the DST wastes is 1.55 kg/L.

Volumes: The following volumes were obtained from the Waste Tank Summary for Month Ending Dec 31, 1994 (attached)

1WSS=T,TY,TX tank farms =9,676 kgal

2WSS= U,S,SX tank farms = 13,485 kgal

3WSS= SY tank farm = 2,608 kgal

1ESS= B,BX,BY tank farms = 8,349 kgal

2ESS= C tank farm = 2,131 kgal

3EDS= AN,AY,AZ tank farms = 10,141 kgal

4ESS= A,AX = 2,443 kgal

5EDS= AP,AW = 8,043 kgal

The radionuclides for both the SSTs and the DSTs are decayed to 12/31/1995

For No Action the following scenario will take place for the tanks:

SST wastes are left in place

DST wastes are retrieved and placed into new DSTs at 50 year intervals, so this occurs twice during the 100 year period of institutional control. After institutional control is lost there will be the 28 original DSTs (with a 1% residual inventory), there will be 26 DSTs from the first retanking (with a 1% residual), and there will be 26 DSTs with the remaining waste (98% of the original inventory).

RESIDUAL INVENTORY IN 28 ORIGINAL DSTs
RESIDUAL = 1% OF CURRENT INVENTORY (1%OF VOLUME)
Decayed to 12/31/1995

Radionuclide	3WDS	3WDS	3EDS	3EDS	5EDS	5EDS	TOTAL	TOTAL
	Ci	pCi/gram	Ci	pCi/gram	Ci	pCi/gram	Ci	pCi/gram
Na, kgs	1.32E+04		5.96E+04		2.70E+04		9.99E+04	
C-14	8.06E-03	52.70359	2.32E+01	39075.17	5.23E-02	110.925	2.33E+01	19107.87
Sr-90	6.10E+02	3987864	1.10E+05	1.84E+08	6.96E+02	1474478	1.11E+05	90926832
Y-90	6.10E+02	3987864	1.10E+05	1.84E+08	6.96E+02	1474478	1.11E+05	90926832
Tc-99	3.66E+01	239201.5	1.58E+02	266251.8	1.60E+01	33898.15	2.11E+02	172977.1
Cs-137	3.66E+04	2.39E+08	2.18E+05	3.67E+08	3.89E+04	82512449	2.94E+05	2.41E+08
Ba-137	3.66E+04	2.39E+08	2.18E+05	3.67E+08	3.89E+04	82512449	2.94E+05	2.41E+08
Eu-154	4.38E+00	28622.44	7.33E+02	1232161	5.33E+00	11287.43	7.43E+02	608925.4
Np-237	3.79E-03	24.78936	4.50E-01	757.1722	1.42E-03	3.014765	4.56E-01	373.5755
Pu-238	1.05E+01	68736.92	1.71E+00	2867.68	1.95E+00	4131.782	1.42E+01	11618.79
Pu-239	2.14E+01	139762.6	4.94E+01	83080.49	1.28E+01	27099.31	8.36E+01	68535
Pu-240	7.64E+00	49907.49	1.27E+01	21361.77	3.60E+00	7622.531	2.39E+01	19627.57
Pu-241	1.85E+02	1212066	1.08E+02	181040.7	1.03E+02	219017.1	3.97E+02	325055.7
Am-241	1.19E+02	778096.4	5.87E+02	986816.8	4.98E+00	10553.78	7.11E+02	582987.1
Total	8.81E+04	5.76E+08	7.18E+05	1.21E+09	1.06E+05	2.26E+08	9.12E+05	7.48E+08

Residual Volumes:3WDS 26080gal;3eds 10141 GAL;5EDS 80430 GAL
1ESS 83490gal;2ESS 21310gal;3EDS 101410gal; 4ESS 24430gal; 5EDS 80430gal
pCi/gram=Ci/(volume(gal)*3.785 L/gal*1.55 kg/L*1000 g/kg)

RESIDUALINVENTORY IN THE SECOND GROUP
OF DST REPLACEMENT TANKS (26 TANKS) 98%
OF ORIGINAL INVENTORY (98% OF ORIG VOL)
Decayed to 12/31/1995

Radionuclide	Ci	pCi/gram
Na, kgs	9791270.37	
C-14	2284.19026	19107.87
Sr-90	10869560.5	90926832
Y-90	10869560.5	90926832
Tc-99	17091.2998	142973.4
Cs-137	28819002.8	2.41E+08
Ba-137	28819002.8	2.41E+08
Eu-154	72792.057	608925.4
Np-237	44.6579034	373.5755
Pu-238	1388.93178	11618.79
Pu-239	8192.8	68535
Pu-240	2346.316	19627.57
Pu-241	38857.7496	325055.7
Am-241	69691.3547	582987.1
Total	89381086.3	7.48E+08

RESIDUAL INVENTORY IN FIRST GROUP
OF DST REPLACEMENT TANKS (26 TANK
DECAYED TO 12/31/95

Radionucli	TOTAL	
	Ci	pCi/gram
Na, kgs	9.99E+04	
C-14	2.33E+01	19107.87
Sr-90	1.11E+05	90926832
Y-90	1.11E+05	90926832
Tc-99	2.11E+02	172977.1
Cs-137	2.94E+05	2.41E+08
Ba-137	2.94E+05	2.41E+08
Eu-154	7.43E+02	608925.4
Np-237	4.56E-01	373.5755
Pu-238	1.42E+01	11618.79
Pu-239	8.36E+01	68535
Pu-240	2.39E+01	19627.57
Pu-241	3.97E+02	325055.7
Am-241	7.11E+02	582987.1
Total	9.12E+05	7.48E+08

NO ACTION POST REMEDIATION CHEMICAL INVENTORY FOR DSTS

RESIDUAL INVENTORY IN ORIGINAL 28 DSTS								
RESISUAL=1% OF ORIGINAL INVENTORY								
METRIC TONS	Residual Volume:3WDS 26080 gal; 3EDS 101410 gal; 5EDS 80430 gal							
Chemical	5EDS	5EDS	3EDS	3EDS	3WDS	3WDS	DST	TOTAL
	TOTAL	mg/kg	TOTAL	mg/kg	TOTAL	mg/kg	TOTAL	mg/kg
Ag+	0.01	30.47	0.00	3.53	0.00	3.79	0.02	13.99
Al+3	0.43	909.16	0.11	176.49	0.14	941.15	0.68	555.82
As+5	0.01	22.06	0.00	0.44	0.00	13.14	0.01	10.40
B+3	0.01	21.57	0.00	1.12	0.00	28.01	0.02	12.40
Ba+2	0.03	65.93	0.01	12.46	0.00	2.13	0.04	31.85
Be+2	0.00	1.42	0.00	0.38	0.00	0.00	0.00	0.73
Bi+3	0.02	36.88	0.01	8.76	0.00	0.00	0.02	18.54
Ca+2	0.13	278.68	0.02	40.21	0.06	406.52	0.22	178.40
Cd+2	0.06	124.33	0.00	1.18	0.00	15.82	0.06	50.66
Ce+3	0.03	59.39	0.00	0.00	0.00	17.25	0.03	25.14
Cr+3	0.09	197.30	0.01	13.18	0.24	1568.58	0.34	279.50
Cu+2	0.00	10.13	0.00	1.75	0.00	22.35	0.01	7.58
Fe+3	1.35	2863.12	0.03	46.02	0.12	813.05	1.50	1231.97
Hg+	0.00	1.22	0.00	0.02	0.00	0.00	0.00	0.48
K+	1.50	3174.44	3.78	6353.51	0.38	2455.87	5.65	4634.85
La+	0.20	420.02	0.01	22.69	0.00	6.46	0.21	174.35
Li+	0.00	0.52	0.00	0.00	0.00	0.37	0.00	0.25
Mg+2	0.10	213.11	0.01	23.40	0.01	33.25	0.12	98.02
Mn+4	0.21	443.14	0.01	18.54	0.04	242.48	0.26	210.88
Mo+6	0.04	85.39	0.01	13.40	0.01	55.69	0.06	46.55
Na+	60.65	1.29E+05	29.36	49348.92	21.59	1.41E+05	111.60	91486.03
Nd+3	0.12	252.19	0.00	0.00	0.00	7.65	0.12	98.51
Ni+2	0.08	177.38	0.01	10.27	0.02	108.75	0.11	87.27
Pb+4	0.04	74.45	0.01	23.36	0.00	21.83	0.05	42.93
Pd	0.01	25.43	0.00	0.00	0.00	0.00	0.01	9.84
Rb	0.00	1.36	0.00	0.00	0.00	0.00	0.00	0.52
Re	0.00	0.77	0.00	3.60	0.00	0.00	0.00	2.05
Rh	0.00	1.81	0.01	24.71	0.00	9.02	0.02	13.88
Ru	0.00	6.12	0.01	14.03	0.00	8.89	0.01	10.33
Sb	0.02	45.16	0.01	22.69	0.00	6.42	0.04	29.34
Se	0.02	40.90	0.03	43.57	0.01	41.63	0.05	42.29
SiO3-	2.09	4435.61	0.14	242.88	0.06	397.47	2.30	1884.15
Sn	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Te	0.00	1.43	0.01	18.99	0.00	6.73	0.01	10.66
Th	0.00	8.54	0.03	42.86	0.01	40.78	0.04	29.33
Ti	0.00	5.56	0.00	4.69	0.00	2.52	0.01	4.76
Tl	0.04	82.29	0.29	490.80	0.01	35.88	0.34	275.71
UO2+2	0.03	63.18	0.27	459.87	0.00	0.00	0.30	248.73
V+5	0.00	1.49	0.00	2.79	0.00	0.90	0.00	2.05
W+6	0.01	15.83	0.00	0.00	0.00	0.00	0.01	6.12
Zn+2	0.01	16.32	0.02	40.68	0.01	87.91	0.05	37.18
Zr+4	0.19	396.94	2.58	4340.18	0.00	12.09	2.77	2271.93
Al(OH)4-2	24.40	51709.96	8.34	14018.05	11.90	77775.32	44.64	36595.72
CO3-2	9.93	21037.90	8.46	14219.75	0.88	5719.43	19.26	15791.01
Cl-	1.48	3127.50	0.52	881.36	0.75	4900.30	2.75	2254.34
Cr(OH)4-	0.41	860.42	0.11	191.61	0.60	3927.98	1.12	918.99
F-	0.36	768.00	3.20	5380.31	0.09	587.76	3.65	2994.98
SO4-2	2.79	5911.89	0.72	1214.39	0.42	2729.33	3.93	3221.55
NO3-	44.50	94315.57	21.98	36949.17	10.40	67997.85	76.89	63034.82
NO2-	19.45	41220.89	8.89	14940.72	2.46	16107.99	30.80	25253.13
PO4-3	0.85	1807.73	0.75	1258.21	0.73	4801.16	2.34	1915.18
OH-	10.24	21690.63	7.57	12717.10	2.42	15796.89	20.22	16574.65
TOC	8.71	18448.16	0.59	998.41	1.29	8450.06	10.59	8683.20

NO ACTION POST REMEDIATION CHEMICAL INVENTORY FOR DSTS

RESIDUAL INVENTORY				RESIDUAL INVENTORY					
IN THE FIRST GROUP OF DST				IN THE SECOND GROUP OF DST					
REPLACEMENT TANKS (26 TANKS)				REPLACEMENT TANKS (26 TANKS) 98% OF ORIGINAL INVENT					
DST					DST				
TOTAL mt	mg/kg				TOTALmt	mg/kg			
0.02	13.99				1.67	13.99			
0.68	555.82				66.44	555.82			
0.01	10.40				1.24	10.40			
0.02	12.40				1.48	12.40			
0.04	31.85				3.81	31.85			
0.00	0.73				0.09	0.73			
0.02	18.54				2.22	18.54			
0.22	178.40				21.33	178.40			
0.06	50.66				6.06	50.66			
0.03	25.14				3.01	25.14			
0.34	279.50				33.41	279.50			
0.01	7.58				0.91	7.58			
1.50	1231.97				147.27	1231.97			
0.00	0.48				0.06	0.48			
5.65	4634.85				554.06	4634.85			
0.21	174.35				20.84	174.35			
0.00	0.25				0.03	0.25			
0.12	98.02				11.72	98.02			
0.26	210.88				25.21	210.88			
0.06	46.55				5.56	46.55			
111.60	91486.03				10936.41	91486.03			
0.12	98.51				11.78	98.51			
0.11	87.27				10.43	87.27			
0.05	42.93				5.13	42.93			
0.01	9.84				1.18	9.84			
0.00	0.52				0.06	0.52			
0.00	2.05				0.25	2.05			
0.02	13.88				1.66	13.88			
0.01	10.33				1.23	10.33			
0.04	29.34				3.51	29.34			
0.05	42.29				5.06	42.29			
2.30	1884.15				225.23	1884.15			
0.00	0.00				0.00	0.00			
0.01	10.66				1.27	10.66			
0.04	29.33				3.51	29.33			
0.01	4.76				0.57	4.76			
0.34	275.71				32.96	275.71			
0.30	248.73				29.73	248.73			
0.00	2.05				0.24	2.05			
0.01	6.12				0.73	6.12			
0.05	37.18				4.44	37.18			
2.77	2271.93				271.59	2271.93			
44.64	36595.72				4374.72	36595.72			
19.26	15791.01				1887.69	15791.01			
2.75	2254.34				269.49	2254.34			
1.12	918.99				109.86	918.99			
3.65	2994.98				358.03	2994.98			
3.93	3221.55				385.11	3221.55			
76.89	63034.82				7535.30	63034.82			
30.80	25253.13				3018.81	25253.13			
2.34	1915.18				228.94	1915.18			
20.22	16574.65				1981.36	16574.65			
10.59	8683.20				1038.01	8683.20			

SST CHEM INVENTORY (mt=METRIC TONS)

Chemical	1WSS	1WSS	2WSS	2WSS	1ESS	1ESS	2ESS	2ESS	4ESS	4ESS	Total	Total
	mt	mg/kg	mt	mg/kg	mt	mg/kg	mt	mg/kg	mt	mg/kg	mt	mg/kg
~~Ag-~~	~~4.4077E-08~~	~~7.48E-07~~	~~6.4563E-08~~	~~8.43E-07~~	~~2.0004E-07~~	~~4.22E-06~~	~~8.9131E-09~~	~~7.37E-07~~	~~2.6798E-09~~	~~1.93E-07~~	~~3.4727E-07~~	~~1.55E-06~~
Al	331.885783	6041.373	1106.35675	14450.64	804.262284	16967.04	386.650822	31957.91	26.3716488	1901.326	2655.52729	12962.21
Al+3	71.1609013	1295.354	723.861283	9454.689	591.580934	12480.23	579.692861	47913.44	25.34949	1827.631	1991.64547	9721.655
~~AlO2-~~	~~454.462483~~	~~8272.657~~	~~1070.63185~~	~~13984.02~~	~~748.602462~~	~~15159.93~~	~~75.8485876~~	~~6269.207~~	~~18.128607~~	~~1307.025~~	~~2337.67499~~	~~11410.7~~
~~Ba+2-~~	~~0.03584445~~	~~0.652483~~	~~0.16952842~~	~~2.214286~~	~~0.1023813~~	~~2.159877~~	~~0.1094386~~	~~9.045445~~	~~0.19007925~~	~~13.70421~~	~~0.60727471~~	~~2.964225~~
Bi+3	166.138173	3024.241	0.27980728	3.654693	94.2547472	1988.436	0.59524445	49.19883	0	0	261.267972	1275.306
~~C2H3O3-~~	~~5.31302316~~	~~96.71386~~	~~2.84917006~~	~~37.21434~~	~~0.32337498~~	~~6.822049~~	~~0.1187926~~	~~9.818582~~	~~2.97146579~~	~~214.2349~~	~~11.5758266~~	~~56.50413~~
~~C6H5O7-~~	~~545.302399~~	~~9926.232~~	~~658.55368~~	~~8601.676~~	~~1225.34883~~	~~25850.45~~	~~110.076317~~	~~9098.154~~	~~24.2481007~~	~~1748.224~~	~~2563.52932~~	~~12513.14~~
CO3-2	706.695958	12864.11	160.440145	2095.583	640.390373	13509.93	61.993225	5123.935	38.0474685	2743.122	1607.56717	7846.885
Ca+2	0.19847652	3.612902	5.81613591	75.96726	54.6674542	1153.287	65.9212376	5448.598	1.53992891	111.0248	128.143233	625.495
Cd+2	0	0	0	0	0	0	0	0	0	0	0	0
Ce+3	116.018281	2111.9	31.5900792	412.6127	88.2318587	1861.375	0.2643164	21.84658	1.75249976	126.3506	237.857035	1161.032
Cl-	21.8706308	398.1148	5.40614279	70.61215	12.6228213	266.2961	0.04012511	3.316467	0.06028003	4.346032	40	195.2487
Cr+3	1.2598231	22.93277	83.3358223	1088.488	0.72471979	15.28898	0.16522952	13.65674	0.82386773	59.39869	86.3094624	421.2953
CrO4-2	0.31226633	5.684237	20.656052	269.7983	0.17963283	3.789606	0.04095465	3.385031	0.20420816	14.72287	21.3931139	104.4244
~~EDTA-~~	~~40.71457~~	~~741.1342~~	~~21.8150504~~	~~284.9365~~	~~2.47838377~~	~~52.28498~~	~~0.91056044~~	~~75.26069~~	~~22.7217742~~	~~1638.18~~	~~88.6403388~~	~~432.6728~~
F-	143.990362	2621.081	30.0273479	392.2012	232.199126	4898.566	399.849986	33048.86	0.30824946	22.22397	806.375072	3936.092
Fe+3	169.920281	3093.088	81.7932519	1068.34	141.83209	2992.147	55.5134069	4588.358	178.037838	12836.06	627.096868	3060.996
Fe(CN)6-4	2.19320032	39.9232	1.36604719	17.84258	248.207799	5236.292	69.9723943	5783.439	0.05295623	3.818005	321.792397	1570.739
~~HEDTA-~~	~~74.0848917~~	~~1348.576~~	~~39.7570865~~	~~519.2858~~	~~4.94783967~~	~~104.3816~~	~~1.65244802~~	~~136.58~~	~~41.259561~~	~~2974.706~~	~~161.701627~~	~~789.3009~~
Hg+	0	0	0	0	0	0	0	0	0	0	0	0
~~K+~~	~~4.99758065~~	~~90.9718~~	~~25.2751211~~	~~330.1301~~	~~28.9440149~~	~~610.6146~~	~~0.18391699~~	~~15.20132~~	~~0.45248115~~	~~32.6227~~	~~59.8531148~~	~~292.1561~~
~~La+-~~	~~1.47911368~~	~~26.92456~~	0	0	~~0.39935236~~	~~8.424898~~	0	0	0	0	~~1.87846604~~	~~9.169202~~
Mn+4	20.9508637	381.3721	11.2742432	147.2581	13.0876718	276.1028	51.2162429	4233.184	23.4767269	1692.61	120.005748	585.7742
Na+	14548	264819.7	21140	276119.4	11580	244296.3	2100	173571.6	3780	272528	53148	259427
Ni+2	5.02266536	91.42843	3.33490631	43.55876	124.830644	2633.477	44.0263945	3638.92	0.99299003	71.59196	178.2076	869.8701
NO2-	1761.2	32059.42	800.5	10455.7	2058.8	43433.27	0.474	39.17759	232.2	16741.01	4853.174	23689.4
NO3-	26280	478379.3	45510	594427.3	18928	399312.7	259	21407.17	4888	352411.9	95865	467937.9
OH-	452.618708	8239.095	2301.43932	30060.17	1041.01779	21961.73	1420.41554	117401.8	174.281895	12565.27	5389.77325	26308.66
PO4-3	2671.09521	48622.4	110.003751	1436.81	1810.74336	38200.17	29.76892	2460.495	0.86067784	62.0526	4622.47192	22563.29
~~Pb-~~	~~2.34804801~~	~~42.74191~~	~~3.86283522~~	~~50.45429~~	~~422.865596~~	~~8920.943~~	~~6.018952~~	~~563.6079~~	~~0.10315133~~	~~7.436939~~	~~435.998582~~	~~2128.204~~
SiO3-	560.04247	10194.55	239.626864	3129.878	404.030794	8523.596	0.70706821	58.44141	2.09005477	150.6874	1206.49725	5889.176
Sn	0	0	0	0	0.00536569	0.113197	0	0	0	0	0.00536569	0.026191
SO4-2	633.822322	11537.57	248.192621	3241.759	552.810135	11662.3	133.797002	11058.74	83.4830873	6018.911	1652.10517	8064.285
Sr+2	0.00093766	0.017068	0.06976261	0.911202	35.8641544	756.6046	0.02533486	2.094006	0.05775941	4.164302	36.017949	175.8115
W+4	0	0	0	0	0	0	0	0	0	0	0	0
Zr+4	13.9861121	254.5916	23.0856858	301.5329	6.49527746	137.027	202.621787	16747.33	0.12778356	9.212858	246.316646	1202.325

Tank Volumes:1ESS 8349 KGAL; 2ESS 2131 KGAL;4ESS 2443 KGAL; 1WSS 9676 KGAL; 2WSS 13485 KGAL

DENSITY = 1.5

mg (chem)/kg (waste)= mt (chem) *1E9 mg/mt/(volume (gal)*3.785 L/gal*1.5 kg/L)

chemicals and quantities with strike through were not reported in the WHC "official" Inventory Data Package, but came through on the unofficial spreadsheets

SST activity concentration by isotope

Radionucli	Decayed to 12/31/1995									
# of Tanks	40		43		40		16		10	
	1WSS	1WSS	2WSS	2WSS	1ESS	1ESS	2ESS	2ESS	4ESS	4ESS
	Ci	pCi/gram	Ci	pCi/gram	Ci	pCi/gram	Ci	pCi/gram	Ci	pCi/gram
Ac-225	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Ac-227	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02
Am-241	1.70E+03	3.09E+04	9.46E+03	1.24E+05	7.49E+03	1.58E+05	9.72E+03	8.03E+05	4.62E+03	3.33E+05
Am-242	2.68E+00	4.87E+01	1.94E+01	2.53E+02	1.88E+01	3.97E+02	2.00E+01	1.65E+03	8.67E+00	6.25E+02
Am-242m	2.69E+00	4.89E+01	1.95E+01	2.54E+02	1.89E+01	3.99E+02	2.01E+01	1.66E+03	8.71E+00	6.28E+02
Am-243	1.02E+00	1.85E+01	7.82E+00	1.02E+02	9.57E+00	2.02E+02	1.16E+01	9.62E+02	3.12E+00	2.25E+02
At-217	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Ba-137m	8.44E+05	1.54E+07	3.78E+06	4.93E+07	3.54E+06	7.46E+07	1.26E+05	1.04E+07	1.37E+05	9.84E+06
Bi-210	1.50E-08	2.73E-07	1.16E-08	1.52E-07	1.34E-08	2.83E-07	7.03E-09	5.81E-07	2.81E-09	2.03E-07
Bi-211	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02
Bi-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bi-213	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Bi-214	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
C-14	2.84E+02	5.17E+03	4.90E+02	6.40E+03	1.83E+03	3.86E+04	2.15E+02	1.78E+04	1.82E+02	1.31E+04
Cm-242	2.22E+00	4.04E+01	1.61E+01	2.10E+02	1.56E+01	3.29E+02	1.66E+01	1.37E+03	7.19E+00	5.18E+02
Cm-244	3.22E+00	5.86E+01	2.39E+01	3.12E+02	5.01E+01	1.06E+03	5.34E+01	4.42E+03	7.20E+00	5.19E+02
Cm-245	2.08E-04	3.79E-03	1.74E-03	2.28E-02	3.83E-03	8.07E-02	4.09E-03	3.38E-01	5.51E-04	3.98E-02
Cs-135	2.07E+01	3.76E+02	6.79E+01	8.87E+02	5.27E+01	1.11E+03	1.61E+00	1.33E+02	2.13E+00	1.54E+02
Cs-137	8.93E+05	1.62E+07	3.99E+06	5.21E+07	3.74E+06	7.89E+07	1.33E+05	1.10E+07	1.44E+05	1.04E+07
Fr-221	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Fr-223	7.15E-05	1.30E-03	5.88E-05	7.68E-04	1.22E-04	2.57E-03	2.14E-05	1.77E-03	3.82E-06	2.75E-04
I-129	1.70E+00	3.09E+01	4.39E+00	5.73E+01	9.14E+00	1.93E+02	5.97E-01	4.93E+01	1.71E-01	1.23E+01
Nb-93m	8.54E+01	1.55E+03	6.76E+02	8.83E+03	3.71E+02	7.83E+03	4.05E+02	3.35E+04	1.50E+03	1.08E+05
Ni-59	0.00E+00	0.00E+00	1.71E+03	2.23E+04	3.33E+03	7.02E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-63	6.83E+03	1.24E+05	4.86E+04	6.35E+05	5.30E+04	1.12E+06	5.87E+04	4.85E+06	1.09E+05	7.86E+06
Np-237	8.26E+00	1.50E+02	1.10E+01	1.44E+02	4.96E+01	1.05E+03	3.37E-01	2.78E+01	4.48E-01	3.23E+01
Np-238	1.28E-02	2.33E-01	9.26E-02	1.21E+00	9.00E-02	1.90E+00	9.55E-02	7.90E+00	4.15E-02	2.99E+00
Np-239	1.02E+00	1.85E+01	7.82E+00	1.02E+02	9.57E+00	2.02E+02	1.16E+01	9.62E+02	3.12E+00	2.25E+02
Pa-231	9.61E-03	1.75E-01	7.33E-03	9.57E-02	1.53E-02	3.22E-01	3.38E-03	2.79E-01	6.37E-04	4.59E-02
Pa-233	8.26E+00	1.50E+02	1.10E+01	1.44E+02	4.96E+01	1.05E+03	3.37E-01	2.78E+01	4.48E-01	3.23E+01
Pa-234	2.75E-01	5.01E+00	1.03E-01	1.35E+00	2.61E-01	5.50E+00	1.03E-01	8.53E+00	2.64E-02	1.90E+00
Pa-234m	1.72E+02	3.13E+03	6.47E+01	8.45E+02	1.63E+02	3.44E+03	6.45E+01	5.33E+03	1.65E+01	1.19E+03
Pb-209	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Pb-210	1.50E-08	2.73E-07	1.16E-08	1.52E-07	1.34E-08	2.83E-07	7.03E-09	5.81E-07	2.81E-09	2.03E-07
Pb-211	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02
Pb-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pb-214	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
Pd-107	9.03E+00	1.64E+02	2.33E+01	3.04E+02	4.95E+01	1.05E+03	3.66E+00	3.03E+02	9.74E-01	7.03E+01
Po-210	1.50E-08	2.73E-07	1.16E-08	1.52E-07	1.34E-08	2.83E-07	7.03E-09	5.81E-07	2.81E-09	2.03E-07
Po-211	1.41E-05	2.57E-04	1.16E-05	1.52E-04	2.41E-05	5.09E-04	4.24E-06	3.50E-04	7.56E-07	5.45E-05
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-213	1.69E-06	3.07E-05	2.81E-06	3.68E-05	5.90E-06	1.24E-04	2.20E-06	1.82E-04	2.78E-06	2.00E-04
Po-214	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
Po-215	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02

SST activity concentration by isotope

Po-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-218	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
Pu-238	2.10E+02	3.82E+03	2.96E+02	3.87E+03	1.85E+02	3.90E+03	1.99E+02	1.64E+04	2.24E+02	1.61E+04
Pu-239	2.08E+03	3.79E+04	3.59E+03	4.69E+04	2.90E+03	6.12E+04	4.84E+03	4.00E+05	4.59E+03	3.31E+05
Pu-240	4.09E+02	7.45E+03	7.91E+02	1.03E+04	6.94E+02	1.46E+04	1.24E+03	1.02E+05	1.17E+03	8.44E+04
Pu-241	3.92E+03	7.13E+04	6.36E+03	8.30E+04	8.46E+03	1.78E+05	1.32E+04	1.09E+06	1.11E+04	7.99E+05
Pu-242	1.33E-05	2.41E-04	9.59E-05	1.25E-03	9.32E-05	1.97E-03	9.89E-05	8.18E-03	4.29E-05	3.09E-03
Ra-223	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02
Ra-224	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ra-225	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Ra-226	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
Ra-228	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rh-106	6.11E-05	1.11E-03	1.70E-02	2.22E-01	8.25E-02	1.74E+00	9.73E-02	8.04E+00	3.97E-01	2.86E+01
Rn-219	5.18E-03	9.43E-02	4.26E-03	5.56E-02	8.84E-03	1.87E-01	1.55E-03	1.28E-01	2.77E-04	2.00E-02
Rn-220	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-222	6.08E-08	1.11E-06	5.03E-08	6.56E-07	5.20E-08	1.10E-06	2.98E-08	2.46E-06	1.58E-08	1.14E-06
Ru-106	6.11E-05	1.11E-03	1.70E-02	2.22E-01	8.25E-02	1.74E+00	9.73E-02	8.04E+00	3.97E-01	2.86E+01
Sb-126	7.94E+00	1.44E+02	2.33E+01	3.04E+02	6.71E+00	1.42E+02	1.39E+01	1.15E+03	3.59E+01	2.59E+03
Sb-126m	5.67E+01	1.03E+03	1.66E+02	2.17E+03	4.79E+01	1.01E+03	9.96E+01	8.23E+03	2.57E+02	1.85E+04
Se-79	9.71E+01	1.77E+03	2.51E+02	3.28E+03	5.21E+02	1.10E+04	3.23E+01	2.67E+03	9.51E+00	6.86E+02
Sm-151	6.24E+04	1.14E+06	1.84E+05	2.40E+06	5.47E+04	1.15E+06	1.01E+05	8.35E+06	2.48E+05	1.79E+07
Sn-126	5.67E+01	1.03E+03	1.66E+02	2.17E+03	4.79E+01	1.01E+03	9.96E+01	8.23E+03	2.57E+02	1.85E+04
Sr-90	1.50E+06	2.73E+07	1.43E+07	1.87E+08	8.32E+06	1.76E+08	4.90E+06	4.05E+08	1.90E+07	1.37E+09
Tc-99	1.17E+03	2.13E+04	3.03E+03	3.96E+04	6.29E+03	1.33E+05	3.93E+02	3.25E+04	1.15E+02	8.29E+03
Th-227	5.11E-03	9.30E-02	4.20E-03	5.49E-02	8.72E-03	1.84E-01	1.53E-03	1.27E-01	2.73E-04	1.97E-02
Th-228	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Th-229	1.72E-06	3.14E-05	2.88E-06	3.76E-05	6.03E-06	1.27E-04	2.25E-06	1.86E-04	2.84E-06	2.05E-04
Th-230	9.00E-06	1.64E-04	7.86E-06	1.03E-04	7.51E-06	1.58E-04	4.51E-06	3.73E-04	3.11E-06	2.24E-04
Th-231	7.22E+00	1.31E+02	2.93E+00	3.83E+01	6.92E+00	1.46E+02	2.81E+00	2.32E+02	6.98E-01	5.03E+01
Th-232	1.85E-14	3.36E-13	3.57E-14	4.66E-13	3.13E-14	6.61E-13	5.59E-14	4.62E-12	5.27E-14	3.80E-12
Th-234	1.72E+02	3.13E+03	6.47E+01	8.45E+02	1.63E+02	3.44E+03	6.45E+01	5.33E+03	1.65E+01	1.19E+03
Tl-207	5.16E-03	9.40E-02	4.25E-03	5.55E-02	8.82E-03	1.86E-01	1.55E-03	1.28E-01	2.76E-04	1.99E-02
Tl-208	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tl-209	3.73E-08	6.78E-07	6.21E-08	8.12E-07	1.30E-07	2.75E-06	4.85E-08	4.01E-06	6.13E-08	4.42E-06
U-233	1.20E-03	2.18E-02	1.75E-03	2.29E-02	5.91E-03	1.25E-01	8.07E-04	6.67E-02	1.18E-03	8.49E-02
U-234	4.91E-02	8.93E-01	4.59E-02	6.00E-01	4.31E-02	9.09E-01	3.04E-02	2.51E+00	2.52E-02	1.82E+00
U-235	7.22E+00	1.31E+02	2.93E+00	3.83E+01	6.92E+00	1.46E+02	2.81E+00	2.32E+02	6.98E-01	5.03E+01
U-236	2.16E-04	3.93E-03	4.18E-04	5.46E-03	3.67E-04	7.73E-03	6.54E-04	5.41E-02	6.17E-04	4.45E-02
U-237	9.60E-02	1.75E+00	1.56E-01	2.03E+00	2.07E-01	4.37E+00	3.23E-01	2.67E+01	2.71E-01	1.96E+01
U-238	1.72E+02	3.13E+03	6.47E+01	8.45E+02	1.63E+02	3.44E+03	6.45E+01	5.33E+03	1.65E+01	1.19E+03
Y-90	1.51E+06	2.76E+07	1.45E+07	1.89E+08	8.41E+06	1.77E+08	4.95E+06	4.09E+08	1.92E+07	1.38E+09
Zr-93	4.54E+01	8.26E+02	8.00E+02	1.04E+04	2.42E+02	5.10E+03	5.63E+02	4.65E+04	2.29E+03	1.65E+05

Volumes:1WSS=9676000 gal,2WSS=13485000 gal, 1ESS=8349000 gal, 2ESS=2131000 gal, 4ESS=2443000 gal

pCi/gram=Ci*1E12/(volume (gal)*3.785 L/gal*1.5 kg/L*1000g/kg)

JEG 0044 C

WHC-EP-0616
Revision 0
Appendix D

Tank Waste Technical Options Report

Appendix D

Tank Waste Radionuclide and Chemical Compositions

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Table D-3. Normalized TRAC Chemical Data by Tank Farm.

Normalized TRAC Chemical Data / Tank Farm

File is CHEM-1.XLS

Kilograms / Tank Farm	A	AX	B	BX	BY	C	S	SX	T	TX	TY	U	Total
Al	2.13E+04	2.93E+03	1.33E+04	3.15E+05	4.11E+05	3.56E+05	5.56E+05	3.96E+05	1.76E+04	2.78E+06	9.48E+03	6.61E+04	2.44E+06
Ba *	1.49E+02	4.13E+01	4.07E+01	3.19E+01	2.97E+01	1.09E+02	4.63E+01	1.12E+02	2.54E+00	2.82E+01	5.13E+00	1.17E+01	6.07E+02
Bi			9.32E+04	6.39E+02	4.34E+02	5.95E+02			1.64E+05	1.48E+03	7.43E+02	2.80E+02	2.61E+05
C2H3O3 *	2.68E+03	9.08E+01	2.85E+01	2.95E+02		1.19E+02	6.10E+02	1.78E+03		5.31E+03		4.64E+02	1.16E+04
C6H5O7 *	2.30E+04	1.25E+03	1.34E+05	5.97E+05	4.94E+05	1.10E+05	2.37E+05	4.06E+05	8.12E+03	5.22E+05	1.47E+04	1.59E+04	2.50E+06
CO3	3.70E+04	1.05E+03	1.13E+05	2.95E+05	2.32E+05	6.20E+04	8.03E+04	6.51E+04	1.15E+04	6.42E+05	5.34E+04	1.50E+04	1.61E+06
Ca	9.68E+01	1.44E+03	3.22E+02	1.10E+03	5.32E+04	6.59E+04	3.41E-02	5.82E+03	1.32E-03	1.98E+02	2.42E-04	5.63E-04	1.28E+05
Cd **	1.71E+02	5.65E+00	5.23E+02	4.17E+02	2.21E+02	6.09E+02	3.61E+02	4.72E+02	6.13E+02	7.42E+01	1.76E+02	1.96E+02	3.84E+03
Ce	1.57E+03	1.78E+02	3.52E+03	2.81E+04	1.97E+04	2.64E+02	9.41E+03	1.18E+04	1.32E+04	1.35E+05	1.52E+03	1.04E+04	2.35E+05
Cl	5.33E+01	6.99E+00	2.45E+03	4.13E+03	6.04E+03	4.01E+01	2.24E+03	2.80E+03	5.24E+02	1.95E+04	1.84E+03	3.65E+02	4.00E+04
Cr	5.25E+01	8.63E+02	5.52E+02	1.51E+02	1.02E+02	1.84E+02	2.37E+04	6.57E+04	8.74E+02	3.51E+02	1.75E+02	3.27E+03	9.59E+04
EDTA *	2.20E+04	6.96E+02	2.18E+02	2.26E+03		9.10E+02	4.67E+03	1.36E+04		4.07E+04		3.55E+03	8.88E+04
F	1.92E+02	1.16E+02	7.96E+04	1.41E+04	9.51E+04	4.00E+05	1.98E+04	4.02E+03	2.30E+04	1.62E+05	9.90E+02	6.18E+03	8.05E+05
Fe	1.67E+05	1.09E+04	6.40E+04	4.68E+04	3.11E+04	5.55E+04	1.95E+04	5.32E+04	9.04E+04	6.03E+04	1.92E+04	9.09E+03	6.27E+05
Fe(CN)6	2.04E+00	5.09E+01	1.03E+03	4.56E+03	2.43E+05	7.00E+04	5.18E+02	8.48E+02	1.02E+02	2.08E+03	7.79E+00	2.88E-03	3.22E+05
HEDTA *	4.00E+04	1.27E+03	4.98E+02	4.40E+03	4.77E+01	1.65E+03	8.56E+03	2.48E+04	2.64E+00	7.40E+04	3.16E+01	6.43E+03	1.62E+05
Hg **	4.01E+01	1.37E+00	1.23E+02	9.78E+01	5.19E+01	1.43E+02	8.45E+01	1.11E+02	1.44E+02	1.74E+01	4.12E+01	4.61E+01	9.00E+02
K *	3.98E+02	5.47E+01	6.11E+03	1.97E+04	3.14E+03	1.84E+02	5.79E+03	1.92E+04	3.49E+03	1.34E+03	1.63E+02	2.49E+02	5.99E+04
La *			3.88E+02						1.48E+03				1.88E+03
Mn	1.86E+04	4.81E+03	3.57E+03	6.27E+03	3.24E+03	5.12E+04	3.07E+03	7.43E+03	1.01E+04	1.07E+04	1.12E+02	7.73E+02	1.20E+05
NO2	1.64E+04	1.89E+03	1.96E+05	9.78E+05	1.71E+06	1.16E+04	4.14E+05	3.21E+05	2.53E+04	1.00E+06	2.79E+04	9.10E+04	4.80E+06
NO3	2.91E+06	3.48E+04	2.38E+06	1.48E+07	1.20E+07	6.38E+06	1.92E+07	2.25E+07	4.08E+05	1.23E+07	4.17E+05	3.32E+06	9.67E+07
Na	1.61E+06	1.30E+04	2.10E+06	7.68E+06	5.88E+06	4.35E+06	7.95E+06	1.13E+07	3.88E+05	8.31E+06	3.86E+05	1.57E+06	5.17E+07
Ni	6.16E+02	3.77E+02	2.12E+03	1.21E+04	1.11E+05	4.40E+04	1.54E+03	1.78E+03	3.30E+02	4.69E+03		3.66E+01	1.78E+05
OH	2.66E+05	3.19E+04	9.96E+04	7.21E+05	8.69E+05	2.53E+06	1.51E+06	2.38E+06	2.27E+05	2.20E+05	8.19E+04	1.86E+05	9.14E+06
PO4	7.30E+02	1.31E+02	2.81E+06	2.45E+05	1.65E+05	2.98E+04	4.85E+04	2.59E+04	3.73E+06	1.57E+06	5.21E+04	3.56E+04	8.74E+06
Pb *	6.96E+00	9.62E+01	4.15E+05	7.43E+03	3.92E+02	6.82E+03	5.96E+02	3.27E+03	1.88E-03	2.35E+03		5.45E-04	4.36E+05
SiO3	1.61E+03	4.82E+02	1.12E+04	3.03E+05	8.97E+04	7.07E+02	2.81E+04	7.54E+04	6.92E+03	4.85E+05	6.61E+04	1.36E+05	1.21E+06
Sn *			5.37E+00										5.37E+00
SO4	6.28E+04	6.43E+02	9.37E+04	3.22E+05	1.37E+06	1.34E+05	1.54E+05	7.50E+04	1.53E+04	5.68E+05	5.09E+04	1.91E+04	1.65E+06
Sr	5.75E+01	2.37E-01	3.38E+01	4.51E+02	3.54E+04	2.53E+01	1.33E+01	5.58E+01	3.76E-03	9.34E-01	8.60E-05	6.63E-01	3.60E+04
WO4 **	3.62E+01	1.24E+00	1.10E+02	8.60E+01	4.68E+01	1.29E+02	7.61E+01	9.96E+01	1.29E+02	1.57E+01	3.71E+01	4.15E+01	8.11E+02
ZrO	1.21E+02	2.88E+01	2.17E+03	3.26E+03	2.21E+03	2.38E+05	2.56E+04	6.21E+01	5.15E+03	7.51E+03	3.76E+03	1.42E+03	2.90E+05
H2O **	1.81E+06	5.98E+05	3.87E+06	3.32E+06	3.93E+06	5.47E+06	5.50E+06	5.42E+06	4.74E+06	4.57E+06	1.25E+06	4.32E+06	4.48E+07
TOC **	2.65E+03	9.93E+02	4.97E+03	1.66E+04		5.60E+04	1.52E+04	2.09E+04	2.45E+04	1.66E+03	9.93E+02	5.56E+04	2.00E+05
Total	7.06E+06	7.06E+06	1.25E+07	2.99E+07	2.66E+07	2.04E+07	3.58E+07	4.32E+07	9.92E+06	3.10E+07	2.44E+06	9.87E+06	2.29E+08
Watch Tanks:													
Acetate			1			1	1	1		2		2	8
Fe(CN)6				4	10	4			2	1	3		24
High Heat	2					2		7					11
Hydrogen	1	2					3	7	1			4	18
Volume (cubic meters)	*Tank Farm Surveillance and Waste Status Report for February 1992*												
Salt	3.68E+03	3.36E+03	1.31E+03	5.87E+02	1.52E+04		1.69E+04	1.06E+04		2.52E+04	2.42E+02	1.04E+04	8.77E+04
Sludge	2.10E+03	7.19E+01	6.42E+03	5.13E+03	2.72E+03	7.48E+03	4.43E+03	5.80E+03	7.54E+03	9.12E+02	2.16E+03	2.42E+03	4.72E+04
Supernatant	3.03E+01	1.14E+01	5.68E+01	1.89E+02		6.40E+02	1.74E+02	2.38E+02	2.80E+02	1.89E+01	1.14E+01	6.36E+02	2.29E+03
Total	5.81E+03	3.43E+03	7.79E+03	5.90E+03	1.80E+04	8.12E+03	2.16E+04	1.69E+04	7.82E+03	2.61E+04	2.42E+03	1.34E+04	1.37E+05
Total (Kgal)	1538	906	2057	1559	4744	2146	5680	4453	2066	6905	638	3550	36239
Rho (Kg/l)	1.21	0.21	1.60	6.07	1.40	2.61	1.67	2.68	1.27	1.19	1.01	0.73	1.67

*TRAC data only **HDW-EIS data only - averaged over farms based on EIS reported phase compositions (Salt/Sludge/Supernate)

Table D-8. Double-Shell Tank Inventory.

	NCAW		DSS/DSSF	NCRW		PFP		CC		
Input Chemical	Solid (Kgs)	Liquid (Kgs)	Liquid (Kgs)	Solid (Kgs)	Liquid (Kgs)	Solid (Kgs)	Liquid (Kgs)	Solid (Kgs)	Liquid (Kgs)	Total (Kgs)*
Ag+	3.22E+02	2.93E+01				8.98E+01				4.41E+02
Al+3	3.67E+04	3.07E+04	1.54E+06	1.53E+04	5.86E+02	1.69E+04	1.69E+02	2.78E+04	5.28E+05	2.20E+06
As+5	3.48E+02	1.82E+02				3.12E+02				8.41E+02
B+3	2.38E+02	8.13E+01	1.29E+01	1.40E+03	1.25E+00	9.00E+01		3.69E+01	7.00E+02	2.56E+03
Ba+2	3.80E+02	9.82E+00	2.98E+02	5.33E+02	4.95E-02			5.40E+01	4.86E+02	1.76E+03
Be+2	9.23E+00	7.17E-01								9.95E+00
Ca+2	1.62E+03	4.21E+01	3.34E+03	1.43E+03	2.90E+01	2.50E+03		7.71E+02	6.94E+03	1.67E+04
Cd+2	6.07E+03	1.80E+01	2.79E+02			3.74E+02				6.74E+03
Co+3	7.81E+02	3.28E+01	1.09E-03	7.93E-04	7.02E-07	7.37E-05				8.14E+02
Cr+3	1.28E+03	4.97E+03	2.30E+04	4.10E+03	9.33E+01	9.31E+03		1.28E+03	2.43E+04	6.83E+04
Cu+2	2.33E+02	1.04E+01	2.09E+02			5.29E+02				9.82E+02
Fe+3	5.94E+04	8.53E+01	1.13E+03	2.89E+03	2.25E+00	9.30E+03		1.44E+03	2.74E+04	1.02E+05
Hg+2			2.80E+02							2.80E+02
K+	2.88E+03	1.92E+04	1.31E+06	5.13E+04	1.93E+04	1.30E+03	3.42E+02	3.13E+02	3.10E+04	1.43E+06
Mg+2	4.63E+02	1.12E+01	5.23E+02	4.11E+02	1.20E+00	7.08E+02		3.28E+02	2.95E+03	5.40E+03
Mo+6	7.16E+01	4.59E+02	2.77E+03	3.60E+01	4.32E-02	3.99E+01		2.52E+02	4.79E+03	8.42E+03
Na+	5.78E+04	5.31E+05	1.13E+07	4.43E+05	1.18E+04	5.74E+04	2.44E+03	4.51E+04	4.46E+06	1.69E+07
Ni+3	3.43E+03	1.39E+01	5.61E+02	4.16E+02	3.58E-01	2.44E+02		2.95E+02	5.60E+03	1.06E+04
Pb+4	4.83E+02	3.42E+01	2.65E+03			5.18E+02				3.68E+03
Rare Earths +3	4.55E+03	6.09E+01	5.16E-01	2.00E+03	5.03E-02	5.82E+02		4.43E+02	3.99E+03	1.16E+04
Rh+3	7.53E+01	1.07E+01	1.28E+00	1.41E+02	1.50E-01	2.14E+02				4.43E+02
Ru+3	2.66E+02	2.43E+01	6.17E-01	5.22E+01	3.30E-02	2.10E+02				5.54E+02
Si+4	3.19E+03	2.14E+03	8.12E+03	1.46E+04	1.07E+02	9.36E+02	1.40E+01	3.09E+04		5.99E+04
Th+4	5.16E+02	1.98E+01				2.90E+02				8.26E+02
Ti+4	2.21E+02	4.59E+00	1.46E+00	1.60E+02	1.49E-01	5.98E+01				4.47E+02
UO2+2	3.41E+03	5.28E+03	7.88E+03	2.65E+04	3.49E+00	1.12E+03		3.20E+00	6.08E+01	4.43E+04
Zn+2	1.63E+02	4.33E+01	8.38E+02	6.38E+01	1.25E-01	1.91E+02		1.05E+02	9.42E+02	2.35E+03
Cl-	9.77E+01	7.41E+02	3.29E+05	2.50E+03	2.21E+03	2.21E+03	8.86E+01	1.10E+02	1.10E+05	4.46E+05
CO3-2	7.57E+03	3.44E+04	2.85E+05	2.07E+04	1.05E+03	1.50E+04	3.75E+02	7.57E+02	7.56E+05	1.12E+06
F-	1.42E+03	7.64E+03	9.47E+04	2.29E+05	7.46E+03	2.37E+03	9.49E+01	3.89E+01	3.88E+04	3.91E+05
Fe(CN)6-3			1.36E+03							1.36E+03
NO2-	1.63E+04	1.27E+05	4.77E+06	3.70E+04		1.53E+04	2.87E+02	8.27E+02	8.27E+05	5.80E+06
NO3-	1.81E+04	3.76E+05	9.26E+06	1.02E+05	3.66E+04	7.75E+04	3.10E+03	4.15E+03	4.14E+06	1.40E+07
OH-	1.68E+05	2.34E+05	7.14E+06	1.74E+05		4.93E+04	9.45E+02	1.64E+05	2.33E+06	1.03E+07
PO4-3	4.50E+03	4.54E+04	3.55E+04			2.37E+04	5.93E+01	1.08E+02	1.08E+05	2.18E+05
SO4-2	1.00E+04	1.04E+05	1.27E+05	2.37E+03	6.62E+02	4.00E+03	9.60E+01	1.32E+02	1.32E+05	3.79E+05
Organic Carbon	4.39E+03	8.24E+03	1.52E+05					9.00E+03	4.41E+05	6.14E+05
H2O		6.54E+06	4.41E+07		2.00E+06		4.84E+05		1.26E+07	6.58E+07
MnO2	2.77E+03	8.67E+00	7.95E+02	1.61E+03		5.43E+03		5.83E+02	1.11E+04	2.23E+04
ZrO2:2H2O	2.76E+04	6.39E+01		5.16E+05		2.65E+02		1.83E+02	1.65E+03	5.46E+05
Total, Kg	4.51E+05	8.07E+06	8.06E+07	1.65E+06	2.08E+06	3.01E+05	4.92E+05	2.89E+05	2.66E+07	1.21E+08

Input Radionuclides**	Solid Ci	Liquid Ci	Total Ci	Solid Ci	Liquid Ci	Solid Ci	Liquid Ci		Total Ci	Total Ci
C-14		3.50E+02	1.00E+03						1.00E+03	2.35E+03
Cs,Ba-137		2.52E+07	2.58E+07	7.66E+05	4.80E+03	3.72E+05			1.42E+07	6.63E+07
I-129		5.00E+00	1.50E+01						7.00E+00	2.70E+01
Sr,Y-90	2.16E+07		6.12E+04	1.40E+05		1.76E+05			3.78E+06	2.58E+07
Tc-99	2.20E+03	2.20E+03	9.30E+03			2.85E+02			1.00E+04	2.40E+04
Am-241	6.00E+04		9.00E+02	6.80E+02		2.40E+04			1.30E+04	9.86E+04
Pu-239,240	8.70E+02		1.10E+03	2.30E+03		1.50E+04			3.90E+03	2.32E+04
Total Ci	2.17E+07	2.52E+07	2.59E+07	9.09E+05	4.80E+03	5.87E+05			1.80E+07	9.22E+07

	Sludge	Supernate	Supernate	Sludge	Supernate	Sludge	Supernate	Sludge	Supernate	Total
Volume, gal ****	1.51E+05	1.78E+06	1.30E+07	6.60E+05	6.60E+04	1.10E+05	3.30E+04	9.12E+04	4.76E+06	2.05E+07
Volume, m3 ****	5.72E+02	6.74E+03	4.92E+04	2.50E+03	2.50E+02	4.16E+02	1.25E+02	3.45E+02	1.80E+04	7.76E+04

Waste	NCAW	DSS/DSSF	NCRW	PFP	CC	OVERALL
Density, Kg/l	1.17	1.64	1.36	1.46	1.46	1.55

* Totals may be higher since analytical data are not available for some elements

** Radionuclides decayed to 1991 to be consistant with the Integated Data Base; daughters are included for Cs-137 and Sr-90

*** NCRW and PFP radionuclide data are based on unwashed sludge core sample analysis

**** Sludge volume numbers include drainable and non-drainable interstitial liquid (the solids were calculated on a dry basis)

WHC-EP-0182-81

Waste Tank Summary for Month Ending December 31, 1994

B. M. Hanlon

Date Published
February 1995

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse Hanford Company P.O Box 1970 Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Approved for Public Release

D195007301

TABLE E-4. INVENTORY SUMMARY BY TANK FARM

December 31, 1994

TANK FARM	TOTAL WASTE	AVAIL SPACE	SUPERNATANT LIQUID VOLUMES (Kgallons) AGING	CC	CP	DC	DN	DN/PD	DN/PT	DSSF	NCPLX	TOTAL	SOLIDS VOLUME DSS	SLUDGE	SALT CAKE	TOTAL
EAST																
A	1537	0	0	0	0	0	0	0	0	9	0	9	0	556	972	1528
AN	6562	1418	0	1919	0	0	859	0	0	2343	0	5121	937	504	0	1441
AP	4194	4926	0	0	1101	0	2274	0	0	819	0	4194	0	0	0	0
AW	3849	2991	0	0	0	0	1282	197	0	1039	0	2518	0	1135	196	1331
AX	906	0	0	3	0	0	0	0	0	0	0	3	0	19	884	903
AY	1668	292	0	0	0	781	772	0	0	0	0	1553	0	115	0	115
AZ	1911	49	1781	0	0	0	0	0	0	0	0	1781	0	130	0	130
B	2057	0	0	0	0	0	0	0	0	0	15	15	0	1697	345	2042
BX	1548	0	0	0	0	0	0	0	0	0	33	33	0	1360	155	1515
BY	4744	0	0	0	0	0	0	0	0	0	0	0	0	719	4025	4744
C	2131	0	0	0	0	0	0	0	0	0	174	174	0	1957	0	1957
Total	31107	9676	1781	1922	1101	781	5187	197	0	4210	222	15401	937	8192	6577	15706
WEST																
S	5510	0	0	0	0	0	0	0	0	17	41	58	0	1166	4286	5452
SX	4425	0	0	0	0	1	0	0	0	0	62	63	0	1254	3108	4362
SY	2608	812	0	180	0	0	0	0	690	0	0	870	1103	71	564	1738
T	2029	0	0	0	0	0	0	0	0	0	43	43	0	1986	0	1986
TX	7009	0	0	0	0	0	0	0	0	0	5	5	0	241	6763	7004
TY	638	0	0	0	0	0	0	0	0	0	3	3	0	571	64	635
U	3550	0	0	0	0	0	0	0	0	31	137	168	0	638	2744	3382
Total	25769	1012	0	180	0	1	0	0	690	48	291	1210	1103	5927	17529	24559
TOTAL	56876	10688	1781	2102	1101	782	5187	197	690	4258	513	16611	2040	14119	24106	40266

Note: +/- 1 Kgal differences are the result of computer rounding

D19500730 1

Request Number 70

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: DAVID E SEROT Date:

Phone Number: 375-3055 Fax Number: 375-4838

Request Information: MANPOWER SPREADSHEETS FOR EXTENSIVE SEPARATIONS AND FILL AND CAP SUBALTERNATIVES

Need Date:

Response: SEE ATTACHED

Data Source/Accuracy: EXTENSIVE SEPARATIONS AND FILL AND CAP DATA PACKAGES

Prepared By: J W GOODWIN Date Sent/Faxed: 5/30/95

Concurrence: M Nelson
Marc Nelson - Deputy Project Manager

What about Waste Retr ?

& Disposal ?

& Mod ?

EXTENSIVE RETRIEVAL
CONSTRUCTION MANPOWER
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF EXTENSIVE SEPARATIONS DATA PACKAGE DATED MAY 1995
REV 0 May 29, 1995 JWG

YEAR (NOTE 1)			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
% MH EXPENDED PER YR, DESIGN (NOTE 2)				.10	.30	.40	.20								100%
% MH EXPENDED PER YR, CONST. (NOTE 1)					1%	1%	2%	4%	9%	19%	26%	20%	12%	6%	100%
	TOTAL MH (NOTE 3)	EQUIV TOTAL MAN*YR (NOTE 4)	EQUIVALENT MEN (NOTE 5)												TOTAL
DESIGN & ENGR	14,000,000	7,000	0	700	2,100	2,800	1,400	0	0	0	0	0	0	0	7,000
CONSTRUCTION															
NONRADIATION WORKERS	29,000,000	14,500	0	0	145	145	290	580	1,305	2,755	3,770	2,900	1,740	870	14,500
SUPERVISORY	8,600,000	4,300	0	0	43	43	86	172	387	817	1,118	860	516	258	4,300
TOTAL	51,600,000	25,800	0	700	2,288	2,988	1,776	752	1,692	3,572	4,888	3,760	2,256	1,128	25,800

NOTES:
1. SCHEDULE AND DISTRIBUTION FROM FIGURE 10-1
2. DESIGN DISTRIBUTION ASSUMED BY JACOBS
3. OVERAL MANHOURS FROM TABLE 9-9
4. JACOBS ASSUMES 2,000 WORKING HOURS IN A YEAR
5. GENERAL CALCULATION: (EQUIVALENT TOTAL MAN YEARS)*(% EXPENDED PER YEAR)

EXTENSIVE SEPARATIONS
OPERATION AND D&D MANPOWER
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF EXTENSIVE SEPARATIONS DATA PACKAGE DATED MAY 1995
REV 0 May 30, 1995 JWG

	TOTAL MH (NOTE 2)	EQUIV TOTAL MAN*YR (NOTE 3)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
YEAR (NOTE 1)			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
% MH EXPENDED PER YR, OPR (NOTE 1)			.2%	.4%	.6%	.8%	10.0%	3.6%	3.8%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%
			EQUIVALENT MEN (NOTE 4)												
NONEXEMPT															
NONRADIATION WORKER	3,300,000	1,650	3	7	10	13	165	59	63	69	69	69	69	69	69
EXEMPT															
RADIATION WORKERS	8,500,000	4,250	9	17	26	34	425	153	162	179	179	179	179	179	179
BARGANING UNIT															
RADIATION WORKER	2,100,000	1,050	2	4	6	8	105	38	40	44	44	44	44	44	44
TOTAL	13,900,000	6,950	14	28	42	56	695	250	264	292	292	292	292	292	292

NOTES:
1. SCHEDULE AND DISTRIBUTION FROM FIGURE 10-2
2. OVERAL MANHOURS FROM TABLE 9-3, INCLUDES CONSTRUCTION, STARTUP, OPERATION AND D&D PERSONNEL
3. JACOBS ASSUMES 2,000 WORKING HOURS IN A YEAR
4. GENERAL CALCULATION: (EQUIVALENT TOTAL MAN YEARS)*(% EXPENDED PER YEAR)
5. DOES NOT INCLUDE MONITORING AND MAINTENANCE OR CLOSURE. IF REQUIRED USE DATA FROM ~~13Y~~ TPA SPREADSHEET.

EXT SEP OPR AND D&D MANHOURS

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	5.6%	7.2%	5.2%	4.8%	1.8%	1.4%	100.0%
													TOTAL
69	69	69	69	69	69	69	92	119	86	79	30	23	1,650
179	179	179	179	179	179	179	238	306	221	204	77	60	4,250
44	44	44	44	44	44	44	59	76	55	50	19	15	1,050
292	292	292	292	292	292	292	389	500	361	334	125	97	6,950

EXT SEP OPR AND D&D MANHOURS

DRY, FILL AND CAP
CONSTRUCTION, OPERATION AND D&D MANPOWER
ESTIMATED BY JACOBS USING HOURS AND SCHEDULE FROM REV B DRAFT OF IN SITU TREATMENT DATA PACKAGE DATED FEB 1995
REV 0 May 29, 1995 JWG

	TOTAL MH (NOTE 2)	EQUIV TOTAL MAN*YR (NOTE 3)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
YEAR (NOTE 1)			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
% MH EXPENDED PER YR, OPR (NOTE 1)			5.0%	5.0%	5.6%	5.5%	5.4%	5.3%	5.4%	5.7%	4.3%	4.3%	4.2%	4.1%	4.0%
			EQUIVALENT MEN (NOTE 4)												
NONEXEMPT															
RADIATION WORKER	950,000	475	28	28	27	26	26	25	26	27	20	20	20	19	19
NONRADIATION WORKER	300,000	150	9	9	8	8	8	8	8	9	6	6	6	6	6
EXEMPT															
RADIATION WORKERS	950,000	475	28	28	27	26	26	25	26	27	20	20	20	19	19
NONRADIATION WORKER	1,000,000	500	29	29	28	28	27	27	27	29	22	22	21	21	20
BARGANING UNIT															
RADIATION WORKER	2,800,000	1,400	81	81	78	77	76	74	76	80	60	60	59	57	56
TOTAL	5,050,000	2,525	146	146	141	139	136	134	136	144	109	109	106	104	101

NOTES:
1. SCHEDULE AND DISTRIBUTION FROM FIGURE 8-3
2. OVERAL MANHOURS FROM TABLE 7-3, INCLUDES CONSTRUCTION, STARTUP, OPERATION AND D&D PERSONNEL
3. JACOBS ASSUMES 2,000 WORKING HOURS IN A YEAR
4. GENERAL CALCULATION: (EQUIVALENT TOTAL MAN YEARS)*(% EXPENDED PER YEAR)
5. DOES NOT INCLUDE MONITORING AND MAINTENANCE OR CLOSURE. IF REQUIRED USE DATA FROM ISV SPREADSHEET.

2013	2014	2015	2016	2017	2018	2019	2020	2021	
3.9%	3.9%	4.2%	4.2%	4.0%	3.7%	3.8%	3.9%	3.0%	100.0%
									TOTAL
19	19	20	20	19	18	18	19	14	475
6	6	6	6	6	6	6	6	5	150
19	19	20	20	19	18	18	19	14	475
20	20	21	21	20	19	19	20	15	500
55	55	59	59	56	52	53	55	42	1,400
98	98	106	106	101	93	96	98	76	2,525

DRY, FILL AND CAP

ENGINEERING INFORMATION REQUEST 037

Supplemental Information

Capsules Vitrify with Tank Waste alternative:

The staffing levels developed for the Capsules Overpack and Ship alternative should be used for the Vitrify with Tank Waste alternative. The schedule for both alternatives is approximately the same and so the annual staffing levels are assumed to be identical.

The engineering data package for the capsules does not provide staffing estimates for the Vitrify with Tank Waste alternative and notes that the estimate would be insignificant as compared to the Extensive Retrieval (Ex Situ Vitrification) alternative [formerly the TPA alternative]. This is a true statement however, this approach does not provide a basis for comparing the Capsules Vitrify with Tank Waste alternative with the other capsule alternatives. The staffing levels for each of the capsule alternatives should be similar since each alternatives (except No Action) involves capsule retrieval, inspection, placement into an overpack or a transportation cask, transport, and handling.

Request Number 071

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Joan Young (ASI) Date: 6/19/95

Phone Number: (509)946-7112 Fax Number: (509)943-6812

Request Information: Stack data for Extensive Separations subalternative

Need Date: 6/20/95

Response: see attached

Data Source/Accuracy: Reference: personal communication with George Jansen Jr on 6/19/95

Prepared By: Colin Henderson CH Date Sent/Faxed:

Concurrence: M Nelson
Marc Nelson - Project Manager

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The stack gases from the HLW vitrification plant and the LLW vitrification plant would be combined and released from a common stack under the Extensive Separations subalternative. No design calculations have been done to size the stack or the exit velocity but the following stack parameters would be used as target values during design:

Stack height = approximately 200' (use 180' to be consistent with other alternatives)
Exit velocity = 15-20 meters/second
Exit temperature = 50 degrees C

The stack would be located nearest to the LLW vitrification plant since the LLW plant will have the highest volumetric flow rate.

The following stack stream information was taken from the extensive separations data package:

Schedule: LLW vitrification 19 years, HLW vitrification 19 years

Plant capacities:LLW vitrification = 200 mt/operating day, HLW vitrification = 1 mt/operating day
capacity factors: HLW 0.0323 kg/(hr-mt) , LLW=0.2924 kg/(hr-mt)

HLW stack stream = stream 1543 = 4.19E+04 mt
LLW stack stream = streams 907+917 = 2.23E+05 + 3.58E+04 mt

LLW = 2.59E+05 mt * .2924 kg/(hr-mt) = 75,731 kg/hr
HLW = 4.19E+04 mt * 0.0323 kg/(hr-mt) = 1,353 kg/hr

Combined stack mass flow rate = 77,084 kg/hour

Assuming an average MW of 29 g/gmol

Volumetric flow rate = 65,000 standard cubic meters/hr = 18.05 cubic meters/sec

delivered 10/23

Request Number 072

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: L. Dean

Date: 09/12/95

Phone Number: 509-946-7112

Fax Number: 509-943-6812

Request Information: Footprint of the proposed privatization alternative showing the location of all facilities, or at least a perimeter enclosing all privatization facilities. If a map or design is not available, provide the geographic coordinates (lat and long) of an area that will enclosed the privatization alternative. Identify any support facilities, such as a power or pipe line corridors, outside the 200 Areas and supply maps or coordinates for these facilities.

Need Date: 10/01/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson CH

Date Sent/Faxed: 10/23/95

Concurrence: Marc E Nelson
Marc Nelson - Project Manager

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TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Phase I Implementation Facility footprint Estimate

ORIGINATOR Colin Henderson DATE 10/23/95

REVISION NO. 0

OBJECTIVE Provide an estimate for the Phase I of Phase I Implementation facility location & footprint

METHODOLOGY noted

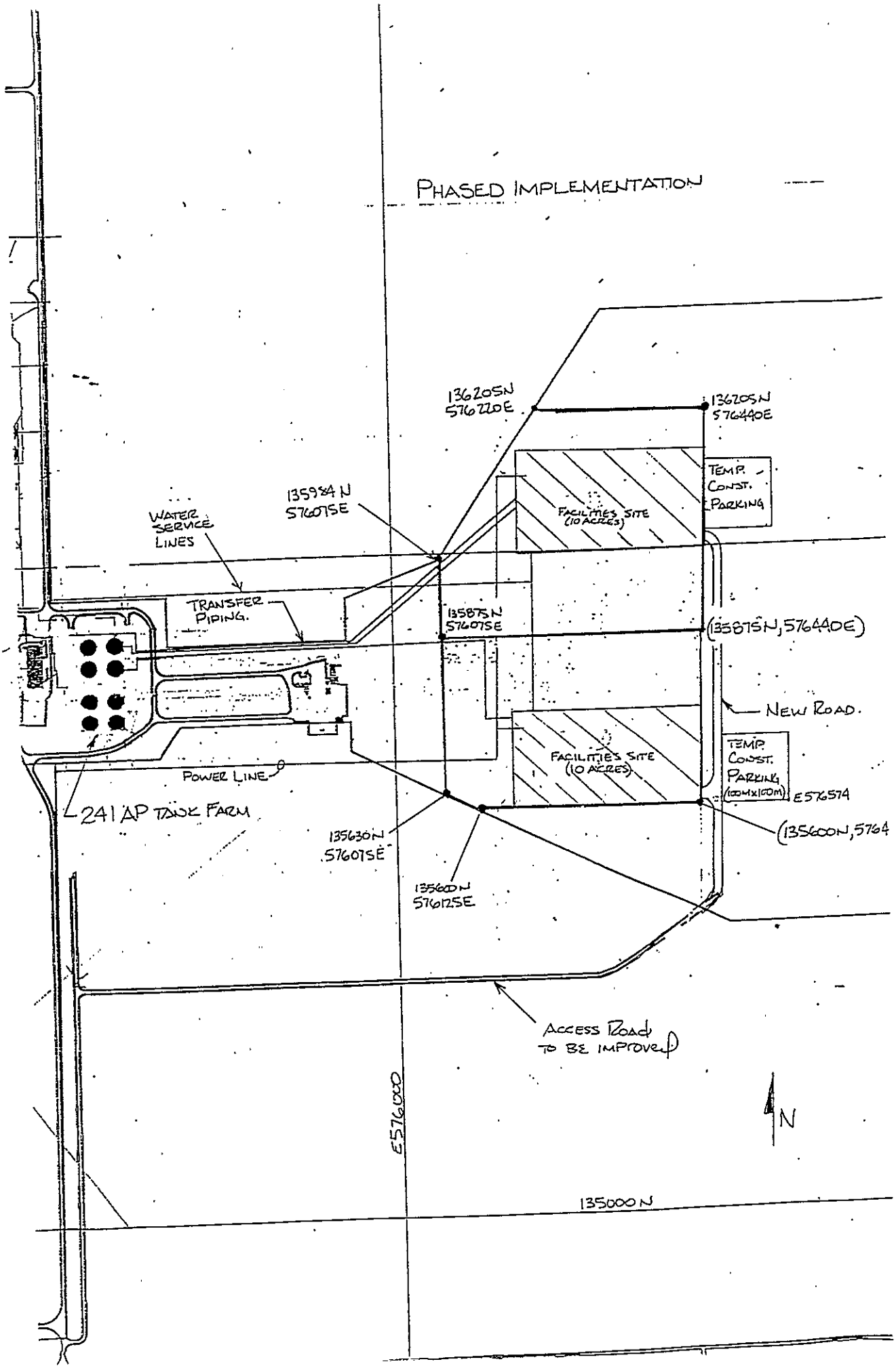
ASSUMPTIONS Noted

(Continue on another sheet if necessary)

Col. Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT


PHASED IMPLEMENTATION
136205N
576220E
136205N
576440E
TEMP. CONST. PARKING
FACILITIES SITE (10 ACRES)
135984 N
576075E
WATER SERVICE LINES
TRANSFER PIPING.
135875N
576075E
(135875N, 576440E)
NEW ROAD.
FACILITIES SITE (10 ACRES)
TEMP. CONST. PARKING (100M x 100M)
E576574
POWER LINE
241 AP TANK FARM
135630N
576075E
(135600N, 5764
135600N
576125E
ACCESS ROAD TO BE IMPROVED
N
E576000
135000 N

JACOBS ENGINEERING GROUP INC.

DATE 10/18/95. SUBJECT SHEET NO. 1

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION DISTURBED AREA.

1) AREA DISTURBED DURING CONSTRUCTION — TOTAL

a) 30 ACRES/SITE (12.2 ha) — 60 Acres (24.3 ha)

b) POWER LINE (1500 m new power line)

Assumed 500 m of new Line outside existing Fence Line.

Area = 500 m x 50 m = 25,000 m² (2.5 ha) — 6 Acres (2.5 ha)

c) Water Service 960 m of buried line

Assumed 475 m of the Line outside of existing Fence line

Area = 475 m x 25 m = 1.18 ha = 3 Acres — 3 Acres (1.18 ha)

d) Road — 6.5 Acres (1.64 ha)

IMPROVE 1480 meters of existing Road

Area = 1480 meters x 10 m = 3.7 acres (1.5 ha)

(10 meters width to improve road)

New Road

570 meters x 20 = 2.8 Acres (1.14 ha)

(20 meters width for new road)

e) WASTE TRANSFER PIPELINES — 0

Assume ALL WASTE TRANSFER PIPING IS INSTALLED WITHIN EXISTING FENCELINE IN CURRENTLY DISTURBED AREA.. INCLUDES LIQUID Effluent transfer line to LERF

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 10/18 SUBJECT SHEET NO. 2

BY CHKD. JOB NO.

1. Cont.

TEMPORARY CONSTRUCTION PARKING 5 ACRES (2 ha)

TOTAL AREA DISTURBED DURING CONSTRUCTION 80.5 ACRES (32 ha)

2. Permanently Disturbed Area = 0

Assume RCRA Closure with no Permanent Land Commitments.

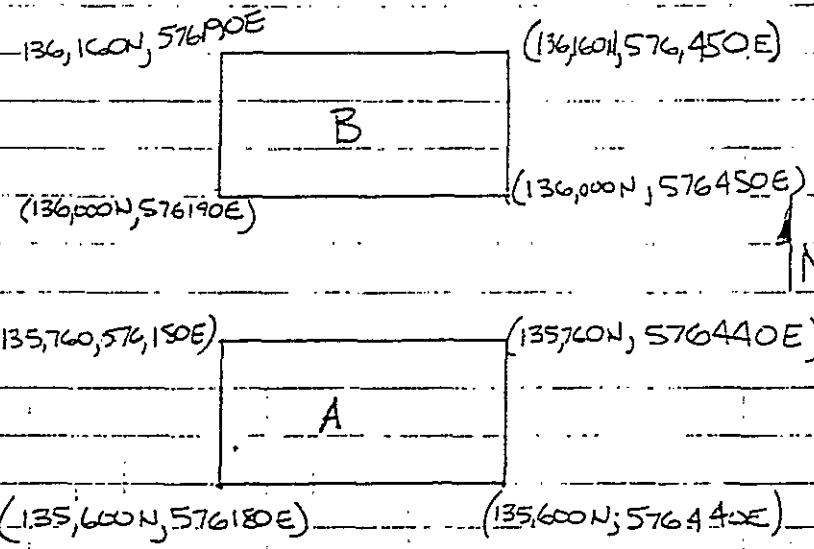
FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

SITE Coordinates:



160
250

EACH SITE 160 m x 260 m = 4.68 ha = 10.3 acres
= 10 acres

STACK LOCATIONS:

1) ASSUME FACILITIES WOULD BE LOCATED IN PROXIMITY TO THE WESTERN END OF EACH SITE TO MINIMIZE PIPELINE LENGTH TO THE FACILITIES
2) CENTER THE STACK N & SOUTH PLACE 30 m IN FROM Edge.

STACK Coordinates

A = N 135,680 ; E 576,210
B = N 136 080 ; E 576 220

FORM 91-005-1 (4/81)

10/23/95

Request Number 073

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: David Serot

Date: 09/13/95

Phone Number: 375-3055

Fax Number: 943-6812

Request Information: Equivalent number of workers per calendar year for the TWRS Privatization Alternative. Data should be consistent with data provided for the other TWRS alternatives and in the same format as data previously provided. Subdivide the data for the Privatization Alternative into: Waste Retrieval and Transfer Stage and Waste Treatment Stage. Subdivide each stage into: Construction, Operations, D&D and M&M phases.

Need Date: ASAP (9/22 at least)

Response:

Data Source/Accuracy:

Prepared By:

Date Sent/Faxed:

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

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3.4.9 Phased Implementation

Overview

The Phased Implementation alternative provides a mechanism to implement the remediation of the tank wastes in a two step process. The first step would be a commercial demonstration, on a reduced scale, of the pretreatment and immobilization processes for selected tank wastes. The second step would involve scaling up the demonstration scale processes to treat the remaining tank wastes. The phased implementation approach could be applied to any of the tank waste alternatives involving waste treatment however, for purposes of analysis, the Ex Situ Intermediate Separations alternative with some additional separations was selected as a representative alternative for analysis. The follow-on or full scale alternatives are addressed by the bounding tank waste alternatives discussed in this EIS.

Under the Phased Implementation alternative readily retrievable and well-characterized wastes from the DSTs would be retrieved and processed in two separate waste treatment facilities designed, constructed, and operated by private contractors. One of the facilities would process liquid DST wastes to produce an immobilized low activity waste (LAW) product while the other facility would produce an immobilized LAW product and an immobilized HLW product.

The immobilized LAW would be sealed in containers at the treatment facilities and then transported to an interim onsite storage facility where it would be stored for eventual onsite disposal. The immobilized HLW would be placed in canisters and transported to an interim storage facility where it would be stored awaiting shipment and disposal at the proposed national HLW repository. The method of interim HLW storage would be the same as that described for the Ex Situ Intermediate Separations alternative.

Each of the LAW treatment facilities would operate for a ten year period during which they would treat the majority of the liquids currently contained in the DSTs. The HLW treatment facility would operate for a six year period.

The following operations would be implemented under Phased Implementation:

- Retrieve the DST liquids for LAW processing;
- Retrieve selected DST wastes for HLW processing;
- Transfer liquid wastes to a receiver tank;
- Transfer selected wastes for HLW processing directly to the HLW plant;
- Perform separations to remove cesium, strontium, technetium, TRU elements, and sludges from the LAW stream;
- Package the radionuclides separated during pretreatment from each of the LAW processing facilities and transport to onsite interim storage for future waste treatment;
- Return sludges separated during LAW processing to the DSTs for storage;
- Immobilize both the LAW and HLW;
- Place the immobilized HLW into canisters;

- Place the immobilized LAW into containers; and
- Transport the immobilized wastes to onsite interim storage facilities.

Following the demonstration period each of the treatment facilities would be decontaminated, and torn down, support facilities would be taken out and the facility site would be restored as near as possible to its original condition.

Process Description

The first step in waste processing would be to recover and transfer the wastes from the DSTs. The waste feed to the LAW facilities would be retrieved and transferred in batches from selected DSTs into two existing DSTs designated as feed tanks. Each LAW facility would have one designated DST as a feed tank. The waste feed to the HLW plant would be retrieved and transferred separately and would go directly to the HLW processing facility. The DST wastes that would be treated at the HLW facility would be high-activity wastes recovered directly from selected tanks and would not include the high-activity wastes separated out of the LAW stream.

Liquid waste retrieval and transfer would utilize equipment and systems currently in place in the DST farms. Sludge washing and slurry pumping using techniques identified for the Ex Situ Intermediate Separations alternative would be used to retrieve wastes for treatment at the HLW plant. The installation and operation of sludge washing and slurry pumping equipment would take place under other projects.

The specific technologies employed for separations and immobilization would be defined by the contractor and therefore are not specifically identified or discussed for this alternative however, representative technologies based on the Ex Situ Intermediate Separations alternative are used for purposes of impact analysis. The separations and immobilization technologies employed for waste immobilization would be controlled by waste product specifications that would control the physical properties, chemistry, radionuclide content, and volume of the immobilized LAW and HLW.

Pretreatment for LAW processing of the liquid wastes would be performed to remove the cesium, strontium, technetium, TRU elements and suspended sludge particles from the waste stream. The separated radionuclides would be packaged in a canister for onsite dry storage, the treated sludges would be returned to the DST farms for storage, and the treated liquid waste stream would then be immobilized. For purposes of impact analysis the immobilization process would include evaporation of the waste stream followed by vitrification. The LAW waste processing facilities would each be designed to treat up to one million gallons of liquid wastes per year. This is equivalent to 20 metric tons of vitrified glass per day at a 20 weight percent waste oxide loading.

The immobilized LAW would be placed into stainless steel containers approximately 1.8

meters long by 1.2 meters wide by 1.3 meters high.

The HLW treatment process would not involve separations processes and would treat the entire waste stream into immobilized HLW. The HLW plant would be designed to produce the equivalent of one metric ton per day of HLW glass at a 45 weight per cent waste oxide loading.

The immobilized HLW would be placed directly into canisters of a size suitable for packaging in a Hanford Multi-Purpose Canister (HMPC) for interim storage and eventual transport to the proposed national HLW repository.

Construction

The two contractors would be provided with a site east of the 200 East area within the area previously identified as the grout disposal area. Each contractor would construct a treatment facility and support facilities as required to support the operation. The following systems and facilities would be constructed:

- Waste transfer systems would include pipelines from the receiver tanks to each of the treatment facilities and would include a separate pipeline to transfer HLW from the existing waste transfer system to one of the treatment facilities;
- Electrical service to each of the sites would involve installing overhead power lines from the existing 200 East area power grid to the designated sites;
- Process water and potable water would be installed to connect the sites with existing distribution lines in the 200 East area;
- Pretreatment and LAW processing facility;
- Pretreatment, LAW and HLW processing facility; and
- Interim storage pads for immobilized LAW and HLW would be constructed in the 200 East area in the location identified for interim storage for the Intermediate Separations alternative. This interim storage facility would be constructed and maintained by the Hanford Site M&I contractor.

Operations

Operations under this alternative would take place simultaneously at the two treatment plants. Both LAW plants would operate for approximately ten years while the HLW treatment operations would take place for six years.

The Hanford Site Maintenance and Integration (M&I) contractor would retrieve and transfer DST wastes to the receiver tanks or in the case of the HLW, directly to the HLW processing facility. The waste treatment contractors would transfer wastes from the receiver tanks to the treatment facilities on an as needed basis.

Each contractor would perform the necessary pretreatment and separations processes on the waste stream, collecting and packaging the separated radionuclides for return to DOE for

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Socioeconomic Data for Phased Implementation

ORIGINATOR Cain Henderson DATE ~~9/~~ 10/23/95

REVISION NO. 0

OBJECTIVE Calculate the staffing levels for Phased Implementation

METHODOLOGY Calculate Staffing Using previously performed estimates and use an overall 15% Reduction for privatization

ASSUMPTIONS Noted

(Continue on another sheet if necessary)

SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

PHASED IMPLEMENTATION STAFFING ESTIMATE

	STAFF HOURS	STAFF YEARS	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SEPARATIONS +HLW/LAW																				
CONSTRUCTION																				
DESIGN AND ENG.	1874000	937	51	61	170	383	255	17												
CONSTRUCTION	10204000	5102		340	1020	1360	1360	680											171	171
SUPERVISORY	1036000	518		34	102	136	136	68											21	21
	0	0																		
	0	0																		
OPERATION	0	0																		
EXEMPT	0	0																		
RAD	928000	464							30	30	30	30	43	43	43	43	43	43	43	43
NONRAD	784000	392							30	30	30	30	34	34	34	34	34	34	34	34
NONEXEMPT	0	0																		
RAD	1440000	720							60	60	60	60	60	60	60	60	60	60	60	60
NONRAD	1536000	768							64	64	64	64	64	64	64	64	64	64	64	64
BARGAINING UNIT	0	0																		
RAD	1224000	612							43	43	43	43	55	55	55	55	55	55	55	55
NONRAD	1224000	612							43	43	43	43	55	55	55	55	55	55	55	55
	0																			
SEPARATIONS + LAW	0																			
CONSTRUCTION	0																			
DESIGN AND ENG.	1344000	672	38	47	149	234	191	13												
CONSTRUCTION	7940000	3970		259	778	1037	1037	519											170	170
SUPERVISORY	878000	439		29	85	113	114	56											21	21
	0	0																		
	0	0																		
OPERATION	0	0																		
EXEMPT	0	0																		
RAD	688000	344							28	28	28	28	29	29	29	29	29	29	29	29
NONRAD	720000	360							30	30	30	30	30	30	30	30	30	30	30	30
NONEXEMPT	0	0																		
RAD	1440000	720							60	60	60	60	60	60	60	60	60	60	60	60
NONRAD	1536000	768							64	64	64	64	64	64	64	64	64	64	64	64
BARGAINING UNIT	0	0																		
RAD	1008000	504							42	42	42	42	42	42	42	42	42	42	42	42
NONRAD	1008000	504							42	42	42	42	42	42	42	42	42	42	42	42
			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TOTAL			89	770	2304	3263	3093	1353	536	536	536	536	578	578	578	578	578	578	961	961

15% Reduction. INCLUDED

interim storage. The LAW waste stream would be immobilized using a technology to treat the waste that would yield a stabilized waste product that would be similar to vitrified glass with regard to waste performance characteristics.

Immobilization of the HLW stream would be accomplished using a technology to treat the waste that would result in a stabilized waste form similar characteristics to borosilicate glass.

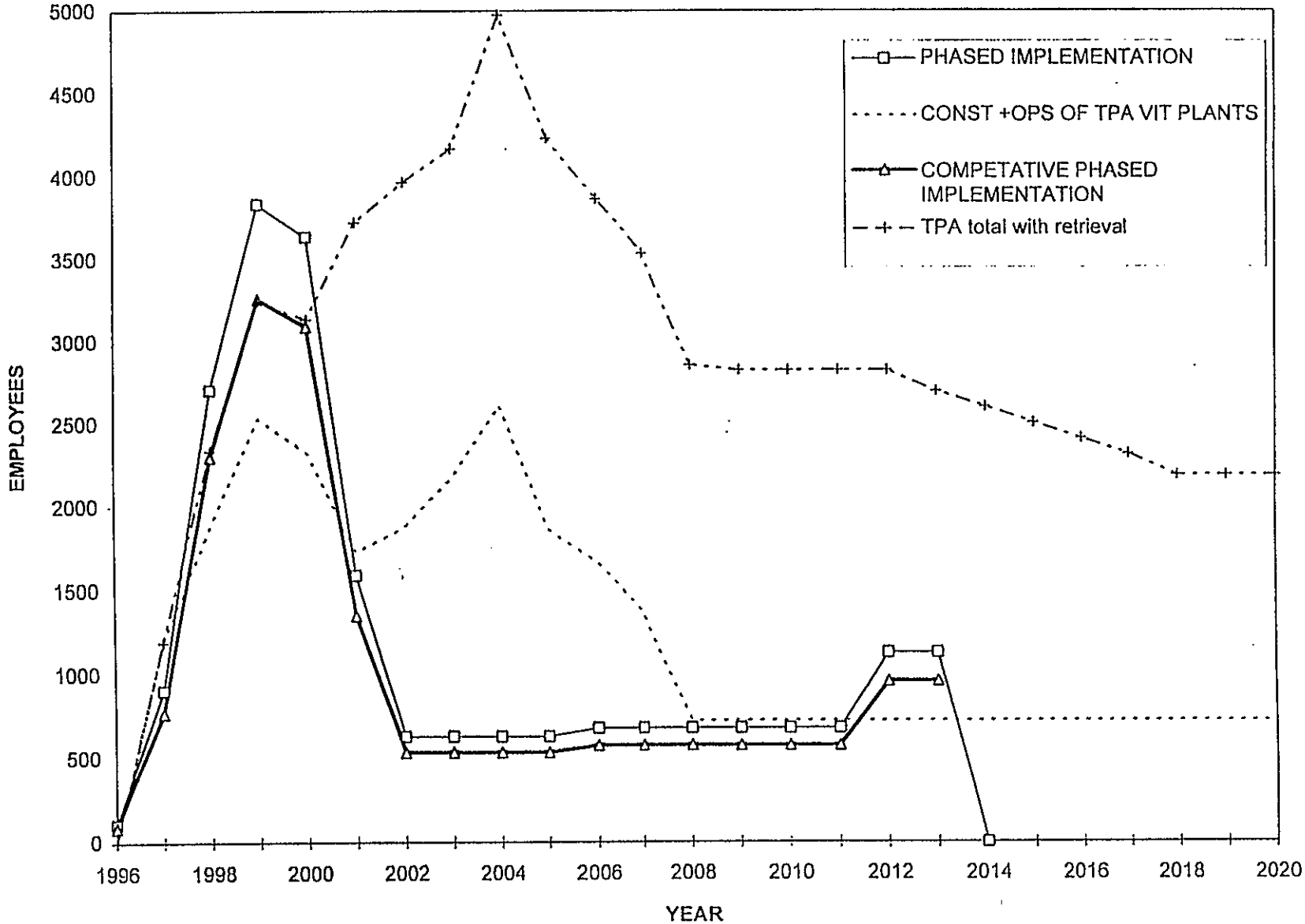
Each of the waste treatment facilities would operate off-gas treatment systems that would include control technologies for priority pollutants and radionuclides. The treatment of the off-gas would be similar processes and equipment as described for the Ex Situ Intermediate Separations alternative.

Post Remediation

Post Remediation activities would include decontamination and decommissioning of the treatment facilities, and closure of the site.

Retrieval of Waste From Tank Farm and Pump to Supply Tanks(s) for Phased Implementation Alternative												
Retrieval Operations	Staff Hours	Person Years	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Exempt												
Rad Workers	40,000	20	2	2	2	2	2	2	2	2	2	2
Nonexempt												
Rad Workers	0	0	0									
Nonrad Workers	0	0	0									
Bargaining Unit												
Rad Workers	120,000	60	6	6	6	6	6	6	6	6	6	6
Health Physics	40,000	20	2	2	2	2	2	2	2	2	2	2
1. Assumed 1 shift per day.												

Phased Implementation Staffing Estimate

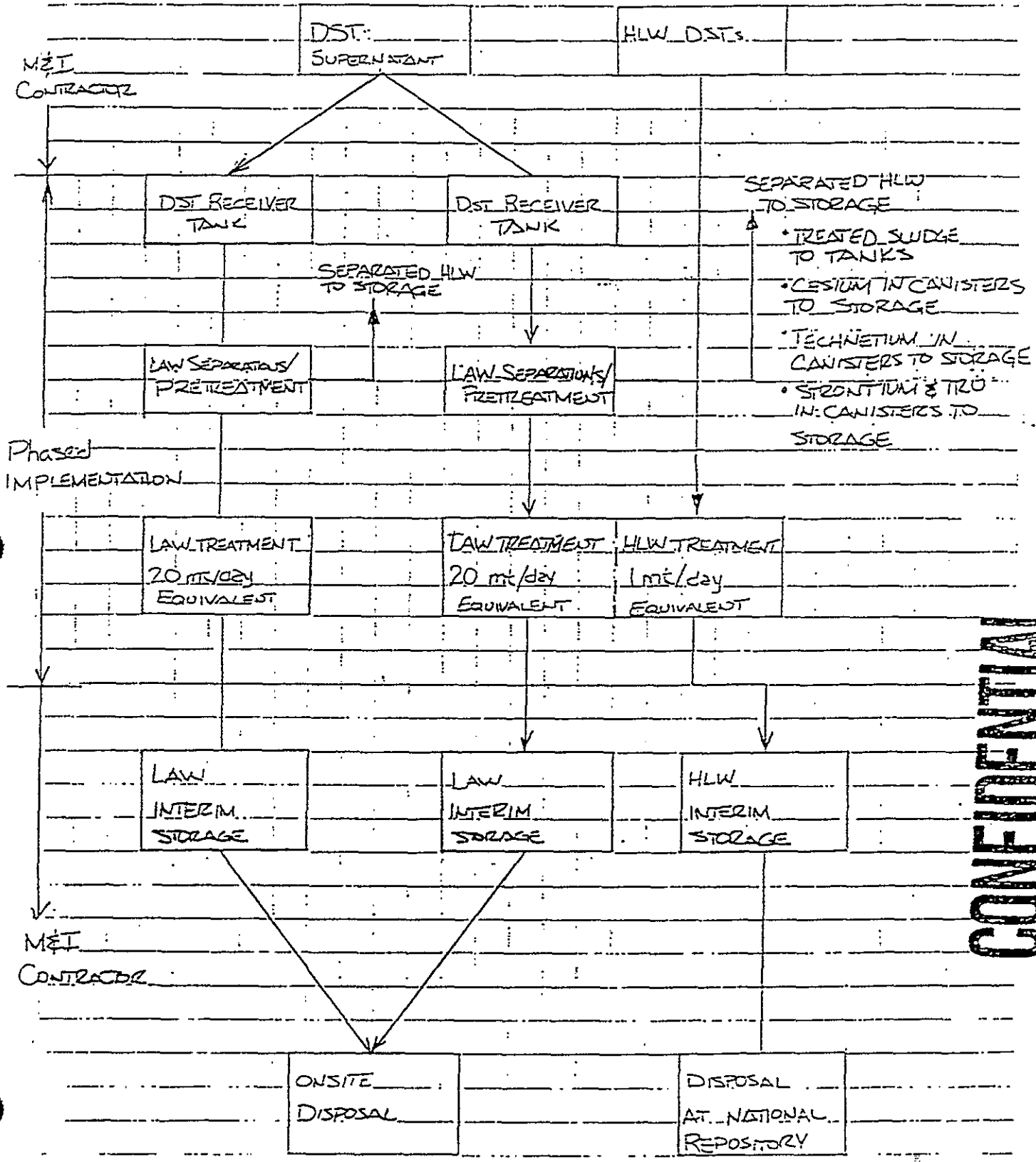


JE JACOBS ENGINEERING GROUP INC.

DATE 10/17/95 SUBJECT SHEET NO.

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION



CONFIDENTIAL

FORM 91-005-1 (4/81)

PHASED IMPLEMENTATION STAFFING ESTIMATE

	STAFF HOURS	STAFF YEARS	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
(HLW + LAW)																				
CONSTRUCTION																				
DESIGN AND ENG.	2204000	1102	60	72	200	450	300	20												
CONSTRUCTION	12000000	6000		400	1200	1600	1600	800											200	200
SUPERVISORY	1220000	610		40	120	160	160	80											25	25
OPERATION																				
EXEMPT																				
RAD	1080000	540							35	35	35	35	50	50	50	50	50	50	50	50
NONRAD	920000	460							35	35	35	35	40	40	40	40	40	40	40	40
NONEXEMPT																				
RAD	1680000	840							70	70	70	70	70	70	70	70	70	70	70	70
NONRAD	1800000	900							75	75	75	75	75	75	75	75	75	75	75	75
BARGAINING UNIT																				
RAD	1440000	720							50	50	50	50	65	65	65	65	65	65	65	65
NONRAD	1440000	720							50	50	50	50	65	65	65	65	65	65	65	65
(LAW)																				
CONSTRUCTION																				
DESIGN AND ENG.	1580000	790	45	55	175	275	225	15												
CONSTRUCTION	9340000	4670		305	915	1220	1220	610											200	200
SUPERVISORY	1038000	519		34	100	134	134	67											25	25
OPERATION																				
EXEMPT																				
RAD	840000	420							35	35	35	35	35	35	35	35	35	35	35	35
NONRAD	840000	420							35	35	35	35	35	35	35	35	35	35	35	35
NONEXEMPT																				
RAD	1680000	840							70	70	70	70	70	70	70	70	70	70	70	70
NONRAD	1800000	900							75	75	75	75	75	75	75	75	75	75	75	75
BARGAINING UNIT																				
RAD	1200000	600							50	50	50	50	50	50	50	50	50	50	50	50
NONRAD	1200000	600							50	50	50	50	50	50	50	50	50	50	50	50
			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
			105	908	2710	3839	3839	1592	630	630	630	630	680	680	680	680	680	680	1130	1130
WITH A 15% OVERALL REDUCTION			89	770	2304	3263	3263	1353	536	536	536	536	578	578	578	578	578	578	961	961

Construction | Ops | D&D

Overall Staffing Estimate using a 15% Reduction for Competitive bidding

Use TPA routine ops by assumption

M+M covered in routine ops (clean close site)

Request Number 074

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Joan Young (ASI)

Date: 5/23/95

Phone Number: 946-7549

Fax Number:

Request Information: see attached memo

Need Date: 10/2/95

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed: 10/3/95

Concurrence:
Marc Nelson - Project Manager

H:\USERS\CHENDERS\EIR\ENINFRQ.074

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Risk data as Requested on attached ASI memorandum

ORIGINATOR Colin Henderson DATE 11/15/95

REVISION NO. 0

OBJECTIVE Calculate the Rad / Non Rad Worker hours and provide requested Emissions data.
(Note: data provided ~~more~~ more a Compilation of data other Calculations)

METHODOLOGY Noted; data taken from WHC data packages

ASSUMPTIONS Noted

(Continue on another sheet if necessary)

SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

ASI Memorandum September 13, 1995

To: Dave Murray

From: Joan Young

Subject: Contract No. #05-K471-S-94-0001 - Data Request for Revisions to TWRS DEIS

Several revisions have been requested by JEG for the TWRS DEIS (17 pages). Briefly, these revisions include adding the following:

- radiological exposures to construction workers (MEI and nominal)
- risk to involved workers during continued operations of the tank farms (including evaporation of the SSTs)
- routine and post remediation risk from the calcination subalternative and the no action capsules subalternative
- modeling results from postremediation risk for the extensive separations subalternative
- risk to involved workers, noninvolved workers, and the general public during monitoring and maintenance (prior to closure and after closure)
- risk from chemical exposures during construction and operations for all alternatives and subalternatives.

Information that is required to resolve these requests has been marked with a "please provide" in the attached Table 1 (17 pages). The column headings indicate the units in which the information must be provided.

If the information has already been provided and it is included in the current Appendix D, then the location of this information is listed in the cell. JEG engineers should verify the appropriateness of these assumptions.

Please be aware that final deadline for analyzing this information is October 16, 1995. Receipt of the technical information requested must be obtained by September 20, 1995.

Attachment

cc: Mike Harker
Colin Henderson
File 2.11.2.2
File 2.11.3.3
Chrono

587.JACM-10030.JKY

RECEIVED
SEP 13 1995

JACOBS ENGINEERING GROUP
ALTERNATIVE BREAKDOWN BY COMPONENT

1.0 TANK WASTE - NO ACTION

1.1 Construction -N/A

1.2 Operation
1.2.1 Continued Operations
-Monitor SSTs and DSTs (100 year period)
RELEASE CONDITIONS- see attached spread sheet titled "Tank Farm Emissions From Current Operations"
EMISSIONS- see attached spread sheet
WORKER EXPOSURE- 84 million staff hours (rad worker and chemical worker)
MODELING- see attached spread sheet
-Monitor MUSTs
RELEASE CONDITIONS -N/A must emissions assumed to be minor compared to tanks
EMISSIONS - N/A
WORKER EXPOSURE - included in the number given for SSTs and DSTs
MODELING - N/A
-Operate Evaporator (intermediate evaporator operations through the year 2005) no operations after 2005
RELEASE CONDITIONS- see attached spread sheet titled "Tank Farm Emissions From Current Operations"
EMISSIONS- see attached spread sheet
WORKER EXPOSURE- 2.7 million staff hours (rad worker and chemical worker)
MODELING- see attached spread sheet

1.2.2 Retrieval - N/A
1.2.3 Separations - N/A
1.2.4 Treatment - N/A
1.2.5 Storage - N/A
1.2.6 Disposal - N/A
1.2.7 Monitoring and Maintenance - N/A(no immobilized HLW) monitoring and maintenance included in continued operations.

1.3 Post Remediation - N/A (no post remediation activities)
1.3.1 Decontamination and Decommissioning
1.3.2 Closure - N/A (no closure activities would occur)
1.3.3 Monitoring - N/A (no post remediation)

2.0 TANK WASTE - LONG-TERM MANAGEMENT

NOTE: The Long-Term management alternative calls for retanking the DST wastes two times during the 100 year institutional control period. The compliant management alternative is the same as the original Tank No Action alternative with retanking. Each of the following construction activities will occur twice during the Long-Term Management alternative.

2.1 Construction (years 6/2033-6/2037, 6/2083-6/2087)
2.1.1 Continued Operations
-Build replacement evaporator

-Build new DSTs at 50 year intervals

RELEASE CONDITIONS -Ground releases, ambient temperature, velocity N/A

EMISSIONS- no radiological estimates, no chemical other than regular non-rad construction emissions. Radiological and chemical exposures would occur from emissions from existing tanks.

WORKER EXPOSURE- total construction staff hours for two retanking campaigns is 7.5E6, assume that 5% of these hours, or 375,000 hours (188 staff-years) are rad zone work associated with tie-ins.

MODELING- release concentrations during construciton N/A

2.1.2 Retrieval

-Build DST retrieval systems

RELEASE CONDITIONS-Construction releases minimal

EMISSIONS- Construction emissioins minimal

WORKER EXPOSURE-Total construction staff hours estimated is 14.2 million. Assume that 5% or 710,000 staff hours would be rad zone work that would have associated rad exposure.

MODELING- n/a

2.1.3 Separations - N/A

2.1.4 Treatment - N/A

2.1.5 Storage - N/A

2.1.6 Disposal - N/A

2.2 Operation

2.2.1 Continued Operations

-Monitor SSTs and DSTs

RELEASE CONDITIONS - see attached spread sheet titled Tank Farm Current Operations

EMISSIONS - see attached spreadsheet

WORKER EXPOSURE- 84 million staff hours

MODELING- see attached spreadsheet

-Monitor MUSTs - must emissions assumed to be negligable, worker exposure hours are included in the SST and DST number.

-Operate Evaporator

RELEASE CONDITIONS - see attached spread sheet titled Tank Farm Current Operations

EMISSIONS - see attached spreadsheet

WORKER EXPOSURE- 2.7 million staff hours, rad worker

MODELING- see attached spreadsheet

-Deactivate and stabilize empty DSTs

-Cap piping, seal entrances - rad worker hours included in construction hours

-fill tank with gravel (not estimated in data package)

-Continue to stabilize and isolate SSTs (interim stabilization) (seal entrances, cap piping etc.)- rad worker hours are included in continued operations

2.2.2 Retrieval

-Retrieve DST wastes

RELEASE CONDITIONS-

EMISSIONS- DST retrieval air emissions Cs-137=.0007 Ci, I-129=.001 Ci, Sr-90=.0001 Ci.

WORKER EXPOSURE- rad worker hours = 3.3 million staff hours (1,650 staff years)
MODELING- release concentration same as routing operating emissions

2.2.3 Separations - N/A
2.2.4 Treatment - N/A
2.2.5 Storage - N/A
2.2.6 Disposal - N/A
2.2.7 Monitoring and Maintenance - N/A(no immobilized HLW)

2.3 Post Remediation - N/A (no post remediation activities)
2.3.1 Decontamination and Decommissioning
-D&D evaporator facilities following each retanking campaign.- rad worker personnel requirements included in operations.
2.3.2 Closure - N/A (no closure activities would occur)
1.3.3 Monitoring - N/A (no post remediation)

3.0 MINIMAL RETRIEVAL (IN SITU VITRIFICATION) ALTERNATIVE

3.1 Construction
3.1.1 Retrieval - N/A
3.1.2 Separations - N/A
3.1.3 Treatment
-Construct tank farm confinement facilities (TFCFs). Construct a TFCF over each tank farm
RELEASE CONDITIONS- Ground, ambient temp., velocity= N/A
EMISSIONS- DO NOT USE TABLE 10/WHC.
WORKER EXPOSURE- 44 million staff hours (rad worker) (22,000 staff years)
MODELING-radiological and chemical releases would come from the tanks and would be the same as continued operations.
3.1.4 Storage - N/A (no interim HLW storage required)
3.1.5 Disposal - N/A (no construction of a disposal facility required, barriers addressed under post remediation)

3.2 Operation
3.2.1 Continued Operations
RELEASE CONDITIONS- see attached spread sheet titled-Tank Farm Continued Operations
EMISSIONS- see attached spread sheet
WORKER EXPOSURE- 22.5 million rad worker hours(11,250 staff years)
MODELING-see attached spread sheet
note: see attached table titled Continued Operatins Phase Out Schedule for the phase out of continued operations as the tanks are vitrified.

-Operating the 242A evaporator as a waste management activity (up through year 1999)
RELEASE CONDITIONS- 22', temp=46 deg C, flow 6.5 m^3/sec, stack radius 0.55 meter
EMISSIONS- see attached spread sheet titled Tank Farm Continued Operations
note: use emissions for periodic evaporator ops
WORKER EXPOSURE- included in operations numbers
MODELING- see attached spread sheet titled Tank Farm Emissions From Current Operations
3.2.2 Retrieval - N/A
3.2.3 Separations - N/A

3.2.4 Treatment

-Remove excess DST liquids in evaporator (would require 5 years of continuous evaporator operations)

RELEASE CONDITIONS- see attached spread sheet titled Tank Farm Emissions from Current Operations

EMISSIONS - see attached spread sheet

WORKER EXPOSURE - staff years included in operations

MODELING- concentrations provided in spread sheet

Vitrification of Tank Wastes

RELEASE CONDITIONS

EMISSIONS- **chemical emissions provided in the attached ISV operating emissions table**

WORKER EXPOSURE- worker exposure to chem emission same as rad worker exposure

MODELING- see attached tables for release concentrations

3.2.5 Storage - N/A (no interim HLW storage)

No risk data

3.2.6 Disposal

-Disposal would occur in place following vitrification

No risk data, disposal is more a classification than an action.

2.2.7 Monitoring and Maintenance

-Monitoring activities would take place at vitrified tank farms prior to closure

RELEASE CONDITIONS- Assume none

EMISSIONS- Assume none

WORKER EXPORSURE- worker hours included in operations hours

MODELING- N/A

3.3 Post Remediation

3.3.1 Decontamination and Decommissioning

-D & D TFCFs and the vitrification equipment

WORKER EXPOSURE - rad worker hours included in operations hours

3.3.2 Closure

RELEASE CONDITIONS N/A

EMISSIONS N/A

WORKER EXPOSURE- rad worker exposure = 182 staff years

MODELING-N/A

3.3.3 Monitoring and Maintenance

-Monitor and maintenance activities would take place at the tank farms for 100 years following closure

WORKER EXPOSURE- 10,500 staff hours per year total from closure data package. Of that number 80% would be rad workers, resulting in 8,400 rad worker hours/year. The M&M phase is 119 years in duration. Resulting in a total rad worker hours estimate of 500 staff years.

4.0 IN SITU FILL AND CAP ALTERNATIVE (Radio frequency drying has been deleted)

4.1 Construction

4.1.1 Retrieval - N/A

4.1.2 Separations - N/A

4.1.3 Treatment

4.1.4 Storage - N/A (no interim HLW storage)

4.1.5 Disposal - N/A (no construction of a disposal facility)

Assume that 25% of the total construction hours (1.9E5) are rad zone work. The total rad worker hours are 24 staff years. Assume chemical exposure hours same as rad worker hours.

4.2 Operation

4.2.1 Continued Operations

Under continued operations there would be routine emissions from the tanks as identified in the attached Tank Farm Emissions From Current Operations spread sheet. There would be periodic operation of the 242A evaporator and the emissions from those operations are in the current operations spread sheet (use periodic operations numbers). The phase out of the routine tank emissions would occur as tank filling operations were completed. The operations phase out schedule identifies the number of tanks remaining under routine operations on an annual basis.

Rad worker person years = 12,740 for continued operations and include the evaporator operations.

4.2.2 Retrieval - N/A

4.2.3 Separations - N/A

4.2.4 Treatment

-Evaporate all excess DST liquids through the 242A evaporator

This would require 5 years (2000-2005) of continuous evaporator operation. Emissions data provided in attached spread sheet.

The person-years noted in the data request 290 for evaporator operations (Table D.50 pg D-99) would be the same for chemical exposures. I can't find where the 290 came from.

4.2.5 Storage- N/A (no interim HLW storage)

4.2.6 Disposal

-Disposal would occur in the tanks following filling operations

Risk = N/A

4.2.7 Monitoring and Maintenance - N/A (no operational phase monitoring of HLW product)

4.3 Post Remediation

4.3.1 Decontamination and Decommissioning

-D&D equipment

D&D rad worker hours included in the operations hours

4.3.2 Closure

-Construct Hanford barriers

-Grout fill all MUSTs and ancillary equipment

-Barriers to be built over all tank farms and MUSTs

RELEASE CONDITIONS-N/A

EMISSIONS- N/A

WORKER EXPOSURE - 183 person years,

MODELING- N/A

4.3.3 Monitoring and Maintenance

-Monitoring and maintenance activities would occur at the tank farms for 100 years following closure.

RELEASE CONDITIONS - N/A
EMISSIONS N/A
WORKER EXPOSURE -625 staff years
MODELING- N/A

5.0 STAGED IMPLEMENTATION - TBD

6.0 SELECTIVE RETRIEVAL

6.1 Construction

6.1.1 Retrieval

-Build retrieval and transfer system

Constrution releated emission releases would be area sources

Total construction estimate for retrieval is for 6,360 staff years. Assume 5% of that is rad work, or 318 staff years of rad work. The 5% estimate is to account for hot tie-ins to existing zone systems.

6.1.2 Separations

Radiological and Chemical exposure to construction personnel involved with constructing the Separations and Treatment facility would come from existing tanks. A clean site was assumed for construction so there are no radiological or hazardous chemical associated with construction of the separations or treatment facilities.

6.1.3 Treatment

Wastes left in tanks (107 tanks)

Rad workers =14 staff years (equal to 60% of the rad worker estimate for fill and cap)

Chemical exposure duration = 14 staff years

Emissions and concentrations from the existing tanks would be the source of exposure. These emissions are provided in the Tank Farm Emissions From current operations.

Retrieved wastes (70 tanks)

See 6.1.2

6.1.4 Storage

See 6.1.2

6.1.5 Disposal

See 6.1.2

6.2 Operations

6.2.1 Continued Operations

Continued operations emissions data for the tank farms and the 242-A evaporator is contained in the attached spreadsheet titled Tank Farm Emissions From Current Operations.

The phase out of current operations emissions as tanks are either retrieved or filled is contained in the attached continued operations phase out schedule.

Continued operations personnel requirements = 19,600 staff years (includes evaporator opeations)

6.2.2 Retrieval

Chemical releases and chemical exposures during retrieval. Assume non radiological air

emissions are 3 X the routine emissions from the tank being retrieved. Assume radiological air emissions due to retrieval operations are 50% of the Extensive Retrieval (Ex Situ Vitrification) alternative. Cs-137=.01 Ci, I-129 = .015 Ci, Sr-90= .0015 Ci.

6.2.3 Separations
Chemical emissions are 50% of the Extensive Retreival Ex Situ Vitrification alternative.
Worker exposure = 60% of Ext Retrieval Ex Situ Vit. : 8,100 staff years (includes separations and treatment)

6.2.4 Treatment
Wastes not retrieved (107 tanks)
-Evaporate pumpable DST liquids through the 242A evaporator (18 DSTs)
Requires 3 years of continuous evaporator operations. Emissions from the evaporator contained in the spread sheet titled Tank Farm Continued Operations.
Worker exposure for chemical exposures would be the same as the rad workers.
Chemical emissions are found in the fill and cap emissions spreadsheet.

Retrieved Wastes (70 tanks, 50% of total waste volume)
The non radiological chemical emissions during operations are 50% of the Extensive Retrieval Ex Situ Vit. The radiological emissions are 90% of the Extensive Retrieval Ex Situ Vitrification.

6.2.5 Storage
No chemical emissions.

6.2.6 Disposal
N/A
6.2.7 Monitoring and Maintenance
-Monitor and maintain approximately 850 stored HLW canisters.
Personnel requirements = 60 staff years for radiation workers

6.3 Post Remediation
6.3.1 Decontamination and Decommissioning
-D&D facilities

6.3.2 Closure
-Close tank farms

-Construct Hanford barriers (caps)
Radiation work = 244 staff years

6.3.3 Monitoring and Maintenance
Radiation work = 677 staff years

7.0 EXTENSIVE RETRIEVAL (EX SITU VITRIFICATION)
7.1 Construction
7.1.1 Retrieval
Radiation worker exposure: assume rad worker =5% of constuction= 60 staff years.

7.1.2 Separations
N/A
7.1.3 Treatment

N/A

7.1.4 Storage
-Construct HLW interim storage facility
-Storage pads for interim HLW Cask storage

7.1.5 Disposal
-Construct LAW disposal facility
-Vaults constructed throughout operational period
-Total of 46 vaults constructed below grade at 5,300 cu. meters per vault

7.2 Operation
7.2.1 Continued Operations
Continued operations emissions from the tank farms is included in the attached spreadsheets titled Tank Farm Emissions From Current Operations.
Personnel for continued operations = 19643 staff years
-Operating the 242A evaporator as a waste management activity
Evaporator emissions from periodic operations are included in the Tank Farm Emission From Current Operations spreadsheet.
7.2.2 Retrieval
-Retrieve wastes
Chemical emissions from any tank undergoing retrieval are 3 X the routine emissions reported in the current operations spreadsheet. Worker exposure to chemicals would be the same as the rad worker estimate.

7.2.3 Separations
Chemical emissions during separations are released out of the LLW vitrification plant stack.
Chemical exposure data is the same as the radiation worker

7.2.4 Treatment
Chemical emissions are released out of the LLW or the HLW vitrification plant stacks.
Chemical exposure data is the same as the radioation worker.

7.2.5 Storage
N/A

7.2.6 Disposal

7.2.7 Monitoring and Maintenance (monitoring of the HLW canisters prior to shipment to the repository)
Rad worker personnel = 60 staff years

7.3 Post Remediation
7.3.1 Decontamination and Decommissioning
-D&D facilities
-Entomb non-contaminated material
-Demolish and landfill contaminated facilities at LAW burial ground

7.3.2 Closure
Rad Worker Exposure = 277 staff years
chemical exposure would be the same, however chemical emissions should be minimal (equal to routine tank emissions at a worst case)

7.3.3 Monitoring and Maintenance
Chemical worker exposure would be the same as radiation worker except chemical emissions would be minimal during monitoring and maintenance.

8.0 NO SEPARATIONS (VITRIFICATION OR CALCINATION) SUBALTERNATIVE

8.1 Construction (vitrification same as calciation)
8.1.1 Retrieval
Rad worker exposure = 5% of construction hours = 60 staff years
8.1.2 Separations - N/A (no high-level/low-level separations would be made)

8.1.3 Treatment (vitrification same as calcination)
-Build support facilities
-Build one vitrification or calcination plant (all waste processed would be considered HLW)
-Build canister handling and storage facilities

8.1.4 Storage
-Construct an on-site interim storage facility to store the vitrified or calicned HLW

8.1.5 Disposal
-All waste retrieved (assumed to be 99%) would be disposed of at the proposed national HLW repository
-the storage area required for calcined HLW would be approximately 50% of the area required for vitrification. The monitoring personnel requirements are assumed to be equal.
8.2 Operation (calcination = vitrification)
8.2.1 Continued Operations
See spread sheet titled Tank Farm Emissions From Current Operations.
Worker Exposure (rad and chemical) = 11492 staff years
-Operating the 242A evaporator as a waste management activity
See spread sheet for Tank Farm Emissions.
8.2.2 Retrieval (calcination = vitrification)
-Retrieve wastes
same as other extensive retrieval alternatives

8.2.3 Separations - N/A (no separations would be done)

8.2.4 Treatment (calcination results in approximately 1/2 of the volume of HLW produced by vitrification)
Chemical emissions previously provided for the vitrification plant emissions
Worker exposure data for chemicals would be the same as the rad worker estimate.
Calcinaton data =release parameters equal vitrification, N0x emissions are 5 times greater for calcination. The radiological emissions are the same except for C-14 which is 812 Ci for calcination versus 5340 Ci for vitrification. This is over the operating life of the calcination plant.

8.2.5 Storage
-Store canisters of HLW on interim storage pads pending shipment to the proposed national HLW repository

8.2.6 Disposal -N/A (no on-site disposal)

8.2.7 Monitoring and Maintenance
-Monitor and maintain stored HLW canisters (calcination = vitrification)
Vitrification = 490 staff years rad worker; chemical exposure should be N/A
note: the calcination options has approx. 50% of the canisters, however the 490 staff years estimated for vitrification are assumed to be a minimum crew and thus would not be reduced for calcination.

8.3 Post Remediation
8.3.1 Decontamination and Decommissioning
-D&D facilities

8.3.2 Closure (calcination = vitrification)
Worker exposure = 215 staff years rad worker
8.3.3 Monitoring and Maintenance (calcination = vitrification)
Worker exposure = 593 staff years

9.0 EXTENSIVE SEPARATIONS SUBALTERNATIVE

9.1 Construction
9.1.1 Retrieval
Worker exposure = 60 staff years

9.2 Operation
9.2.1 Continued Operations
Emissions - see Tank Farm Emissions from Current Operations
Worker Exposure - 13,010 staff years
9.2.2 Retrieval
Scenario is the same as other extensive retrieval alternatives
9.2.3 Separations
Chemical emissions -
Worker exposure to chemical is the same as rad worker exposure
9.2.4 Treatment (treatment operations similar to Extensive Retrieval (Ex Situ Vitrification))

9.2.5 Storage
Chemical emissions - N/A
Chemical exposure - N/A

9.2.6 Disposal
N/A

9.2.7 Monitoring and Maintenance

Chemical emissions and chemical exposure - N/A

9.3 Post Remediation

9.3.1 Decontamination and Decommissioning
-D & D pretreatment facilities, vitrification facilities, HLW interim storage
-D & D equipment

9.3.2 Closure
-Close tank farms
-Construct surface barriers
Worker exposure - 281 staff years.

9.3.3 Monitoring and Maintenance
Worker exposure - 820 staff years

10.0 CESIUM / STRONTIUM CAPSULES

10.1 Construction

No Action (continued storage of capsules at WESF for 10 years)
-No construction

Dry-Well Disposal
-Construct dry well storage site
-Storage site to be approx 38,000 square meters

Overpack and Ship
-Overpack in WESF

Vitrification with Tank Waste
-Build or modify a cell in the HLW vitrification facility to cutup, remove capsule contents, and chemically treat if required and feed into the HLW vitrification feed stream.
-Cell to be a part of the HLW vitrification facility.

10.2 Operation

No Action (continued storage of the capsules in WESF)
Radiation workers 761 staff years. The average annual exposure for WESF rad worker is 6.2 mrem/person. The top 5% got 40.4 mrem/year and 95% of the people got 4.4mrem/person
Radiological emissions are in the attached spreadsheet titled WESF Operating Emissions.
Assume the chemical emissions and exposure at WESF are negligable.
Release parameters are included in the emissions spreadsheet.

Dry-Well Disposal

Chemical emissions and chemical exposures during dry-well disposal are assumed negligable.

Overpack and Ship

Chemical emissions and chemical exposures during Overpack and Ship are assumed negligable.

Vitrification
Chemical emissions and chemical exposures during Vitrify with Tank Wastes are assumed negligable.

10.3 Post Remediation

No Action

N/A

Dry-Well Disposal

Radiation worker = 440 staff years

Overpack and Ship

N/A

Vitrification with Tank Wastes

N/A

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TITLE: SOURCE TERM AND RISK CALCULATION FOR WORKER EXPOSURE

Hours Per Year = 2000

Alternative	Dose	1.0 No Action					2.0 Long Term Management			
	mrem/yr	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs
Construction										
Transfer Lines										
Rad Zone	14	na	na	na	na		2.73E+05	137	2	7.66E-04
Non Rad Zone	0	na	na	na	na		3.82E+04	19	0	1.07E-04
Continued Operations										
Rad Zone	14	na	na	na	na		3.75E+05	188	3	1.05E-03
Non Rad Zone	0	na	na	na	na		7.13E+06	3,563	0	0.00E+00
Retrieval										
Rad Zone	14	na	na	na	na		7.84E+05	392	5	2.19E-03
Non Rad Zone	0	na	na	na	na		1.49E+07	7,445	0	0.00E+00
Treatment Facilities										
Rad Zone	14	na	na	na	na		na	na	na	na
Non Rad Zone	0	na	na	na	na		na	na	na	na
									10	4.11e-03
Operation										
Continued Operations										
- Monitoring SSTs, DSTs, and MUSTs										
Tank farm Rad Zone	14	1.00E+08	50000	700	2.80E-01	b,l	1.00E+08	50,000	700	2.80E-01
Non Rad Zone	0	?	?	?	?	b,l	?	?	?	?
-Operate 242A Evaporator										
Rad Zone NEX	200	1.28E+06	640	128	5.12E-02	l,m	1.28E+06	640	128	5.12E-02
Rad Zone EX	0	3.00E+05	150	0	0.00E+00	l,m	3.00E+05	150	0	0.00E+00
Non Rad Zone	0	1.50E+06	750	0	0.00E+00	l,m	1.50E+06	750	0	0.00E+00
Exempt				828	3.31e-01				828	3.31e-
Retrieval										
Rad Zone Nonexempt	200	na	na	na	na		2.87E+06	1,435	287	1.15E-01
Rad Zone Exempt	200	na	na	na	na		7.73E+05	386	77	3.09E-02
Non Rad Zone	0	na	na	na	na		2.43E+06	1,214	0	0.00E+00
									364	1.46e-
Evaporate DSTs										
Rad EX	0	na	na	na	na		1.17E+06	585	0	0.00E+00
Rad NEX	200	na	na	na	na		2.92E+05	146	29	1.17E-02
Non Rad	0	na	na	na	na		1.02E+06	509	0	0.00E+00
									29	1.17e-
Separate and Treat Waste										
Rad EX	200	na	na	na	na		na	na	na	na
Rad NEX	0	na	na	na	na		na	na	na	na
Bargaining Unit	200	na	na	na	na		na	na	na	na
Non Rad	0	na	na	na	na		na	na	na	na
Process Capsules										
Rad	200	na	na	na	na		na	na	na	na
Non Rad	0	na	na	na	na		na	na	na	na
Storage and Disposal										
Rad	200	na	na	na	na		na	na	na	na
Non Rad	0	na	na	na	na		na	na	na	na
Monitoring and Maintenance										
Rad	14	na	na	na	na		na	na	na	na
Non Rad	0	na	na	na	na		na	na	na	na
Post Remediation										
Closure										
Rad Zone	14	na	na	na	na		na	na	na	na
Non Rad Zone	0	na	na	na	na		na	na	na	na
Monitoring of Final Waste Form										
Rad Zone	14	na	na	na	na		na	na	na	na
Non Rad Zone	0	na	na	na	na		na	na	na	na
Total			1.03E+08	5.15E+04	8.28E+02	3.31E-01		1.35E+08	6.76E+04	1.23E+03	4.93E-01

na is not applicable

References

(a) Henderson, Lain "Project W-314 Waste Transfer System Upgrades - Engineering Data" Internal Memo from Rick Boes, WHC, September 14, 1995. Assumed 2000 hrs

(b) Henderson, Lain "Response to Engineering Data Request" Personal Communication 9 September 26, 1995

(c) from Tables 3-2 and 3-3 of Hedeburg 1994, Rev. 0. Worker hours adjusted to 2000 hrs per year.

(d) from Tables 4-2, 4-3, 4-5, and 4-24 of McLamore 1992, Rev. 0. Worker hours adjusted to 2000 hours per year.

(e) Assumed 2% of construction hours are rad zone work.

(f) one value is 50% of the total for the Extensive Retrieval Alternative

(g) one value is 50% of the total for the In Situ Fill and Cap Alternative

(h) from Tables 3-1 and 3-3 of Hedeburg 1994, Rev. 0 and Appendix A. Worker hours adjusted to 2000 hours per year.

(i) from Tables 6-1, 6-2, and 6-14 of Lagoy 1994, Rev. 0. Worker hours adjusted to 2000 hours per year.

(j) from Tables 3-1 and 3-3 of Garson et al. 1992, Rev. 0. Worker hours adjusted to 2000 hours per year.

(k) from Tables 4-2 and 4-3 of Nankervis 1992, Rev. 0. Worker hours adjusted to 2000 hours per year.

(l) Henderson, Lain "Loaded Upscales" Internal Memo and Utility Calculations.

(m) from Tables 3-2 and 3-21 of Wang 1992, Rev. 0. See footnotes to Table 3-21 for dose assumptions. Worker hours adjusted to 2000 hours per year.

(n) included in total Waste

(o) assume half of the labor hours required for the Long Term Management Alternative since evaporate for 3 years instead.

(p) assume the labor hours are 20% less for the cold-spoon alternative

In Situ Vit

Ex Situ / In Situ Combination

Ref.	3.0 Minimal Retrieval In Situ Vitrification					4.0 In Situ Fill and Cap					16.0 Selective Retrieval					
	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Wor Hor
a	2.73E+05	137	2	7.66E-04	a	2.73E+05	137	2	7.66E-04	a	2.73E+05	137	2	7.66E-04	a	2.73E
a	3.82E+04	19	0	0.00E+00	a	3.82E+04	19	0	0.00E+00	a	3.82E+04	19	0	0.00E+00	a	3.82E
b	na	na	na	na		na	na	na	na		na	na	na	na		n
b	na	na	na	na		na	na	na	na		na	na	na	na		n
c	na	na	na	na		na	na	na	na		7.98E+05	399	6	2.23E-03	c,f	1.33E
c	na	na	na	na		na	na	na	na		1.52E+07	7,581	0	0.00E+00	c,f	2.53E
	1.12E+07	5,595	78	3.13E-02	d,e	4.80E+04	24	0	1.34E-04	d,e	3.15E+04	16	0	8.81E-05	f,g	0
	3.36E+07	16,785	0	0.00E+00	d,e	1.44E+05	72	0	0.00E+00	d,e	2.66E+07	13,292	0	0.00E+00	f,g	4.00E
			80	3.21e-02				2	9.00e-04				8	3.08e-03		
b,j	2.12E+07	10,610	149	5.94E-02	b,j	2.42E+07	12,100	169	6.78E-02	b,j	3.79E+07	18,960	265	1.06E-01	b,j	3.80E
b,j	?	?	?	?	b,j	?	?	?	?	b,j	?	?	?	?	b,j	?
l,m	1.28E+06	640	128	5.12E-02	l,m	1.28E+06	640	128	5.12E-02	l,m	1.28E+06	640	128	5.12E-02	l,m	1.28E
l,m	3.00E+05	150	0	0.00E+00	l,m	3.00E+05	150	0	0.00E+00	l,m	3.00E+05	150	0	0.00E+00	l,m	3.00E
l,m	1.50E+06	750	0	0.00E+00	l,m	1.50E+06	750	0	0.00E+00	l,m	1.50E+06	750	0	0.00E+00	l,m	1.50E
			277	1.11e-01				297	1.19e-01				343	1.37e-01		
c	na	na	na	na		na	na	na	na		2.25E+07	11,258	2252	9.01E-01	c,f	3.75E
c	na	na	na	na		na	na	na	na		3.97E+06	1,987	397	1.59E-01	c,f	6.62E
c	na	na	na	na		na	na	na	na		1.66E+07	8,278	0	0.00E+00	c,f	2.76E
			0	0.00E+00	per J. Yoder								2649	1.06e+00		
m	na	na	na	na		5.85E+05	293	0	0.00E+00	m,o	3.51E+05	176	0	0.00E+00	g	n
m	na	na	na	na	n	1.46E+05	73	15	5.84E-03	m,o	8.76E+04	44	9	3.50E-03	g	n
m	na	na	na	na	n	5.09E+05	255	0	0.00E+00	m,o	3.05E+05	153	0	0.00E+00	g	n
			15	5.84e-03				15	5.84e-03				9	3.50e-03		
	3.97E+06	1,987	397	1.59E-01	d	5.23E+05	262	52	2.09E-02	d	1.84E+07	9,202	1840	7.36E-01	th	2.98E
	1.88E+06	938	0	0.00E+00	d	5.23E+05	262	0	0.00E+00	d	5.23E+05	262	0	0.00E+00	th	0
	7.95E+06	3,974	795	3.18E-01	d	1.55E+06	773	155	6.18E-02	d	1.55E+06	773	155	6.18E-02	th	0
	3.97E+06	1,987	0	0.00E+00	d	6.50E+05	325	0	0.00E+00	d	3.17E+06	1,583	0	0.00E+00	th	4.19E
			1192	4.77e-01				207	8.27e-02				1995	7.98e-01		
	na	na	na	na		na	na	na	na		na	na	na	na		n
	na	na	na	na		na	na	na	na		na	na	na	na		n
	na	na	na	na		na	na	na	na		na	na	na	na		n
	na	na	na	na		na	na	na	na		na	na	na	na		n
	na	na	na	na		na	na	na	na		120,000	60	1	3.36E-04	b	1.20E
	na	na	na	na		na	na	na	na		?	?	?	?	b	?
													1	3.36e-04		
	3.64E+05	182	3	1.02E-03	b	3.66E+05	183	3	1.02E-03	b	4.88E+05	244	3	1.37E-03	b	5.54E
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E
	1.00E+06	500	7	2.80E-03	b	1.25E+06	625	9	3.50E-03	b	1.35E+06	677	9	3.79E-03	b	1.35E
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E
	8.85E+07	4.43E+04	1.56E+03	6.23E-01		3.39E+07	1.69E+04	5.32E+02	2.13E-01		1.53E+08	7.66E+04	5.07E+03	2.03E+00		2.16E
			10	3.82e-03				12	4.52e-03				12	5.16e-03		

Ex Site Intermediate Separations

10/16/95

Ex Site No Separations

Ex Site Extensive Separations

7.0 Extensive Retrieval (Ex Situ VR) Alternative				8.0 No Separations Alternative					9.0 Extensive Separations Alternative						
Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Dose	Worker Hours
137	2	7.66E-04	a	2.73E+05	137	2	7.66E-04	a	2.73E+05	137	2	7.66E-04	a		na
19	0	1.07E-04	a	3.82E+04	19	0	0.00E+00	a	3.82E+04	19	0	0.00E+00	a		na
na	na	na		na	na	na	na		na	na	na	na			na
na	na	na		na	na	na	na		na	na	na	na			na
665	9	3.72E-03	c	1.33E+06	665	9	3.72E-03	c	1.33E+06	665	9	3.72E-03	c		na
12,635	0	0.00E+00	c	2.53E+07	12,635	0	0.00E+00	c	2.53E+07	12,635	0	0.00E+00	c		na
0	0	0.00E+00	h	0	0	0	0.00E+00	i	0	0	0	0.00E+00	i	14	na
20,000	0	0.00E+00	h	3.27E+07	18,030	0	0.00E+00	i	5.74E+07	31,675	0	0.00E+00	i	0	na
	11	4.59e-03				11	4.49e-03				11	4.49e-03			
19,003	266	1.06E-01	b,l	2.17E+07	10,852	152	6.08E-02	b,l	2.47E+07	12,370	173	6.93E-02	b,l		na
?	?	?	b,l	?	?	?	?	b,l	?	?	?	?	b,l		na
640	128	5.12E-02	l,m	1.28E+06	640	128	5.12E-02	l,m	1.28E+06	640	128	5.12E-02	l,m		na
150	0	0.00E+00	l,m	3.00E+05	150	0	0.00E+00	l,m	3.00E+05	150	0	0.00E+00	l,m		na
750	0	0.00E+00	l,m	1.50E+06	750	0	0.00E+00	l,m	1.50E+06	750	0	0.00E+00	l,m		na
	384	1.57e-01				280	1.12e-01				301	1.21e-01			
18,764	3753	1.50E+00	c	3.64E+07	18,212	3642	1.46E+00	c	3.75E+07	18,764	3753	1.50E+00	c		na
3,311	662	2.65E-01	c	5.52E+06	2,759	552	2.21E-01	c	6.62E+06	3,311	662	2.65E-01	c		na
13,797	0	0.00E+00	c	2.76E+07	13,797	0	0.00E+00	c	2.76E+07	13,797	0	0.00E+00	c		na
	4415	1.77e+00				4194	1.68e+00				4415	1.77e+00			
na	na	na		na	na	na	na		na	na	na	na			na
na	na	na		na	na	na	na		na	na	na	na			na
na	na	na		na	na	na	na		na	na	na	na			na
14,901	2980	1.19E+00	h	1.52E+06	759	152	6.07E-02	i	9.38E+06	4,691	938	3.75E-01	i		na
0	0	0.00E+00	h	0	0	0	0.00E+00	i	0	0	0	0.00E+00	i		na
0	0	0.00E+00	h	2.26E+06	1,130	226	9.04E-02	i	2.32E+07	11,589	2318	9.27E-01	i		na
2,097	0	0.00E+00	h	4.15E+06	2,075	0	0.00E+00	i	3.64E+06	1,821	0	0.00E+00			na
	2980	1.19e+00				378	1.51e-01				3256	1.30e+00			
na	na	na		na	na	na	na		na	na	na	na		6.2	na
na	na	na		na	na	na	na		na	na	na	na		0	na
na	na	na		na	na	na	na		na	na	na	na		6.2	1.52E+06
na	na	na		na	na	na	na		na	na	na	na		0	4.13E+05
60	1	3.36E-04	b	1.08E+06	540	8	3.02E-03	b,p	1.20E+05	60	1	3.36E-04	b		na
?	?	?	b	1.20E+05	60	0	0.00E+00	b,p	?	?	?	?	b		na
	1	3.36e-04				8	3.02-03				1	3.36e-04			
277	4	1.55E-03	b	4.30E+05	215	3	1.20E-03	b	5.62E+05	281	4	1.57E-03	b		na
0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b		na
677	9	3.79E-03	b	1.19E+06	593	8	3.32E-03	b	1.64E+06	820	11	4.59E-03	b		na
0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b	0.00E+00	0	0	0.00E+00	b		na
1.08E+05	7.81E+03	3.13E+00		1.65E+08	8.40E+04	4.88E+03	1.95E+00		2.22E+08	1.14E+05	8.00E+03	3.20E+00			1.94E+06
	13	5.34e-03				11	4.52e-03				15	6.16e-03			

10.0 Capsule-No Action Alternative				11. Capsule-Onsite Storage					12.0 Capsule-Overpack and Ship					13.0 Caps… with Tan…		
…erson Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Person Rem	Risk LCFs	Ref.	Worker Hours	Person Year	Pers… Re…
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		0.00E+00	0	0	0.00E+00	k	0.00E+00	0	0	0.00E+00	k	na	na	na
na	na	na		4.20E+05	210	0	0.00E+00	k	2.00E+05	100	0	0.00E+00	k	na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
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na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
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na	na	na		na	na	na	na		na	na	na	na		na	na	na
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na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		2.80E+05	140	1	3.47E-04	k	1.54E+05	77	0	1.91E-04	k	na	na	na
na	na	na		1.08E+05	54	0	0.00E+00	k	6.80E+04	·34	0	0.00E+00	k	na	na	na
						1	3.47e-04					1.91e-04				
761	5	1.89E-03	b	1.40E+06	700	4	1.74E-03	k	1.30E+05	65	0	1.61E-04	k	na	na	na
207	0	0.00E+00	b	3.80E+05	190	0	0.00E+00	k	5.00E+04	25	0	0.00E+00	k	na	na	na
	5	1.89e-03				4	1.74e-03					1.61e-04				
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		na	na	na	na		na	na	na	na		na	na	na
na	na	na		8.80E+05	440	6	2.46E-03	b	na	na	na	na		na	na	na
na	na	na		?	?	?	?	b	na	na	na	na		na	na	na
…E+02	4.72E+00	1.89E-03		3.47E+06	1.73E+03	1.14E+01	4.55E-03		6.02E+05	3.01E+02	8.80E-01	3.52E-04		0.00E+00	0.00E+00	0.00E…
						6	2.46e-03									

Risk LCFs	Ref.
na	
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0.00E+00

Request Number 075

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Michael R. Harker September 14, 1995

Phone Number: 736-0601 Fax Number: 736-7504

Requested Information: Please refer to attachment for requested data
Need Date: ASAP

Response: SEE ATTACHED

Data Source/Accuracy:

Prepared By: _____ Date Sent/Faxed: _____

Concurrence: Marc C. Nelson
Marc Nelson - Deputy Project Manager

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Modifications To Transportation Calculations (Result of alternative Changes & Adding Closure)

ORIGINATOR Colin Henderson DATE ~~9/19/95~~ 10/23/95

REVISION NO. 0

OBJECTIVE Calculate the number of trips required for each of the alternatives during Closure and modify number of trips due to changes in alternatives

METHODOLOGY Use basic assumptions from WHC data packages

ASSUMPTIONS noted.

(Continue on another sheet if necessary)

SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

- total km_____

- Storage - N/A
- Disposal - N/A
- Closure

Assume: Barrier Mat'l Contained in est. for tank farms.

Minimal Retrieval in situ vit.

- Construction - grout fill and construct Hanford barrier over all MUSTs located outside tank farm areas, construct Hanford barrier over each tank farm
  - Truck - Onsite
    - Borrow
      - trips/year 43
      - km/trip 10 Round trip
      - years 18
      - total km 7740
  - Rail - Onsite - N/A
  - Truck - Offsite
    - Concrete
      - trips/year 9
      - km/trip 140 round trip
      - years 18
      - total km 22,700
    - Raw Material
      - trips/year_____
      - km/trip_____
      - years_____
      - total km_____
    - Equipment
      - trips/year_____
      - km/trip_____
      - years_____
      - total km_____
    - Miscellaneous
      - trips/year_____
      - km/trip_____
      - years_____
      - total km_____
  - Rail - Offsite
    - Concrete
      - trips/year_____
      - km/trip_____
      - years_____
      - total km_____
    - Raw Material
      - trips/year_____

N/A

Borrow - Pit 30

$\frac{4700\ m^3}{6.1\ m^3/Load} = 770$ trips.

Cement

$\frac{2000\ m^3}{16\ cu\ yd \times \frac{.77\ m^3}{yd^3}} = 160$ trip

Closure schedule = 18 yrs. 2016/2033

- Approximately 35% of the 40 MUSTs are outside or away from the tank farms. (using the graphic we put in App A)

- Closure data pkg addresses 28 MUSTs and ancillary equipment (valve pits, diversion boxes, piping)

$\frac{40}{28} = 1.4$

Concrete = 13,700 m³ (1.4) = 19,180 m³

outside tank farms = 35% × 19,180 m³

= 6,713 m³ Concrete

Concrete = 30% Cement = 2000 m³

70% Sand & Gravel = 4700 m³

Fill & Cap

Construction - grout fill all MUSTs and ancillary equipment, Hanford barrier

- Truck - Onsite
  - * Borrow
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
- Rail - Onsite - N/A
- Truck - Offsite
  - * Concrete
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
  - * Raw Material
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
  - * Equipment
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
  - * Miscellaneous
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____ N/A
- Rail - Offsite
  - * Concrete
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
  - * Raw Material
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - • total km_____
  - * Equipment
    - + trips/year_____

19,180 m³ Concrete

Cement = 5700 m³

Sand/Gravel = 13,400 m³

Trips

Cement = 5700 m³ / 12.3 m³/load = 463

Sand/Gravel = 2200 trips

Schedule = 18 yrs

2016/2033

Selective Retrieval

Someone fill with Gravel

- total km_____

Closure

- Construction - grout MUSTs and ancillary equipment, fill empty tanks, Hanford barrier
  - Truck - Onsite
    - Borrow
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
  - Rail - Onsite - N/A
  - Truck - Offsite
    - Concrete
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
    - Raw Material
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
    - Equipment
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
    - Miscellaneous
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
  - Rail - Offsite
    - Concrete
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____
    - Raw Material
      - trips/year_____
      - km/trip_____
      - years_____
        - total km_____

- Rail - Onsite
    - trips/year_____
    - km/trip_____
    - years_____
        - total km_____
- Truck - Offsite - N/A
- Rail - Offsite - N/A

- Transport HLW to Yucca Mountain
    - Truck - Onsite - N/A
    - Rail - Onsite
    - Truck - Offsite - N/A
        - trips/year_____
        - km/trip_____
        - years_____
            - total km_____
    - Rail - Offsite - N/A
        - trips/year_____
        - km/trip_____
        - years_____
            - total km_____

Extensive Retrieval (at Site Vit)

- Closure
    - Construction - grout MUSTs and ancillary equipment, fill empty tanks, Hanford barrier
        - Truck - Onsite
            - Borrow
                - trips/year_____
                - km/trip_____
                - years_____
                - total km_____
        - Rail - Onsite - N/A
        - Truck - Offsite
            - Concrete
                - trips/year_____
                - km/trip_____
                - years_____
                - total km_____
            - Raw Material
                - trips/year_____
                - km/trip_____
                - years_____
                - total km_____
            - Equipment
                - trips/year_____

Same as fill & Cap.

- Truck - Offsite - N/A
  - + trips/year_____
  - + km/trip_____
  - + years_____
    - total km_____
- Rail - Offsite - N/A
  - + trips/year_____
  - + km/trip_____
  - + years_____
    - total km_____

No Separations
Vitrification

Closure

- Construction - grout MUSTs and ancillary equipment, fill empty tanks, Hanford barrier

Same as fill & Cap

- Truck - Onsite
  - * Borrow
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - total km_____
- Rail - Onsite - N/A
- Truck - Offsite
  - * Concrete
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - total km_____
  - * Raw Material
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - total km_____
  - * Equipment
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - total km_____
  - * Miscellaneous
    - + trips/year_____
    - + km/trip_____
    - + years_____
      - total km_____
- Rail - Offsite
  - * Concrete

NO SEPARATIONS (CALCINATION) SUBALTERNATIVE

- Transportation Activities
  - Retrieval
    - Waste Transport
      - Truck
        - MUSTs
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
        - Tank Residual
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
      - Rail - N/A
    - Construction - retrieval and transfer system
      - Truck - Onsite
        - Borrow
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
      - Rail - Onsite - N/A
      - Truck - Offsite (construction materials being transported from offsite)
        - Concrete
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
        - Raw Material
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
        - Equipment
          - trips/year_____
          - km/trip_____
          - years_____
            - total km_____
        - Miscellaneous

the retrieval portion of this alt. is identical to No Sep. Vitrificati

+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

■ Rail - Offsite
* Concrete
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____
* Raw Material
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____
* Equipment
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____
* Miscellaneous
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

o Pretreatment - N/A
o Treatment - Ex Situ Vitrification —— Calcination Const. Identical to Vitrification with Respect to transportation Requirements
- Construction - support facilities, calcination plant, canister handling and storage facility
■ Truck - Onsite
* Borrow
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____
■ Rail - Onsite - N/A
■ Truck - Offsite (construction materials being transported from offsite)
* Concrete
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

* Raw Material
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____
* Equipment
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____
* Miscellaneous
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____

■ Rail - Offsite
* Concrete
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____
* Raw Material
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____
* Equipment
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____
* Miscellaneous
  + trips/year_____
  + km/trip_____
  + years_____
    • total km_____

- Processing
■ Truck - Onsite - N/A
■ Rail - Onsite - N/A
■ Truck - Offsite
* Chemicals
  + trips/year 500
  + km/trip 800

Note: No Sep Vit
Was 50 trips/yr
Now (Rev0) 500 trips/yr

+ years 14
• total km 5.6E6

* Miscellaneous
+ trips/year
+ km/trip
+ years
• total km

■ Rail - Offsite
* Chemicals
+ trips/year
+ km/trip
+ years
• total km

Combined

* Miscellaneous
+ trips/year 50
+ km/trip 800
+ years 14
• total km 5.6E5

o Storage - HLW interim storage facility
- Construction - interim storage facility for calcined HLW
■ Truck - Onsite
* Borrow
+ trips/year
+ km/trip
+ years
• total km

■ Rail - Onsite - N/A
■ Truck - Offsite
* Concrete
+ trips/year
+ km/trip
+ years
• total km

* Raw Material
+ trips/year
+ km/trip
+ years
• total km

* Equipment
+ trips/year
+ km/trip
+ years
• total km

Recognize that requirements for interim HLW storage for Calcinate are ~ 1/2 of Vitrification. This info is folded into facility Construction.

The change due to smaller storage pads would be a small % of the total Concrete required for the treatment facilities. Assume equal.

        * Miscellaneous
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
    ■ Rail - Offsite
        * Concrete
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Raw Material
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Equipment
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Miscellaneous
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
- Transport HLW cask to storage
    ■ Truck - Onsite
        + trips/year 736
        + km/trip 1 Km
        + years 14
            • total km 10,304
    ■ Rail - Onsite
        + trips/year N/A
        + km/trip
        + years
            • total km_____
    ■ Truck - Offsite - N/A
    ■ Rail - Offsite - N/A

o Disposal - N/A
- Transport HLW to Yucca Mountain
    ■ Truck - Onsite - N/A
    ■ Rail - Onsite

- Truck - Offsite - N/A
  - trips/year_____
  - km/trip_____ N/A
  - years_____
    - total km_____
- Rail - Offsite - N/A
  - trips/~~year~~ 1030
  - km/trip 2.93E3
  - ~~years~~_____
    - total km 3.02E6

- Closure
  - Construction - grout MUSTs and ancillary equipment, fill empty tanks, Hanford barrier

    Same as fill & Cap.
    - Truck - Onsite
      - Borrow
        - trips/year_____
        - km/trip_____
        - years_____
          - total km_____
    - Rail - Onsite - N/A
    - Truck - Offsite
      - Concrete
        - trips/year_____
        - km/trip_____
        - years_____
          - total km_____
      - Raw Material
        - trips/year_____
        - km/trip_____
        - years_____
          - total km_____
      - Equipment
        - trips/year_____
        - km/trip_____
        - years_____
          - total km_____
      - Miscellaneous
        - trips/year_____
        - km/trip_____
        - years_____
          - total km_____
    - Rail - Offsite
      - Concrete

+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

* Raw Material
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

* Equipment
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

* Miscellaneous
+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

- Employee Traffic _____ Same as No Sep. (Vt).
  - Continued operations
    - Construction person-years_____
    - Operations person-years_____
    - M&M person-years_____
  - Retrieval
    - Construction person-years_____
    - Operations person-years_____
    - M&M person-years_____
  - Pretreatment - N/A
  - Treatment
    - Construction person-years_____
    - Operations person-years_____
    - M&M person-years_____
  - Storage
    - Construction person-years_____
    - Operations person-years_____
    - M&M person-years_____
  - Disposal - N/A
  - Closure
    - Construction person-years_____
    - Operations person-years_____
    - M&M person-years_____

- Schedule - (month and year started/month and year completed)

- Construction
- Operation
- M&M
- HLW disposal
- Closure

Schedule Identical to No Sep Vit.

+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

- Truck - Offsite - N/A
- Rail - Offsite - N/A

Transport HLW to Yucca Mountain

- Truck - Onsite - N/A
- Rail - Onsite
- Truck - Offsite - N/A
  + trips/year_____
  + km/trip_____
  + years_____
  • total km_____
- Rail - Offsite - N/A
  + trips/year_____
  + km/trip_____
  + years_____
  • total km_____

Extension Separation

Dry Well Storage

o Closure

- Construction - grout MUSTs and ancillary equipment, fill empty tanks, Hanford barrier — Same as fill & Cap.
  - Truck - Onsite
    * Borrow
      + trips/year_____
      + km/trip_____
      + years_____
      • total km_____
  - Rail - Onsite - N/A
  - Truck - Offsite
    * Concrete
      + trips/year_____
      + km/trip_____
      + years_____
      • total km_____
    * Raw Material
      + trips/year_____
      + km/trip_____
      + years_____
      • total km_____
    * Equipment
      + trips/year_____
      + km/trip_____

NO ACTION (CAPSULES) ALTERNATIVE

- Transportation Activities
  - Routine maintenance
    - Truck
      - trips/year 1
      - km/trip
      - years
        - total km
  - Closure
    - Construction N/A
      - Truck - Onsite
        - Borrow
          - trips/year
          - km/trip
          - years
            - total km
      - Rail - Onsite - N/A
      - Truck - Offsite
        - Concrete
          - trips/year
          - km/trip
          - years
            - total km
        - Raw Material
          - trips/year
          - km/trip
          - years
            - total km
        - Equipment
          - trips/year
          - km/trip
          - years
            - total km
        - Miscellaneous
          - trips/year
          - km/trip
          - years
            - total km
      - Rail - Offsite
        - Concrete
          - trips/year
          - km/trip

        - years_____
            - total km_____
    - Raw Material
        - trips/year_____
        - km/trip_____
        - years_____
            - total km_____
    - Equipment
        - trips/year_____
        - km/trip_____
        - years_____
            - total km_____
    - Miscellaneous
        - trips/year_____
        - km/trip_____
        - years_____
            - total km_____
- Employee Traffic
    - operations person-years 1000
    - M&M person-years N/A
- Schedule - (month and year started/month and year completed)
    - Operation 1997 - 2006
    - M&M N/A
    - Closure N/A

Dry-well Storage

- * years_____
  - + total km_____
- Raw Material
  - * trips/year_____
  - * km/trip_____
  - * years_____
    - + total km_____
- Equipment
  - * trips/year_____
  - * km/trip_____
  - * years_____
    - + total km_____
- Miscellaneous
  - * trips/year_____
  - * km/trip_____
  - * years_____
    - + total km_____

- Closure
  - Construction
    - Truck - Onsite
      - * Borrow
        - + trips/year_____
        - + km/trip_____
        - + years_____
          - • total km_____
    - Rail - Onsite - N/A
    - Truck - Offsite
      - * Concrete
        - + trips/year N/A
        - + km/trip_____
        - + years_____
          - • total km_____
      - * Raw Material
        - + trips/year N/A
        - + km/trip_____
        - + years_____
          - • total km_____
      - * Equipment
        - + trips/year N/A.
        - + km/trip_____
        - + years_____
          - • total km_____
      - * Miscellaneous

+ trips/year 224
+ km/trip 800
+ years
• total km 179000

- Rail - Offsite
  * Concrete
    + trips/year N/A
    + km/trip
    + years
    • total km
  * Raw Material
    + trips/year
    + km/trip
    + years
    • total km
  * Equipment
    + trips/year
    + km/trip
    + years
    • total km
  * Miscellaneous
    + trips/year
    + km/trip
    + years
    • total km

- Employee Traffic
  - Construction (including closure) person-years
  - Operations person-years
  - M&M person-years

- Schedule - (month and year started/month and year completed)
  - Construction
  - Operation
  - M&M
  - Closure 2029 – 2030

        * years_____
            + total km_____
    - Raw Material
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Equipment
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Miscellaneous
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____

Over pack of Ship

- Closure
    - Construction
    - Truck - Onsite
        * Borrow
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
    - Rail - Onsite - N/A
    - Truck - Offsite
        * Concrete
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Raw Material
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Equipment
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
        * Miscellaneous

Out of Scope.

+ trips/year_____
+ km/trip_____
+ years_____
• total km_____

- Rail - Offsite
  * Concrete
    + trips/year_____
    + km/trip_____
    + years_____
    • total km_____
  * Raw Material
    + trips/year_____
    + km/trip_____
    + years_____
    • total km_____
  * Equipment
    + trips/year_____
    + km/trip_____
    + years_____
    • total km_____
  * Miscellaneous
    + trips/year_____
    + km/trip_____
    + years_____
    • total km_____

- Employee Traffic
  - Construction (including closure) person-years_____
  - Operations person-years_____
  - M&M person-years_____

- Schedule - (month and year started/month and year completed)
  - Construction_____
  - Operation_____
  - M&M_____
  - Closure_____

VITRIFY WITH TANK WASTE ALTERNATIVE

- Transportation Activities
  - Capsule Transport
    - WESF to ~~Interim storage~~ Vit facility.
      - Truck
        - trips/~~year~~ 300
        - km/trip 4 Km
        - years –
          - total km 1200 Km.
      - Rail - N/A
    - Interim storage to vitrification facility
      - Truck
        - trips/year N/A
        - km/trip
        - years
          - total km
      - Rail - N/A
    - Capsule containers from vitrification facility to LLW burial ground
      - Truck
        - trips/year 12
        - km/trip 18 Km
        - years 14
          - total km 3024
      - Rail - N/A

WAG.

A Buss cask holds ~~up~~ between 1 and 16 capsules depending on heat load

Assume an ave. of 8 capsule

241 trips. Round to 300 trips

  - Construction - modify WESF for overpacking, modify cell in HLW vitrification facility to remove capsule content.
    - Truck - Onsite
      - Borrow
        - trips/year
        - km/trip
        - years
          - total km
    - Rail - Onsite - N/A
    - Truck - Offsite (construction materials being transported from offsite)
      - Concrete
        - trips/year
        - km/trip
        - years
          - total km
      - Raw Material
        - trips/year
        - km/trip

        * years_____
            + total km_____
    - Equipment
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Miscellaneous
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
- Rail - Offsite
    - Concrete
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Raw Material
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Equipment
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____
    - Miscellaneous
        * trips/year_____
        * km/trip_____
        * years_____
            + total km_____

o Closure
- Construction
    - Truck - Onsite N/A
        * Borrow
            + trips/year_____
            + km/trip_____
            + years_____
                • total km_____
    - Rail - Onsite - N/A
    - Truck - Offsite

- Concrete
  - trips/year_____
  - km/trip_____
  - years_____
    - total km_____
- Raw Material
  - trips/year_____
  - km/trip_____
  - years_____
    - total km_____
- Equipment
  - trips/year_____
  - km/trip_____
  - years_____
    - total km_____
- Miscellaneous
  - trips/year_____
  - km/trip_____
  - years_____
    - total km_____

- Rail - Offsite
  - Concrete
    - trips/year_____
    - km/trip_____
    - years_____
      - total km_____
  - Raw Material
    - trips/year_____
    - km/trip_____
    - years_____
      - total km_____
  - Equipment
    - trips/year_____
    - km/trip_____
    - years_____
      - total km_____
  - Miscellaneous
    - trips/year_____
    - km/trip_____
    - years_____
      - total km_____

- Employee Traffic
  - Construction (including closure) person-years_____

        - Operations person-years_____
        - M&M person-years_____
- Schedule - (month and year started/month and year completed)
    - Construction_____
    - Operation_____
    - M&M_____
    - Closure_____

Sent. 10/20

Request Number 076

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Arrie Bachrach

Date: 09/13/95

Phone Number: (818) 568-7114

Fax Number: (818) 568-7135

Request Information: Acreages locations facility dimensions (including height) and areas of temporary disturbance and permanent commitment associated with Privatization alternative (for Land Use and Visual).

Need Date: ASAP

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson CH.

Date Sent/Faxed: 10/20/95

Concurrence: Marc C Nelson
Marc Nelson - Project Manager

engin\enginfrq.076

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Land disturbances for Phased Implementation

ORIGINATOR Colin Henderson DATE 10/20/95

REVISION NO. 0

OBJECTIVE Estimate the temporary land disturbances associated with Phase I of Phased Implementation

METHODOLOGY Noted

ASSUMPTIONS Noted

(Continue on another sheet if necessary)

SIGNATURE

CALCULATION & RESULTS ATTACHED

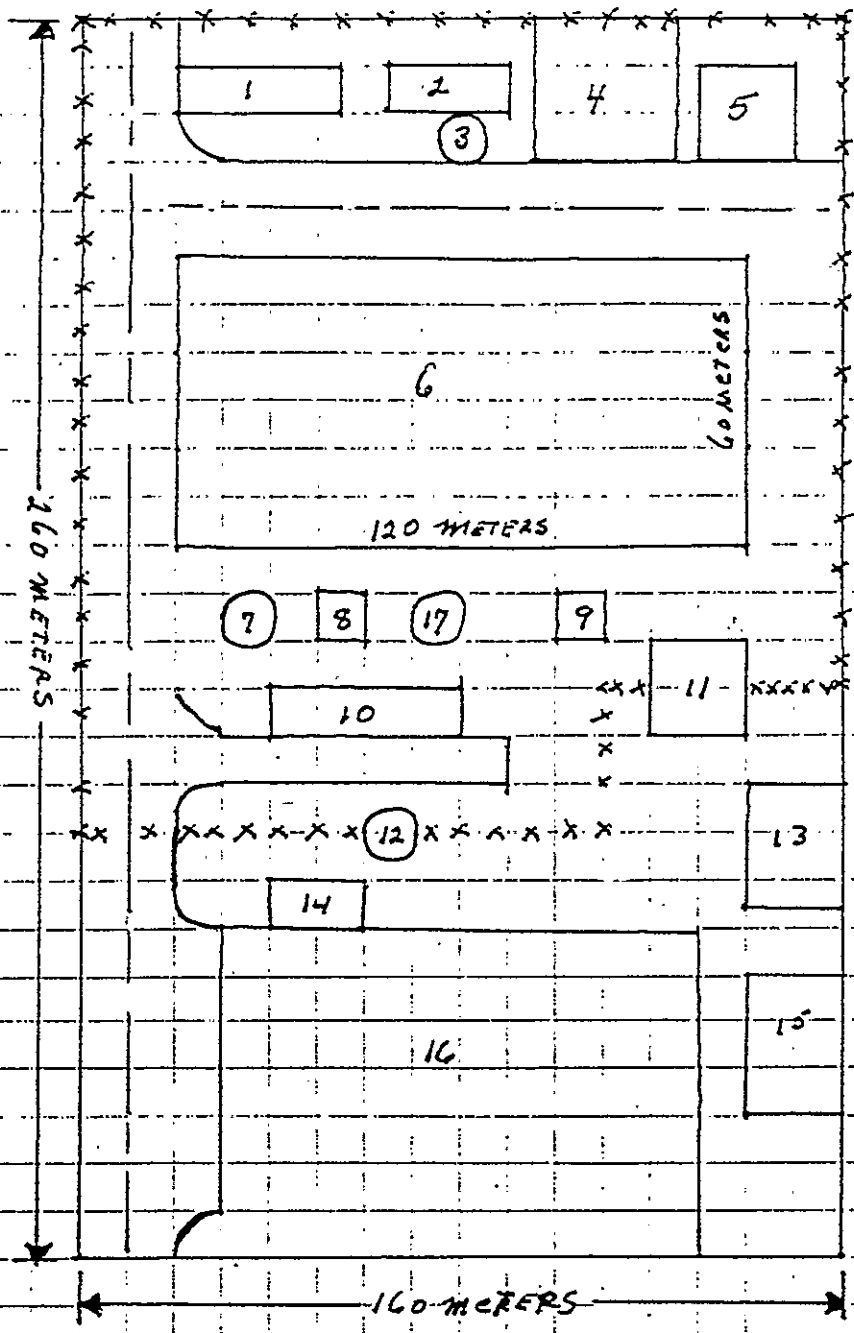
JACOBS\FORMS\CALCVR.SHT

Each of the facilities consist of a parking lot, an operations support (maintenance) building, an emergency response center building, an emergency diesel generator, a regulated entrance building, tanks (approximately 6) for bulk process chemical storage, a cooling tower, a control room building (or trailer), an electrical substation and switch gear unit, a gaseous emissions stack (150 ft. high), an anhydrous ammonia storage tank, and a storage area for palletized containers and container packaged process chemicals.

The Separations/LAW and HLW facility process building is approximately 120 meters long by 60 meters wide and will stand about 39 meters high.

The Separations/LAW facility process building is approximately 120 meters long by 40 meters wide and will stand about 39 meters high.

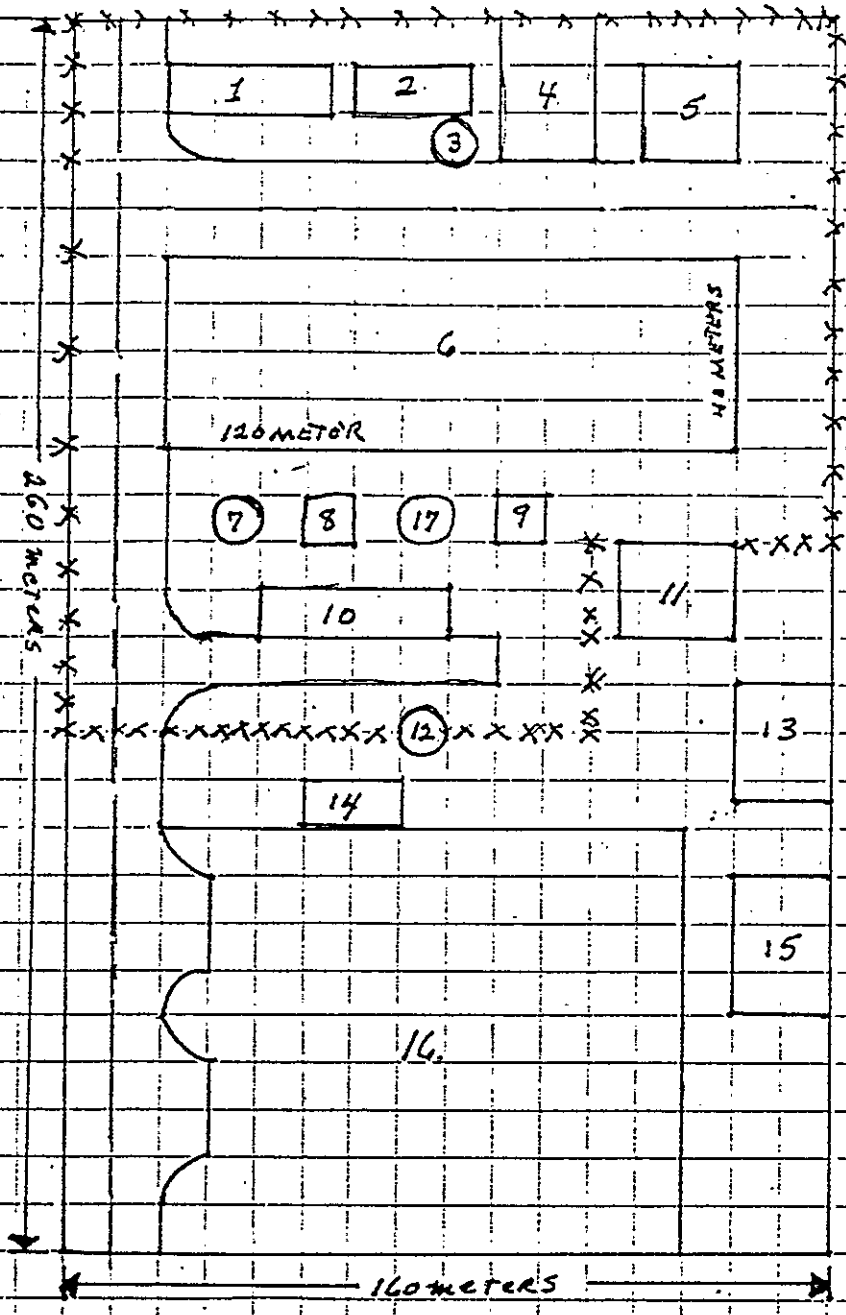
Note: This Layout could be seen from the air. Depending on distance and lay or the land, all or only some portions will be visible from the main road to the 200 East Area.



1. Cold Chemical supply
2. Anhyrous NH_3 w/BERM
3. VENT STACK
4. Empty Container storage
5. Sub station and Electri Switch GEAR
6. PROCESS Building
7. PROCESS chemical supply tank
8. Cooling TOWER
9. control Room trailer
10. Dry bulk materials for Feed to glass melter
11. Regulated ENTRANCE Building including Radiation zone control
12. Diesel Fuel tank for EMERGENCY GENERATOR
13. EMERGENCY RESPONSE Center
14. EMERGENCY Diesel GENERATOR
15. OPERATIONS SUPPORT Building
16. Plant PARKING
17. PROCESS chemical tank

APPROXIMATE scale
1" = 40 METERS

LAY-OUT FOR PLOT NUMBER 2



1. Cold Chemical supply
2. Anhydrous NH_3 w/Berm
3. Vent stack
4. Empty container storage
5. Substation and Electric switch gear
6. Process bldg
7. Process chemical supply
8. Cooling tower
9. Control Room trailer
10. Dry bulk materials for feed to glass melter
11. Regulated entrance building including Radiation zone control
12. Diesel fuel tank for emergency generator
13. Emergency response center
14. Emergency Diesel generator
15. Operations support building
16. Plant parking
17. Process chemical tank

Approximate scale
1" = 40 meters

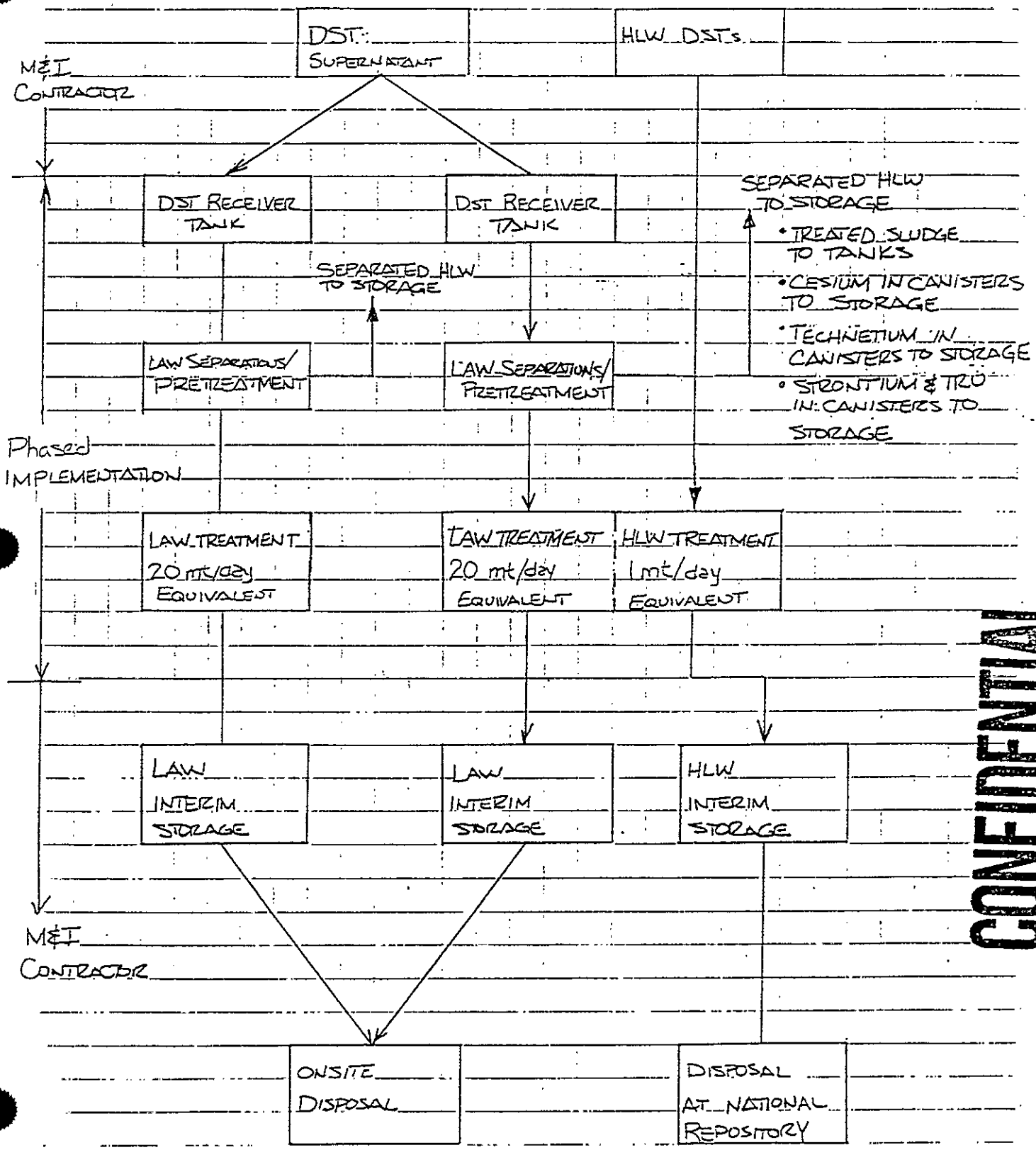
LAY OUT FOR PLOT NUMBER 4

JACOBS ENGINEERING GROUP INC.

DATE 10/17/95 SUBJECT SHEET NO.

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION



CONFIDENTIAL

FORM 91-005-T (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 10/18/95 SUBJECT SHEET NO.

BY CH. CHKD. JOB NO.

PHASED IMPLEMENTATION INVENTORY.

THE OVERALL INVENTORY IS REPRESENTED BY WHC-SD-WM-EV-102 REV 0 WHERE:

- LAW FEED IS THE SOLUBLE DOUBLE SHELL TANK INVENTORY

- HLW FEED IS THE INSOLUBLE DOUBLE SHELL TANK INVENTORY

FORM 91-005-1 (4/81)

WHC-SD-WM-EV-102 Rev. 0
UC-630

Single-Shell and Double-Shell Tank Waste Inventory Data Package for the Tank Waste Remediation System Environmental Impact Statement

C. E. Golberg
J. D. Guberski

Date Published
July 1995

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse Hanford Company P.O Box 1970 Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

Table 1. Estimated Mass of Nonradioactive Chemical Components of Single-Shell[1] and Double-Shell Tank[2] Wastes in Metric Tons. (2 sheets)

Chemical	Single-Shell Tanks				Double-Shell Tanks			Grand Total
	Sludge	Saltcake	Interstitial Liquid	Total	Soluble	Insoluble	Total	
Ag^{+}					3.28E-01	1.38E+00	1.70E+00	1.70E+00
$Al(OH)_4^{-}$	6.25E+02	1.25E+03	4.57E+02	2.33E+03	5.09E+03		5.09E+03	7.43E+03
Al^{+3} (3)	1.99E+03			1.99E+03		6.78E+01	6.78E.01	2.06E+03
As^{+5}					7.70E-01	4.98E-01	1.27E+00	1.27E+00
B^{+3}					5.19E-01	9.94E-01	1.51E+00	1.51E+00
Ba^{+2}					7.91E-01	3.09E+00	3.88E+00	3.88E+00
Be^{+2}					8.19E-02	7.61E-03	8.95E-02	8.95E-02
Bi^{+3}	2.61E+02			2.61E+02	2.26E+00		2.26E+00	2.64E+02
Ca^{+2}	1.28E+02			1.28E+02	1.03E+01	1.15E+01	2.18E+01	1.50E+02
Cd^{+2}	3.84E+00			3.84E+00	1.67E-01	6.01E+00	6.18E.00	1:00E+01
Ce^{+3}	2.35E+02			2.35E+02	2.26E-02	3.04E+00	3.07E+00	2.38E+02
Cl^{-}	4.00E+01			4.00E+01	2.73E+02	1.49E+00	2.74E+02	3.14E+02
CO_3^{-2}	1.15E+03	4.13E+02	3.96E+01	1.61E+03	1.92E+03	5.83E+01	1.98E+03	3.59E+03
Cr^{+3}	8.63E+01			8.63E+01		3.41E+01	3.41E+01	1.20E+02
CrO_4^{-2}			2.14E+01	2.14E+01	1.20E+02		1.20E+02	1.41E+02
Cu^{+2}					1.77E-01	7.46E-01	9.23E-01	9.23E-01
F^{-}	3.00E+02		5.00E+01	8.05E+02	3.52E+02	1.91E+01	3.71E+02	1.18E+03
$Fe(CN)_6^{-4}$	3.22E+02			3.22E+02				3.22E+02
Fe^{+3}	6.27E+02			6.27E+02	8.09E+00	1.42E+02	1.50E+02	7.77E+02
Hg^{+}	9.00E-01			9.00E-01	5.84E-02		5.84E-02	9.58E-01
K^{+}					5.46E+02	2.02E+01	5.66E+02	5.66E+02
La^{+}					2.19E-01	2.10E+01	2.12E+01	2.12E+01
Li^{+}					5.77E-03	2.46E-02	3.04E-02	3.04E-02
Mg^{+2}					9.65E-01	1.10E+01	1.20E+01	1.20E+01
Mn^{+4}	1.20E+02			1.20E+02	7.69E+00	1.80E+01	2.57E+01	1.46E+02
Mo^{+6}					4.87E+00	8.01E-01	5.67E+00	5.67E+00
Na^{+}	1.58E+04	3.39E+04	2.30E+03	5.48E+04	1.40E+04	2.30E+02	1.43E+04	6.91E+04
Ni^{+2}	1.78E+02			1.78E+02	4.07E+00	6.57E+00	1.06E+01	1.89E+02
NO_2^{-}	2.00E+03	1.53E+03	1.27E+03	4.80E+03	4.80E+03	8.42E+00	4.81E+03	9.61E+03
NO_3^{-}	1.48E+04	8.03E+04	1.71E+03	9.68E+04	1.03E+04	3.91E+01	1.03E+04	1.07E+05
OH^{-}	4.22E+03	8.51E+02	3.15E+02	5.39E+03	2.33E+03	1.23E+02	2.45E+03	7.84E+03
Pb^{+4}					1.96E+00	3.28E+00	5.24E+00	5.24E+00
PO_4^{-3}	3.89E+03	6.43E+02	8.58E+01	4.62E+03	3.29E+02	2.16E+01	3.51E+02	4.97E+03
SiO_3^{-2}	1.21E+03			1.21E+03	1.53E+01	2.14E+02	2.29E+02	1.44E+03
SO_4^{-2}	5.01E+02	1.15E+03		1.65E+03	3.86E+02	6.68E+00	3.93E+02	2.04E+03
Sr^{+2}	3.60E+01			3.60E+01				3.60E+01
TOC (4)			2.00E+02	2.00E+02	1.26E+03	6.84E+01	1.33E+03	1.53E+03
UO_2^{+2}					3.54E+00	2.68E+01	3.03E+01	3.03E+01
V^{+5}					6.20E-02	1.88E-01	2.50E-01	2.50E-01
W^{+4}	1.44E+01			1.44E+01	7.47E-01		7.47E-01	1.52E+01
Zn^{+2}					3.59E+00	9.45E-01	4.54E+00	4.54E+00
Zr^{+4}	2.46E+02			2.46E+02	4.48E-01	2.77E+02	2.77E+02	5.24E+02
Total w/o H_2O	4.93E+04	1.23E+05	6.40E+03	1.79E+05	4.18E+04	1.45E+03	4.32+04	2.22E+05
H_2O	2.62E+04	1.40E+04	5.16E+03	4.54E+04	8.59E+04		8.95+04	1.35E+05
Total	7.55E+04	1.37E+05	1.16E+04	2.24E+05	1.31E+05	1.45E+03	1.33E+05	3.57E+05

Table 2. Radionuclide Inventory for Single-Shell Tanks and Double-Shell Tanks[1] in Curies. (3 sheets)

Radionuclides	Single-Shell Tanks Total	Double-Shell Tanks[2]		
		Soluble	Insoluble	Total
Ac-225	1.98E-05			
Ac-227	2.21E-02			
Ac-228				
Am-241 [3]	3.30E+04	5.31E+03	6.54E+04	7.07E+04
Am-242	6.82E+01			
Am-242m	6.86E+01			
Am-243	3.32E+01			
At-217	1.98E-05			
Ba-135m				
Ba-137m	7.68E+06	2.48E+07	6.49E+05	2.54E+07
Bi-210	7.17E-08			
Bi-211	2.21E-02			
Bi-212	3.72E-14			
Bi-213	1.98E-05			
Bi-214	2.70E-07			
C-14 [3]	3.00E+03	3.45E+02	1.99E+03	2.34E+03
Cm-242	5.66E+01			
Cm-244	1.18E+02			
Cm-245	1.04E-02			
Cs-135	1.45E+02			
Cs-137	3.12E+06	2.61E+07	6.83E+05	2.68E+07
Eu-154		5.37E+04	1.44E+03	5.51E+04
Fr-221	1.98E-05			
Fr-223	3.06E-04			
I-129 [3]	1.60E+01			
Nb-93m	3.20E+03			
Ni-59	5.03E+03			
Ni-63	2.69E+05			
Np-237	6.91E+01			
Np-238	3.26E-01			
Np-239	3.32E+01			
Pa-231	3.80E-02			
Pa-233	6.97E+01			
Pa-234	7.69E-01			
Pa-234m	4.81E+02			
Pb-209	1.98E-05			
Pb-210	7.17E-08			
Pb-211	2.21E-02			
Pb-212	3.72E-14			
Pb-214	2.70E-07			
Pd-107	8.65E+01			
Po-210	7.17E-08			
Po-211	6.04E-05			
Po-212	2.38E-14			
Po-213	1.94E-05			
Po-214	2.70E-07			

Table 2. Radionuclide Inventory for Single-Shell Tanks and Double-Shell Tanks[1] in Curies. (3 sheets)

Radionuclides	Single-Shell Tanks Total	Double-Shell Tanks[2] Soluble	Double-Shell Tanks[2] Insoluble	Double-Shell Tanks[2] Total
Po-215	2.21E-02			
Po-216	3.72E-14			
Po-218	2.70E-07			
Pu-236				
Pu-238	1.08E+03			
Pu-239 [3]	1.80E+04	1.31E+03	7.05E+03	8.36E+03
Pu-240 [3]	4.30E+03	3.28E+02	2.07E+03	2.40E+03
Pu-241	3.55E+04	7.76E+02	3.86E+06	3.94E+04
Pu-242	4.32E-04			
Ra-223	2.21E-02			
Ra-224	3.72E-14			
Ra-225	1.98E-05			
Ra-226	2.70E-07			
Ra-228	7.42E-14			
Rh-106	3.79E-02			
Rn-219	2.21E-02			
Rn-220	3.72E-14			
Rn-222	2.70E-07			
Ru-106	3.79E-02			
Sb-126	3.78E+01			
Sb-126m	6.27E+02			
Se-79	9.11E+02			
Sm-151 [3]	6.30E+05			
Sn-126	6.27E+02			
Sr-90 [3]	4.36E+07	6.15E+05	9.47E+06	1.01E+07
Tc-99 [3]	1.10E+04	2.07E+04	3.99E+02	2.11E+04
Th-227	2.18E-02			
Th-228	3.72E-14			
Th-229	1.98E-05			
Th-230	3.90E-05			
Th-231	2.06E+01			
Th-232	6.42E-13			
Th-233				
Th-234	4.81E+02			
Tl-207	2.21E-02			
Tl-208	1.34E-14			
Tl-209	4.28E-07			
U-232				
U-233	1.21E-02			
U-234	2.12E-01			
U-235	2.06E+01			
U-236	2.88E-03			
U-237	8.69E-01			
U-238	4.81E+02			
Y-90	4.36E+07	6.15E+05	9.47E+06	1.01E+07
Zr-93	3.94E+03			
TOTAL	1.04E+08	5.23E+07	2.04E+07	7.27E+07

Table . Non-Radiological Operating Emissions.
(Units as Indicated) (2 sheets)

Item	SEP/LLW	SEP/LLW + HLW
Particulates[2] (kg)	7.0E + 2	8.7E + 2
VOC[3] (kg)	215	220
Fugitive dust	n/a	n/a
TAPS[4] (state) (kg)		
HCl[5]	1.20 E + 2	1.21 E + 2
HF[5]	4.42E + 3	4.52E + 3
Ammonia[6]	1.22 E + 3	1.77E + 3
Nitric Acid[7]	1.00 E + 3	1.60 E + 3
HAPS (metals)[8]	< 100 Kg/yr	< 100 Kg/yr
NOx (as NO_2) (kg)	1.08 E + 4	1.09E + 4
SOx (as SO_2) (kg)	1.157 E + 4	1.58 E + 4
CO[11]	< 100,000 Kg/yr	< 100,000 Kg/yr

Notes:

CO = carbon dioxide
H = hydrogen
F = fluorine
HWVP = Hanford Waste Vitrification Plant
J = joule
LLW = low-level waste
kg = kilogram
N = nitrogen
NOx = nitrogen oxide and nitrogen dioxide
S = sulfur
TAPS = Task Authorization and Planning System
VOC = volatile organic carbon

[illegible] from meeting the heat load.

SEP/LLW ⟹ 20 MT/D glass product avg. rate
10 yrs operation

HLW ⟹ 1 MT/D glass product avg. rate
6 yrs operation

Table [illegible] Non-Radiological Operating Emissions.
(Units as Indicated) (2 sheets)

[2]Particulate emission estimate assumes cooling tower emissions are 95% of total particulate emissions (i.e. cooling tower emissions/0.95 = total emissions). Particulate emission are essentially 100% PM_{10}. Cooling tower emissions are a ratio of cooling water recirculation rates used for the alternatives. Emissions from standby power diesel engines, diesel tanks, and welding are all considered to result in emission of less than 100 kg/yr for the pollutants being analyzed.

[3]The VOC emissions shown are for kerosene handling and tankage activities assuming the use of an aboveground tank. VOC emissions from the main processes and other auxiliary sources are not currently defined. It is assumed that glycolic acid, if received, stored, and handled as a liquid, does not exhibit a significant vapor pressure, and if handled as a solid it is assumed to be controlled by filter media (i.e. baghouses, etc.) to less than 100 kg/yr.

[4]Emissions for TAP pollutants estimated to exceed 100 kg/yr are shown. Emissions from any single particulate source (silos, material handling, etc.) is considered to be controlled to a level that results in emissions below 100 kg/yr. Therefore, no particulate TAP emissions above 100 kg/yr are expected.

[5]The chlorine and fluorine emissions are expressed as HCl and HF, respectively (assumed chemical form). These emissions are based on the WHC material balances with an assumed decontamination factor of 200 for the venturi scrubber and mist eliminator.

[6]Ammonia slip from NOx control process. The ammonia emissions for Pretreatment/LLW is taken directly from the WHC material balances. The ammonia requirement for the 20 Mg/d joule-heated melter is based on assuming complete conversion of NOx precursors to NOx. The ammonia emissions for the 20 Mg/d joule-heated melter are based on a relative slip of 0.27% (in accordance with the material balance for Pretreatment/LLW).

[7]Nitric acid emissions are from decontamination activities where 100 kg/yr is estimated per melter plant.

[8]No HAPS metals will be emitted above 100 kg/yr. Appropriate NO_x abatement equipment will be installed to reduce the emission to below 40,000 kg/year.

[9]The ~~unmitigated~~ controlled NO_x emission ~~[illegible]~~ as NO_2 is based on the ~~operating characteristics of the melters~~ material balance.

~~[10]The unmitigated SO_x emission is 9.7E+4 kg/year as SO_2.~~

[11]The unmitigated CO emission is ~~[illegible]~~ is based on the mass of CO from ~~Pretreatment/LLW~~ material balance ~~[illegible]~~. The flowsheets, at the present time, do not include abatement equipment for CO. Also it is assumed that the abatement equipment used for NO_x + SO_x does not effect CO, which it should. Therefore assuming less than 100,000 Kg/yr is justified.

PHASED IMPLEMENTATION

Table .. Radiological Operating Emissions. (Ci)

Radionuclide	SEP/LLW		SEP/LLW + HLW	
	Air[2]	Water[3]	Air[2]	Water[3]
^{241}Am	3.26E-06	3.2E-5	1.44E-03	3.2E-5
^{14}C	4.0E+02	n/a	4.2E+02	n/a
^{137}Cs	1.87E-02	5.2E-3	1.04E+00	5.2E-3
^{129}I				
$^{239,240}Pu$	7.90E-07	3.2E-5	1.58E-03	3.2E-5
^{106}Ru	n/a	n/a	n/a	n/a
^{151}Sm	n/a	n/a	n/a	n/a
^{90}Sr	7.20E-04	2.1E-4	1.60E+00	2.1E-4
^{99}Tc	9.83E-06	n/a	9.95E-05	n/a
^{93}Zr	n/a	n/a	n/a	n/a
%PM-10[5] (MT)	1.47E-02	—	1.51E-02	—

Notes:

[1]All values in Ci except for % PM-10 which is in metric tonnes

[2]Air values taken from material balances (Streams 907 and 917 in Appendix A)

[3]Water values are based on effluent streams from both Pretreatment/low-level waste (LLW) and high-level waste (HLW) flowsheets (Streams 807 and 802 respectively) and design basis for Liquid Effluent Treatment Facility (LETF) C-018. Yearly flowrates of these streams were calculated. Engineering judgement set the total amount of effluent to be processed by the LETF equal to 20% of the flow for all but one year of operation. For the last year, 100% was to be processed. The composition of the effluent was assumed to be comparable to the feed set in the design basis. Therefore the concentrations of radionuclides/chemicals in the discharge in the design sheet equals what the discharge would be for the process effluent. Ratio'd from Tri-Party Agreement (7.5% of Tri Party agreement for both cases)

Table 9-6. Radiological Operating Emissions. (Ci)

Radionuclide[1]	Tri-Party Agreement Preferred Alternative	
	Air[2]	Water[3]
^{241}Am	5.3E-02	4.2E-4
^{14}C	5.3E+03	n/a[4]
^{137}Cs	2.5E+01	6.9E-2
^{129}I	1.6E+01	3.5E-4
$^{239,240}Pu$	1.7E-02	4.2E-4
^{106}Ru	1.9E-08	1.0E-2
^{151}Sm	3.2E-01	NA
^{90}Sr	2.7E+01	2.8E-3
^{99}Tc	1.6E-02	n/a
^{93}Zr	1.8E-01	n/a
%PM-10[5]	2.67E-01	- -[6]

Notes:

[1]All values in Ci except for % PM-10 which is in metric tonnes

[2]Air values taken from material balances (Streams 907 and 917 in Appendix A)

[3]Water values are based on effluent streams from both Pretreatment/low-level waste (LLW) and high-level waste (HLW) flowsheets (Streams 807 and 802 respectively) and design basis for Liquid Effluent Treatment Facility (LETF) C-018. Yearly flowrates of these streams were calculated. Engineering judgement set the total amount of effluent to be processed by the LETF equal to 20% of the flow for all but one year of operation. For the last year, 100% was to be processed. The composition of the effluent was assumed to be comparable to the feed set in the design basis. Therefore the concentrations of radionuclides/chemicals in the discharge in the design sheet equals what the discharge would be for the process effluent.

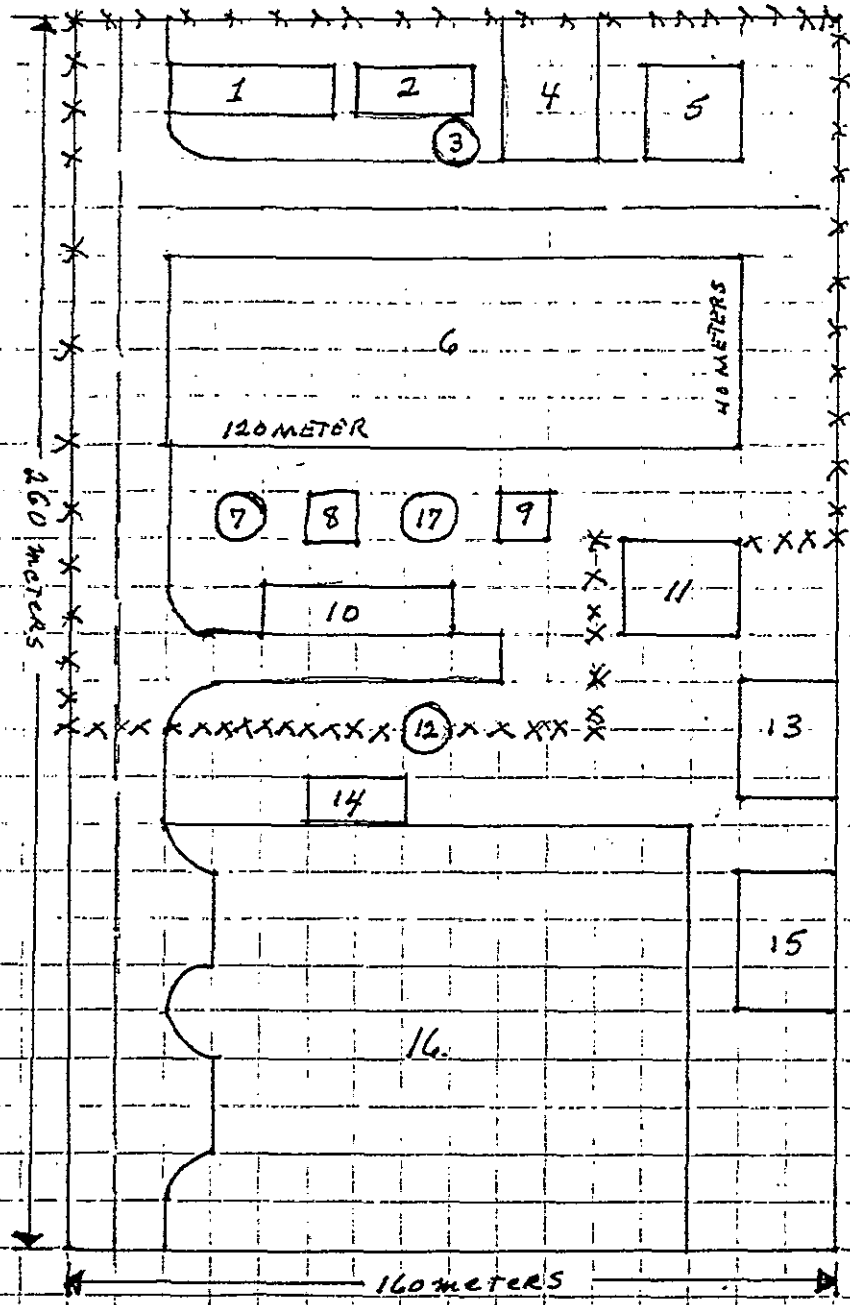
Table 9-5. Non-Radiological Operating Emissions.
(Units as Indicated) (2 sheets)

Item	Tri-Party Agreement Preferred Alternative
Thermal releases[1] (J)	2.1E+16
Particulates[2] (kg)	1.5E+4
VOC[3] (kg)	770
Fugitive dust	n/a
TAPS[4] (state) (kg)	
HCl[5]	2.6E+3
HF[6]	6.1E+3
Ammonia[7]	2.4E+4
Nitric Acid[8]	1.4E+3
HAPS (metals)[9]	<100 kg/yr
NOx (as NO_2) (kg)	1.1E+4[9]
SOx (as SO_2) (kg)	1.5E+4[10]
CO	<100,000 kg/yr[11]

Notes:

CO = carbon dioxide
H = hydrogen
F = fluorine
HWVP = Hanford Waste Vitrification Plant
J = joule
LLW = low-level waste
kg = kilogram
N = nitrogen
NOx = nitrogen oxide and nitrogen dioxide
S = sulfur
TAPS = Task Authorization and Planning System
VOC = volatile organic carbon

[1]Derived from factoring the heat load.

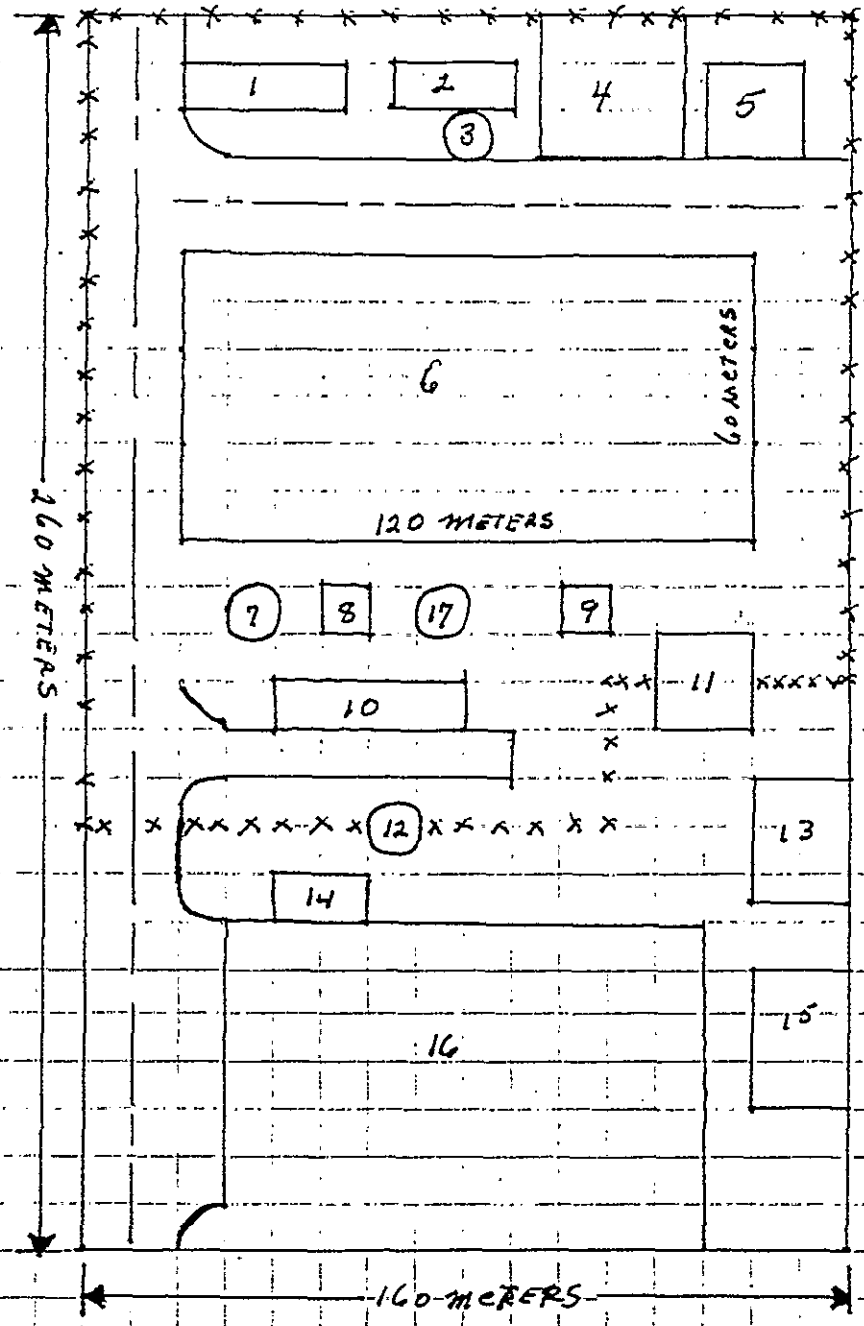


1. Cold Chemical supply
2. Anhydrous NH_3 w/ber.
3. Vent stack
4. Empty container storag
5. Substation and electric switch gear
6. Process bldg
7. Process chemical suppl.
8. Cooling tower
9. Control Room trailer
10. Dry bulk materials for feed to glass melte
11. Regulated entrance building including Radiation zone contro
12. Diesel fuel tank for emergency generator
13. Emergency Response Center
14. Emergency Diesel Generator
15. Operations support building
16. Plant parking
17. Process chemical tank

Approximate scale
1" = 40 meters

LAY OUT FOR PLOT NUMBER 4

LAW ONLY

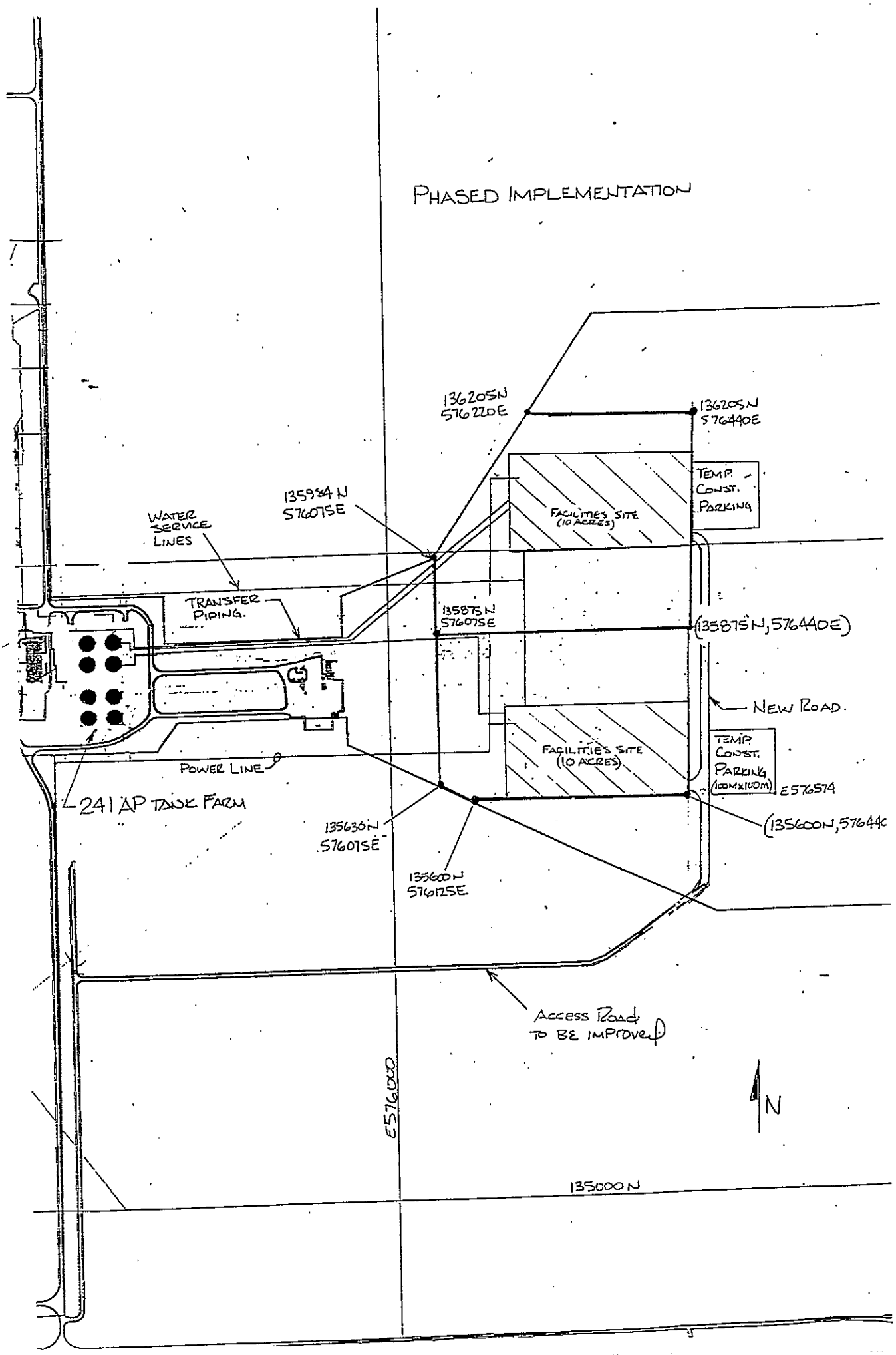


1. Cold Chemical supply
2. ANHYROUS NH_3 w/BERM
3. VENT STACK
4. EMPTY Container storag.
5. sub station and ELECTRI Switch GEAR
6. PROCESS Building
7. PROCESS Chemical supply TANK
8. Cooling TOWER
9. control ROOM trailer
10. Dry bulk materials for Feed to glass melter
11. Regulated ENTRANCE Building including Radiation zone control
12. Diesel Fuel tank for EMERGENCY GENERATOR
13. EMERGENCY RESPONSE Center
14. EMERGENCY Diesel GENERATOR
15. OPERATIONS SUPPORT Building
16. Plant PARKING
17. PROCESS Chemical tank

APPROXIMATE scale
1" = 40 METERS

LAY-OUT FOR PLOT NUMBER 2

LAW+HLW.


PHASED IMPLEMENTATION
136205N
576220E
136205N
576440E
TEMP. CONST. PARKING
FACILITIES SITE (10 ACRES)
135984 N
576075E
WATER SERVICE LINES
TRANSFER PIPING.
135875N
576075E
(135875N, 576440E)
NEW ROAD.
FACILITIES SITE (10 ACRES)
TEMP. CONST. PARKING (100M x 100M)
E576574
POWER LINE
241 AP TANK FARM
135630N
576075E
(135600N, 576440
135600N
576125E
ACCESS ROAD TO BE IMPROVED
E576000
N
135000 N

JACOBS ENGINEERING GROUP INC.

DATE 10/18/95. SUBJECT SHEET NO. 1

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION DISTURBED AREA.

1) AREA DISTURBED DURING CONSTRUCTION — TOTAL

a) 30 ACRES/SITE (12.2 ha) — 60 Acres (24.3 ha)

b) POWER LINE (1500 m new power line)

Assumed 500 m of new Line outside existing Fence Line.

AREA = 500 m x 50 m = 25,000 m². (2.5 ha) — 6 Acres (2.5 ha)

c) Water Service 960 m of buried line

Assumed 475 m of the Line outside of existing Fence line

AREA = 475 m x 25 m = 1.18 ha = 3 Acres — 3 Acres (1.18 ha)

d) Road — 6.5 Acres (1.64 ha)

IMPROVE 1480 meters of existing Road

AREA = 1480 meters x 10 m = 3.7 acres (1.5 ha)

(10 meters width to improve road)

New Road

570 meters x 20 = 2.8 Acres (1.14 ha)

(20 meters width for new road)

e) WASTE TRANSFER PIPELINES — 0

Assume ALL WASTE TRANSFER PIPING is INSTALLED WITHIN EXISTING FENCELINE IN CURRENTLY DISTURBED AREA. INCLUDES LIQUID Effluent transfer line to LERF.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 10/18 SUBJECT SHEET NO. 2

BY _____ CHKD. _____ JOB NO. _____

1. CONT.

TEMPORARY CONSTRUCTION PARKING — 5 ACRES (2 ha)

TOTAL AREA DISTURBED DURING CONSTRUCTION — 80.5 ACRES (32 ha)

2. Permanently DISTURBED AREA = 0

ASSUME RCRA CLOSURE WITH NO PERMANENT LAND COMMITMENTS.

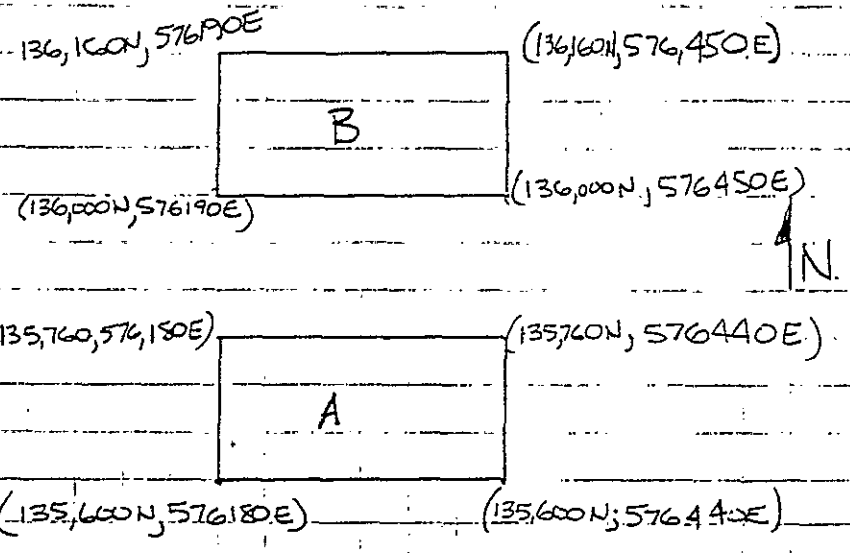
FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

SITE Coordinates:



160
260

EACH SITE 160 m x 260 m = 4.68 ha = 10.3 Acres
= 10 Acres

STACK LOCATIONS:

1) Assume FACILITIES WOULD BE LOCATED IN PROXIMITY TO THE WESTERN END OF EACH SITE TO MINIMIZE PIPELINE Length TO THE FACILITIES

2) CENTER THE STACK N & South PLACE 30 m IN FROM Edge.

STACK COORDINATES

A = N 135,680 ; E 576,210
B = N 136,080 ; E 576,220

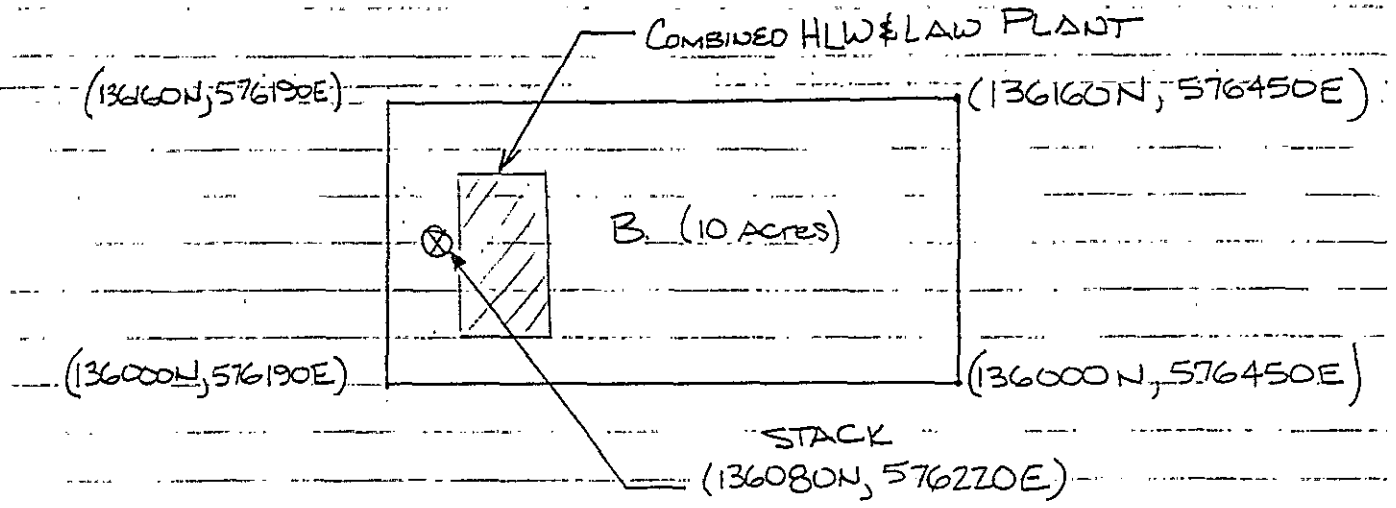
FORM 91-005-1 (4/81)

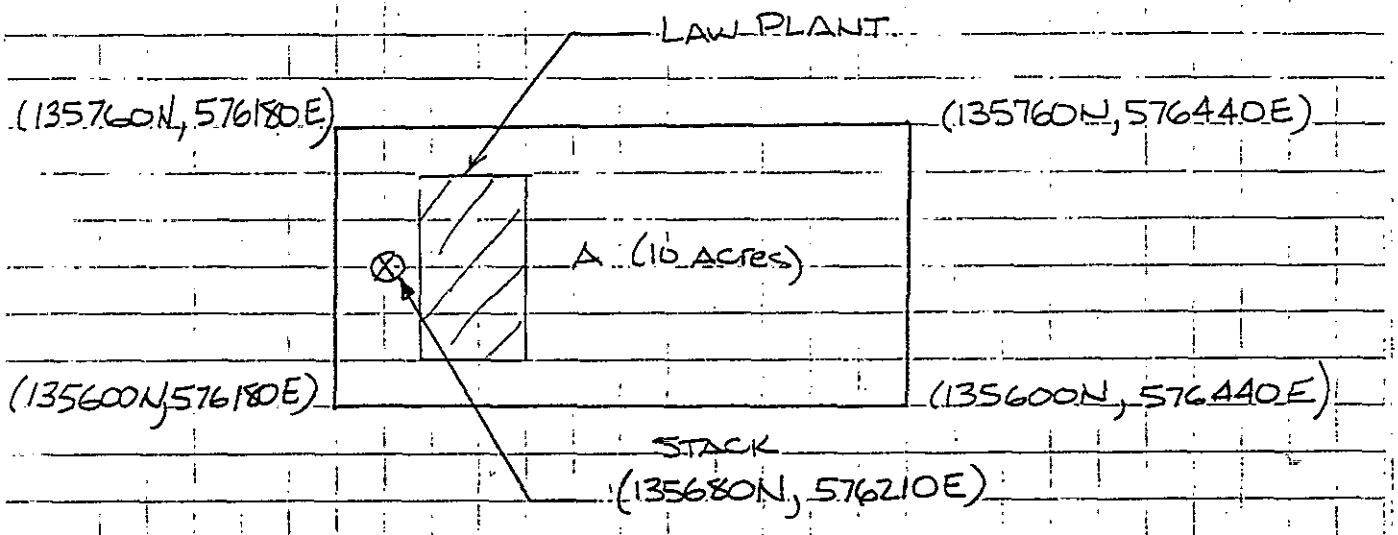
JACOBS ENGINEERING GROUP INC.

DATE 10/18 SUBJECT Phased Implementation Locations SHEET NO.

BY CHKD. JOB NO.

SITE COORDINATES:





ASSUME STACK HEIGHT = 150' ft

EXIT VELOCITY = 45 ft/sec.

FORM 91-005-1 (4/81)

Table Construction Resource Requirements

Construction Resource	Separation/LAW+HLW	Separation/LAW
Land (meters^2)	1.22 E+05	1.22 E+05
surface Committed temporarily	30 ACRES	30 ACRES
Water (meters^3)	2.3 E+05	1.61 E+05
Energy		
Electrical (GWh)	30	21
Propane (meters^3)	0	0
Diesel Fuel (Liters)	1.07 E+07	7.5 E+06
Gasoline (Liters)	4.6 E+06	3.22 E+06
Materials		
Concrete (Meters^3)	1.3254 E+04	1.0741 E+04
Steel		
Carbon Steel (MT)	4.86 E+04	3.40 E+04
Stainless Steel (MT)	8.61 E+03	6.03 E+03
Hastelloy/Inconel (MT)	1.51 E+03	1.06 E+03
Excavation (meters^3)	1.6145 E+05	1.1391 E+05
Rip Rap (meters^3)	0	0
Structure Backfill (meters^3)	2.045 E+04	1.965 E+04

TRANSPORTATION:

Construction	Sep LLW + HLW	Sep/LLW
Temporary Land	30 ACRES	30 ACRES
1. CONCRETE		
GRAVEL borrow pit	1084 TRIPS	879 TRIPS
Sand tricities area	510 TRIPS.	414 TRIPS
CEMENT Portland/Seattle TRUCK Assumed 4 sack/cuyd mix	155 TRIPS	125 TRIPS
2. Miscellaneous Construction materials - lumber tricities	1000 TRIPS	800 TRIPS
3. STEEL		
Carbon steel Seattle/Portland TRUCK	3564 TRIPS	2494 TRIPS
4. STAINLESS steel Seattle/Portland TRUCK	632 TRIPS	443 TRIPS
Hastelloy/Inconel Seattle/Portland TRUCK	111 TRIPS	78 TRIPS
4. Diesel fuel tricities ~~5000~~ 5000 gallon TRUCK	565 TRIPS	397 TRIPS
5. Gasoline tricities ~~5000~~ 5000 gallon TRUCK	243 TRIPS	171 TRIPS

Non Radiological Construction Emissions (Estimated)

Const. Emission Pollutant		SEP/LAW + HLW	SEP/LAW
Particulate	Kg	1.0 E+04	1.0 E+04
SO_x (as SO_2)	Kg	1.896 E+03	1.896 E+03
CO/CO_2	Kg	1.386 E+06	1.386 E+06
Hydrocarbons (Exhaust + Fugitive	Kg	8.02 E+04	8.02 E+04
NO_x (as NO_2)	Kg	1.38 E+05	1.38 E+05
aldehydes (as HCHO)	Kg	69 ~~345~~	69
Organic acids	Kg	N/A	N/A
thermal Releases	J	9.8 E+13	9.8 E+13
Fugitive dust	t	82	82

used the values from table B.14 for the NO Separations subalternative and applied 20% to the values given.

Construction personnel were selected by assuming the same total number per year as for the equivalent 200 MT/day plant and support facilities. Construction period was for 2 years. Hence for a Construction period assumed over 10 years then for 2 years 20% of the ten year totals estimated would be appropriate.

Request Number 71

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn Date: 09/14/95

Phone Number: (904) 332-3318 x6058 Fax Number: (904) 333-6631

Requested Information: Preliminary "fact-finding" information concerning various processes that are general to several alternatives. Depending on results, additional data requests may follow.

Need Date: 09/18/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson Date Sent/Faxed: 9/18/95

Concurrence: M Nelson
Marc Nelson - Deputy Project Manager

ENGINEERING INFORMATION REQUEST -077

REQUESTED BY- JOHN KUHN (ESE)

Hanford Barriers-

We will need to address air quality impacts resulting from the construction of the Hanford Barriers. The following alternatives will require the construction of a Hanford barrier:

a. Minimal Retrieval (In Situ Vitrification)
b. Minimal Retrieval (Fill and Cap)
c. Selective Retrieval
d. Extensive Retrieval (Ex Situ Vitrification)
e. Extensive Retrieval - No Separations (Vitrification or Calcination)
f. Extensive Retrieval (Extensive Separations)
g. Possibly the Capsule Dry-Well disposal alternative (was Dry-Well Storage)

a,b, and e require the construction of a barrier over the existing tank farms.
c,d, and f have low activity waste (LAW) disposal vaults and would require the construction of a barrier over the tanks as well as over the disposal vaults.

MUSTs-

With regard to MUSTs we do not have adequate information on the MUSTs to do any kind of emissions estimates. The emissions from the MUSTs would be small and addressed through the use of conservative estimates for the SSTs and DSTs. No additional analysis of air quality impacts from the MUSTs is required.

Borrow Sites-

Pit 30 coordinates: these should be the same as you have for the BTCH plant
McGee Ranch coordinates: North 139700 East 559600
Vernita Quarry coordinates: North 142700 East 560,600

See the attached table and map showing land disturbances areas at the proposed borrow sites. (Note: Location E=Pit 30, Location F=McGee Ranch, Location G=Vernita Quarry)
The table identifies borrow site area associated with operations and post remediation (barrier) activities. Only Pit 30 would be used as a source for borrow material during construction/operations. All three sites would be used as sources of borrow material for construction of the Hanford barrier.

LETF-

The LETF will be a permitted waste treatment facility that will treat wastes from several different onsite sources. No analysis of air quality impacts from the LETF are required.

Evaporator-

The evaporator emissions from continued or routine operations will be provided for each of the alternatives.

242A Evaporator
Stack coordinate location North=135996, East=575374
Stack height - 22' (this is 39.5 ft below max height of the structure, assume the facility has a multi-level roof line)
Stack configuration - vertical without a weather cap
Stack diameter - 42"
Volumetric flow rate - between 13,000 and 15,000 cfm
Stack gas temperature during operation = 110-115 degrees F

Alterative	Temporary Commitments (see note 3)			Permanent Commitments (see note 4)		
	Area (sq meters)	Location	Currently Disturbed	Area (sq meters)	Location	Currently Disturbed
No Action						
Retrieval Operations	N/A (in ops)					
Post Remediation	N/A			1.70E+05	D	Yes
	N/A					
Minimal Retrieval (In Situ Vitrification)						
Retrieval	N/A					
Operations	2.10E+05	D	Yes			
	6.97E+05	note 1	Partially			
	1.97E+05	E	No			
Post Remediation	2.00E+05	note 2	Partially	2.50E+05	D	Yes
	1.38E+05	E	No			
	1.26E+05	F	No			
	2.13E+05	G	No			
Fill and Cap						
Retrieval	N/A					
Operations	1.00E+04	D	Yes			
	2.51E+05	E	No			
Post Remediation	2.00E+05	note 2	Partially	2.50E+05	D	Yes
	1.38E+05	E	No			
	1.26E+05	F	No			
	2.13E+05	G	No			
Selective Retrieval						
Retrieval	1.60E+04	A	Yes	2.00E+03	A	Yes
	6.90E+03	E	No			
Operations	8.16E+05	C	Partially	7.9E+04	C	Partially
	5.30E+04	E	No			
Post Remediation	2.20E+05	note 2	Partially	2.9E+05	D+C	Partially
	2.63E+05	E	No			
	1.46E+05	F	No			
	2.34E+05	G	No			

BORROW SITE AREAS CALCULATED USING VOLUMES AND AN ASSUMED CONSTANT EXCAVATION DEPTH OF 3.0 meters.

Extensive Retrieval (Ex Situ Vit)						
Retrieval	3.20E+04	A	Yes	4.00E+03	A	Yes
	1.38E+04	E	No			
Operations	8.10E+05	C	Partially	6.80E+04	C	Partially
	1.06E+05	E	No			
Post Remediation	2.40E+05	note 2	Partially	3.30E+05	D+C	Partially
	4.51E+05	E	No			
	1.75E+05	F	No			
	2.67E+05	G	No			
No Separations						
Retrieval	3.20E+04	A	Yes	4.00E+03	A	Yes
	1.38E+04	E	No			
Operations	6.00E+05	C	Partially	2.00E+04	C	Partially
	4.11E+04	E	No			
Post Remediation	2.00E+05	note 2	Partially	2.50E+05	D	Yes
	3.90E+05	E	No			
	1.26E+05	F	No			
	2.13E+05	G	No			
Extensive Separations						
Retrieval	3.20E+04	A	Yes	4.00E+03	A	Yes
	1.38E+04	E	No			
Operations	1.30E+06	C	Partially	7.00E+04	C	Partially
	1.24E+05	E	No			
Post Remediation	2.40E+05	note 2	Partially	3.30E+05	D+C	Partially
	4.56E+05	E	No			
	1.78E+05	F	No			
	2.70E+05	G	No			
Capsules No Action	N/A			0.6	WESF	Yes
Capsules Dry-Well Storage	3.8	B	No	1.8	B	No
Capsules Overpack and Ship	2.0	C	Partially	N/A		
Capsules Vitrify with Tank Waste	1.0	C	Partially	N/R		

Note 1: Area required for the power lines for in situ vitrification. A 50m wide corridor is assumed.
Note 2: Temporarily disturbed area for barrier construction would be distributed throughout the tank farms and borrow sites.
Note 3: The existing tank farms occupy 17 ha of land committed to waste management use, this quantity is

Jacobs Engineering Group Inc.

3250 West Clearwater
Kennewick, Washington 99336

Telephone: (509) 736-0616
Fax: (509) 736-7504

FAX TRANSMISSION COVER SHEET

Date: 9/20/95

To: JOHN KUHN

Fax: 904-333-6631

Subject: INFORMATION - TNRS EIS

Sender: COLIN HENDERSON

YOU SHOULD RECEIVE 7 PAGE(S), INCLUDING THIS COVER SHEET. IF YOU DO NOT RECEIVE ALL THE PAGES, PLEASE CALL.

JOHN, Look this over & Give me a call.

Sent Fedex 9/25.

Request Number 078

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 09/14/95

Phone Number: (904) 332-3318 ext 6058 Fax Number: (904) 333-6631

Request Information: Data for the Tanks No Action alternative/continued operations. See attached sheet for detailed information.

Need Date: 9/22/95

Response: see attached

Data Source/Accuracy: Data souce: WHC-SD-WM-EV-099, Rev 0 No Disposal Action Engineering Data Package for the TWRS Environmental Impact Statement. DOE/RL-95-07 Hanford Site Air Operating Permit Application.

Prepared By: Colin Henderson CH.

Date Sent/Faxed: 09/25/95

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

H:\USERS\CHENDERS\EIR\ENINFRQ.078

Continued Operations/Tanks, No Action

1.0 Has retanking definitely been eliminated as a component of this alternative? If so, we will not consider emissions from construction or retrieval activities.

1.2.1 As I discussed with you last week, I have developed emissions data for the 20 "organic watch list tanks", using the tank headspace analysis, and your calculations. I have no data for the additional DST, or for any of the SSTs. If the impacts of these other tanks are to be studied, I will need additional emissions data for these tanks. Alex provided me with some data for the Tanks- No Action alternative that shows radiological releases for existing DST's. Again, I have no radiological data for the SSTs.

ENGINEERING INFORMATION REQUEST: 078

SUBJECT: Tanks No Action

During the comment resolution meetings held the week of 9/18 it was decided that the Tanks No Action alterative should be restructured as follows:

No Action- Continued storage of the tank wastes for a period of 100 years without any retanking of the DST wastes. There would be no remediation of the wastes with this alternative.

Long Term Management (the name may change) - Continued management of the tanks wastes with no remediation and retanking of the DST wastes at 50 year intervals. This is essentially what we have analyzed as Tanks No Action in the past.

No Action

The No Action alternative air emissions would result from tank emissions associated with current operations. The 242-A evaporator would be operated periodically up through 2005, the time when all future waste additions and salt-well pumping of SSTs are completed.

The routine nonradiological and radiological emissions are provided in the attached spreadsheets labeled Tank Farm Emissions From Current Operations. These spreadsheets provide annual and hourly emission rates and emission concentrations on a tank farm by tank farm basis (based on 1994 numbers). The nonradiological emissions are assumed to occur at the same annual rates throughout the 100 year No Action period. The radiological emissions will have to be decayed using decay equations as outlined in Engineering Information Request Number 057.

The evaporator operations during the No Action alternative would correspond to a periodic operations scenario where the evaporator would be operated on an as needed basis up through the year 2005. The annual emissions from the evaporator are best represented by the column titled Periodic Ops on the Tank Farm Emissions spreadsheet. The hourly emission rate and the release concentration are assumed to be the same whether the evaporator is operated continuously or periodically.

Long Term Management

The Long Term Management alternative air emissions would result from tank emissions associated with current operations. Construction emissions would be associated with constructing replacement DSTs at fifty year intervals. Operation of the 242-A evaporator would occur periodically up through 2005, the time all future waste additions and salt-well pumping of SSTs are completed. The replacement evaporators (built for the retanking campaigns) would run continuously for approximately 5 years during each retanking campaign.

The routine nonradiological and radiological emissions are provided in the attached spreadsheets labeled Tank Farm Emissions From Current Operations. These spreadsheets provide annual and hourly emission

rates and emission concentrations on a tank farm by tank farm basis (based on 1994 numbers). The nonradiological numbers are assumed to occur at the same annual rates throughout the 100 year management period. The radiological emissions will have to be decayed to the year of interest using the the following decay equations:

$$N = No e^{-xt} \text{ where } x = \ln 2 / t^{1/2}$$

No is the quantity at time zero, $t^{1/2}$ is the half life in years of the isotope in question.

Since the tank farms and the evaporator each have different radionuclide emissions the above equation would have to be evaluated for each isotope being released from each tank farm for the year or years of interest.

The evaporator operations during the Long Term Management alternative would correspond to a periodic operations scenario where the evaporator would be operated on an as needed basis up through the year 2005. The annual emissions from the evaporator are best represented by the column titled Periodic Ops on the Tank Farm Emissions spreadsheet. The hourly emission rates and the release concentrations during evaporator operations are assumed to be the same whether the evaporator is operated continuously or periodically. Evaporator operations would be associated with each retanking campaign. These evaporator runs would be continuous operations for 5 year periods during the retanking. The annual emission rates for continuous evaporator operations are provided in the Continuous Ops column of the Tank Farm Emissions spreadsheet. The dates associated with retanking are 6/2037-6/2042 and 6/2087-6/2092. Again, the radiological emissions need to be decayed to the projected release dates.

RETANKING CONSTRUCTION EMISSIONS

The WHC engineering data package for the Tanks No Action estimated the nonradiological construction emissions by scaling the No Separations nonradiological construction emissions by the cost ratio. This appears to have resulted in overestimating the construction emissions. In particular, there is approximately 7 times more CO in the WHC data package than estimated using the reported fuel quantities (there is more carbon in the CO estimate than in the estimated construction fuel requirements).

The construction energy requirements (propane, gasoline, and diesel) identified in the WHC No Action data package (WHC-SD-WE-EV-099 Rev 0) Table 5-9 titled Construction Resource Requirements uses values reported in RHO-RE-ST-30 (the engineering support data for the HDW EIS). The Continued Storage alternative analyzed in the HDW EIS is very similar to our "continued management" alternative (e.g., retanking the DSTs twice in 100 years and build new evaporators each time). Using the same basis the following are the nonradiological construction emissions for the continued management alternative (retanking). These should provide a better representation of the construction emissions than the WHC data package .

Non Radiological Construction Emissions for Retanking DST wastes (two retanking campaigns)

Construction Emission Pollutant	Evaporator construction	Retrieval	Tank Replace ment	Total	Annual Emission
Particulate (kg)	100.0	170.0	100.0	370.0	46.3
S0x (kg)	215.0	89.0	214.0	518.0	64.8
C0 (kg)	2,120.0	6,095.0	2,120.0	10.335.0	1,291.9
Hydrocarbons (kg)	220.0	630.0	220.0	1,070.0	133.8
N0x (kg)	415.0	700.0	416.0	1,531.0	191.4
Aldehydes (kg)	25.0	0.0	25.0	50.0	6.3
Organic acids (kg)	25.0	0.0	25.0	50.0	6.3
Thermal releases (J)	3.10e+12	8.00e+12	3.40e+12	6.50e+12	8.13e+11
Fugitive dust (metric tons)	0.5	0.0	13.0	13.5	1.7

Source: RHO-RE-ST-30 Table 4-16 pg 4-22 and 4-23 for evaporator and retanking.
WHC-SD-WE-EV-097 Rev 0 for retrieval emissions.

The new tanks will be located in the same area as the Extensive Retrieval (Ex Situ Vitrification) facilities so the location of the new tanks should correspond to PROC.

The construction duration is 6/2033- 6/2037 and 6/2083-6/2087. Total duration is 8 years. The annual emissions can be factored from the total emissions provided above.

The borrow site (Pit 30) would be used as a source of aggregate for concrete. The total aggregate requirement is estimated at 84,000 m^3. The fugitive dust emissions should be split 90% at the location of the new tanks and 10% at the borrow site. The basis of this split is that the new tanks excavation is estimated at 3.7E+06 m^3 , substantially higher than the borrow requirements.

200 East

Tank Farm Emissions From Current Operations				
Tank Farm 241-A (5 Single-Shell tanks)		Avg Exit Velocity .0242 (ft/sec)		Area 5 (sq. ft)
Passive Ventilation		Avg Exit Temperature 138 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	3.38E+00	3.38E+00	3.86E-04	3.13E-02
Nitrogen Oxide	2.04E-01	2.04E-01	2.32E-05	1.88E-03
1,3-Butadiene	1.47E-02	1.47E-02	1.68E-06	1.36E-04
2-Hexanone	2.67E-01	2.67E-01	3.05E-05	2.47E-03
2-Pentanone	4.24E-01	4.24E-01	4.84E-05	3.92E-03
Acetone	5.09E+00	5.09E+00	5.81E-04	4.71E-02
Acetonitrile	2.45E+00	2.45E+00	2.80E-04	2.27E-02
Benzene	1.17E-01	1.17E-01	1.33E-05	1.08E-03
Heptane	2.99E-01	2.99E-01	3.42E-05	2.77E-03
Methyl N-Amyl Ketone	2.89E-01	2.89E-01	3.30E-05	2.68E-03
N-Hexane	3.12E-01	3.12E-01	3.56E-05	2.89E-03
Nonane	1.63E-01	1.63E-01	1.86E-05	1.51E-03
Octane	1.70E-01	1.70E-01	1.95E-05	1.58E-03
Toluene	2.37E-02	2.37E-02	2.71E-06	2.20E-04
Ammonia	2.34E+01	2.34E+01	2.67E-03	2.17E-01
Phosphoric Acid, Tributyl Ester	6.12E-01	6.12E-01	6.99E-05	5.67E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	2.78E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	6.75E-02	2.90E-05	3.31E-09	3.11E-12
Plutonium-239 Ci/yr	1.39E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.78E+00	8.26E-04	9.42E-08	5.50E-11

Tank Farm Emissions From Current Operations

Tank Farm 241-AX (4 Single-Shell tanks) Avg Exit Velocity .0225 (ft/sec) Area 4 (sq. ft)

Passive Ventilation Avg Exit Temperature 105.25 (F Height 3 (ft)

Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	2.52E+00	2.48E+00	2.83E-04	3.08E-02
Nitrogen Oxide	1.52E-01	1.52E-01	1.73E-05	1.89E-03
1,3-Butadiene	1.10E-02	1.03E-02	1.18E-06	1.28E-04
2-Hexanone	1.99E-01	1.99E-01	2.27E-05	2.48E-03
2-Pentanone	3.16E-01	2.80E-01	3.19E-05	3.48E-03
Acetone	3.80E+00	3.80E+00	4.33E-04	4.72E-02
Acetonitrile	1.83E+00	1.83E+00	2.09E-04	2.28E-02
Benzene	8.69E-02	8.69E-02	9.92E-06	1.08E-03
Heptane	2.23E-01	2.23E-01	2.55E-05	2.77E-03
Methyl N-Amyl Ketone	2.16E-01	2.16E-01	2.46E-05	2.68E-03
N-Hexane	2.32E-01	2.32E-01	2.65E-05	2.89E-03
Nonane	1.21E-01	1.21E-01	1.38E-05	1.51E-03
Octane	1.27E-01	1.27E-01	1.45E-05	1.58E-03
Toluene	1.77E-02	1.77E-02	2.02E-06	2.20E-04
Ammonia	1.74E+01	1.74E+01	1.99E-03	2.17E-01
Phosphoric Acid, Tributyl Ester	4.56E-01	4.56E-01	5.21E-05	5.68E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	2.07E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	5.03E-02	2.36E-05	2.69E-09	3.40E-12
Plutonium-239 Ci/yr	1.03E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.32E+00	6.71E-04	7.66E-08	6.01E-11

Tank Farm Emissions From Current Operations				
Tank Farm 241-B (16 Single-Shell tanks)		Avg Exit Velocity .1938 (ft/sec)		Area 5.78 (sq. ft)
Passive Ventilation		Avg Exit Temperature 66.94 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	9.62E+00	9.62E+00	1.10E-03	9.61E-03
Nitrogen Oxide	7.94E-01	5.79E-01	6.61E-05	5.79E-04
1,3-Butadiene	4.18E-02	4.18E-02	4.77E-06	4.18E-05
2-Hexanone	7.60E-01	7.60E-01	8.68E-05	7.60E-04
2-Pentanone	1.21E+00	1.21E+00	1.38E-04	1.21E-03
Acetone	1.45E+01	1.45E+01	1.65E-03	1.45E-02
Acetonitrile	6.98E+00	6.98E+00	7.97E-04	6.98E-03
Benzene	3.32E-01	3.32E-01	3.79E-05	3.31E-04
Heptane	8.51E-01	8.51E-01	9.72E-05	8.51E-04
Methyl N-Amyl Ketone	8.23E-01	8.23E-01	9.40E-05	8.23E-04
N-Hexane	8.87E-01	8.87E-01	1.01E-04	8.87E-04
Nonane	4.62E-01	4.62E-01	5.28E-05	4.62E-04
Octane	4.85E-01	4.85E-01	5.53E-05	4.84E-04
Toluene	6.75E-02	6.75E-02	7.71E-06	6.75E-05
Ammonia	6.65E+01	6.65E+01	7.60E-03	6.65E-02
Phosphoric Acid, Tributyl Ester	1.74E+00	1.74E+00	1.99E-04	1.74E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	7.57E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	1.84E-01	9.07E-05	1.04E-08	1.05E-12
Plutonium-239 Ci/yr	3.78E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.84E+00	2.46E-03	2.81E-07	1.77E-11

Tank Farm Emissions From Current Operations				
Tank Farm 241-BX (12 Single-Shell tanks)		Avg Exit Velocity .1595 (ft/sec)		Area 6.12 (sq. ft)
Passive Ventilation		Avg Exit Temperature 67.75 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	7.56E+00	7.56E+00	8.63E-04	8.67E-03
Nitrogen Oxide	4.55E-01	4.55E-01	5.19E-05	5.22E-04
1,3-Butadiene	3.29E-02	3.29E-02	3.75E-06	3.77E-05
2-Hexanone	5.98E-01	5.98E-01	6.82E-05	6.86E-04
2-Pentanone	9.48E-01	9.48E-01	1.08E-04	1.09E-03
Acetone	1.14E+01	1.14E+01	1.30E-03	1.31E-02
Acetonitrile	5.49E+00	5.49E+00	6.26E-04	6.29E-03
Benzene	2.61E-01	2.61E-01	2.98E-05	2.99E-04
Heptane	6.69E-01	6.69E-01	7.64E-05	7.67E-04
Methyl N-Amyl Ketone	6.47E-01	6.47E-01	7.39E-05	7.42E-04
N-Hexane	6.97E-01	6.97E-01	7.96E-05	8.00E-04
Nonane	3.64E-01	3.64E-01	4.15E-05	4.17E-04
Octane	3.81E-01	3.81E-01	4.35E-05	4.37E-04
Toluene	5.31E-02	5.31E-02	6.06E-06	6.09E-05
Ammonia	5.23E+01	5.23E+01	5.97E-03	6.00E-02
Phosphoric Acid, Tributyl Ester	1.37E+00	1.37E+00	1.56E-04	1.57E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	4.18E-01	2.11E-04	2.41E-08	2.81E-12
Plutonium-239 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.06E-02	5.44E-06	6.21E-10	4.49E-14

Tank Farm Emissions From Current Operations				
Tank Farm 241-BY (12 Single-Shell tanks)		Avg Exit Velocity .06996 (ft/sec)		Area 7.94 (sq. ft)
Passive Ventilation		Avg Exit Temperature 95.83 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	4.06E+00	4.06E+00	4.63E-04	8.18E-03
Nitrogen Oxide	2.51E-01	2.51E-01	2.87E-05	5.06E-04
1,3-Butadiene	1.76E-02	1.76E-02	2.01E-06	3.55E-05
2-Hexanone	3.24E-01	3.24E-01	3.70E-05	6.53E-04
2-Pentanone	5.16E-01	5.16E-01	5.89E-05	1.04E-03
Acetone	6.16E+00	6.16E+00	7.03E-04	1.24E-02
Acetonitrile	2.95E+00	2.95E+00	3.37E-04	5.95E-03
Benzene	1.42E-01	1.42E-01	1.62E-05	2.86E-04
Heptane	3.69E-01	3.69E-01	4.21E-05	7.43E-04
Methyl N-Amyl Ketone	3.50E-01	3.50E-01	4.00E-05	7.06E-04
N-Hexane	3.96E-01	3.96E-01	4.52E-05	7.98E-04
Nonane	1.97E-01	1.97E-01	2.25E-05	3.98E-04
Octane	2.09E-01	2.09E-01	2.39E-05	4.22E-04
Toluene	3.12E-02	3.12E-02	3.57E-06	6.30E-05
Ammonia	3.13E+01	3.13E+01	3.58E-03	6.32E-02
Phosphoric Acid, Tributyl Ester	7.33E-01	7.33E-01	8.37E-05	1.48E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	3.95E-02	2.36E-05	2.69E-09	5.50E-13
Plutonium-239 Ci/yr	1.18E-05	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.55E-02	2.36E-05	2.69E-09	3.42E-13

Tank Farm Emissions From Current Operations				
Tank Farm 241-C (13 Single-Shell tanks)		Avg Exit Velocity .01854 (ft/sec)		Area 12.79 (sq. ft)
Passive Ventilation		Avg Exit Temperature 78.08 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	5.77E+00	5.77E+00	6.59E-04	3.09E-02
Nitrogen Oxide	3.95E-01	3.95E-01	4.51E-05	1.87E-03
1,3-Butadiene	2.51E-02	2.51E-02	2.87E-06	1.35E-04
2-Hexanone	4.56E-01	4.56E-01	5.21E-05	2.45E-03
2-Pentanone	7.24E-01	7.24E-01	8.26E-05	3.88E-03
Acetone	8.70E+00	8.70E+00	9.93E-04	4.66E-02
Acetonitrile	4.19E+00	4.19E+00	4.78E-04	2.25E-02
Benzene	1.99E-01	1.99E-01	2.27E-05	1.07E-03
Heptane	5.11E-01	5.11E-01	5.83E-05	2.74E-03
Methyl N-Amyl Ketone	4.93E-01	4.93E-01	5.63E-05	2.64E-03
N-Hexane	5.32E-01	5.32E-01	6.08E-05	2.85E-03
Nonane	2.78E-01	2.78E-01	3.17E-05	1.49E-03
Octane	2.91E-01	2.91E-01	3.32E-05	1.56E-03
Toluene	4.05E-02	4.05E-02	4.62E-06	2.17E-04
Ammonia	4.55E+01	4.55E+01	5.19E-03	2.15E-01
Phosphoric Acid, Tributyl Ester	1.05E+00	1.05E+00	1.19E-04	5.60E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	1.07E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	3.95E-03	0.00E+00	0.00E+00	0.00E+00
Plutonium-239 Ci/yr	1.28E-03	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.63E-02	2.54E-05	2.90E-09	9.79E-13

ank Farm Emissions From Current Operations				
296-AN 8 Source Emissions Roll-Up		Avg Exit Velocity 18.2 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 14.92 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	3.63E-01	3.63E-01	4.14E-05	4.13E-05
1, 3-Butadiene	2.62E-02	2.62E-02	2.99E-06	2.99E-06
2-Hexanone	4.77E-01	4.77E-01	5.45E-05	5.44E-05
2-Pentanone	7.58E-01	7.58E-01	8.65E-05	8.63E-05
Acetone	9.07E+00	9.07E+00	1.04E-03	1.03E-03
Acetonitrile	4.38E+00	4.38E+00	5.00E-04	4.99E-04
Benzene	2.08E-01	2.08E-01	2.37E-05	2.37E-05
Heptane	5.33E-01	5.33E-01	6.09E-05	6.08E-05
Methyl N-Amyl Ketone	5.16E-01	5.16E-01	5.89E-05	5.88E-05
N-Hexane	5.56E-01	5.56E-01	6.35E-05	6.34E-05
Nonane	2.90E-01	2.90E-01	3.31E-05	3.31E-05
Octane	3.04E-01	3.04E-01	3.47E-05	3.46E-05
Toluene	4.24E-02	4.24E-02	4.84E-06	4.83E-06
		Ci/yr	Ci/hr	grams/m^3
Strontium-90		1.20E-07	1.37E-11	9.84E-17
Total Alpha		None Detected		

Tank Farm Emissions From Current Operations				
296-AP 9 Source Emissions Roll-Up		Avg Exit Velocity 35.8 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 13.33 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	4.15E-01	4.15E-01	4.74E-05	2.41E-05
1, 3-Butadiene	2.99E-02	2.99E-02	3.42E-06	1.73E-06
2-Hexanone	5.45E-01	5.45E-01	6.22E-05	3.16E-05
2-Pentanone	8.65E-01	8.65E-01	9.88E-05	5.01E-05
Acetone	1.04E+01	1.04E+01	1.19E-03	6.04E-04
Acetonitrile	5.01E+00	5.01E+00	5.72E-04	2.90E-04
Benzene	2.38E-01	2.38E-01	2.71E-05	1.38E-05
Heptane	6.10E-01	6.10E-01	6.96E-05	3.53E-05
Methyl N-Amyl Ketone	5.90E-01	5.90E-01	6.73E-05	3.42E-05
N-Hexane	6.36E-01	6.36E-01	7.26E-05	3.68E-05
Nonane	3.31E-01	3.31E-01	3.78E-05	1.92E-05
Octane	3.47E-01	3.47E-01	3.97E-05	2.01E-05
Toluene	4.84E-02	4.84E-02	5.53E-06	2.81E-06
		Ci/yr	Ci/hr	grams/m^3
Strontium-90		6.60E-08	7.53E-12	2.75E-17

ɜnk Farm Emissions From Current Operations				
296-AW 7 Source Emissions Roll-Up		Avg Exit Velocity 30 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 15.75 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	3.11E-01	3.11E-01	3.55E-05	2.15E-05
1, 3-Butadiene	2.25E-02	2.25E-02	2.57E-06	1.56E-06
2-Hexanone	4.09E-01	4.09E-01	4.67E-05	2.83E-05
2-Pentanone	6.50E-01	6.50E-01	7.42E-05	4.49E-05
Acetone	7.79E+00	7.79E+00	8.90E-04	5.39E-04
Acetonitrile	3.76E+00	3.76E+00	4.29E-04	2.60E-04
Benzene	1.79E-01	1.79E-01	2.04E-05	1.24E-05
Heptane	4.57E-01	4.57E-01	5.22E-05	3.16E-05
Methyl N-Amyl Ketone	4.43E-01	4.43E-01	5.05E-05	3.06E-05
N-Hexane	4.77E-01	4.77E-01	5.45E-05	3.30E-05
Nonane	2.49E-01	2.49E-01	2.84E-05	1.72E-05
Octane	2.60E-01	2.60E-01	2.97E-05	1.80E-05
Toluene	3.63E-02	3.63E-02	4.14E-06	2.51E-06
		Ci/yr	Ci/hr	grams/m^3
Cesium-137		2.80E-08	3.20E-12	2.24E-17
Strontium-90		1.60E-07	1.83E-11	7.96E-17
·tal Alpha (Pu-239)		1.50E-08	1.71E-12	1.68E-14

ank Farm Emissions From Current Operations				
296-AYAZ 5 Source Emissions Roll-Up		Avg Exit Velocity 31.91 (ft/sec	Area 1.77 (sq. ft)	
Active Ventilation		Avg Exit Temperature 110 (F)	Height 50 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	2.08E-01	2.08E-01	2.37E-05	4.12E-06
1, 3-Butadiene	1.50E-02	1.50E-02	1.71E-06	2.97E-07
2-Hexanone	2.73E-01	2.73E-01	3.12E-05	5.41E-06
2-Pentanone	4.33E-01	4.33E-01	4.94E-05	8.58E-06
Acetone	5.20E+00	5.20E+00	5.93E-04	1.03E-04
Acetonitrile	2.50E+00	2.50E+00	2.86E-04	4.96E-05
Benzene	1.19E-01	1.19E-01	1.36E-05	2.36E-06
Heptane	3.05E-01	3.05E-01	3.48E-05	6.04E-06
Methyl N-Amyl Ketone	2.95E-01	2.95E-01	3.37E-05	5.85E-06
N-Hexane	3.18E-01	3.18E-01	3.64E-05	6.31E-06
Nonane	1.66E-01	1.66E-01	1.90E-05	3.29E-06
Octane	1.74E-01	1.74E-01	1.99E-05	3.45E-06
Toluene	2.42E-02	2.42E-02	2.77E-06	4.80E-07
		Ci/yr	Ci/hr	grams/m^3
Cesium-137		5.30E-05	6.05E-09	1.22E-14
Strontium-90		8.20E-06	9.36E-10	1.17E-15
dine-129		4.60E-05	5.25E-09	5.18E-09
tal Alpha (Pu-239)		5.70E-09	6.51E-13	1.83E-15

Tank Farm Emissions From Current Operations								
242A 6 Source Emissions Roll-UP		Avg Exit Velocity 37.8 (ft/sec)		Area 9.62 (sq. ft)				
Active Ventilation		Avg Exit Temperature 117 (F)		Height 22 (ft)				
					Operating release			
	Continuous Ops	Periodic Ops	Periodic Ops	Continuous	Concentration			
Emissions	Potential (tons/yr)	Actual (tons/yr)	Actual (kg/hr)	Actual (kg/hr)	g/m^3	Area (ft^2)	Velocity (ft/s)	
2-Hexanone	3.80E-04	2.88E-05	2.98E-06	3.94E-05	1.06E-06	9.62	37.8	
Acetone	1.06E-01	7.98E-03	8.27E-04	1.10E-02	2.97E-04	9.62	37.8	
Methyl Isobutyl Ketone	7.25E-03	5.44E-04	5.64E-05	7.51E-04	2.03E-05	9.62	37.8	
N-Butyl Alcohol	8.00E-01	6.00E-02	6.22E-03	8.29E-02	2.24E-03	9.62	37.8	
Ammonia	1.00E-01	7.51E-03	7.78E-04	1.04E-02	2.80E-04	9.62	37.8	
	Ci/yr	Ci/yr		Ci/hr	grams/m^3			
Total Alpha (Ci) (Pu)	1.41E-04	2.10E-05		1.61E-08	7.00E-12	9.62	37.8	
Total Beta (Ci) (Sr-90)	8.04E-05	1.20E-05		9.18E-09	1.78E-15	9.62	37.8	

note: total alpha and beta taken from WHC-SD-WM-EV-099 and are from 1987 evaporator operations (11 MM gal run, Capacity=73.6 MM gal/yr so continuous ops =6.7 times periodic)

note: evaporator emissions are the sum of the building ventilation and the vessel vent systems which each have a stack. The shorter stack was chosen as the release point for all emissions.

200 West

Tank Farm Emissions From Current Operations				
		Avg Exit Velocity .36 (ft/s)		Area 1.08 (ft2)
241-S Tank Farm (12 Single-Shell Tanks)		Avg Exit Temperature 94.2 (F)		Height 3 (ft)
Passive Ventilation				
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.14E-02	1.14E-02	1.30E-06	3.28E-05
Nitrogen Oxide	6.86E-04	7.44E-04	8.49E-08	2.14E-06
1,3-Butadiene	4.96E-05	5.37E-05	6.13E-09	1.55E-07
2-Hexanone	9.01E-04	9.76E-04	1.11E-07	2.81E-06
2-Pentanone	1.43E-03	1.55E-03	1.77E-07	4.46E-06
Acetone	1.72E-02	1.86E-02	2.12E-06	5.35E-05
Acetonitrile	8.27E-03	8.96E-03	1.02E-06	2.58E-05
Benzene	3.94E-04	4.26E-04	4.87E-08	1.23E-06
Heptane	1.01E-03	1.09E-03	1.25E-07	3.15E-06
Methyl N-Amyl Ketone	9.76E-04	1.06E-03	1.21E-07	3.04E-06
N-Hexane	1.05E-03	1.14E-03	1.30E-07	3.28E-06
Nonane	5.48E-04	5.94E-04	6.78E-08	1.71E-06
Octane	5.75E-04	6.23E-04	7.11E-08	1.79E-06
Toluene	8.00E-05	8.67E-05	9.90E-09	2.50E-07
Ammonia	7.88E-02	8.54E-02	9.75E-06	2.46E-04
Phosphoric Acid, Tributyl Ester	1.91E-03	2.24E-03	2.55E-07	6.44E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	9.36E-07	0.00E+00	0.00E+00	0.00E+00
Cesium 137	2.28E-04	8.20E-08	9.36E-12	2.73E-15
Plutonium-239	4.68E-07	0.00E+00	0.00E+00	0.00E+00
Strontium-090	6.00E-03	2.41E-06	2.75E-10	4.99E-14

Tank Farm Emissions From Current Operations				
241-SX Tank Farm (2 Single-Shell Tanks)		Avg Exit Velocity .014 (ft/s)		Area 2 (ft2)
Passive Ventilation		Avg Exit Temperature 76.5 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	8.78E-04	8.78E-04	1.00E-07	3.51E-05
Nitrogen Oxide	5.28E-05	5.28E-05	6.03E-09	2.11E-06
1,3-Butadiene	3.82E-06	3.82E-06	4.36E-10	1.53E-07
2-Hexanone	6.94E-05	6.94E-05	7.92E-09	2.78E-06
2-Pentanone	1.10E-04	1.10E-04	1.26E-08	4.41E-06
Acetone	1.32E-03	1.32E-03	1.51E-07	5.30E-05
Acetonitrile	6.38E-04	6.38E-04	7.28E-08	2.55E-05
Benzene	3.02E-05	3.02E-05	3.45E-09	1.21E-06
Heptane	7.78E-05	7.78E-05	8.88E-09	3.11E-06
Methyl N-Amyl Ketone	7.52E-05	7.52E-05	8.58E-09	3.01E-06
N-Hexane	8.10E-05	8.10E-05	9.25E-09	3.24E-06
Nonane	4.22E-05	4.22E-05	4.82E-09	1.69E-06
Octane	4.42E-05	4.42E-05	5.05E-09	1.77E-06
Toluene	6.16E-06	6.16E-06	7.03E-10	2.46E-07
Ammonia	6.08E-03	6.08E-03	6.94E-07	2.43E-04
Phosphoric Acid, Tributyl Ester	1.59E-04	1.59E-04	1.82E-08	6.36E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.74E-05	8.00E-09	9.13E-13	9.33E-14
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	4.60E-04	2.40E-07	2.74E-11	1.55E-10
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tank Farm Emissions From Current Operations				
241-T Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0246 (ft/s)		Area 16 (ft2)
Passive Ventilation		Avg Exit Temperature 65.2 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.21E-02	1.21E-02	1.39E-06	3.45E-05
Nitrogen Oxide	7.30E-04	7.30E-04	8.34E-08	2.08E-06
1,3-Butadiene	5.28E-05	5.28E-05	6.02E-09	1.50E-07
2-Hexanone	9.59E-04	9.59E-04	1.09E-07	2.73E-06
2-Pentanone	1.52E-03	1.52E-03	1.74E-07	4.32E-06
Acetone	1.83E-02	1.83E-02	2.09E-06	5.19E-05
Acetonitrile	8.80E-03	8.80E-03	1.01E-06	2.50E-05
Benzene	4.19E-04	4.19E-04	4.78E-08	1.19E-06
Heptane	1.07E-03	1.07E-03	1.23E-07	3.05E-06
Methyl N-Amyl Ketone	1.04E-03	1.04E-03	1.19E-07	2.95E-06
N-Hexane	1.12E-03	1.12E-03	1.28E-07	3.18E-06
Nonane	5.84E-04	5.84E-04	6.66E-08	1.66E-06
Octane	6.12E-04	6.12E-04	6.98E-08	1.74E-06
Toluene	8.52E-05	8.52E-05	9.72E-09	2.42E-07
Ammonia	8.39E-02	8.39E-02	9.58E-06	2.39E-04
Phosphoric Acid, Tributyl Ester	3.75E-03	2.20E-03	2.51E-07	6.24E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.68E-04	7.60E-08	8.68E-12	6.30E-14
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	3.84E-05	2.30E-08	2.63E-12	1.06E-12
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tank Farm Emissions From Current Operations				
241-TX Tank Farm (18 Single-Shell Tanks)	Avg Exit Velocity .1816 (ft/s)		Area 5.82 (ft2)	
Passive Ventilation	Avg Exit Temperature 72.3 (F)		Height 3 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.06E-02	1.06E-02	1.21E-06	1.13E-05
Nitrogen Oxide	6.91E-04	6.91E-04	7.89E-08	7.32E-07
1,3-Butadiene	4.58E-05	4.58E-05	5.23E-09	4.85E-08
2-Hexanone	8.32E-04	8.32E-04	9.50E-08	8.82E-07
2-Pentanone	1.32E-03	1.32E-03	1.51E-07	1.40E-06
Acetone	1.59E-02	1.59E-02	1.81E-06	1.68E-05
Acetonitrile	7.64E-03	7.64E-03	8.73E-07	8.10E-06
Benzene	3.63E-04	3.63E-04	4.15E-08	3.85E-07
Heptane	9.32E-04	9.32E-04	1.06E-07	9.88E-07
Methyl N-Amyl Ketone	9.01E-04	9.01E-04	1.03E-07	9.55E-07
N-Hexane	9.71E-04	9.71E-04	1.11E-07	1.03E-06
Nonane	5.06E-04	5.06E-04	5.78E-08	5.37E-07
Octane	5.31E-04	5.31E-04	6.06E-08	5.62E-07
Carbon Tetrachloride	3.91E-06	3.91E-06	4.46E-10	1.35E-07
Ethyl Butyl Ketone	1.31E-05	1.31E-05	1.50E-09	4.53E-07
Methyl Chloride	5.78E-07	5.78E-07	6.60E-11	2.00E-08
Tetrahydrofuran	1.01E-06	1.01E-06	1.15E-10	3.49E-08
Toluene	3.91E-06	3.91E-06	4.46E-10	4.14E-09
Ammonia	1.31E-05	1.31E-05	1.50E-09	1.39E-08
Phosphoric Acid, Tributyl Ester	5.78E-07	5.78E-07	6.60E-11	6.13E-10
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	7.08E-05	7.08E-05	8.08E-09	1.21E-09
Strontium-090	6.98E-02	6.98E-02	7.97E-06	5.32E-10

Tank Farm Emissions From Current Operations				
241-TY Tank Farm (6 Single-Shell Tanks)		Avg Exit Velocity .0253 (ft/s)		Area 5.79 (ft2)
Passive Ventilation		Avg Exit Temperature 66.0 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	4.68E-03	4.68E-03	5.34E-07	3.57E-05
Nitrogen Oxide	2.82E-04	2.82E-04	3.21E-08	2.15E-06
1,3-Butadiene	2.03E-05	2.03E-05	2.32E-09	1.55E-07
2-Hexanone	3.70E-04	3.70E-04	4.22E-08	2.82E-06
2-Pentanone	5.86E-04	5.86E-04	6.69E-08	4.48E-06
Acetone	7.04E-03	7.04E-03	8.04E-07	5.38E-05
Acetonitrile	3.39E-03	3.39E-03	3.87E-07	2.59E-05
Benzene	1.61E-04	1.61E-04	1.84E-08	1.23E-06
Heptane	4.14E-04	4.14E-04	4.72E-08	3.16E-06
Methyl N-Amyl Ketone	4.00E-04	4.00E-04	4.57E-08	3.06E-06
N-Hexane	4.31E-04	4.31E-04	4.92E-08	3.29E-06
Nonane	2.25E-04	2.25E-04	2.57E-08	1.72E-06
Octane	2.36E-04	2.36E-04	2.69E-08	1.80E-06
Toluene	3.28E-05	3.28E-05	3.75E-09	2.51E-07
Ammonia	3.24E-02	3.24E-02	3.69E-06	2.47E-04
Phosphoric Acid, Tributyl Ester	8.47E-04	8.47E-04	9.67E-08	6.47E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	4.00E-04	4.00E-04	4.57E-08	8.91E-10
Cesium 137	4.31E-04	4.31E-04	4.92E-08	3.81E-11
Plutonium-239	2.25E-04	2.25E-04	2.57E-08	2.78E-08
Strontium-090	2.36E-04	2.36E-04	2.69E-08	1.30E-11

Tank Farm Emissions From Current Operations				
241-U Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0236 (ft/s)	Area 16.0 (ft2)	
Passive Ventilation		Avg Exit Temperature 75.6 (F)	Height 3 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.16E-02	1.16E-02	1.33E-06	3.45E-05
Nitrogen Oxide	7.00E-04	7.00E-04	7.99E-08	2.08E-06
1,3-Butadiene	5.05E-05	5.05E-05	5.77E-09	1.50E-07
2-Hexanone	9.19E-04	9.19E-04	1.05E-07	2.73E-06
2-Pentanone	1.46E-03	1.46E-03	1.66E-07	4.33E-06
Acetone	1.75E-02	1.75E-02	2.00E-06	5.20E-05
Acetonitrile	8.43E-03	8.43E-03	9.63E-07	2.51E-05
Benzene	1.08E-03	1.08E-03	1.23E-07	3.21E-06
Heptane	1.03E-03	1.03E-03	1.17E-07	3.05E-06
Methyl N-Amyl Ketone	9.95E-04	9.95E-04	1.14E-07	2.96E-06
N-Hexane	1.07E-03	1.07E-03	1.22E-07	3.18E-06
Nonane	5.59E-04	5.59E-04	6.38E-08	1.66E-06
Octane	5.86E-04	5.86E-04	6.69E-08	1.74E-06
Toluene	7.49E-05	7.49E-05	8.55E-09	2.23E-07
Ammonia	8.04E-02	8.04E-02	9.18E-06	2.39E-04
Phosphoric Acid, Tributyl Ester	2.10E-03	2.10E-03	2.40E-07	6.25E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.08E-03	1.08E-03	1.23E-07	9.36E-10
Cesium 137	1.03E-03	1.03E-03	1.17E-07	3.54E-11
Plutonium-239	9.95E-04	9.95E-04	1.14E-07	4.77E-08
Strontium-090	1.07E-03	1.07E-03	1.22E-07	2.29E-11

Tank Farm Emissions From Current Operations				
296-SX 14 Source Emissions Roll-Up		Avg Exit Velocity 10.6 (ft/s)		Area 9.62 (ft2)
Passive Ventilation		Avg Exit Temperature 165 (F)		Height 15 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	2.24E-01	2.24E-01	2.56E-05	2.46E-06
Nitrogen Oxide	7.43E-04	7.43E-04	8.48E-08	8.16E-09
1,3-Butadiene	5.36E-05	5.36E-05	6.12E-09	5.89E-10
2-Hexanone	9.77E-04	9.77E-04	1.12E-07	1.07E-08
2-Pentanone	1.55E-03	1.55E-03	1.77E-07	1.70E-08
Acetone	1.86E-02	1.86E-02	2.12E-06	2.04E-07
Acetonitrile	8.96E-03	8.96E-03	1.02E-06	9.84E-08
Benzene	4.26E-04	4.26E-04	4.86E-08	4.68E-09
Heptane	1.09E-03	1.09E-03	1.24E-07	1.20E-08
Methyl N-Amyl Ketone	1.06E-03	1.06E-03	1.21E-07	1.16E-08
N-Hexane	1.14E-03	1.14E-03	1.30E-07	1.25E-08
Nonane	5.94E-04	5.94E-04	6.78E-08	6.52E-09
Octane	6.23E-04	6.23E-04	7.11E-08	6.84E-09
Toluene	8.67E-05	8.67E-05	9.90E-09	9.52E-10
Ammonia	4.17E+00	4.17E+00	4.76E-04	4.58E-05
Phosphoric Acid, Tributyl Ester	2.24E-03	2.24E-03	2.56E-07	2.46E-08
Total Alpha		None Detected		
Total Beta		9.10E-08	1.04E-11	

Tank Farm Emissions From Current Operations				
296-SY 4 Source Emissions Roll-Up		Avg Exit Velocity 33.3 (ft/s)		Area .35 (ft2)
~~Passive~~ Ventilation		Avg Exit Temperature 110 (F)		Height 11 (ft)
Active				
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	5.16E-02	5.16E-02	5.89E-06	4.96E-06
Nitrogen Oxide	1.72E-04	1.72E-04	1.96E-08	1.65E-08
1,3-Butadiene	1.24E-05	1.24E-05	1.42E-09	1.19E-09
2-Hexanone	2.25E-04	2.25E-04	2.57E-08	2.16E-08
2-Pentanone	3.58E-04	3.58E-04	4.09E-08	3.44E-08
Acetone	4.30E-03	4.30E-03	4.91E-07	4.13E-07
Acetonitrile	2.07E-03	2.07E-03	2.36E-07	1.99E-07
Benzene	9.83E-05	9.83E-05	1.12E-08	9.44E-09
Heptane	2.52E-04	2.52E-04	2.88E-08	2.42E-08
Methyl N-Amyl Ketone	2.44E-04	2.44E-04	2.79E-08	2.34E-08
N-Hexane	2.63E-04	2.63E-04	3.00E-08	2.53E-08
Nonane	1.37E-04	1.37E-04	1.56E-08	1.32E-08
Octane	1.44E-04	1.44E-04	1.64E-08	1.38E-08
Toluene	2.00E-05	2.00E-05	2.28E-09	1.92E-09
Ammonia	9.63E-01	9.63E-01	1.10E-04	9.25E-05
Phosphoric Acid, Tributyl Ester	5.15E-04	5.16E-04	5.89E-08	4.96E-08
Total Alpha		8.1E-09	9.25E-13	
Total Beta		7.00E-07	7.99E-11	

sent fedex 9/25

Request Number 079

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 09/14/95

Phone Number: (904) 332-3318 ext 6058 Fax Number: (904) 333-6631

Request Information: Data for the Minimal Retrieval In Situ Vitrification alternative.

Need Date: 9/22/95

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed: 9/25/95

Concurrence: Marc C. Nelson
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST -079

Minimal Retrieval (In Situ Vitrification)

Ref 2.1.3 Construction Emissions:
The construction emissions in the latest revision of the WHC engineering data package agrees with the totals in the Engineering Information Request -056 as amended with the following change. Fugitive dust emissions of 2.20E+05 kg were added to the nonradiological construction emission estimates.

Ref 2.2.1 Continued Operations for the In Situ Vitrification alternative would be the same as for the tanks No Action alternative. Emissions from the tank farms for the continued operations portion of the In Situ Vitrification alternative are reported the Tank Farm Emissions from Current Operations (see Eng. Inf. Req. 078). Periodic evaporator operations would occur during continued operations. The number of tanks undergoing continued operations will decline as tanks are vitrified. The continued operations phase out schedule attached provides the percentage of tanks remaining under continued operations on an annual basis.

Ref 2.2.4 The excess DST liquids would be evaporated in the 242-A evaporator. Stack and release parameters are reported in Engineering Information Request-077. Evaporation of DST liquids would require five years of continuous evaporator operations between the years 2000-2005. Note: continuous operation of the evaporator results in emissions reported as continuous actual in the current emissions spreadsheet.

Also attached is a copy of the spreadsheet titled ISV Emissions that lists the operating and construction emissions as developed from the WHC In Situ Engineering data package Rev. 0.

ISV.EMM

ISV Emissions

	Operating Emissions			
Component	Total Emission	Annual Emissions	Average Hourly	Peak Hourly
	Curies	based on 5 yrs of ISV		
		Curies/year	Ci/hr	Ci/hr
Am-241	1.00E-06	2.00E-07	4.57E-12	6.85E-12
C-14	5.30E+03	1.06E+03	2.42E-02	3.63E-02
Cs-137	3.50E-04	7.00E-05	1.60E-09	2.40E-09
I-129	1.60E+01	3.20E+00	7.31E-05	1.10E-04
Pu-239,240	3.30E-07	6.60E-08	1.51E-12	2.26E-12
Ru-106	3.80E-13	7.60E-14	1.74E-18	2.60E-18
Sm-151	6.30E-06	1.26E-06	2.88E-11	4.32E-11
Sr-90	5.40E-04	1.08E-04	2.47E-09	3.70E-09
Tc-99	3.20E-07	6.40E-08	1.46E-12	2.19E-12
Zr-93	3.90E-08	7.80E-09	1.78E-13	2.67E-13
	kg	kilograms/year		
Particulate	6.00E+04	1.20E+04	2.74E-01	4.11E-01
S0x	0	0.00E+00	0.00E+00	0.00E+00
CO	0	0.00E+00	0.00E+00	0.00E+00
Hydrocarbons	11	2.20E+00	5.02E-05	7.53E-05
N0x	3.60E+05	7.20E+04	1.64E+00	2.47E+00
Aldehydes	N/A		0.00E+00	0.00E+00
Organic Acids	N/A		0.00E+00	0.00E+00
NH3	5.60E+04	1.12E+04	2.56E-01	3.84E-01
Assumptions: Each tank farm will have a confinement facility				
	There will be 4 vitrification systems in place with at least two in operation at all times			
	One stack for each Tank Farm Confinement Facility (may be conservative)			
	May have two systems operating in one tank farm or may vitrify tanks in			
	different tank farms at the same time resulting in emissions from two stacks.			
	The WHC data package does not address this issue.			
	The radiological emissions are 100% PM10			
	Average hourly emissions based on 5 yrs operations @ 24 hrs per day			
		with two ISV systems in operation		
	Peak hourly emissions based on 3 ISV systems in opertions simultaneously			
Reference WHC-SD-WM-EV-101 In Situ Rev 0 (Public Release)				

ISV Emissions

	Constuction Emissions				
Component	Total Emission	Annual Emissions	Hourly Emissions	Red factor	
	kg	kg/year (19 years)	kg/hr (1550 hrs/yr)		
Particulate	6.20E+04	3.26E+03	2.11E+00	.58	
Fugitive Dust	2.20E+05	1.16E+04	7.47E+00		
S0x	7.90E+04	4.16E+03	2.68E+00	.92	
CO	3.50E+06	1.84E+05	1.19E+02	0.3	
Hydrocarbons	2.90E+05	1.53E+04	9.85E+00		
N0x	6.30E+05	3.32E+04	2.14E+01	0.56	
Aldehydes	1.80E+04	9.47E+02	6.11E-01	0.48 x.0095	
Organic Acids	4.00E+03	2.11E+02	1.36E-01		
Assumptions:	Emissions will be spread throughout the tank farms				

#012

Continued Operations Phase Out Schedule

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No Action																
Min Retrieval (In Situ Vit)																
Waste Treatment 2008-2013 Number of Tanks Treated														30	59	89
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	67%	50%
Min Retrieval (Fill and Cap)																
Waste Treatment 2006-2013 Number of Tanks Treated												22	44	66	89	111
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	88%	75%	63%	50%	38%
Selective Retrieval																
Retrieval 2001-2023, Number of Tanks Treated							3	6	9	12	15	18	21	24	27	30
Fill and Cap 2006-2013												13	27	40	54	67
Total Tanks Treated							3	6	9	12	15	32	48	64	81	97
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	98%	97%	95%	93%	91%	82%	73%	64%	54%	45%
Extensive Retrieval (Ex Situ Vit)																
Retrieval 2001-2023, Number of Tanks Treated							8	15	23	31	38	46	54	62	69	77
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	91%	87%	83%	78%	74%	70%	65%	61%	57%
Extensive Retrieval (No Separations)																
Retrieval 2001-2018, Number of Tanks Treated							10	20	30	39	49	59	69	79	89	98
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	94%	89%	83%	78%	72%	67%	61%	56%	50%	44%
Extensive Retrieval (Extensive Separations)																
Retrieval 2001-2024, Number of Tanks Treated							7	15	22	30	37	44	52	59	66	74
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	92%	88%	83%	79%	75%	71%	67%	63%	58%

Continued Operations Phase Out Schedule

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
118	148	177											
33%	17%	0%											
133	155	177											
25%	13%	0%											
33	37	40	43	46	49	52	55	58	61	64	67	70	
80	94	107											
114	130	147	150	153	156	159	162	165	168	171	174	177	
36%	26%	17%	15%	14%	12%	10%	9%	7%	5%	3%	2%	0%	
85	92	100	108	115	123	131	139	146	154	162	169	177	
52%	48%	43%	39%	35%	30%	26%	22%	17%	13%	9%	4%	0%	
108	118	128	138	148	157	167	177						
39%	33%	28%	22%	17%	11%	6%	0%						
81	89	96	103	111	118	125	133	140	148	155	162	170	177
54%	50%	46%	42%	38%	33%	29%	25%	21%	17%	13%	8%	4%	0%

fedex 9/26.

Request Number 080

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 09/14/95

Phone Number: (904) 332-3318 ext 6058 Fax Number: (904) 333-6631

Request Information: Data for the In Situ Fill and Cap sub-alternative. See attached sheet for detailed information.

Need Date: 9/22/95

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson CH

Date Sent/Faxed: 9/26/95

Concurrence: Marc C. Nelson
Marc Nelson - Project Manager

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In Situ, Fill and Cap subalternative

3.1.3 Were the emissions from the construction of the gravel handling equipment included in the construction emissions previously provided? If not, are they significant? If they are significant, I would assume that the location of the source is very close to the subject tank farm, and that the additional emissions can be assigned to the area source that describes the tank farm. Please confirm.

3.2.4 Will the excess DST liquids be removed using the existing (242A) evaporator, or a new one? In either case, we would require the location and stack parameters, as well as the radiological and non-radiological emissions.

3.2.4 Need emissions of radionuclide and non-radiological components during RF drying operations. Your breakdown shows 45 drying systems being operated continuously. How many tank farms does this represent? Does each drying system have its own stack? What are the stack parameters and locations?

3.2.4 Will the cyclonic separators have their own stack? If so, are the emissions significant? If so, we require the location, parameters, and emission rates.

ENGINEERING INFORMATION REQUEST: 080

SUBJECT: Fill and Cap Subalternative

The past revision of the In Situ data package from Westinghouse did not include fugitive dust emissions. The Rev 0 In Situ data package reports fugitive dust from construction at 1.0E+04 kg. The other change was the aldehydes were 8.5E+02 kg and they are now 7.5E+02 kg. Both of these changes take place over the entire construction period of (2003-2005) two years.

The fugitive dust emissions would be emitted from excavation of the material and during the unloading operations at the four stock piles.

The following is taken from the In Situ data package from WHC:

Gravel would be excavated from existing Pit 30 (between 200 West and 200 East areas) and is considered a construction cost. The gravel would be stored in four stockpiles (60m x 60 m) ; each would serve the following clusters of tank farms:

East 1. 241-A, 241-AX, 241-AW, 241-AP, 241-AY, 241-AZ
2. 241-B, 241-BX, 241-BY, 241-C, 241-AN

West 3. 241-T, 241-TX, 241-TY
4. 241-S, 241-SX, 241-U, 241-SY

Each stockpile would be serviced by a loader to load a conveyor network which services one tank at a time.

Since the gravel would have to be excavated and screened and loaded into trucks at Pit 30 the fugitive dust emissions are assumed to be split 60% at Pit 30 and 40% at the stockpiles.

Location	Total Emission kg	Annual Average kg/yr	Phase	Source ID
Pit 30	6,000	3,000	Construction	BTCH
Stock Pile1	1,000	500	Construction	adjacent to 241-AX
Stock Pile 2	1,000	500	Construction	adjacent to 241-BX
Stock Pile 3	1,000	500	Construction	adjacent to 241-TY
Stock Pile 4	1,000	500	Construction	adjacent to 241-S

The stock pile locations are assumed to be located adjacent to a centrally located tank farm from within the groups identified for stock piles 1,2,3, and 4.

DST Liquids

The excess DST liquids will be evaporated in the 242A evaporator. The location and stack parameters are provided in EIR-077. The reduction of the DST liquids would require 5 years of continuous evaporator operations. Emissions from the evaporator during DST liquid evaporation are provided in the attached spreadsheet titled 242-A Evaporator Operations. The continuous actual numbers correspond to continuous operations.

Radio Frequency drying

RF drying of the SSTs and DSTs has been deleted from the Fill and Cap alternative.
Tank emissions are the same as continued operations until the tanks are filled with gravel

Cyclonic Separators

The cyclone separators would be installed in the ventilation system as the first stage of particulate removal.

The assumptions used to for gravel filling include:

The DSTs would require evaporation in the 242-A evaporator which would require operating the evaporator for 5 years.

Gravel filling of the tanks takes 4 years to complete (approximately 1 tank per week).
The time required to fill a tank is approximately 3 days of operations (at 50 metric tons/hour which is about 33 cubic meters per hour it would require 3 days running 24 hours/day)

The gravel filling operation would require the use of a portable exhauster similar to the RF drying scenario.

AIR EMISSIONS SCENARIO

Continued Operations: Tank farm emissions from current or routine operations are provided in the response to Engineering Information Request -078. The phase out of current operations would occur as the tanks are filled (assume no air emissions following tank filling). The attached continued operations phase out schedule shows the number of tanks remaining under continued operations on an annual basis.

Construction Activities

Construction emissions for Fill and Cap are a combination of the emissions provided in Engineering Information Request -057 as amended above. Note: Construction Emissions Estimates have been modified for certain criteria pollutants based on equipment utilization see general Calculations for Emission modifications. CH. 12/5

Gravel Filling Operations

The emissions during gravel fill are 10X the routine emissions from any given tank on an hourly basis. Filling a tank with gravel is estimated to take approximately 3 days of operations. Two tanks could potentially be undergoing gravel filling at the same time in different tank farms. The emissions from gravel filling operations are identified in the attached spreadsheet titled Gravel Fill Operating Emissions

Continued Operations Phase Out Schedule

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No Action																
Min Retrieval (In Situ Vit)																
Waste Treatment 2008-2013 Number of Tanks Treated														30	59	89
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	67%	50%
Min Retrieval (Fill and Cap)																
Waste Treatment 2006-2013 Number of Tanks Treated												22	44	66	89	111
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	88%	75%	63%	50%	38%
Selective Retrieval																
Retrieval 2001-2023, Number of Tanks Treated							3	6	9	12	15	18	21	24	27	30
Fill and Cap 2006-2013												13	27	40	54	67
Total Tanks Treated							3	6	9	12	15	32	48	64	81	97
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	98%	97%	95%	93%	91%	82%	73%	64%	54%	45%
Extensive Retrieval (Ex Situ Vit)																
Retrieval 2001-2023, Number of Tanks Treated							8	15	23	31	38	46	54	62	69	77
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	91%	87%	83%	78%	74%	70%	65%	61%	57%
Extensive Retrieval (No Separations)																
Retrieval 2001-2018, Number of Tanks Treated							10	20	30	39	49	59	69	79	89	98
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	94%	89%	83%	78%	72%	67%	61%	56%	50%	44%
Extensive Retrieval (Extensive Separations)																
Retrieval 2001-2024, Number of Tanks Treated							7	15	22	30	37	44	52	59	66	74
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	92%	88%	83%	79%	75%	71%	67%	63%	58%

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
118	148	177											
33%	17%	0%											
133	155	177											
25%	13%	0%											
33	37	40	43	46	49	52	55	58	61	64	67	70	
80	94	107											
114	130	147	150	153	156	159	162	165	168	171	174	177	
36%	26%	17%	15%	14%	12%	10%	9%	7%	5%	3%	2%	0%	
85	92	100	108	115	123	131	139	146	154	162	169	177	
52%	48%	43%	39%	35%	30%	26%	22%	17%	13%	9%	4%	0%	
108	118	128	138	148	157	167	177						
39%	33%	28%	22%	17%	11%	6%	0%						
81	89	96	103	111	118	125	133	140	148	155	162	170	177
54%	50%	46%	42%	38%	33%	29%	25%	21%	17%	13%	8%	4%	0%

Tank Farm Emissions From Current Operations							
242A 6 Source Emissions Roll-UP		Avg Exit Velocity 37.8 (ft/sec)		Area 9.62 (sq. ft)			
Active Ventilation		Avg Exit Temperature 117 (F)		Height 22 (ft)			
					Operating release		
	Continuous Ops	Periodic Ops	Periodic Ops	Continuous	Concentration		
Emissions	Potential (tons/yr)	Actual (tons/yr)	Actual (kg/hr)	Actual (kg/hr)	g/m^3	Area (ft^2)	Velocity (ft/s)
2-Hexanone	3.80E-04	2.88E-05	2.98E-06	3.94E-05	1.06E-06	9.62	37.8
Acetone	1.06E-01	7.98E-03	8.27E-04	1.10E-02	2.97E-04	9.62	37.8
Methyl Isobutyl Ketone	7.25E-03	5.44E-04	5.64E-05	7.51E-04	2.03E-05	9.62	37.8
N-Butyl Alcohol	8.00E-01	6.00E-02	6.22E-03	8.29E-02	2.24E-03	9.62	37.8
Ammonia	1.00E-01	7.51E-03	7.78E-04	1.04E-02	2.80E-04	9.62	37.8
	Ci/yr	Ci/yr		Ci/hr	grams/m^3		
Total Alpha (Ci) (Pu)	1.41E-04	2.10E-05		1.61E-08	7.00E-12	9.62	37.8
Total Beta (Ci) (Sr-90)	8.04E-05	1.20E-05		9.18E-09	1.78E-15	9.62	37.8

note: total alpha and beta taken from WHC-SD-WM-EV-099 and are from 1987 evaporator operations (11 MM gal run, Capacity=73.6 MM gal/yr so continuous ops =6.7 times periodic)

note: evaporator emissions are the sum of the building ventilation and the vessel vent systems which each have a stack. The shorter stack was chosen as the release point for all emissions.

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-A (5 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation on existing tanks		Flow rate 30 cubic meters/min (1000 cfm)				
Tank Farm Emissions From Current Operations						
			Routine	Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hour)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hour)	Filling (g/m3)	
Carbon Monoxide	3.38E+00	3.38E+00	7.72E-05	7.72E-04	4.29E-04	
Nitrogen Oxide	2.04E-01	2.04E-01	4.65E-06	4.65E-05	2.58E-05	
1,3-Butadiene	1.47E-02	1.47E-02	3.36E-07	3.36E-06	1.87E-06	
2-Hexanone	2.67E-01	2.67E-01	6.10E-06	6.10E-05	3.39E-05	
2-Pentanone	4.24E-01	4.24E-01	9.68E-06	9.68E-05	5.38E-05	
Acetone	5.09E+00	5.09E+00	1.16E-04	1.16E-03	6.46E-04	
Acetonitrile	2.45E+00	2.45E+00	5.60E-05	5.60E-04	3.11E-04	
Benzene	1.17E-01	1.17E-01	2.66E-06	2.66E-05	1.48E-05	
Heptane	2.99E-01	2.99E-01	6.83E-06	6.83E-05	3.79E-05	
Methyl N-Amyl Ketone	2.89E-01	2.89E-01	6.61E-06	6.61E-05	3.67E-05	
N-Hexane	3.12E-01	3.12E-01	7.12E-06	7.12E-05	3.96E-05	
Nonane	1.63E-01	1.63E-01	3.71E-06	3.71E-05	2.06E-05	
Octane	1.70E-01	1.70E-01	3.89E-06	3.89E-05	2.16E-05	
Toluene	2.37E-02	2.37E-02	5.42E-07	5.42E-06	3.01E-06	
Ammonia	2.34E+01	2.34E+01	5.34E-04	5.34E-03	2.97E-03	
Phosphoric Acid, Tributyl Ester	6.12E-01	6.12E-01	1.40E-05	1.40E-04	7.77E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hour)	(Ci/hour)	(g/m3)	
Americium-241 Ci/yr	2.78E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	6.75E-02	2.90E-05	6.63E-10	6.63E-09	4.26E-14	
Plutonium-239 Ci/yr	1.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	1.78E+00	8.26E-04	1.88E-08	1.88E-07	7.53E-13	
Gravel filling a tank takes approx 3 days,						

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment			
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)	
Tank Farm 241-AX (4 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)	
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)			
				Emissions Per	Conc. of
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	Filling (g/m3)
Carbon Monoxide	2.52E+00	2.48E+00	7.08E-05	7.08E-04	3.93E-04
Nitrogen Oxide	1.52E-01	1.52E-01	4.33E-06	4.33E-05	2.40E-05
1,3-Butadiene	1.10E-02	1.03E-02	2.94E-07	2.94E-06	1.63E-06
2-Hexanone	1.99E-01	1.99E-01	5.69E-06	5.69E-05	3.16E-05
2-Pentanone	3.16E-01	2.80E-01	7.98E-06	7.98E-05	4.43E-05
Acetone	3.80E+00	3.80E+00	1.08E-04	1.08E-03	6.02E-04
Acetonitrile	1.83E+00	1.83E+00	5.22E-05	5.22E-04	2.90E-04
Benzene	8.69E-02	8.69E-02	2.48E-06	2.48E-05	1.38E-05
Heptane	2.23E-01	2.23E-01	6.36E-06	6.36E-05	3.54E-05
Methyl N-Amyl Ketone	2.16E-01	2.16E-01	6.16E-06	6.16E-05	3.42E-05
N-Hexane	2.32E-01	2.32E-01	6.63E-06	6.63E-05	3.69E-05
Nonane	1.21E-01	1.21E-01	3.46E-06	3.46E-05	1.92E-05
Octane	1.27E-01	1.27E-01	3.62E-06	3.62E-05	2.01E-05
Toluene	1.77E-02	1.77E-02	5.05E-07	5.05E-06	2.80E-06
Ammonia	1.74E+01	1.74E+01	4.98E-04	4.98E-03	2.76E-03
Phosphoric Acid, Tributyl Ester	4.56E-01	4.56E-01	1.30E-05	1.30E-04	7.23E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)
Americium-241 Ci/yr	2.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	5.03E-02	2.36E-05	6.73E-10	6.73E-09	4.33E-14
Plutonium-239 Ci/yr	1.03E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.32E+00	6.71E-04	1.92E-08	1.92E-07	7.66E-13

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-B (16 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hr)	Filling (g/m3)	
Carbon Monoxide	9.62E+00	9.62E+00	6.86E-05	6.86E-04	3.81E-04	
Nitrogen Oxide	7.94E-01	5.79E-01	4.13E-06	4.13E-05	2.29E-05	
1,3-Butadiene	4.18E-02	4.18E-02	2.98E-07	2.98E-06	1.66E-06	
2-Hexanone	7.60E-01	7.60E-01	5.42E-06	5.42E-05	3.01E-05	
2-Pentanone	1.21E+00	1.21E+00	8.60E-06	8.60E-05	4.78E-05	
Acetone	1.45E+01	1.45E+01	1.03E-04	1.03E-03	5.74E-04	
Acetonitrile	6.98E+00	6.98E+00	4.98E-05	4.98E-04	2.77E-04	
Benzene	3.32E-01	3.32E-01	2.37E-06	2.37E-05	1.31E-05	
Heptane	8.51E-01	8.51E-01	6.07E-06	6.07E-05	3.37E-05	
Methyl N-Amyl Ketone	8.23E-01	8.23E-01	5.87E-06	5.87E-05	3.26E-05	
N-Hexane	8.87E-01	8.87E-01	6.33E-06	6.33E-05	3.52E-05	
Nonane	4.62E-01	4.62E-01	3.30E-06	3.30E-05	1.83E-05	
Octane	4.85E-01	4.85E-01	3.46E-06	3.46E-05	1.92E-05	
Toluene	6.75E-02	6.75E-02	4.82E-07	4.82E-06	2.68E-06	
Ammonia	6.65E+01	6.65E+01	4.75E-04	4.75E-03	2.64E-03	
Phosphoric Acid, Tributyl Ester	1.74E+00	1.74E+00	1.24E-05	1.24E-04	6.90E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	7.57E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	1.84E-01	9.07E-05	6.47E-10	6.47E-09	4.16E-14	
Plutonium-239 Ci/yr	3.78E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	4.84E+00	2.46E-03	1.75E-08	5.26E-08	2.10E-13	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-BX (12 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hr)	Filling (g/m3)	
Carbon Monoxide	7.56E+00	7.56E+00	7.19E-05	7.19E-04	4.00E-04	
Nitrogen Oxide	4.55E-01	4.55E-01	4.33E-06	4.33E-05	2.40E-05	
1,3-Butadiene	3.29E-02	3.29E-02	3.13E-07	3.13E-06	1.74E-06	
2-Hexanone	5.98E-01	5.98E-01	5.69E-06	5.69E-05	3.16E-05	
2-Pentanone	9.48E-01	9.48E-01	9.02E-06	9.02E-05	5.01E-05	
Acetone	1.14E+01	1.14E+01	1.08E-04	1.08E-03	6.02E-04	
Acetonitrile	5.49E+00	5.49E+00	5.22E-05	5.22E-04	2.90E-04	
Benzene	2.61E-01	2.61E-01	2.48E-06	2.48E-05	1.38E-05	
Heptane	6.69E-01	6.69E-01	6.36E-06	6.36E-05	3.54E-05	
Methyl N-Amyl Ketone	6.47E-01	6.47E-01	6.16E-06	6.16E-05	3.42E-05	
N-Hexane	6.97E-01	6.97E-01	6.63E-06	6.63E-05	3.69E-05	
Nonane	3.64E-01	3.64E-01	3.46E-06	3.46E-05	1.92E-05	
Octane	3.81E-01	3.81E-01	3.62E-06	3.62E-05	2.01E-05	
Toluene	5.31E-02	5.31E-02	5.05E-07	5.05E-06	2.80E-06	
Ammonia	5.23E+01	5.23E+01	4.98E-04	4.98E-03	2.76E-03	
Phosphoric Acid, Tributyl Ester	1.37E+00	1.37E+00	1.30E-05	1.30E-04	7.23E-05	
	(Ci/yr)	(Ci/yr)	(Ci/yr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	4.18E-01	2.11E-04	2.01E-09	2.01E-08	1.29E-13	
Plutonium-239 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	1.06E-02	5.44E-06	5.18E-11	5.18E-10	2.07E-15	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-BY (12 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	filling (gm3)	
Carbon Monoxide	4.06E+00	4.06E+00	3.86E-05	3.86E-04	2.14E-04	
Nitrogen Oxide	2.51E-01	2.51E-01	2.39E-06	2.39E-05	1.33E-05	
1,3-Butadiene	1.76E-02	1.76E-02	1.68E-07	1.68E-06	9.31E-07	
2-Hexanone	3.24E-01	3.24E-01	3.08E-06	3.08E-05	1.71E-05	
2-Pentanone	5.16E-01	5.16E-01	4.91E-06	4.91E-05	2.73E-05	
Acetone	6.16E+00	6.16E+00	5.86E-05	5.86E-04	3.25E-04	
Acetonitrile	2.95E+00	2.95E+00	2.81E-05	2.81E-04	1.56E-04	
Benzene	1.42E-01	1.42E-01	1.35E-06	1.35E-05	7.49E-06	
Heptane	3.69E-01	3.69E-01	3.51E-06	3.51E-05	1.95E-05	
Methyl N-Amyl Ketone	3.50E-01	3.50E-01	3.33E-06	3.33E-05	1.85E-05	
N-Hexane	3.96E-01	3.96E-01	3.77E-06	3.77E-05	2.09E-05	
Nonane	1.97E-01	1.97E-01	1.88E-06	1.88E-05	1.04E-05	
Octane	2.09E-01	2.09E-01	1.99E-06	1.99E-05	1.11E-05	
Toluene	3.12E-02	3.12E-02	2.97E-07	2.97E-06	1.65E-06	
Ammonia	3.13E+01	3.13E+01	2.98E-04	2.98E-03	1.66E-03	
Phosphoric Acid, Tributyl Ester	7.33E-01	7.33E-01	6.97E-06	6.97E-05	3.87E-05	
	(Ci/yr)	(Ci/yr)	(Ci/yr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	3.95E-02	2.36E-05	3.75E-07	3.75E-06	2.41E-11	
Plutonium-239 Ci/yr	1.18E-05	0.00E+00	1.12E-10	1.12E-09	1.01E-11	
Strontium-090 Ci/yr	4.55E-02	2.36E-05	4.32E-07	4.32E-06	1.73E-11	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment			
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)	
Tank Farm 241-C (13 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)	
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)			
				Emissions Per	Conc. of
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	filling (g/m3)
Carbon Monoxide	5.77E+00	5.77E+00	5.07E-05	5.07E-04	2.82E-04
Nitrogen Oxide	3.95E-01	3.95E-01	3.47E-06	3.47E-05	1.93E-05
1,3-Butadiene	2.51E-02	2.51E-02	2.20E-07	2.20E-06	1.22E-06
2-Hexanone	4.56E-01	4.56E-01	4.01E-06	4.01E-05	2.23E-05
2-Pentanone	7.24E-01	7.24E-01	6.36E-06	6.36E-05	3.53E-05
Acetone	8.70E+00	8.70E+00	7.64E-05	7.64E-04	4.24E-04
Acetonitrile	4.19E+00	4.19E+00	3.68E-05	3.68E-04	2.04E-04
Benzene	1.99E-01	1.99E-01	1.75E-06	1.75E-05	9.70E-06
Heptane	5.11E-01	5.11E-01	4.49E-06	4.49E-05	2.49E-05
Methyl N-Amyl Ketone	4.93E-01	4.93E-01	4.33E-06	4.33E-05	2.41E-05
N-Hexane	5.32E-01	5.32E-01	4.67E-06	4.67E-05	2.60E-05
Nonane	2.78E-01	2.78E-01	2.44E-06	2.44E-05	1.35E-05
Octane	2.91E-01	2.91E-01	2.55E-06	2.55E-05	1.42E-05
Toluene	4.05E-02	4.05E-02	3.56E-07	3.56E-06	1.98E-06
Ammonia	4.55E+01	4.55E+01	3.99E-04	3.99E-03	2.22E-03
Phosphoric Acid, Tributyl Ester	1.05E+00	1.05E+00	9.18E-06	9.18E-05	5.10E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)
Americium-241 Ci/yr	1.07E-04	0.00E+00	9.40E-10	9.40E-09	1.52E-12
Cesium-137 Ci/yr	3.95E-03	0.00E+00	3.47E-08	3.47E-07	2.23E-12
Plutonium-239 Ci/yr	1.28E-03	0.00E+00	1.13E-08	1.13E-07	1.01E-09
Strontium-090 Ci/yr	4.63E-02	2.54E-05	4.06E-07	4.06E-06	1.62E-11

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AN 8 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
7 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	per tank	Release Conc g/m^3)	
Nitrogen Oxide	3.63E-01	3.63E-01	5.92E-06	5.92E-05	3.29E-05	
1, 3-Butadiene	2.62E-02	2.62E-02	4.28E-07	4.28E-06	2.38E-06	
2-Hexanone	4.77E-01	4.77E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	7.58E-01	7.58E-01	1.24E-05	1.24E-04	6.86E-05	
Acetone	9.07E+00	9.07E+00	1.48E-04	1.48E-03	8.22E-04	
Acetonitrile	4.38E+00	4.38E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	2.08E-01	2.08E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	5.33E-01	5.33E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	5.16E-01	5.16E-01	8.42E-06	8.42E-05	4.68E-05	
N-Hexane	5.56E-01	5.56E-01	9.07E-06	9.07E-05	5.04E-05	
Nonane	2.90E-01	2.90E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	3.04E-01	3.04E-01	4.96E-06	4.96E-05	2.75E-05	
Toluene	4.24E-02	4.24E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Strontium-90		1.20E-07	1.96E-12	1.96E-11	7.82E-17	
Total Alpha		None Detected				

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AP 9 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
8 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	4.15E-01	4.15E-01	5.93E-06	5.93E-05	3.29E-05	
1, 3-Butadiene	2.99E-02	2.99E-02	4.27E-07	4.27E-06	2.37E-06	
2-Hexanone	5.45E-01	5.45E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	8.65E-01	8.65E-01	1.23E-05	1.23E-04	6.86E-05	
Acetone	1.04E+01	1.04E+01	1.49E-04	1.49E-03	8.27E-04	
Acetonitrile	5.01E+00	5.01E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	2.38E-01	2.38E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	6.10E-01	6.10E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	5.90E-01	5.90E-01	8.41E-06	8.41E-05	4.67E-05	
N-Hexane	6.36E-01	6.36E-01	9.07E-06	9.07E-05	5.04E-05	
Nonane	3.31E-01	3.31E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	3.47E-01	3.47E-01	4.96E-06	4.96E-05	2.75E-05	
Toluene	4.84E-02	4.84E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Strontium-90		6.60E-08	9.42E-13	9.42E-12	3.76E-17	

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AW 7 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
6 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	3.11E-01	3.11E-01	5.92E-06	5.92E-05	3.29E-05	
1, 3-Butadiene	2.25E-02	2.25E-02	4.28E-07	4.28E-06	2.38E-06	
2-Hexanone	4.09E-01	4.09E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	6.50E-01	6.50E-01	1.24E-05	1.24E-04	6.87E-05	
Acetone	7.79E+00	7.79E+00	1.48E-04	1.48E-03	8.24E-04	
Acetonitrile	3.76E+00	3.76E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	1.79E-01	1.79E-01	3.40E-06	3.40E-05	1.89E-05	
Heptane	4.57E-01	4.57E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	4.43E-01	4.43E-01	8.42E-06	8.42E-05	4.68E-05	
N-Hexane	4.77E-01	4.77E-01	9.08E-06	9.08E-05	5.04E-05	
Nonane	2.49E-01	2.49E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	2.60E-01	2.60E-01	4.95E-06	4.95E-05	2.75E-05	
Toluene	3.63E-02	3.63E-02	6.90E-07	6.90E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/hour	
Cesium-137		2.80E-08	5.33E-13	5.33E-12	3.43E-17	
Strontium-90		1.60E-07	3.04E-12	3.04E-11	1.22E-16	
Total Alpha		1.50E-08	2.85E-13	2.85E-12		

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AYAZ 5 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
4 tanks DSTs		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank Farm	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	2.08E-01	2.08E-01	5.93E-06	5.93E-05	3.29E-05	
1, 3-Butadiene	1.50E-02	1.50E-02	4.27E-07	4.27E-06	2.37E-06	
2-Hexanone	2.73E-01	2.73E-01	7.79E-06	7.79E-05	4.33E-05	
2-Pentanone	4.33E-01	4.33E-01	1.23E-05	1.23E-04	6.86E-05	
Acetone	5.20E+00	5.20E+00	1.48E-04	1.48E-03	8.24E-04	
Acetonitrile	2.50E+00	2.50E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	1.19E-01	1.19E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	3.05E-01	3.05E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	2.95E-01	2.95E-01	8.41E-06	8.41E-05	4.67E-05	
N-Hexane	3.18E-01	3.18E-01	9.09E-06	9.09E-05	5.05E-05	
Nonane	1.66E-01	1.66E-01	4.74E-06	4.74E-05	2.63E-05	
Octane	1.74E-01	1.74E-01	4.97E-06	4.97E-05	2.76E-05	
Toluene	2.42E-02	2.42E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Cesium-137		5.30E-05	1.51E-09	1.51E-08	9.73E-14	
Strontium-90		8.20E-06	2.34E-10	2.34E-09	9.35E-15	
Iodine-129		4.60E-05	1.31E-09	1.31E-08	4.14E-08	
Total Alpha		5.70E-09	1.63E-13	1.63E-12		

Tank Farm Emissions From Current Operations					
		Avg Exit Velocity .36 (ft/s)		Area 1.08 (ft2)	
241-S Tank Farm (12 Single-Shell Tanks)		Avg Exit Temperature 94.2 (F)		Height 3 (ft)	
Passive Ventilation				Gravel Filling	
		Actual per tank	Routine actual per	Actual (Kg/hr)	
Emissions	Potential (Kg/yr)	farm (Kg/yr)	tank (Kg/hr)	Per Tank	Conc. (g/m3)
Carbon Monoxide	1.14E-02	1.14E-02	1.08E-07	1.08E-06	2.77E-05
Nitrogen Oxide	6.86E-04	7.44E-04	7.07E-09	7.07E-08	1.80E-06
1,3-Butadiene	4.96E-05	5.37E-05	5.11E-10	5.11E-09	1.30E-07
2-Hexanone	9.01E-04	9.76E-04	9.29E-09	9.29E-08	2.37E-06
2-Pentanone	1.43E-03	1.55E-03	1.47E-08	1.47E-07	3.76E-06
Acetone	1.72E-02	1.86E-02	1.77E-07	1.77E-06	4.51E-05
Acetonitrile	8.27E-03	8.96E-03	8.52E-08	8.52E-07	2.17E-05
Benzene	3.94E-04	4.26E-04	4.06E-09	4.06E-08	1.04E-06
Heptane	1.01E-03	1.09E-03	1.04E-08	1.04E-07	2.65E-06
Methyl N-Amyl Ketone	9.76E-04	1.06E-03	1.01E-08	1.01E-07	2.57E-06
N-Hexane	1.05E-03	1.14E-03	1.08E-08	1.08E-07	2.76E-06
Nonane	5.48E-04	5.94E-04	5.65E-09	5.65E-08	1.44E-06
Octane	5.75E-04	6.23E-04	5.92E-09	5.92E-08	1.51E-06
Toluene	8.00E-05	8.67E-05	8.25E-10	8.25E-09	2.10E-07
Ammonia	7.88E-02	8.54E-02	8.13E-07	8.13E-06	2.07E-04
Phosphoric Acid, Tributyl Ester	1.91E-03	2.24E-03	2.13E-08	2.13E-07	5.43E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)
Americium-241	9.36E-07	0.00E+00	0.00E+00	0.00E+00	
Cesium 137	2.28E-04	8.20E-08	7.80E-13	7.80E-12	
Plutonium-239	4.68E-07	0.00E+00	0.00E+00	0.00E+00	
Strontium-090	6.00E-03	2.41E-06	2.29E-11	2.29E-10	

Tank Farm Emissions From Current Operations					
				Area 2 (ft2)	
241-SX Tank Farm (2 Single-Shell Tanks)		Avg Exit Velocity .014 (ft/s)		Height 3 (ft)	
Passive Ventilation		Avg Exit Temperature 76.5 (F)		Gravel Filling	
			Routine actual per	Actual (Kg/hr)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank (Kg/hr)	Per Tank	Conc (g/m3)
Carbon Monoxide	8.78E-04	8.78E-04	5.01E-08	5.01E-07	1.78E-04
Nitrogen Oxide	5.28E-05	5.28E-05	3.01E-09	3.01E-08	1.07E-05
1,3-Butadiene	3.82E-06	3.82E-06	2.18E-10	2.18E-09	7.73E-07
2-Hexanone	6.94E-05	6.94E-05	3.96E-09	3.96E-08	1.40E-05
2-Pentanone	1.10E-04	1.10E-04	6.29E-09	6.29E-08	2.23E-05
Acetone	1.32E-03	1.32E-03	7.56E-08	7.56E-07	2.68E-04
Acetonitrile	6.38E-04	6.38E-04	3.64E-08	3.64E-07	1.29E-04
Benzene	3.02E-05	3.02E-05	1.72E-09	1.72E-08	6.11E-06
Heptane	7.78E-05	7.78E-05	4.44E-09	4.44E-08	1.57E-05
Methyl N-Amyl Ketone	7.52E-05	7.52E-05	4.29E-09	4.29E-08	1.52E-05
N-Hexane	8.10E-05	8.10E-05	4.62E-09	4.62E-08	1.64E-05
Nonane	4.22E-05	4.22E-05	2.41E-09	2.41E-08	8.53E-06
Octane	4.42E-05	4.42E-05	2.52E-09	2.52E-08	8.94E-06
Toluene	6.16E-06	6.16E-06	3.52E-10	3.52E-09	1.25E-06
Ammonia	6.08E-03	6.08E-03	3.47E-07	3.47E-06	1.23E-03
Phosphoric Acid, Tributyl Ester	1.59E-04	1.59E-04	9.08E-09	9.08E-08	3.22E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)
Americium-241	1.74E-05	8.00E-09	4.57E-13	4.57E-12	
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	4.60E-04	2.40E-07	1.37E-11	1.37E-10	
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Tank Farm Emissions From Current Operations					
241-T Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0246 (ft/s)		Area 16 (ft2)	
Passive Ventilation		Avg Exit Temperature 65.2 (F)		Height 3 (ft)	
			Routine actual per	Gravel filling actual	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank (Kg/hr)	(kg/hr) per tank	Conc (g/m3)
Carbon Monoxide	1.21E-02	1.21E-02	8.66E-08	8.66E-07	2.18E-05
Nitrogen Oxide	7.30E-04	7.30E-04	5.21E-09	5.21E-08	1.31E-06
1,3-Butadiene	5.28E-05	5.28E-05	3.76E-10	3.76E-09	9.48E-08
2-Hexanone	9.59E-04	9.59E-04	6.84E-09	6.84E-08	1.72E-06
2-Pentanone	1.52E-03	1.52E-03	1.08E-08	1.08E-07	2.73E-06
Acetone	1.83E-02	1.83E-02	1.30E-07	1.30E-06	3.28E-05
Acetonitrile	8.80E-03	8.80E-03	6.28E-08	6.28E-07	1.58E-05
Benzene	4.19E-04	4.19E-04	2.99E-09	2.99E-08	7.52E-07
Heptane	1.07E-03	1.07E-03	7.66E-09	7.66E-08	1.93E-06
Methyl N-Amyl Ketone	1.04E-03	1.04E-03	7.41E-09	7.41E-08	1.87E-06
N-Hexane	1.12E-03	1.12E-03	7.98E-09	7.98E-08	2.01E-06
Nonane	5.84E-04	5.84E-04	4.16E-09	4.16E-08	1.05E-06
Octane	6.12E-04	6.12E-04	4.36E-09	4.36E-08	1.10E-06
Toluene	8.52E-05	8.52E-05	6.08E-10	6.08E-09	1.53E-07
Ammonia	8.39E-02	8.39E-02	5.99E-07	5.99E-06	1.51E-04
Phosphoric Acid, Tributyl Ester	3.75E-03	2.20E-03	1.57E-08	1.57E-07	3.95E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	1.68E-04	7.60E-08	8.68E-12	8.68E-11	
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	3.84E-05	2.30E-08	2.63E-12	2.63E-11	
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Tank Farm Emissions From Current Operations					
241-TX Tank Farm (18 Single-Shell Tanks)		Avg Exit Velocity .1816 (ft/s)		Area 5.82 (ft2)	
Passive Ventilation		Avg Exit Temperature 72.3 (F)		Height 3 (ft)	Conc. of Emiss
			Routine actual per	Emissions per tank	form filling (g/m3)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank (Kg/hr)	being filled (kg/hr)	
Carbon Monoxide	1.06E-02	1.06E-02	6.74E-08	6.74E-07	6.33E-06
Nitrogen Oxide	6.91E-04	6.91E-04	4.38E-09	4.38E-08	4.11E-07
1,3-Butadiene	4.58E-05	4.58E-05	2.90E-10	2.90E-09	2.73E-08
2-Hexanone	8.32E-04	8.32E-04	5.28E-09	5.28E-08	4.96E-07
2-Pentanone	1.32E-03	1.32E-03	8.37E-09	8.37E-08	7.86E-07
Acetone	1.59E-02	1.59E-02	1.01E-07	1.01E-06	9.44E-06
Acetonitrile	7.64E-03	7.64E-03	4.85E-08	4.85E-07	4.55E-06
Benzene	3.63E-04	3.63E-04	2.30E-09	2.30E-08	2.16E-07
Heptane	9.32E-04	9.32E-04	5.91E-09	5.91E-08	5.55E-07
Methyl N-Amyl Ketone	9.01E-04	9.01E-04	5.72E-09	5.72E-08	5.37E-07
N-Hexane	9.71E-04	9.71E-04	6.16E-09	6.16E-08	5.78E-07
Nonane	5.06E-04	5.06E-04	3.21E-09	3.21E-08	3.01E-07
Octane	5.31E-04	5.31E-04	3.36E-09	3.36E-08	3.16E-07
Carbon Tetrachloride	3.91E-06	3.91E-06	2.48E-11	2.48E-10	7.59E-08
Ethyl Butyl Ketone	1.31E-05	1.31E-05	8.31E-11	8.31E-10	2.54E-07
Methyl Chloride	5.78E-07	5.78E-07	3.67E-12	3.67E-11	1.12E-08
Tetrahydrofuran	1.01E-06	1.01E-06	6.41E-12	6.41E-11	1.96E-08
Toluene	3.91E-06	3.91E-06	2.48E-11	2.48E-10	2.33E-09
Ammonia	1.31E-05	1.31E-05	8.31E-11	8.31E-10	7.80E-09
Phosphoric Acid, Tributyl Ester	5.78E-07	5.78E-07	3.67E-12	3.67E-11	3.44E-10
	(Ci/yr)	(Ci/yr)	(Ci/hr)	Ci/hr	
Americium-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	7.08E-05	7.08E-05	4.49E-10	4.49E-09	
Strontium-090	6.98E-02	6.98E-02	4.43E-07	4.43E-06	

Tank Farm Emissions From Current Operations					
241-TY Tank Farm (6 Single-Shell Tanks)		Avg Exit Velocity .0253 (ft/s)		Area 5.79 (ft2)	
Passive Ventilation		Avg Exit Temperature 66.0 (F)		Height 3 (ft)	
			Routine actual	Emissions per tank	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	per tank (Kg/hr)	being filled (kg/hr)	Concentration (g/m
Carbon Monoxide	4.68E-03	4.68E-03	8.90E-08	8.90E-07	6.02E-05
Nitrogen Oxide	2.82E-04	2.82E-04	5.36E-09	5.36E-08	3.62E-06
1,3-Butadiene	2.03E-05	2.03E-05	3.87E-10	3.87E-09	2.62E-07
2-Hexanone	3.70E-04	3.70E-04	7.04E-09	7.04E-08	4.76E-06
2-Pentanone	5.86E-04	5.86E-04	1.12E-08	1.12E-07	7.54E-06
Acetone	7.04E-03	7.04E-03	1.34E-07	1.34E-06	9.06E-05
Acetonitrile	3.39E-03	3.39E-03	6.46E-08	6.46E-07	4.37E-05
Benzene	1.61E-04	1.61E-04	3.07E-09	3.07E-08	2.08E-06
Heptane	4.14E-04	4.14E-04	7.87E-09	7.87E-08	5.32E-06
Methyl N-Amyl Ketone	4.00E-04	4.00E-04	7.62E-09	7.62E-08	5.15E-06
N-Hexane	4.31E-04	4.31E-04	8.21E-09	8.21E-08	5.55E-06
Nonane	2.25E-04	2.25E-04	4.28E-09	4.28E-08	2.90E-06
Octane	2.36E-04	2.36E-04	4.49E-09	4.49E-08	3.03E-06
Toluene	3.28E-05	3.28E-05	6.25E-10	6.25E-09	4.23E-07
Ammonia	3.24E-02	3.24E-02	6.16E-07	6.16E-06	4.16E-04
Phosphoric Acid, Tributyl Ester	8.47E-04	8.47E-04	1.61E-08	1.61E-07	1.09E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	4.00E-04	4.00E-04	7.62E-09	7.62E-08	
Cesium 137	4.31E-04	4.31E-04	8.21E-09	8.21E-08	
Plutonium-239	2.25E-04	2.25E-04	4.28E-09	4.28E-08	
Strontium-090	2.36E-04	2.36E-04	4.49E-09	4.49E-08	

Tank Farm Emissions From Current Operations					
241-U Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0236 (ft/s)		Area 16.0 (ft2)	
Passive Ventilation		Avg Exit Temperature 75.6 (F)		Height 3 (ft)	
			Routine actual	emissions per tank	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	kg/hr per tank	being filled kg/hr	Concentration (g/m
Carbon Monoxide	1.16E-02	1.16E-02	8.29E-08	8.29E-07	2.18E-05
Nitrogen Oxide	7.00E-04	7.00E-04	4.99E-09	4.99E-08	1.31E-06
1,3-Butadiene	5.05E-05	5.05E-05	3.61E-10	3.61E-09	9.49E-08
2-Hexanone	9.19E-04	9.19E-04	6.56E-09	6.56E-08	1.73E-06
2-Pentanone	1.46E-03	1.46E-03	1.04E-08	1.04E-07	2.73E-06
Acetone	1.75E-02	1.75E-02	1.25E-07	1.25E-06	3.29E-05
Acetonitrile	8.43E-03	8.43E-03	6.02E-08	6.02E-07	1.58E-05
Benzene	1.08E-03	1.08E-03	7.71E-09	7.71E-08	2.03E-06
Heptane	1.03E-03	1.03E-03	7.34E-09	7.34E-08	1.93E-06
Methyl N-Amyl Ketone	9.95E-04	9.95E-04	7.10E-09	7.10E-08	1.87E-06
N-Hexane	1.07E-03	1.07E-03	7.65E-09	7.65E-08	2.01E-06
Nonane	5.59E-04	5.59E-04	3.99E-09	3.99E-08	1.05E-06
Octane	5.86E-04	5.86E-04	4.18E-09	4.18E-08	1.10E-06
Toluene	7.49E-05	7.49E-05	5.35E-10	5.35E-09	1.41E-07
Ammonia	8.04E-02	8.04E-02	5.74E-07	5.74E-06	1.51E-04
Phosphoric Acid, Tributyl Ester	2.10E-03	2.10E-03	1.50E-08	1.50E-07	3.95E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	1.08E-03	1.08E-03	1.23E-07	1.23E-06	
Cesium 137	1.03E-03	1.03E-03	1.17E-07	1.17E-06	
Plutonium-239	9.95E-04	9.95E-04	1.14E-07	1.14E-06	
Strontium-090	1.07E-03	1.07E-03	1.22E-07	1.22E-06	

Tank Farm Emissions From Current Operations					
296-SX 14 Source Emissions Roll-Up		Avg Exit Velocity 10.6 (ft/s)		Area 9.62 (ft2)	
Passive Ventilation		Avg Exit Temperature 165 (F)		Height 15 (ft)	
			routine actual (kg/h	emissions per tank	Conc. of emissions
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	per tank	being filled kg/hr	from filling g/m3
Carbon Monoxide	2.24E-01	2.24E-01	1.70E-06	1.70E-05	1.66E-06
Nitrogen Oxide	7.43E-04	7.43E-04	5.65E-09	5.65E-08	5.50E-09
1,3-Butadiene	5.36E-05	5.36E-05	4.08E-10	4.08E-09	3.97E-10
2-Hexanone	9.77E-04	9.77E-04	7.44E-09	7.44E-08	7.23E-09
2-Pentanone	1.55E-03	1.55E-03	1.18E-08	1.18E-07	1.15E-08
Acetone	1.86E-02	1.86E-02	1.42E-07	1.42E-06	1.38E-07
Acetonitrile	8.96E-03	8.96E-03	6.82E-08	6.82E-07	6.63E-08
Benzene	4.26E-04	4.26E-04	3.24E-09	3.24E-08	3.15E-09
Heptane	1.09E-03	1.09E-03	8.30E-09	8.30E-08	8.07E-09
Methyl N-Amyl Ketone	1.06E-03	1.06E-03	8.07E-09	8.07E-08	7.85E-09
N-Hexane	1.14E-03	1.14E-03	8.68E-09	8.68E-08	8.44E-09
Nonane	5.94E-04	5.94E-04	4.52E-09	4.52E-08	4.40E-09
Octane	6.23E-04	6.23E-04	4.74E-09	4.74E-08	4.61E-09
Toluene	8.67E-05	8.67E-05	6.60E-10	6.60E-09	6.42E-10
Ammonia	4.17E+00	4.17E+00	3.17E-05	3.17E-04	3.09E-05
Phosphoric Acid, Tributyl Ester	2.24E-03	2.24E-03	1.70E-08	1.70E-07	1.66E-08
Total Alpha		None Detected			
Total Beta		9.10E-08	6.93E-13	6.93E-12	

Tank Farm Emissions From Current Operations					
296-SY 4 Source Emissions Roll-Up		Avg Exit Velocity 33.3 (ft/s)		Area .35 (ft2)	
Passive Ventilation		Avg Exit Temperature 110 (F)		Height 11 (ft)	conc of emissions
			routine actual per	emissions per tank	per tank being filled
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank kg/hr	being filled kg/hr	g/m3
Carbon Monoxide	5.16E-02	5.16E-02	1.96E-06	1.96E-05	1.67E-05
Nitrogen Oxide	1.72E-04	1.72E-04	6.54E-09	6.54E-08	5.57E-08
1,3-Butadiene	1.24E-05	1.24E-05	4.72E-10	4.72E-09	4.02E-09
2-Hexanone	2.25E-04	2.25E-04	8.56E-09	8.56E-08	7.29E-08
2-Pentanone	3.58E-04	3.58E-04	1.36E-08	1.36E-07	1.16E-07
Acetone	4.30E-03	4.30E-03	1.64E-07	1.64E-06	1.39E-06
Acetonitrile	2.07E-03	2.07E-03	7.88E-08	7.88E-07	6.70E-07
Benzene	9.83E-05	9.83E-05	3.74E-09	3.74E-08	3.18E-08
Heptane	2.52E-04	2.52E-04	9.59E-09	9.59E-08	8.16E-08
Methyl N-Amyl Ketone	2.44E-04	2.44E-04	9.28E-09	9.28E-08	7.90E-08
N-Hexane	2.63E-04	2.63E-04	1.00E-08	1.00E-07	8.52E-08
Nonane	1.37E-04	1.37E-04	5.21E-09	5.21E-08	4.44E-08
Octane	1.44E-04	1.44E-04	5.48E-09	5.48E-08	4.66E-08
Toluene	2.00E-05	2.00E-05	7.61E-10	7.61E-09	6.48E-09
Ammonia	9.63E-01	9.63E-01	3.66E-05	3.66E-04	3.12E-04
Phosphoric Acid, Tributyl Ester	5.15E-04	5.16E-04	1.96E-08	1.96E-07	1.67E-07
Total Alpha		8.10E-09	3.08E-13	3.08E-12	

fedex 9/26

Request Number 081

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 09/14/95

Phone Number: (904) 332-3318 ext 6058 Fax Number: (904) 333-6631

Request Information: Data for the Selective Retrieval alternative. See attached sheets for detailed information.

Need Date: 9/22/95

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson CH

Date Sent/Faxed: 9/26/95

Concurrence: Marc C. Nelson
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST: 081

SUBJECT: Selective Retrieval

Reference

4.1.1 The transfer annexes, and waste storage/sampling facility would be located in the same areas as identified for the Extensive Retrieval (Ex Situ Vitrification) alternative.

4.1.1 Emissions from the construction of the transfer annexes and storage/sampling facility can be estimated by scaling the emissions for Extensive Retrieval by 50%.

4.1.2 The combined pretreatment LAW vitrification plant would be located in the same area as ST-L.

4.1.2 Emissions from the construction of the pretreatment facility and the low activity waste (LAW) would occur within the ST-L area source. Construction emissions can be scaled at 50%. See attached table for treatment facility construction emissions. These construction emissions are scaled from the modified TPA construction emissions.

4.1.3 Tanks that will be retrieved for exsitu processing are identified in the attached figure. A listing of the retrieved tanks is as follows:

241-AN tank farm: AN-102,103, 104,105,107
241-AW tank farm: AW-101
241-AZ tank farm: AZ-101, 102
241-SY tank farm: SY-101, 103
241-A tank farm: A-101, 102, 104, 106
241-B tank farm: B-101, 108, 109, 110, 111, 202
241-BX tank farm: BX-101, 102, 104, 105, 106, 109, 110, 111, 112
241-BY tank farm: BY-101, 103, 104, 105, 106, 107, 110, 111
241-C tank farm: C-102, 103, 104, 105, 106, 107
241-S tank farm: S-101, 107, 109, 110, 111, 112
241-SX tank farm: SX-103, 104, 105, 106, 111, 114, 115
241-T tank farm:T-105, 112
241-TX tank farm: TX-109, 110, 113, 114, 115, 116, 117, 118
241-TY tank farm: TY-103, 105
241-U tank farm: U-101, 110

All other tanks will be filled and capped.

4.1.3 The location of the HLW vit facility will correspond to ST-H.

4.1.4 The emissions from the construction of the storage pads for interim storage of HLW are accounted for in the emissions for the HLW vit plant.

4.1.5 The emissions from the construction of the LLW disposal vaults are accounted for in the emission estimates made for the alternative. (I don't think the construction emissions were broken down to be facility specific)

4.2.2 Retrieval air emissions: assume non radiological air emissions are ~~zero.~~ Use 3X Continued
Assume radiological air emissions due to retrieval operations are 50% of the Extensive Retrieval (Ex Situ Vitrification) alternative.

4.2.4 Radio frequency drying of the tanks has been deleted. The emissions from gravel filling for selective retrieval can be scaled using the following factors:

89 out of 149 of the SSTs will be filled with gravel.

18 of the 28 DSTs will be filled with gravel.

See Engineering Information Request 080 for Fill and Cap Emissions. Associated with the fill and cap of the DST would be 3 years of continuous evaporator operations to reduce the liquids in the 18 DSTs that are not retrieved. Three years is obtained from 5 yrs for evaporating contents of 28 DSTs X (18/28). The emissions from continuous evaporator operations are provided in the response to Eng. Inf. Req. -078.

4.2.4 The locations for the gravel stock piles would be the same as identified for the Fill and Cap alternative.

4.2.4 The attached tables show the percentages of the various radionuclides that are recovered under the Selective Retrieval alternative. For the purpose of estimating air emissions it appears that we would be conservative for most isotopes by saying that 90% of the inventory gets retrieved and thus the air radiological air emissions for selective retrieval are 90% of those estimated for Extensive Retrieval (Ex Situ Vitrification). The exception to this is the C-14 which is recovered at approximately 95%.

Since the total volume of waste retrieved under Selective Retrieval for exsitu processing is approximately 50% of the total waste volume the non radiological operating emissions should be scaled at 50%.

Note: Specific recovery percentages of chemical constituents for selective retrieval will be developed in the future. Refinement of the Selective Retrieval chemical emissions would be possible at that time.

The stack parameters are assumed to be the same as the Extensive Retrieval (Ex Situ Vitrification) alternative. The volumetric flow rate in the off-gas system would be lower but the stack diameter is assumed to be reduced to yield the same exit velocities.

4.2.5 The air emissions from 4.2.5, 4.2.6, and 4.2.7 are considered negligible

Continued Operations :

See attached continued operations phase out schedule for phase out of continued operations during the waste treatment operations. See Eng. Inf. Request -078 for continued operations emissions.

TABLE 2

Percentage of the SST inventory recovered from 60 tanks for the Selective Retrieval alternative (based on 99% retrieval)					
	Gmcl				
	Ac225	74.28			
	Ac227	89.37			
	Am241	89.22			
	Am242	91.09			
	Am242m	91.09			
	Am243	92.60			
	At217	74.27			
	Ba135m	N/A			
	Ba137m	88.32			
	Bi210	82.97			
	Bi211	89.36			
	Bi213	74.28			
	Bi214	83.72			
	C14	92.89			
	Cm242	91.09			
	Cm244	93.89			
	Cm245	93.89			
	Cs135	84.79			
	Cs137	88.32			
	Fr221	74.29			
	Fr223	89.38			
	I129	91.65			
	Nb93m	77.38			
	Ni59	N/A			
	Ni63	78.79			
	Np237	89.57			
	Np239	92.59			
	Pa231	90.46			
	Pa233	89.58			
	Pa234m	91.42			
	Pb209	74.27			
	Pb210	82.96			
	Pb211	89.36			
	Pb214	83.72			
	Pd107	91.97			
	Po210	82.91			
	Po213	74.26			
	Po214	83.71			
	Po215	89.37			
	Po218	83.71			
	Pu238	74.21			
	Pu239	78.55			
	Pu240	79.83			
	Pu241	81.48			
	Ra223	89.37			
	Ra225	74.28			
	Ra226	83.72			
	Ru106	36.50			

Sb126	72.34			
Sb126m	72.33			
Se79	91.67			
Sm151	71.82			
Sn126	72.31			
Sr90	65.38			
Tc99	91.62			
Th227	89.37			
Th229	74.31			
Th230	81.60			
Th231	91.08			
Th233	N/A			
Th234	91.42			
Tl207	89.37			
U233	78.32			
U234	80.43			
U235	91.07			
U238	91.42			
Y90	65.38			
Zr93	66.40			

TABLE 3

Percentage of the DST inventory recovered from 10 DSTs					
for the Selective Retrieval alterative (based on 99% retrieval)					
Radionuclides					
(Ci)					
Na, kgs	77.68				
14C	98.79				
90Sr	87.14				
90Y	87.14				
99Tc	91.44				
137Cs	89.36				
137Ba	89.36				
154Eu	97.60				
235U	N/A				
238U	N/A				
237Np	97.87				
238Pu	11.92				
239Pu	28.27				
240Pu	26.13				
241Pu	23.98				
241Am	70.66				
Curies	88.69				

Continued Operatio. .ase Out Schedule

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No Action																
Min Retrieval (In Situ Vit)																
Waste Treatment 2008-2013 Number of Tanks Treated														30	59	89
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	67%	50%
Min Retrieval (Fill and Cap)																
Waste Treatment 2006-2013 Number of Tanks Treated												22	44	66	89	111
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	88%	75%	63%	50%	38%
Selective Retrieval																
Retrieval 2001-2023, Number of Tanks Treated							3	6	9	12	15	18	21	24	27	30
Fill and Cap 2006-2013												13	27	40	54	67
Total Tanks Treated							3	6	9	12	15	32	48	64	81	97
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	98%	97%	95%	93%	91%	82%	73%	64%	54%	45%
Extensive Retrieval (Ex Situ Vit)																
Retrieval 2001-2023, Number of Tanks Treated							8	15	23	31	38	46	54	62	69	77
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	91%	87%	83%	78%	74%	70%	65%	61%	57%
Extensive Retrieval (No Separations)																
Retrieval 2001-2018, Number of Tanks Treated							10	20	30	39	49	59	69	79	89	98
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	94%	89%	83%	78%	72%	67%	61%	56%	50%	44%
Extensive Retrieval (Extensive Separations)																
Retrieval 2001-2024, Number of Tanks Treated							7	15	22	30	37	44	52	59	66	74
% of tanks remaining under continued operations	100%	100%	100%	100%	100%	100%	96%	92%	88%	83%	79%	75%	71%	67%	63%	58%

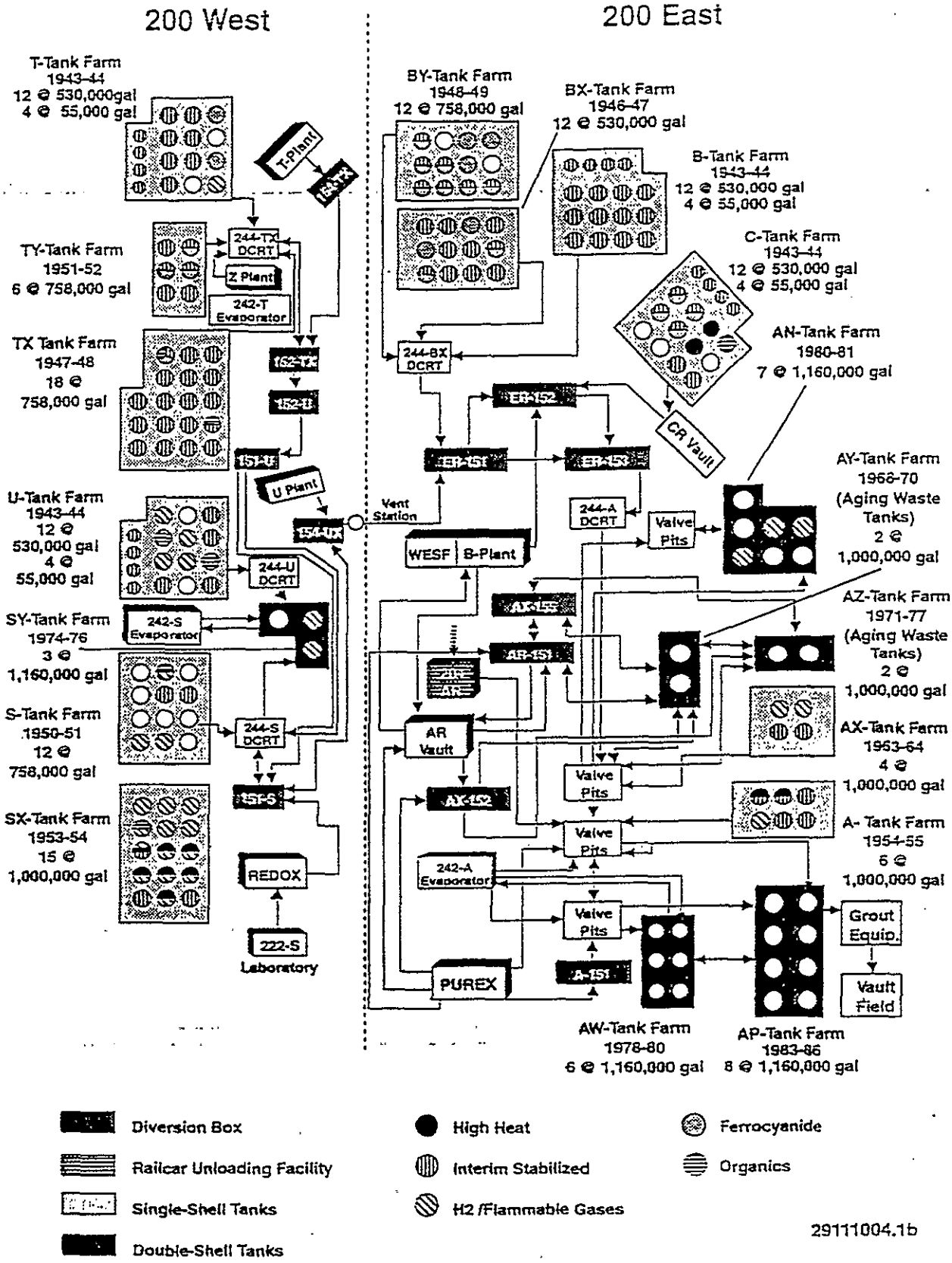
2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
118	148	177											
33%	17%	0%											
133	155	177											
25%	13%	0%											
33	37	40	43	46	49	52	55	58	61	64	67	70	
80	94	107											
114	130	147	150	153	156	159	162	165	168	171	174	177	
36%	26%	17%	15%	14%	12%	10%	9%	7%	5%	3%	2%	0%	
85	92	100	108	115	123	131	139	146	154	162	169	177	
52%	48%	43%	39%	35%	30%	26%	22%	17%	13%	9%	4%	0%	
108	118	128	138	148	157	167	177						
39%	33%	28%	22%	17%	11%	6%	0%						
81	89	96	103	111	118	125	133	140	148	155	162	170	177
54%	50%	46%	42%	38%	33%	29%	25%	21%	17%	13%	8%	4%	0%

Tank Farm Emissions From Current Operations							
242A 6 Source Emissions Roll-UP		Avg Exit Velocity 37.8 (ft/sec)		Area 9.62 (sq. ft)			
Active Ventilation		Avg Exit Temperature 117 (F)		Height 22 (ft)			
					Operating release		
	Continuous Ops	Periodic Ops	Periodic Ops	Continuous	Concentration		
Emissions	Potential (tons/yr)	Actual (tons/yr)	Actual (kg/hr)	Actual (kg/hr)	g/m^3	Area (ft^2)	Velocity (ft/s)
2-Hexanone	3.80E-04	2.88E-05	2.98E-06	3.94E-05	1.06E-06	9.62	37.8
Acetone	1.06E-01	7.98E-03	8.27E-04	1.10E-02	2.97E-04	9.62	37.8
Methyl Isobutyl Ketone	7.25E-03	5.44E-04	5.64E-05	7.51E-04	2.03E-05	9.62	37.8
N-Butyl Alcohol	8.00E-01	6.00E-02	6.22E-03	8.29E-02	2.24E-03	9.62	37.8
Ammonia	1.00E-01	7.51E-03	7.78E-04	1.04E-02	2.80E-04	9.62	37.8
	Ci/yr	Ci/yr		Ci/hr	grams/m^3		
Total Alpha (Ci) (Pu)	1.41E-04	2.10E-05		1.61E-08	7.00E-12	9.62	37.8
Total Beta (Ci) (Sr-90)	8.04E-05	1.20E-05		9.18E-09	1.78E-15	9.62	37.8

note: total alpha and beta taken from WHC-SD-WM-EV-099 and are from 1987 evaporator operations (11 MM gal run, Capacity=73.6 MM gal/yr so continuous ops =6.7 times periodic)

note: evaporator emissions are the sum of the building ventilation and the vessel vent systems which each have a stack. The shorter stack was chosen as the release point for all emissions.

Figure 1-4. Hanford Site Tank System Schematic Diagram.



S.

Ex Situ Intermediate Separations (TPA)
Waste Treatment Facility Construction Emissions

Pollutant	Unit	As Reported in Data pkg	Reduction Factor	Modified TPA Emission	Selective Retrieval Emission	Selective Retrieval annual emissions
Particulate	kg	1.30E+05	0.58	6.90E+04	34500	3833
S0x	kg	1.60E+04	0.92	1.29E+04	6450	717
CO	kg	3.20E+07	0.3	1.00E+07	5000000	555556
Hydrocarbons	kg	1.60E+06	0.34	5.50E+05	275000	30556
N0x	kg	1.90E+06	0.56	9.50E+05	475000	52778
Aldehydes as HCHO	kg	5.60E+04	0.0091	5.10E+02	255	28
Organic Acids	kg	n/a				
Thermal Releases	J	8.00E+14				
Fugitive Dust	metric ton	840		497	248.5	28

note: the 497 metric tons of fugitive dust taken from the data pkg appendix. The 840 t number appears in error.

Construction duration is 9 years for the main facilities. The construction of the LLW disposal vaults would begin following construction of the LLW vitrification plant and would continue as required through the operations period as required.

Sent 10/2

Request Number 082

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 9/13/95

Phone Number: (904) 332-3318 Fax Number: (904) 333-6631

Request Information: Data for the extensive retrieval, TPA and no separations (vitrification and calcination). Please refer to the attached sheet for detailed information.

Need Date: 09/22/95

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson CH Date Sent/Faxed: 10/2/95

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

engin\eninfrq.082

Intermediate Separations (formerly TPA, or Extensive Retrieval)

Due to time constraints a cross check of this alternative against the released version of the engineering data package received from Westinghouse will not be made at this time. With the exception of the construction emissions estimates this alternative is unchanged from the previous version. The construction emissions were modified from the values provided in the WHC data package.

Ref 5.1.3 The only borrow site that would be utilized during the construction phase of this alternative is Pit 30 which corresponds to the source (BTCH).

The modified construction emissions for this alternative are as follows:

Pollutant	kg	Reduction Factor
CO	1E+07	0.3
Hydrocarbon	5.5E+05	0.34
N0x	9.5E+05	0.56
HCHO	482	0.0091
S0x	12,900	0.92
Particulate	69,000	0.58

See attached calculation dated 6/16/95 for additional backup. The reduction factors can be applied to the No Separations alternative. Note the formaldehyde reduction factor was established separately.

No Separations (Vitrification) formerly (Extensive Retrieval - No Separations (Vitrification))

This alternative is unchanged with the exception of the construction emissions that were modified from the original construction emissions estimates in the WHC data packages.

The construction emissions for the No Separations alternative (both vitrification and calcination) should be reduced by the reduction factors provided above for the Intermediate Separations alternative. The latest construction emissions data from the WHC data package is attached.

Extensive Retrieval No Separations (Calcination)

Ref 6.1 The locations and sources for this alternative are the same as for the vitrification alternative.
Ref 6.1 The construction emissions for calcination would be the same as those identified for the No Separations Vitrification alternative.
Ref 6.2.2 Retrieval emissions would remain the same.
Ref 6.2.4 The stack parameters are assumed to be the same as for the vitrification alternative. The off-gasses from the process are scrubbed and cooled in the off-gas treatment

system for both alternatives to the point that the exit temperatures would be similar.

The changes in the operating emissions are as follows:

Non Radiological emissions- N0x emissions are 5 times higher for the calcination process. All other emissions would remain the same.

Radiological emissions- the only change in radiological emissions is for the C-14 which is 812 Ci versus 5340 Ci for the vitrification process.

The construction emissions for calcination are the same as the construction emissions for the vitrification alternative.

Request Number 083

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn

Date: 09/13/95

Phone Number: (904) 332-3318

Fax Number: (904) 333-6631

Request Information: Data for the extensive separations alternative. Please refer to the attached sheet for additional information

Need Date: 09/22/95

Response: See Attached

Data Source/Accuracy: Reference personal communication with George Jansen Jr. on 06/19/95

Prepared By: Colin Henderson CH

Date Sent/Faxed: Sent 10/2/95

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

ngin\enginfrq.083

Extensive Separations Alternative

7.1.2 It appears that construction emissions for the processing facilities will be different than for the other ex-situ vitrification alternatives. Please provide new construction emissions data. Can the construction emissions be assigned to existing source PROC? If not, please provide location of construction activity.

7.2.3,4 We will require emissions data from the HLW and the LLW vitrification processes. We have some data provided by Alex regarding radiological emissions - otherwise, we have no data for non-radiological releases. In addition, if the stack parameters and locations differ from those used for ST-H and ST-L, please provide the new data.

Construction Emissions:
I propose using the modified construction emissions for the Intermediate Separations alternative for the Extensive Separations alternative with the following modifications:

Fugitive dust remains the same- the impacted area, volume of excavation, and volume of concrete required for the construction phase is nearly identical between the two alternatives and so the fugitive dust emissions should be nearly identical.

Other construction emissions would be increased by a nominal 20% to account for slight increases in the estimates for diesel, gasoline, and construction materials. The 20% increase should be above the modified or reduced construction emissions developed for the Intermediate Separations alternative.

The construction schedule identified in the data package for the Extensive Separations treatment facilities is 12/97-12/2006 with construction of the LLW disposal vaults 9/2005-9/2019. The Intermediate Separations construction schedule is 12/97- 12/2007 for the treatment facilities and 12/2003-12/2019 for the disposal vaults. The construction schedule for the Ext. Separations alternative (Table 9-21 attached) is noted as being highly optimistic. For this reason, the same construction durations should be assumed for the Extensive Separations alternative as was used for the Intermediate Separations alternative.
Construction emissions can be assigned to existing source PROC.
See attached comparison of construction resources.

Operating Emissions:
The stack gases from the HLW vitrification plant and the LLW vitrification plant would be combined and released from a common stack under the Extensive Separations subalternative. No design calculations have been done to size the stack or the exit velocity but the following stack parameters would be used as target values during design:

Stack height = approximately 200' (use 180' to be consistent with other alternatives)
Exit velocity = 15-20 meters/second
Exit temperature = 50 degrees C

The stack would be located nearest to the Extensive Separations LLW vitrification plant (which is located in the same spot as the Intermediate Separations or TPA HLW vitrification plant) since the LLW plant will have the highest volumetric flow rate.

The following stack stream information was taken from the extensive separations data package:

Schedule: LLW vitrification 19 years, HLW vitrification 19 years
Plant capacities:LLW vitrification = 200 mt/operating day, HLW vitrification = 1 mt/operating day
capacity factors: HLW 0.0323 kg/(hr-mt) , LLW=0.2924 kg/(hr-mt)

HLW stack stream = stream 1543 = 4.19E+04 mt
LLW stack stream = streams 907+917 = 2.23E+05 + 3.58E+04 mt

LLW = 2.59E+05 mt * .2924 kg/(hr-mt) = 75,731 kg/hr
HLW = 4.19E+04 mt * 0.0323 kg/(hr-mt) = 1,353 kg/hr

Combined stack mass flow rate = 77,084 kg/hour

Assuming an average MW of 29 g/gmol

Volumetric flow rate = 65,000 standard cubic meters/hr = 18.05 cubic meters/sec

The radiological and non radiological emissions are provided in the attached tables. A spreadsheet based on the complete list of elements carried in the detailed material balance (similar to the Intermediate Separations and No Separations) was not performed due to time constraints. If any individual components identified in the spreadsheets developed for the emissions from the other alternatives are of interest they can be provided on an as needed basis.

Table 9-5. Nonradiological Operating Emissions. (2 sheets)

Item	Extensive Separation Alternative
Thermal release[1]	1.94×10^{16} J
Particulates[2]	3.08×10^{5} kg
PM-10 content, percent	0.003
VOC[3]	9.8×10^{3} kg
Fugitive dust	n/a
Toxic Air Pollutants[4]	
Formic Acid	1.54×10^{3} kg
Hydrofluoric Acid	1.26×10^{3} kg
Hydrogen Peroxide	2.8×10^{1} kg
Nitric Acid	2.16×10^{4} kg
Oxalic Acid	Negligible
Sodium Hydroxide	9.8×10^{1} kg
Hazardous Air Pollutants[4]	
Arsenic	Negligible
Beryllium	Negligible
Cadmium	Negligible
Chromium	4.48×10^{1} kg
Nickel	1.4 kg
Manganese	9.8 kg
Mercury	Negligible
Lead	Negligible

$$\text{RELEASE CONC} = \left(\text{TOTAL EMISSION kg}\right) \times \left(\frac{1000\ g}{kg}\right) \times \left(\frac{1}{19\,yr \times 365\,day \times 24\,hr \times 60\,min \times 60\,sec}\right) \times \left(\frac{1}{18.05\ m^3/sec}\right) = \text{Emission Concentration } g/m^3$$

Table 9-5. Nonradiological Operating Emissions. (2 sheets)

NOx (as NO_2)[4]	1.47×10^7 kg
SOx (as SO_2)[4]	1.33×10^6 kg
CO[4]	2.44×10^6 kg

Notes:

n/a = not applicable

[1]Refer to calculation E/B-SD-W236B-CAL-PR-EIS-016.

[2]Particulate emission estimate assumes cooling tower emissions are 95 percent of total particulate emissions (i.e., cooling tower emissions/0.95 = total emissions). Particulate emissions are essentially PM_{10}. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

[3]VOC emissions are not presented in material balance but are estimated based on vapor liquid equilibrium during storage. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

[4]Emissions of Toxic Air Pollutants (TAP) Hazardous Air Pollutants (HAP) NOx, SO_2 and CO are not presented in the material balance but are estimated based on vapor liquid equilibrium during storage. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

For additional information, see Appendix F, and also Jansen, G., 1995, *Backup Information for Data Tables in Extensive Separations Alternative Engineering Data Package*, WHC-SD-WM-DP-129, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Table 9-6. Radiological Operating Emissions (Curies).

Radionuclide[1]	Extensive Separation Alternative[2]	
	Air[3]	Water
^{241}Am	5.2E-2	4.2E-4
^{14}C	5.3E+3	n/a
^{137}Cs	1.7E+1	6.9E-2
^{129}I	1.7E+1	3.5E-4
$^{239,240}Pu$	1.6E+1	4.2E-4
^{106}Ru	1.9E-8	1.0E-2
^{151}Sm	3.2E-1	n/a
^{90}Sr	2.7E+1	2.8E-3
^{99}Tc	1.6E-2	n/a
^{93}Zr	2.0E-3	n/a
Percent PM -10 [4]	1.4E-6	—[5]

Notes:

n/a = not applicable
PM = particulate material
VOC = volatile organic compound

[1]All values in Ci except for percent PM - 10 which is in metric tons.

[2]Air values are based on material balances (streams 907 and 917 in LLW Vitrification Flowsheet; streams 1371, 1374, and 1543 in Integrated Pretreatment-HLW Vitrification Flowsheet - see Table A-7 of Appendix A) with radionuclide distribution determined using waste inventory data from Golberg (1995). Carbon-14 and iodine-129 values were not explicitly represented in flowsheet. Valuess estimated for the TPA Preferred Alternative (Slaathaug 1995) were used based on consistency of other radionuclide values between the two alternatives. Golberg, C. E., 1995, *Single-Shell and Double Shell Tank Waste Inventory Data Package for the Tank Waste Remediation System Environmental Impact Statement*, WHC-SD-WM-EV-102, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

[3]Values were based on those estimated for the TPA Preferred Alternative (Slaathaug 1995). The water values are based on effluent stream 1210 in the Integrated Pretreatment-HLW Vitrification Flowsheet and effluent stream 807 in the LLW Vitrification Flowsheet, along with the design basis for the Liquid Effluent Treatment Facility (LETF) C-018.

[4]Percent PM - 10 set equal to the total amount of solids in the streams as a percentage.

[5]LETF design sheet include solids, but for the discharge stream "—" was entered.

For additional information, see Appendix F, and also Jansen, G., 1995, *Backup Information for Data Tables in Extensive Separations Alternative Engineering Data Package*, WHC-SD-WM-DP-129, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Slaathaug, E. J., 1995, *Tri-Party Agreement Alternative Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement*, WHC-SD-WM-EV-104, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

EXTENSIVE SEPARATIONS CONSTRUCTION EMISSIONS

GIVEN: CONSTRUCTION EMISSIONS ESTIMATED IN EXT. SEPARATIONS DATA PACKAGE (WHC-SD-WM-EV-100 REV. 0) ARE DISPROPORTIONATELY HIGHER THAN OTHER VITRIFICATION ALTERNATIVES.

APPROACH: COMPARE CONSTRUCTION RESOURCE REQUIREMENTS BETWEEN EXT. SEPARATIONS AND INTERMEDIATE SEPARATIONS and SCALE CONST. EMISSIONS.

CONST. RESOURCE	EXT SEPARATIONS	INT. SEPARATIONS	% Δ
Diesel (liters)	2.9E7	2.1E7	28%
Gas (liters)	9.7E6	7.6E6	22%
Excavation (m^3)	1.8E6	1.7E6	5%
Concrete (m^3)	4.4E5	4.8E5	-9%
Steel (mt)	1.49E5	1.14E5	23%

FUGITIVE DUST Generating ACTIVITIES ARE ASSUMED TO BE EQUAL.

OTHER CONSTRUCTION EMISSIONS SHOULD BE 20% Higher THAN THE INTERMEDIATE SEPARATIONS.

FORM 91-005-1 (4/81)

Table 9-21. Unit Process: Sequence of Construction (Calendar Year Start/Completion Date).

Unit Process	Extensive Separation Alternative
Sludge wash	n/a
Radionuclide removal	7/2001 - 12/2006[1]
Low-level waste vitrification	12/1997 - 07/2005[2]
Low-level waste disposal	09/2005 - 09/2019[3]
High-level waste vitrification	07/2001 - 12/2006[4]
High-level waste transportation/disposal	n/a

Notes:

n/a = not applicable

[1]See the *Tank Waste Remediation System Facility Configuration Study* (Boomer et al. 1994), page 114.

[2]See Boomer et al. 1994, page 63.

[3]See Boomer et al. 1994, pages 33 and 63.

[4]See Boomer et al. 1994, page 144.

[5]The assumed construction schedule and the 14 year facility operations schedule are highly optimistic for the extensive separations alternative. There is considerably higher technical risk for extensive separations than for the other TWRS-EIS alternatives evaluated. Consequently, there is higher schedule risk associated with this alternative than with the other alternatives.

Boomer, K. D., J. M. Colby, T. W. Crawford, J. S. Garfield, C. E. Golberg, C. E. Leach, D. E. Mitchell, F. D. Nankani, E. J. Slaathaug, L. M. Swanson, T. L. Waldo, and C. M. Winkler, 1994, *Tank Waste Remediation System Facility Configuration Study*, WHC-SD-WM-ES-295, Westinghouse Hanford Company, Richland, Washington.

For additional information, see Appendix F, and also Jansen, G., 1995, *Backup Information for Data Tables in Extensive Separations Alternative Engineering Data Package*, WHC-SD-WM-DP-129, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Table 6-11. Nonradiological Construction Emissions (Units as Indicated).

Construction Emission Pollutant	No Separations
Particulate (kg)	8.61E4[1]
SO_x (as SO_2) (kg)	1.01E4[1]
CO (kg)	2.31E7[1]
Hydrocarbons (kg) (exhaust and fugitive)	1.18E6[1,2]
NO_x(as NO_2) (kg)	1.24E6[1]
Aldehydes (kg) (as HCHO)	3.79E4[1]
Organic acids (kg)	0
Thermal releases (J)	4.90E14[3]
Fugitive dust (t)	3.55E2[4]

Notes:

J = joules
kg = kilograms
t = tons

[1]The criteria pollutant (particulate, SOx, CO, hydrocarbon, and NOx) emissions were calculated using factors from the U.S. Environmental Protection Agency publication, AP-42, "Compilation of Air Pollutant Emission Factors." The sections of the document used in the calculations include the following:

Volume I, Section 3.3 - "Gasoline and Diesel Industrial Engines"
Volume II, Appendix H - "Highway Mobile Source Emissions Factor Tables"
Volume II, Section II-7 - "Heavy Duty Construction Equipment"

The emission factors for each pollutant are presented as "grams of pollutant per hour of equipment operation" for heavy construction equipment, "grams of pollutant per mile traveled" for heavy and light duty transportation vehicles, and "grams of pollutant per horsepower-hour of operation" for stationary industrial engines. The diesel engine SO_2 emission factor is revised to 7.1216/1,000 gallons based on a maximum allowable fuel sulfur content of 0.05 percent by weight.

Construction equipment lists with equipment duty cycles were obtained for the "no separations" alternative. Each piece of equipment was associated with one AP-42 equipment category and the emission factors applicable to that category were assigned to the piece of equipment. Emissions were calculated by multiplying the duty cycle information (in miles, hours, or horsepower-hours) by the emission factors. Emissions for each criteria pollutant were then totalled and are presented in the table.

[2]The hydrocarbon emissions estimate includes diesel and gasoline engine exhaust emissions and fugitive crankcase emissions for gasoline engines. The hydrocarbon emissions resulting from other fugitive emissions sources (bulk fuel receiving, fuel storage, equipment refueling, asphalt paving activities, etc.) are negligible in comparison with the diesel and gasoline engine hydrocarbon emissions.

Table 6-11. Nonradiological Construction Emissions (Units as Indicated).

Notes (Continued):

[3]The thermal release estimate includes internal combustion engine heat sources, other heat sources (electric equipment, road paving, concrete heat of formation, etc.) are considered to be negligible in comparison. An average working engine efficiency of 25 percent (75 percent thermal loss) for diesel engines and 20 percent (80 percent thermal loss) for gasoline engines is assumed: and 3,118,569 gallons of diesel at 140,000 British Thermal Units per gallon (Btu/gal) and 1,336,905 gallons of gasoline at 127,650 Btu/gal (1055.1 J/Btu) is assumed.

[4]Fugitive particulate emissions are estimated for the following site preparation activities: construction material excavation, handling, preparation, and storage; and paved and unpaved road traffic. Controls for certain material handling and processing activities (wet processing or filter controls) and watering of most unpaved roads are assumed. Road traffic emissions are calculated for high use heavy duty construction vehicles (scrapers, dozers, dump trucks, etc.); emissions from sporadic use of light duty vehicles (pickup trucks, flat bed trucks, vans, etc.) is negligible in comparison. Emissions were calculated using 1) EPA, "Estimation of Air Impacts from Area Sources of Particulate Matter Emissions at Superfund Sites," 1993; 2) EPA AP-42 "Compilation of Air Pollutant Emission Factors," 1993; and 3) EPA "Emission Control Technologies and Emission Factors for Unpaved Road Emissions," 1987.

For additional backup information, see Appendix B.

Request Number 84

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn (ESE) Date: 9/14/95

Phone Number: (904) 332-3318 Fax Number:

Request Information: Location of nearest residence

Need Date: 9/22/95

Response: EIR cancelled (copy of library Radionuclide Air Emmission Report for the Hanford Site Calendar Year 1993 DOE/RL -94-51 provided)

Data Source/Accuracy:

Prepared By: Colin Henderson CH

Date Sent/Faxed: 9/22/95

Concurrence: Marc C. Nelson
Marc Nelson - Project Manager

H:\USERS\CHENDERS\EIR\ENGINFRQ.084

Request Number 085

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn

Date: 09/13/95

Phone Number: (904) 332-3318

Fax Number: (904) 333-6631

Request Information: Data for the Cs\Sr Capsules alternatives. Please refer to the attached sheet for additional information

Need Date: 09/22/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson CH.

Date Sent/Faxed: Faxed 10/2/95

Concurrence: Marc C. Nelson
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST 85

The new No Action alternative for the capsules will consist of continued capsule storage in the WESF water filled basins. Construction emissions from the Capsules No Action alternative will be negligible.

The emissions for the continued operations of WESF are provided in the attached table titled WESF Continued Operations Emissions.

WESF Continued Operations Emissions				
Stack Height = 70 feet (was 75 ft. in prior communications)				
Stack diameter= 3.5 feet				
Stack exit velocity 33.4 ft/sec				
Stack gas temperature = 20 degrees C				
Volumetric Flow rate 9.17 cubic meters /sec				
Releases occur 365 days/yr, 24 hrs/day				
Stack coordinates = N136433 , E573361				
Isotope	Annual Emission	Average Concentration		
	Ci	uCi/ml		
Sr-90	5.10E-06	1.74E-14		
Cs-137	2.60E-06	8.70E-15		
Pu-239/240	2.40E-07	8.00E-16		
Total Beta	4.70E-09	7.70E-14		
Based on 1994 Emissions , Emissions assumed to be the same for 1997-2006				

Request Number 086

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: John Kuhn

Date: 09/13/95

Phone Number: (904)-332-3318

Fax Number: (904)-333-6631

Request Information: Data for the privatization components of the various alternatives.

Please refer to the attached sheet for detailed information

Need Date: 09/22/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed:

Concurrence: Marc E Nelson
Marc Nelson - Project Manager

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Privatization Scenarios

We understand that the privatization options involve pilot scale demonstrations of the various disposal alternatives. Please confirm our understanding of how the privatization option will affect the various alternatives, as outlined below. More detailed data requests may follow as our understanding of the scenarios improves. Our most immediate needs are to identify any new source locations that must be modeled for these scenarios, and to identify release parameters for those sources. Emissions data will also required, but can be provided later.

Minimal Retrieval	Our understanding is that a pilot scale test will be very similar to the operations that would normally be performed for these alternatives, only shorter in duration. However, specific locations for the demonstrations may be chosen that differ from the "worst-case" locations that were analyzed previously for these alternatives.
Ex-Situ Vitrification	The privatization option will significantly affect the analysis of these alternatives. Additional process facilities would be constructed in areas that are different from any previously modeled. If locations of the construction areas, and the locations and stack parameters of these plants can be identified, we can begin modeling immediately. Emissions data can be provided later, if necessary. We understand that the emission rates from the pilot scale facilities would be less than the full-scale plants. We anticipate that some form of scale factor will be provided for these emissions.
No-Action	We are unclear what, if any, implications the privatization scenario may have for this alternative.
Capsules	We are unclear what, if any, implications the privatization scenario may have for these alternatives.
Borrow sites	We do not have an understanding of the role of the borrow sites in the privatization scenarios.
Scheduling	We would assume that the operation of the demonstration plant would occur before full-scale operations occur.

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Emission data for Phased Implementation

ORIGINATOR Colin Henderson DATE ~~9/15/95~~ 10/23/95

REVISION NO. 0

OBJECTIVE Calculate Air emissions for Phase 1 of Phased Implementation Alternative

METHODOLOGY Noted

ASSUMPTIONS Noted.

(Continue on another sheet if necessary)

Col Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

PHASED IMPLEMENTATION

Table .. Radiological Operating Emissions. (Ci)

Radionuclide	SEP/LLW		SEP/LLW + HLW	
	Air	Water	Air	Water
^{241}Am	3.26E-06	3.2E-5	1.44E-03	3.2E-5
^{14}C	4.0E+02	n/a	4.2E+02	n/a
^{137}Cs	1.87E-02	5.2E-3	1.04E+00	5.2E-3
^{129}I	~~1.16E+00~~	~~2.6E-5~~	~~1.12E-00~~	~~2.6E-5~~
$^{239,240}Pu$	7.90E-07	3.2E-5	1.58E-03	3.2E-5
^{106}Ru	n/a	n/a	n/a	n/a
^{151}Sm	n/a	n/a	n/a	n/a
^{90}Sr	7.20E-04	2.1E-4	1.60E+00	2.1E-4
^{99}Tc	9.83E-06	n/a	9.95E-05	n/a
^{93}Zr	n/a	n/a	n/a	n/a
%PM-10^5 (MT)	1.47E-02	—	1.51E-02	—

Note

These emissions were estimated using the same on-stream factor (60%) and average operating rate (60%) that the full scale operations used, and as such represent emissions over the operating period.

To estimate peak emissions when operating the facilities at 100% design capacity, multiply the emissions in this Table by a factor of 2.8.

D. Stein
10/23/95

PHASED IMPLEMENTATION

Table . . Non-Radiological Operating Emissions.
(Units as Indicated) (2 sheets)

Item	SEP/LLW	SEP/LLW + HLW
Particulates[2] (kg)	7.0E + 2	8.7E + 2
VOC[3] (kg)	215	220
Fugitive dust	n/a	n/a
TAPS[4] (state) (kg)		
HCl[5]	1.20 E + 2	1.21 E + 2
HF[5]	4.42E + 3	4.52E + 3
Ammonia[6]	1.22 E + 3	1.77E + 3
Nitric Acid[7]	1.00 E + 3	1.60 E + 3
HAPS (metals)[8]	< 100 Kg/yr	< 100 Kg/yr
NOx (as NO_2) (kg)	1.08 E + 4	1.09E + 4
SOx (as SO_2) (kg)	1.57 E + 4	1.58 E + 4
CO "	< 100,000 Kg/yr	< 100,000 Kg/yr

Note

These emissions were estimated using the same on-stream factor (60%) and average operating rate (60%) that the full scale operations used, and as such represent emissions over the operating period.

To estimate peak emissions when operating the facilities at 100% design capacity, multiply the emissions in this Table by a factor of 2.8.

D. Stern
10/23/95

3.4.9 Phased Implementation

Overview

The Phased Implementation alternative provides a mechanism to implement the remediation of the tank wastes in a two step process. The first step would be a commercial demonstration, on a reduced scale, of the pretreatment and immobilization processes for selected tank wastes. The second step would involve scaling up the demonstration scale processes to treat the remaining tank wastes. The phased implementation approach could be applied to any of the tank waste alternatives involving waste treatment however, for purposes of analysis, the Ex Situ Intermediate Separations alternative with some additional separations was selected as a representative alternative for analysis. The follow-on or full scale alternatives are addressed by the bounding tank waste alternatives discussed in this EIS.

Under the Phased Implementation alternative readily retrievable and well-characterized wastes from the DSTs would be retrieved and processed in two separate waste treatment facilities designed, constructed, and operated by private contractors. One of the facilities would process liquid DST wastes to produce an immobilized low activity waste (LAW) product while the other facility would produce an immobilized LAW product and an immobilized HLW product.

The immobilized LAW would be sealed in containers at the treatment facilities and then transported to an interim onsite storage facility where it would be stored for eventual onsite disposal. The immobilized HLW would be placed in canisters and transported to an interim storage facility where it would be stored awaiting shipment and disposal at the proposed national HLW repository. The method of interim HLW storage would be the same as that described for the Ex Situ Intermediate Separations alternative.

Each of the LAW treatment facilities would operate for a ten year period during which they would treat the majority of the liquids currently contained in the DSTs. The HLW treatment facility would operate for a six year period.

The following operations would be implemented under Phased Implementation:

- Retrieve the DST liquids for LAW processing;
- Retrieve selected DST wastes for HLW processing;
- Transfer liquid wastes to a receiver tank;
- Transfer selected wastes for HLW processing directly to the HLW plant;
- Perform separations to remove cesium, strontium, technetium, TRU elements, and sludges from the LAW stream;
- Package the radionuclides separated during pretreatment from each of the LAW processing facilities and transport to onsite interim storage for future waste treatment;
- Return sludges separated during LAW processing to the DSTs for storage;
- Immobilize both the LAW and HLW;
- Place the immobilized HLW into canisters;

- Place the immobilized LAW into containers; and
- Transport the immobilized wastes to onsite interim storage facilities.

Following the demonstration period each of the treatment facilities would be decontaminated, and torn down, support facilities would be taken out and the facility site would be restored as near as possible to its original condition.

Process Description

The first step in waste processing would be to recover and transfer the wastes from the DSTs. The waste feed to the LAW facilities would be retrieved and transferred in batches from selected DSTs into two existing DSTs designated as feed tanks. Each LAW facility would have one designated DST as a feed tank. The waste feed to the HLW plant would be retrieved and transferred separately and would go directly to the HLW processing facility. The DST wastes that would be treated at the HLW facility would be high-activity wastes recovered directly from selected tanks and would not include the high-activity wastes separated out of the LAW stream.

Liquid waste retrieval and transfer would utilize equipment and systems currently in place in the DST farms. Sludge washing and slurry pumping using techniques identified for the Ex Situ Intermediate Separations alternative would be used to retrieve wastes for treatment at the HLW plant. The installation and operation of sludge washing and slurry pumping equipment would take place under other projects.

The specific technologies employed for separations and immobilization would be defined by the contractor and therefore are not specifically identified or discussed for this alternative however, representative technologies based on the Ex Situ Intermediate Separations alternative are used for purposes of impact analysis. The separations and immobilization technologies employed for waste immobilization would be controlled by waste product specifications that would control the physical properties, chemistry, radionuclide content, and volume of the immobilized LAW and HLW.

Pretreatment for LAW processing of the liquid wastes would be performed to remove the cesium, strontium, technetium, TRU elements and suspended sludge particles from the waste stream. The separated radionuclides would be packaged in a canister for onsite dry storage, the treated sludges would be returned to the DST farms for storage, and the treated liquid waste stream would then be immobilized. For purposes of impact analysis the immobilization process would include evaporation of the waste stream followed by vitrification. The LAW waste processing facilities would each be designed to treat up to one million gallons of liquid wastes per year. This is equivalent to 20 metric tons of vitrified glass per day at a 20 weight percent waste oxide loading.

The immobilized LAW would be placed into stainless steel containers approximately 1.8

meters long by 1.2 meters wide by 1.3 meters high.

The HLW treatment process would not involve separations processes and would treat the entire waste stream into immobilized HLW. The HLW plant would be designed to produce the equivalent of one metric ton per day of HLW glass at a 45 weight per cent waste oxide loading.

The immobilized HLW would be placed directly into canisters of a size suitable for packaging in a Hanford Multi-Purpose Canister (HMPC) for interim storage and eventual transport to the proposed national HLW repository.

Construction

The two contractors would be provided with a site east of the 200 East area within the area previously identified as the grout disposal area. Each contractor would construct a treatment facility and support facilities as required to support the operation. The following systems and facilities would be constructed:

- Waste transfer systems would include pipelines from the receiver tanks to each of the treatment facilities and would include a separate pipeline to transfer HLW from the existing waste transfer system to one of the treatment facilities;
- Electrical service to each of the sites would involve installing overhead power lines from the existing 200 East area power grid to the designated sites;
- Process water and potable water would be installed to connect the sites with existing distribution lines in the 200 East area;
- Pretreatment and LAW processing facility;
- Pretreatment, LAW and HLW processing facility; and
- Interim storage pads for immobilized LAW and HLW would be constructed in the 200 East area in the location identified for interim storage for the Intermediate Separations alternative. This interim storage facility would be constructed and maintained by the Hanford Site M&I contractor.

Operations

Operations under this alternative would take place simultaneously at the two treatment plants. Both LAW plants would operate for approximately ten years while the HLW treatment operations would take place for six years.

The Hanford Site Maintenance and Integration (M&I) contractor would retrieve and transfer DST wastes to the receiver tanks or in the case of the HLW, directly to the HLW processing facility. The waste treatment contractors would transfer wastes from the receiver tanks to the treatment facilities on an as needed basis.

Each contractor would perform the necessary pretreatment and separations processes on the waste stream, collecting and packaging the separated radionuclides for return to DOE for

interim storage. The LAW waste stream would be immobilized using a technology to treat the waste that would yield a stabilized waste product that would be similar to vitrified glass with regard to waste performance characteristics.

Immobilization of the HLW stream would be accomplished using a technology to treat the waste that would result in a stabilized waste form similar characteristics to borosilicate glass.

Each of the waste treatment facilities would operate off-gas treatment systems that would include control technologies for priority pollutants and radionuclides. The treatment of the off-gas would be similar processes and equipment as described for the Ex Situ Intermediate Separations alternative.

Post Remediation

Post Remediation activities would include decontamination and decommissioning of the treatment facilities, and closure of the site.

FACILITY SIZES

Each of the facilities consist of a parking lot, an operations support (maintenance) building, an emergency response center building, an emergency diesel generator, a regulated entrance building, tanks (approximately 6) for bulk process chemical storage, a cooling tower, a control room building (or trailer), an electrical substation and switch gear unit, a gaseous emissions stack (150 ft. high), an anhydrous ammonia storage tank, and a storage area for palletized containers and container packaged process chemicals.

The Separations/LAW and HLW facility process building is approximately 120 meters long by 60 meters wide and will stand about 39 meters high.

The Separations/LAW facility process building is approximately 120 meters long by 40 meters wide and will stand about 39 meters high.

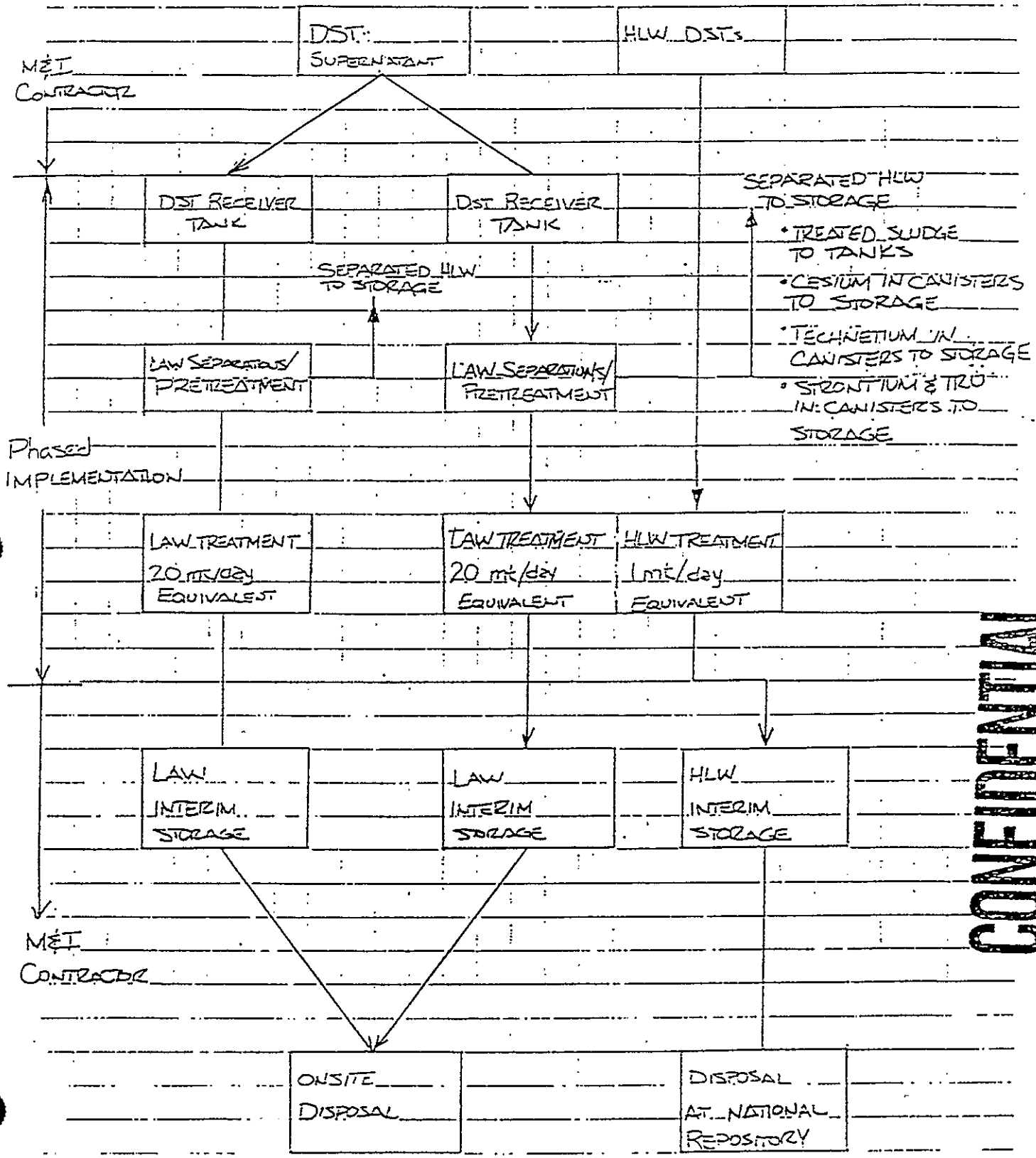
Note: This Layout could be seen from the air. Depending on distance and lay or the land, all or only some portions will be visible from the main road to the 200 East Area.

JACOBS ENGINEERING GROUP INC.

DATE 10/17/95 SUBJECT SHEET NO.

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION



CONFIDENTIAL

FORM 91-005-1 (4/91)

JACOBS ENGINEERING GROUP INC.

DATE 10/18/95. SUBJECT SHEET NO. 1

BY CH CHKD. JOB NO.

PHASED IMPLEMENTATION DISTURBED AREA.

i) AREA DISTURBED DURING CONSTRUCTION TOTAL

a) 30 ACRES/SITE: (12.2 ha) — 60 Acres (24.3 ha)

b) POWER LINE (1500 m new power line)

Assumed 500 m of new Line outside existing Fence Line.

AREA = 500 m x 50 m = 25000 m² (2.5 ha) — 6 Acres (2.5 ha)

c) Water Service 960 m of buried line

Assumed 475 m of the Line outside of existing Fence line

AREA = 475 m x 25 m = 1.18 ha = 3 Acres — 3 Acres (1.18 ha)

d) Road — 6.5 Acres (1.64 ha)

IMPROVE 1480 meters of existing Road

AREA = 1480 meters x 10 m = 3.7 acres (1.5 ha)

(10 meters width to improve road)

New Road

570 meters x 20 = 2.8 Acres (1.14 ha)

(20 meters width for new road)

e) WASTE TRANSFER PIPELINES — 0

ASSUME ALL WASTE TRANSFER PIPING IS INSTALLED WITHIN EXISTING FENCELINE IN CURRENTLY DISTURBED AREA. INCLUDES LIQUID Effluent transfer line to LERF

FORM 91-0051 (4/91)

JACOBS ENGINEERING GROUP INC.

DATE 10/15 SUBJECT SHEET NO. 2

BY _____ CHKD. _____ JOB NO. _____

1. Cont.

TEMPORARY CONSTRUCTION PARKING 5 ACRES (2 ha)

TOTAL AREA DISTURBED DURING CONSTRUCTION 80.5 ACRES (32 ha)

2. Permanently Disturbed Area = 0

Assume RCRA Closure with no Permanent Land Commitments.

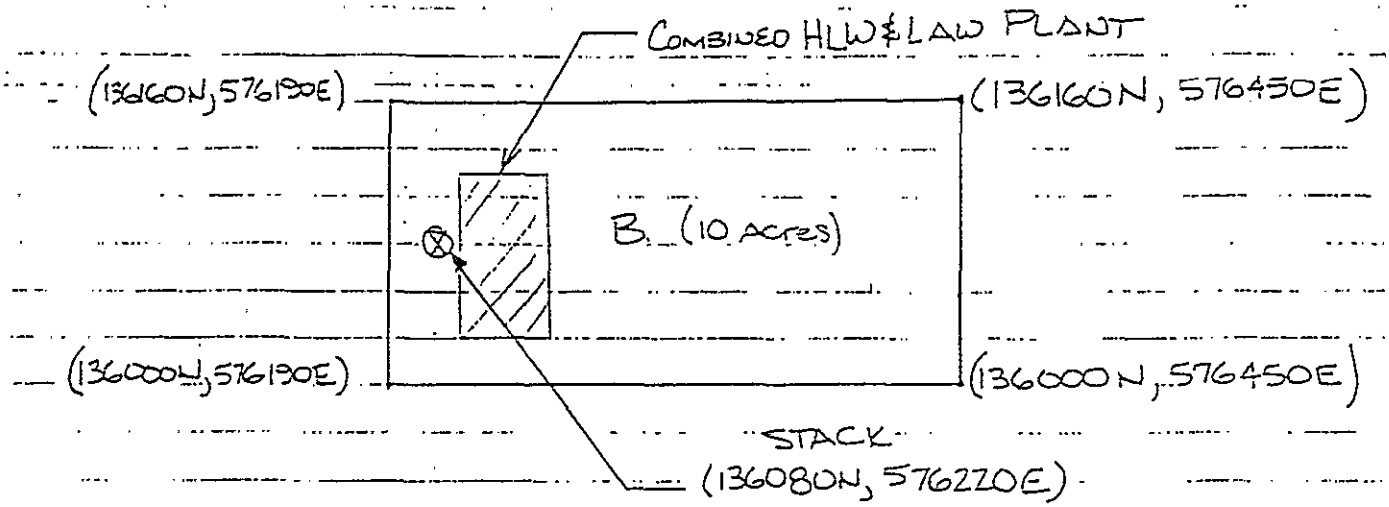
FORM 91-005-1 (4/91)

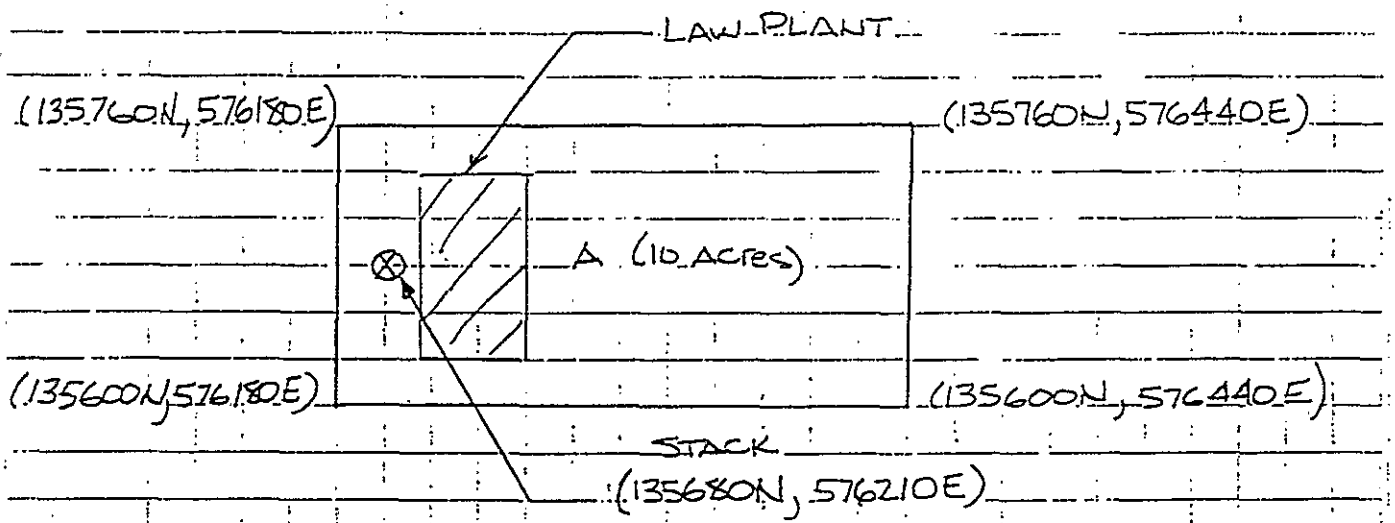
JACOBS ENGINEERING GROUP INC.

DATE 10/18 SUBJECT Phased Implementation Locations. SHEET NO.

BY CHKD. JOB NO.

SITE COORDINATES:





Assume Stack Height = 150 ft

Exit Velocity = 45 ft/sec

Exit Temp = 150 °F

Stack Ø = 1m.

FORM 91-005-1 (4/81)

Non Radiological Construction Emissions (Estimated)

Const. Emission Pollutant		52P/LAW + HLW	52P/LAW
Particulate	Kg	1.0 E+04	1.0 E+04
SO_x (as SO_2)	Kg	1.896 E+03	1.896 E+0
CO/CO_2	Kg	1.386 E+06	1.386 E+06
Hydrocarbons (Exhaust + Fugitive	Kg	8.02 E+04	8.02 E+04
NO_x (as NO_2)	Kg	1.38 E+05	1.38 E+05
aldehydes (as HCHO)	Kg	69 ~~345~~	69
Organic acids	Kg	N/A	N/A
thermal Releases	J	9.8 E+13	9.8 E+13
Fugitive Dust	t	82	82

used the values from table B.14 for the No Separations subalternative and applied 20% to the values given.

Construction personnel were selected by assuming the same total number per year as for the equivalent 200 MT/day plant and support facilities. Construction period was for 2 years. Hence for a Construction period assumed over 10 years then for 2 years 20% of the ten year totals estimated would be appropriate.

JACOBS ENGINEERING GROUP
ALTERNATIVE BREAKDOWN BY COMPONENT

1.0 NO ACTION

1.1 Construction - N/A

1.2 Operation
1.2.1 Continued Operations
-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operate Evaporator (periodic operations to maintain waste volumes up through yr 2005)
-Evaporate all diluted slurry transfers to maintain waste volume
-Transfer waste additions to DSTs for accumulation and batch transfer wastes to and from the evaporator
-Treat condensate at the Liquid Effluent Treatment Facility (LETF)
-Accept new wastes in DSTs (up to year 2005)
1.2.2 Retrieval - N/A
1.2.3 Separations - N/A
1.2.4 Treatment - N/A
1.2.5 Storage - N/A
1.2.6 Disposal - N/A
1.2.7 Monitoring and Maintenance - N/A(no immobilized HLW)

1.3 Post Remediation - N/A (no post remediation activities)
1.3.1 Decontamination and Decommissioning - N/A
1.3.2 Closure - N/A (no closure activities would occur)
1.3.3 Monitoring - N/A (no post remediation)

2.0 LONG-TERM MANAGEMENT

NOTE: The Long-Term Management alternative calls for retanking the DST wastes two times during the 100 year institutional control period. Each of the following construction activities (except for W-314) will occur twice during the Long-Term Management alternative.

2.1 Construction
2.1.1 W-314 Transfer System Upgrade
-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.
2.1.2 Continued Operations
-Build replacement evaporator (build a new evaporator for each retanking campaign)

-Build new DST at 50 year intervals
- -26 new DSTs (54 total) to replace existing 28 DSTs
- -Diesel generator building
- -Gas sampling and stack monitoring facilities
- -Administration building
- -Tank ventilation systems
- -Second retanking will have the required effluent treatment constructed with the new evaporator

2.1.3 Retrieval
-Build tank retrieval systems
- -Mixer pumps
- -Transfer pumps and associated facilities as necessary
- -Tank cooling systems
- -Modifications to existing valve and pump pits
- -Build DST transfer piping
- -Connect existing DST facilities with new tank farms and new evaporator

2.1.4 Separations - N/A
2.1.5 Treatment - N/A
2.1.6 Storage - N/A
2.1.7 Disposal - N/A

2.2 Operation
2.2.1 Continued Operations
-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operate 242-A Evaporator
- -Evaporate all diluted slurry transfers to maintain waste volume
- -Transfer waste additions to DSTs for accumulation and batch transfer wastes to and from the evaporator
- -Treat condensate at the Liquid Effluent Treatment Facility (LETF)
  - -First retanking will use Liquid Effluent Treatment Facility (LETF)
  - -Second retanking will have the required effluent treatment constructed with the new evaporator

-Accept new wastes into DSTs (until yr 2005)
-Deactivate and stabilize empty DSTs
- -Cap piping, seal entrances
- -fill tank with gravel (not estimated in data package)
- -Continue to stabilize and isolate SSTs (interim stabilization) (seal entrances, cap piping etc.)

2.2.2 Retrieval
- -Retrieve DST wastes
- -Direct transfer supernate to new DSTs

-Add dilution liquids to remaining wastes, run mixer pumps and slurry pump
-Process slurry through the evaporator
-Retrieve 99% of DST waste

2.2.3 Separations - N/A
2.2.4 Treatment - N/A
2.2.5 Storage - N/A
2.2.6 Disposal - N/A
2.2.7 Monitoring and Maintenance - N/A(no immobilized HLW)

2.3 Post Remediation - N/A (no post remediation activities)
2.3.1 Decontamination and Decommissioning
-D&D evaporator facilities following each retanking campaign.
2.3.2 Closure - N/A (no closure activities would occur)
1.3.3 Monitoring - N/A (no post remediation)

3.0 IN SITU FILL AND CAP

3.1 Construction
3.1.1 W-314 Transfer System Upgrade
-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.
3.1.2 Retrieval - N/A
3.1.3 Separations - N/A
3.1.4 Treatment
-Install gravel handling equipment for tank filling
-Modify tanks as required to accommodate gravel slingers (enlarge tank risers)
-Construct gravel storage sites for stockpiles, 4 stockpiles, 2 in 200E and 2 in 200W
3.1.5 Storage - N/A (no interim HLW storage)
3.1.6 Disposal - N/A (no construction of a disposal facility)

3.2 Operation
3.2.1 Continued Operations
-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity (up to 2005)
-Accept new wastes into DSTs until yr 2005
3.2.2 Retrieval - N/A
3.2.3 Separations - N/A
3.2.4 Treatment

-Evaporate all excess DST liquids through the 242A evaporator
-Use a 30 cu meter/min (1000 cfm) exhauster to ventilate tanks
-Set up portable conveyors from gravel stock pile to slinger
-Install cyclone separators in HVAC system to remove particulate
-Operate gravel filling equipment, estimated 3 days to fill a tank at 50 mt/hr
3.2.5 Storage- N/A (no interim HLW storage)
3.2.6 Disposal
-Disposal would occur in the tanks following drying and filling operations
3.2.7 Monitoring and Maintenance - N/A (no operational phase monitoring of HLW product)

3.3 Post Remediation
3.3.1 Decontamination and Decommissioning
-D&D equipment
3.3.2 Closure
-Construct Hanford barriers
-Grout fill all MUSTs and ancillary equipment
-Barriers to be built over all tank farms and MUSTs
3.3.3 Monitoring and Maintenance
-Monitoring and maintenance activities would occur at the tank farms for 100 years following closure.

4.0 IN SITU VITRIFICATION
4.1 Construction
4.1.1 W-314 Transfer System Upgrade
-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.
4.1.2 Retrieval - N/A
4.1.3 Separations - N/A
4.1.4 Treatment
-Construct tank farm confinement facilities (TFCFs). Construct a TFCF over each tank farm
-Assemble in sections adjacent to tank farms
-Construct foundation around perimeter of tank farm
-Assemble prefabricated sections (75' wide)
-Construct HVAC system
-Construct off gas treatment system
-Construct frit handling system to fill tank domes with sand
-Construct electrical power system
-New substation
-Several miles of 115 KVA transmission line
-Temporary runs of 115KVA lines from transmission line to individual farms
4.1.5 Storage - N/A (no interim HLW storage required)
4.1.6 Disposal - N/A (no construction of a disposal facility required, barriers addressed under post

remediation)

4.2 Operation

4.2.1 Continued Operations

-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity (up to yr 2005)
-Accept new wastes into DSTs until yr 2005

4.2.2 Retrieval - N/A

4.2.3 Separations - N/A

4.2.4 Treatment

-Remove excess DST liquids in evaporator (5 years of continuous evaporator operation)
-Add required glass formers, sand to fill up tank dome spaces
-Vitrify wastes (includes tanks and area between resulting in the vitrification of the entire tank farm)
-Operate offgas treatment
-Collect and dispose of calcium sulfate from SO2 scrubbing
-Treat liquids condensed in offgas system by collecting and trucking to the LETF
-Move equipment from tank to tank

4.2.5 Storage - N/A (no interim HLW storage)

4.2.6 Disposal

-Disposal would occur in place following vitrification

2.2.7 Monitoring and Maintenance

-Monitoring activities would take place at vitrified tank farms prior to closure

4.3 Post Remediation

4.3.1 Decontamination and Decommissioning

-D & D TFCFs and the vitrification equipment
    -contaminated material and equipment disposed of onsite in LAW burial grounds

4.3.2 Closure

-Grout fill and construct Hanford barriers over all MUST tanks located outside of the tank farm areas
-Construct Hanford barriers
    -Surface barriers would be installed over each tank farm after ISV complete

4.3.3 Monitoring and Maintenance

-Monitor and maintenance activities would take place at the tank farms for 100 years following closure

5.0 EX SITU INTERMEDIATE SEPARATIONS

5.1 Construction

5.1.1 W-314 Transfer System Upgrade

-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E

-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.

5.1.2 Retrieval

-Build retrieval and transfer system
- -Waste transfer annexes (2 in 200 East, 2 in 200 West)
- -Waste storage and sampling facility (in 200 West used for cross site transfer)
- -Piping, approx 40 miles of doublewall pipe (includes cross site transfer line)
- -24 SST sluicing systems
- -12 SST arm based systems with confinement structures
- -Install mixer pumps in DSTs, 2 to 4 mixer pumps per tank
- -Must retrieval and transfer system, retrieval similar to SST and DST tanks, transfer by container

5.1.3 Separations

-Build pretreatment facility
- -Pretreatment and LAW vit facility are combined
- -Waste receipt and sampling
- -Cesium ion exchange
- -Pretreatment will utilize between 4 and 8 existing DSTs for in tank sludge washing operations

5.1.4 Treatment

-Build support facilities
- -Mechanical Utilities building (shared utilities)
- -Cooling tower
- -Cold chemical facilities
- -Warehouses
- -Fab shop, Mockup shop
- -Fire protection facilities, storage and pumping
- -Operations control, Operations support buildings
- -Waste staging and sampling facility
- -Power lines, substation, 2.5 km of 13.8 KV line

-Construct LAW vitrification facility
- -Melter feed system
- -Glass former handling system
- -Fuel and oxygen system
- -Evaporator
- -Two 100 metric ton per day combustion melters
- -Cullet quench and handling system
- -Waste container handling system
- -Offgas system

-Construct HLW vitrification facility
- -Melter feed system
- -Glass former handling system
- -Evaporator
- -One 20 metric ton per day joule heated HLW melter
- -Offgas system
- -Canister handling system
- -Recycle streams

5.1.5 Storage
-Construct HLW interim storage facility
-Storage pads for interim HLW Cask storage
5.1.6 Disposal
-Construct LAW disposal facility
-Vaults constructed throughout operational period
-Total of 46 vaults constructed below grade at 5,300 cu. meters per vault

5.2 Operation
5.2.1 Continued Operations
-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity (until yr 2005)
-Accept new wastes in DSTs until yr 2005
5.2.2 Retrieval
-Retrieve wastes
-Sluice SSTs (110 tanks)
-Arm based retrieval (50 tanks)
-Slurry pump DST wastes
-Retrieve MUST wastes (sluice and/or arm based retrieval)
-Move retrieval/confinement systems tank to tank
-SST sluicing systems move 4 to 5 times
-SST arm based systems and confinement structures move 4 times
-Transfer wastes to vitrification plant
-Batch transfer wastes from 200W to 200E
-Batch transfer wastes to waste staging and sampling facility
-Container transfer MUST wastes
-Place contaminated tank internal equipment retrieved from the tanks and contaminated retrieval equipment in burial boxes and dispose of at onsite burial grounds (10,000 cu. meters)
5.2.3 Separations
-Pretreat wastes to separate HLW and LAW streams
-Utilizes DSTs, in tank sludge wash plus enhanced wash with NaOH (could be done out of tank)
-Remove cesium from wash liquids and put into HLW with ion exchange
5.2.4 Treatment
-Operate LAW vitrification plant
-Receive and sample wastes
-Evaporate water from wastes
-Operate 2 combustion melters (feed streams of oxygen, kerosene, wastes, glass formers)
-Glass at 25 wt % sodium oxide
-Quench molten glass to make cullet

-Place vitrified cullet into canisters (32 cubic meter disposal containers)
- -Size and dry cullet
- -Mix with matrix material
- -Place cullet and matrix material into containers
- -Transport containers to the onsite LLW disposal vaults

-Operate HLW vitrification plant
- -Receive and sample wastes
- -Evaporate water from wastes
- -Operate 1 joule heated melter, capacity 20 metric ton/day
- -Glass at 45 wt % waste oxides
- -Pour glass monoliths .68m dia x 4.57 m long
- -Overpack glass into Hanford multi purpose canisters, 4 glass logs / cask

-Operate offgas treatment at both HLW and LAW plant
- -Quench and cool offgas
- -Remove radionuclides and recycle to process
- -Destroy NOx and recover sulfur from SO2

-Treat liquid effluent at both HLW and LAW plant
- -Collect effluent in recycle tanks
- -Sample and recycle off spec effluent, transfer on-spec to adjustment tank
- -Adjust pH of on spec effluent
- -Batch transfer to retention basin for later transfer to Liquid Effluent Treatment Facility

-Transport HLW casks to interim storage pads
- -Take overpacked casks and transport from canister handling facility to storage pad

5.2.5 Storage

-Store vitrified HLW MPCs on-site on interim storage pads prior to transport to the proposed national HLW repository

5.2.6 Disposal

-Transport casks to the proposed national HLW repository
- -Rail transport, 171 trips, 10 casks on 10 rail cars each week (repository limited to handling 2 casks per OD), transportation takes 3.3 years

-LAW disposal in on-site in retrievable disposal vaults

5.2.7 Monitoring and Maintenance

-Monitor and maintain stored casks
- -Routine surveillance on 1,705 casks

5.3 Post Remediation

5.3.1 Decontamination and Decommissioning

-D&D facilities
- -Entomb non-contaminated material
- -Demolish and landfill contaminated facilities at LAW burial ground

5.3.2 Closure

-Close tank farms
- -Barrier construction after completion of LAW vitrification
- -Grout fill MUSTs and ancillary equipment
- -Stabilize empty SSTs and DSTs by filling with grout or gravel

-Construct Hanford barriers (caps)
- -Construct barrier over all tank farms and LAW disposal vaults

5.3.3 Monitoring and Maintenance

-Monitoring and Maintenance would take place at the tank farms and disposal vaults for 100 yrs

following closure

6.0 EX SITU NO SEPARATIONS

6.1 Construction

6.1.1 W-314 Transfer System Upgrade

-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.

6.1.2 Retrieval

-Build retrieval and transfer system
  -Waste transfer annexes (2 in 200 East, 2 in 200 West)
  -Waste storage and sampling facility (in 200 West used for cross site transfer)
  -Piping, approx 40 miles of doublewall pipe, includes cross site transfer line
  -Subsurface barriers for SSTs, package currently assumes all SSTs will have barrier
  -24 SST sluicing systems
  -12 SST arm based systems with confinement structures
  -Install mixer pumps in DSTs, 2 to 4 mixer pumps per DST
  -Must retrieval and transfer system, retrieval similar to SST and DST tanks, transfer by container

6.1.3 Separations - N/A (no high-level/low-level separations would be made)

6.1.4 Treatment

-Build support facilities
  -Mechanical Utilities building (shared utilities)
  -Cooling tower
  -Cold chemical handling facilities
  -Warehouses
  -Fab shop, Mockup shop
  -Fire protection facilities, water storage and pumping
  -Operations control, Operations support buildings
  -Waste staging and sampling facility (6 tanks @100 kgal each)
  -Power lines, substation, 2.5 km of 13.8 KV line
-Build one vitrification or calcination plant (all waste processed would be considered HLW)
  -feed system for the melter or calciner
  -glass former handling system for the vitrification melter
  -fuel and oxygen systems
  -evaporator
  -two 100 metric ton per day combustion melters
  -two 50 mt per day calciners (same waste input as vitrification, no glass formers so 50% of output)
  -cullet quench and handling system
  -offgas system
  -recycle loops

-Build canister handling and storage facilities
    -canister facilities
    -build interim storage pads

6.1.5 Storage

-Construct an on-site interim storage facility to store the vitrified or calicned HLW

6.1.6 Disposal

-All waste retrieved (assumed to be 99%) would be disposed of at the proposed national HLW repository

6.2 Operation

6.2.1 Continued Operations

-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity(up to 2005)
-Accept new wastes into DSTs (up to 2005)

6.2.2 Retrieval

-Retrieve wastes
    -Sluice SSTs (110 tanks)
    -Arm based retrieval (50 tanks)
    -Slurry pump DST wastes
    -Retrieve MUST wastes (sluice and/or arm based)
-Move retrieval/confinement systems tank to tank
    -SST sluicing systems move 4 to 5 times
    -SST arm based systems and confinement structures move 4 times
-Transfer wastes to vitrification plant
    -Batch transfer wastes from 200W to 200E
    -Batch transfer wastes to waste staging and sampling facility
    -Container transFer MUST wastes
-Place contaminated tank internal equipment retrieved from the tanks and contaminated retrieval equipment in burial boxes and dispose of at onsite burial grounds (10,000 cu. meters)

6.2.3 Separations - N/A (no separations would be done)

6.2.4 Treatment

<u>Operate vitrification plant</u>
    -Receive and sample wastes
    -Evaporate water from wastes
    -Operate 2 combustion melters (feed streams of oxygen, kerosene, wastes, glass formers)
    -Glass at 25 wt % sodium oxide
    -Quench molten glass to make cullet
-Place vitrified cullet into canisters (22,481 canisters @ 10 cu. meters each)
    -Size and dry cullet
    -Transfer cullet to canisters
    -Weld and decontaminate canisters
    -Overpack canisters into multi purpose overpack canister (1 canister per overpack)

Operate Calcination plant
-Receive and sample wastes
-Evaporate water from wastes
-Operate two spray calciners
-Compact calcined wastes into briquettes
-Place briquettes into canisters (10,300 canisters @ 10 cu. meters each)
    -Cool briquettes prior to placement into canisters
    -Weld and decontaminate
    -Overpack canisters into a multi purpose overpack canister (1 canister per overpack)

Common to Vitrification or Calcination
-Operate offgas treatment
    -Quench and cool offgas
    -Remove radionuclides and recycle to process
    -Destroy NOx and recover sulfur from SO2
-Treat liquid effluent
    -Collect effluent in recycle tanks
    -Sample and recycle off spec effluent, transfer on-spec to adjustment tank
    -Adjust pH of on spec effluent
    -Batch transfer to retention basin for later transfer to Liquid Effluent Treatment Facility
-Transport casks to storage pads
    -Take overpacked casks and transport from canister handling facility to storage pad
-Transport casks to HLW repository
    -Rail transport, 10 casks on 10 rail cars each week, 2248 trips for vitrification 1,030 trips for calcination (repository limited to handling 2 casks per OD)

6.2.5 Storage
-Store canisters of HLW on interim storage pads pending shipment to the proposed national HLW repository

6.2.6 Disposal -N/A (no on-site disposal)

6.2.7 Monitoring and Maintenance
-Monitor and maintain stored HLW canisters

6.3 Post Remediation

6.3.1 Decontamination and Decommissioning
-D&D facilities
    -Entomb non contaminated in place
    -Demolish and landfill contaminated facilities at LAW burial ground

6.3.2 Closure
-Close tank farms
    -Grout fill MUSTs and ancillary equipment
    -Gravel fill empty DSTs and SSTs
-Construct surface barriers
    -Surface barrier to be installed over every tank farm

6.3.3 Monitoring and Maintenance
-Monitoring activities would take place in the tank farms for 100 years following closure

7.0 EX SITU EXTENSIVE SEPARATIONS

7.1 Construction

7.1.1 W-314 Transfer System Upgrade

-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.

7.1.2 Retrieval

-Build retrieval and transfer system (identical to Extensive Retrieval (Ex Situ Vitrification))

7.1.3 Separations

-Build pretreatment facility, the separations facility and the HLW facility are combined(similar to but more extensive than the facility for Extensive Retrieval (Ex Situ Vit)

7.1.4 Treatment

-Build support facilities
-Construct LAW vitrification facility (200 mt/day)
for LAW
-Construct HLW vitrification facility (1 mt/day)

7.1.5 Storage

-Construct an interim storage facility for the vitrified HLW

7.1.6 Disposal

-Construct LAW disposal facility
-Construct sulfur cement handling and transfer system

7.2 Operation

7.2.1 Continued Operations

-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity (up to 2005)
-Accept new wastes in DSTs

7.2.2 Retrieval

-Retrieve wastes
-Move retrieval/confinement systems tank to tank
-Transfer wastes to pretreatment facility
-Place contaminated tank internal equipment retrieved from the tanks and contaminated retrieval equipment in burial boxes and dispose of at onsite burial grounds (4,000 cu. meters)

7.2.3 Separations

-Operate pretreatment facility
-Operate offgas treatment
-Treat liquid effluent
-Transfer HLW and TRU to HLW vitrification plant
-Transfer LAW to LAW vitrification plant

7.2.4 Treatment (treatment operations similar to Exsitu Intermediate Separations
-Operate HLW vitrification plant
-Operate LAW vitrification plant
-Transport vitrified HLW to proposed national HLW repository
-Vitrify TRU wastes in HLW vitrification plant
-Transport vitrified TRU wastes to WIPP
7.2.5 Storage
-Temporarily store vitrified HLW on site
7.2.6 Disposal
-Dispose of LAW on site in containers
7.2.7 Monitoring and Maintenance
-Monitor HLW storage

7.3 Post Remediation
7.3.1 Decontamination and Decommissioning
-D & D pretreatment facilities, vitrification facilities, HLW interim storage
-D & D equipment
7.3.2 Closure
-Close tank farms
-Construct surface barriers
-Grout fill MUSTs and ancillary equipment
-Grout or gravel fill empty DSTs and SSTs
-Barrier to be placed over every tank farm and LAW disposal vaults
7.3.3 Monitoring and Maintenance
-Monitor LAW disposal and tank farms for 100 years following closure

8.0 EX SITU/IN SITU COMBINATION
8.1 Construction
8.1.1 W-314 Transfer System Upgrade
-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.
8.1.2 Retrieval
-Build retrieval and transfer system
-Waste transfer annexes (2 in 200East and 2 in 200West)
-Waste storage and sampling facility located in 200West, used for cross site transfer
-Piping to connect the tanks selected for retrieval and the transfer annexes and from the transfer annexes to the cross site transfer system
-10 SST sluicing systems
-5 SST arm based systems with confinement structures
-Install mixer pumps in DSTs, 2 to 4 mixer pumps per DST

8.1.3 Separations

-Build pretreatment facility
- -Pretreatment and LAW vitrification facility would be combined
- -Waste receipt and sampling
- -Sludge washing
- -Cesium Ion Exchange

8.1.4 Treatment

Wastes left in tanks (107 tanks)

-Install gravel filling equipment for tank filling
-Modify tanks as required to accommodate gravel slingers
-Construct gravel storage sites for stockpiles, 4 stockpiles, 2 in each area
-No construction required for radiofrequency drying, all equipment required will be trailer mounted.

Retrieved wastes (70 tanks)

-Build support facilities
- -Mechanical Utilities building (shared utilities)
- -Cooling tower
- -Cold chemical facilities
- -Warehouses
- -Fab shop, Mockup shop
- -Fire protection facilities, storage and pumping
- -Operations control, Operations support buildings
- -Waste staging and sampling facility
- -Power lines, substation, 2.5 km of 13.8 KV line

-Construct LAW vitrification facility
- -Melter feed system
- -Glass former handling system
- -Fuel and oxygen system
- -Evaporator
- -Two 50 metric ton per day combustion melters
- -Cullet quench and handling system
- -LAW container handling system
- -Offgas system

-Construct HLW vitrification facility
- -Melter feed system
- -Glass former handling system
- -Evaporator
- -One 10 metric ton per day joule heated HLW melter
- -Offgas system
- -Canister handling system
- -Recycle streams

8.1.5 Storage

-Construct storage pads for interim storage of vitrified HLW before transport to the repository

8.1.6 Disposal

-Construct LAW disposal facility
- -Vaults constructed throughout operational period
- -Total of 23 vaults constructed below grade at 5,300 cu. meters per vault

8.2 Operations

8.2.1 Continued Operations

-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity

8.2.2 Retrieval

-Retrieve wastes from selected tanks
    -Sluice SSTs (60 tanks)
    -Arm based retrieval (20 tanks)
    -Slurry pump DST wastes
-Move retrieval/confinement systems tank to tank
    -SST sluicing systems move 5 to 6 times
    -SST arm based systems and confinement structures move 4 times
-Transfer wastes to vitrification plant
    -Batch transfer wastes from 200W to 200E
    -Batch transfer wastes to waste staging and sampling facility
-Place contaminated tank internal equipment retrieved from the tanks and contaminated retrieval equipment in burial boxes and dispose of at onsite burial grounds (4,000 cu. meters)

8.2.3 Separations

-Pretreat wastes to separate HLW and LAW streams
    -Utilizes DSTs, in tank sludge wash plus enhanced wash with NaOH
    -Remove cesium from wash liquids using ion exchange, transfer cesium to HLW plant

8.2.4 Treatment

<u>Wastes not retrieved (107 tanks)</u>

-Evaporate pumpable DST liquids through the 242A evaporator (18 DSTs)
-Set up portable conveyors from gravel stock pile to slinger
-Install cyclone separators in HVAC system to remove particulate
-Operate gravel filling equipment, estimated 3 days to fill a tank at 50 mt/hr

<u>Retrieved Wastes</u> (70 tanks, 50% of total waste volume)

-Operate LAW vitrification plant
    -Receive and sample wastes
    -Evaporate water from wastes
    -Operate 2 combustion melters (feed streams of oxygen, kerosene, wastes, glass formers)
    -Glass at 25 wt % sodium oxide
    -Quench molten glass to make cullet
-Place vitrified cullet into containers (32 cubic meter containers)
    -Size and dry cullet
    -Mix with matrix material
    -Transport LAW containers to LAW vaults
-Operate HLW vitrification plant
    -Receive and sample wastes
    -Evaporate water from wastes

-Operate 1 joule heated melter, capacity 10 metric ton/day
-Glass at 45 wt % waste oxides
-Pour glass monoliths .68m dia x 4.57 m long
-Overpack glass into casks, 4 glass logs / cask
-Operate offgas treatment at both HLW and LAW plant
-Quench and cool offgas
-Remove radionuclides and recycle to process
-Destroy NOx and recover sulfur from SO2
-Treat liquid effluent at both HLW and LAW plant
-Collect effluent in recycle tanks
-Sample and recycle off spec effluent, transfer on-spec to adjustment tank
-Adjust pH of on spec effluent
-Batch transfer to retention basin for later transfer to Liquid Effluent Treatment Facility
-Transport HLW casks to interim storage pads
8.2.5 Storage
-Store MPC casks on site on interim storage pads
8.2.6 Disposal
-107 tanks disposed of in situ following drying and gravel filling
-LAW disposed of on site in retrievable disposal vaults
8.2.7 Monitoring and Maintenance
-Monitor and maintain approximately 850 stored HLW canisters.

8.3 Post Remediation
8.3.1 Decontamination and Decommissioning
-D&D facilities
-Entomb non-contaminated material/facilities
-Demolish and landfill contaminated facilities at LAW burial ground
8.3.2 Closure
-Close tank farms
-Barrier construction after completion of LAW vitrification
-Grout fill MUSTs and ancillary equipment
-Stabilize empty SSTs and DSTs that were selected for retrieval by filling with grout or gravel
-Construct Hanford barriers (caps)
-Construct barrier over all tank farms and LAW disposal vaults
8.3.3 Monitoring and Maintenance
-Monitoring and maintenance of disposal sites and tank farms for 100 years following closure

9.0 PHASED IMPLEMENTATION

The phased implementation alternative would consist of two LAW treatment plants using a treatment process such as vitrification (or a similar process) to produce a stabilized waste form meeting DOE specifications. The phased implementation alternative for LAW would operate for approximately 10 years and the HLW plant would operate for approximately 6 years. Each of the LAW plants would treat approximately 1 million gallons of DST liquid waste per year (equivalent to 20 mt/day of 20 wt% glass). A separate HLW facility would be built to process HLW into a stabilized product with an operating capacity of 1 metric ton per day of immobilized HLW.

9.1 Construction

9.1.1 W-314 Transfer System Upgrade (M&I responsibility)
-Replacement line from T Plant to the SY tank farm in 200 W
-Replacement line from PFP to the SY tank farm in 200 W
-Replacement lines within the 241-SY tank farm in 200 W
-A Farm Trunk line, replacement of the distribution lines going to the A tank farms in 200 W
-Replacement lines within the 241-AY/AZ tank farms in 200E
-204-AR replacement piping to replace the waste transfer line connecting the 204-AR truck and rail unloading station with the DSTs in 200 E
-Miscellaneous diversion box and valve pit lining to provide leak containment.

9.1.2 Retrieval
-Assumed that all DSTs have the necessary equipment and systems in place to pump out and transfer liquid wastes to the receiver tanks. For the HLW retrieval functions retrieval equipment would be installed in those tanks selected for HLW processing under separate projects.
-Build transfer lines from designated DST receiver tank to each LAW facility. Transfer lines would consist of a supply line, a return line and a spare. Each LAW facility would have a designated DST that would serve as a reciever tank.
-Build transfer lines (supply, return, spare) from the existing 200E waste transfer system to the HLW facility.
-Build transfer lines from LAW plants to the existing waste transfer system for the transfer of liquid effluents to the Liquid Effluent Retrention Facility or the Liquid Effluent Treatment Facility.

9.1.3 Separations
-Build pretreatment facilities, each LAW plant would have separations facilities

9.1.4 Treatment
-Build support facilities
    -Support facilities would be constructed to provide operations support and utilities
    -Overhead power lines from existing grid near the east fence of 200 East to each of the sites
    -Water supply lines from the existing distribution to each of the sites
-Construct LAW treatment facilities (two facilities treating approximately 1 million gal. of waste per year)
-Construct one HLW plant to process HLW from a specific group of DSTs. (HLW capacity 1 mt/day) note: the HLW plant would not process the HLW resulting from the separations at the LAW facilities but would instead be provided a separate HLW stream. The HLW plant would be combined with one of the LAW plants and would include:
    -Evaporator
    -One metric ton per day HLW treatment process
    -Offgas system
    -Canister handling system
    -Recycle streams

9.1.5 Storage
-Construct HLW interim storage facility
    -Assumed to be an onsite storage pad located in the same area as the interim HLW storage pads for other Ex Situ alternatives
-Construct LAW interim storage facility
    -Concrete storage pad located in the same area as the interim HLW storage pads for the all of the Ex Situ alternatives.

9.1.6 Disposal- N/A for phased implementation LAW would be disposed of onsite in the follow on phase and HLW would be stored for transport to the repository in the follow on phase.

9.2 Operation

9.2.1 Continued Operations

-Management of operations
-Operate and maintain facilities and equipment
-Monitor tanks
-Monitor leak detection equipment
-Tank status reporting
-Security and surveillance of facilities
-Operating the 242A evaporator as a waste management activity

9.2.2 Retrieval

-Retrieve DST liquid wastes
-Transfer wastes to one of two DST receiver tanks designated as LAW feed tanks
-Transfer wastes from the receiver tanks to the LAW treatment facilities by pipeline
-Retrieve and transfer HLW from designated DSTs for HLW treatment.

9.2.3 Separations

-Pretreat wastes to separate HLW and LAW streams

-Treatment would involve separating the liquids and solids, treating the waste streams to remove fission products, TRU and Tc-99, pumping the treated sludge back to DSTs, transporting the separated fission products and Tc in casks to dry storage (Canister Storage Building)

9.2.4 Treatment

-Operate LAW treatment plant and place immobilized LAW wastes into containers
-Operate HLW plant. If the HLW treatment plant is not implemented the separated HLW would be placed in canisters for dry storage.
-Operate offgas treatment at both HLW and LAW plant

-Quench and cool offgas
-Remove radionuclides and recycle to process

-Liquid effluent at both HLW and LAW plants to be collected and transferred to the Liquid Effluent Retention Facility or directly to the Liquid Effluent Treatment Facility.
-Transport HLW canisters to interim storage
-Transport LAW containers to interim storage facility prior to disposal onsite

9.2.5 Storage

-Store immobilized HLW on-site in the same manner as the immobilized HLW from all Ex Situ alternatives proposed national HLW repository
-Store immobilized LAW on storage pads prior to onsite disposal

9.2.6 Disposal- N/A disposal would occur under the follow on phase

9.2.7 Monitoring and Maintenance

-Monitor and maintain stored casks

9.3 Post Remediation

9.3.1 Decontamination and Decommissioning

-D&D facilities, D&D of demonstration plants to take place following 10 year demonstration phase (Clean Closure)

9.3.2 Closure

-Close tank farms

9.3.3 Monitoring and Maintenance

10.0 CESIUM / STRONTIUM CAPSULES

JACOBS ENGINEERING GROUP
ALTERNATIVE BREAKDOWN BY COMPONENT

10.1 Construction

No Action

-N/A

Onsite Disposal

-Construct dry well storage site

-Storage site to be approx 38,000 square meters

Overpack and Ship

-Overpack in WESF

Vitrify with Tank Waste

-Build or modify a cell in the HLW vitrification facility to cutup, remove capsule contents, and chemically treat if required and feed into the HLW vitrification feed stream.

-Cell to be a part of the HLW vitrification facility.

10.2 Operation

No Action

-Continued storage in WESF basins for up to 10 years

Onsite Disposal

-Continued Operations, continued storage of the capsules in WESF

-Retrieve and inspect capsules

-Overpack capsules into canisters

-Overpack at WESF 2-4 capsules per canister

-Seal canisters, 584 total canisters

-Transport to dry well storage facility

-Place capsules in dry wells

-Monitor & maintain dry well storage

Overpack and Ship

-Continued operations, continued storage of the capsules in WESF

-Remove and inspect capsules

-Overpack capsules into canisters

-215 to 387 canisters total (The data package specifies the range of canister based on the number of capsules overpacked per canister. Conservatively assume the 387 number)

-Place canisters into Hanford multi purpose cask (MPC), 4 canisters per cask

-Transport to interim storage, casks to be stored with HLW casks from vit plant

-Monitor interim storage

-Transport to HLW repository

Vitrify with Tank Waste

-Continued operations, continued storage of the capsules in WESF

-Remove/transport capsules to processing facility

-Cut up capsules and remove Cs/Sr contents

-Chemically treat Cs/Sr if/as required for vitrification

-Blend with vitrification feed stream

-Decontaminate and crush empty capsule containers

-Transport empty capsule containers to onsite burial grounds

10.3 Post Remediation

No Action - N/A

Onsite Disposal

-Install intrusion prevention barriers (precast concrete blocks) over dry-wells

Overpack and Ship

-Close storage facility

Vitrify with Tank Wastes

-Close HLW storage facility

-D & D capsule processing cell

Request Number 087

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

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Phone Number: (904)-332-3318

Fax Number: (904) 333-6631

Request Information: Data for the WP 314 distribution line project. Please refer to the attached sheet for additional information.

Need Date: 09/22/95

Response:

Data Source/Accuracy:

Prepared By: Colin Henderson CH.

Date Sent/Faxed: Sent 10/02/95

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST 87

The information received to date from Westinghouse on the W-314 project identifies six potential (some are not likely to be built) transfer line replacement segments. These six components of W-314 are identified as follows:

- T-Plant Transfer line - approximately 3,000 meters of buried pipeline connecting T-Plant with the SY tank farm. This activity would take place in 200 West
- PFP Transfer line - approximately 1,620 meters of buried pipeline connecting PFP with the SY tank farm. This activity would take place in 200 West.
- 241-SY Piping - approximately 2,200 meters of buried pipe within the SY tank farm. This activity would take place in 200 West.
- A Farm Trunk Line - approximately 3,780 meters of buried pipeline within the A tank farms of 200 East.
- 241-AY/241-AZ Piping -approximately 2,200 meters of buried pipeline within the AY and AZ tank farms in 200 East.
- 204-AR piping-the 204-AR facility receives and unloads waste delivered by truck or railcar. The replacement line of approximately 137 meters would replace an existing line.

Two additional components of W-314 are diversion box and valve pit liner installations. This activity involves installing a stainless steel liner or an epoxy coating in selected valve pits and diversion boxes to provide compliant liquid containment. The emissions from these activities would be negligible.

The recommended approach to the construction emissions for W-314 would be to take the volume of excavation identified and estimate the fugitive dust emissions that would likely occur as a result of construction. The estimated dust emissions could then be discussed with the notation that controls would be utilized to minimize dust emissions. Addressing W-314 in this manner would not require emissions modeling.

The proposed schedule for the transfer system work is:

SY tank farm - construction 6/1999-12/2001 and turn over to ops 6/2002
AY/AZ tank farm - construction 10/2000 - 10/2003 with turn over by 4/2004
remaining components construction 12/1998-12/2004 with turn over by 6/2005

EXCAVATION:

W-314 Component	Excavation (cubic meters)	Backfill (cubic meters)	Line Length (meters)
T-Plant transfer line	3,030	3,384	3,000
PFP transfer line	1,184	778	1,620
241-SY piping	2,293	2,293	2,200
A Farm Trunk Line	1,538	7,935	3,780
241-AY/AZ piping	2,293	2,293	2,200
204-AR Piping	146	146	137

The one discrepancy between excavation and backfill occurs with the A farm trunk line. Assume that this difference is sand taken from Pit 30.

Sent out. 10/1

Request Number 88

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Mike Harker

Date: 5/23/95

Phone Number: 736-0616

Fax Number:

Request Information: Provide chemical constituents and concentrations that would be in the air emissions for the following routine operations: Tank farm, evaporator, fill and cap, In Situ vitrification, intermediate separations vit., intermediate separations vit., No separations vit, no separations calcination, extensive separations vit., extensive separations pretreatment, comb. vitrification, comb. pretreatment., comb. fill and cap., WESF basin storage, WESF retrieval and overpack, staged implementation vit, staged implementation pretreatment

Need Date: ASAP

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed: 10/1/95

Concurrence: Marc E. Nelson
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST -88

Tank farm routine operations:
See attached spreadsheet titled Tank Farm Emissions From Current Operations. These tables provide the estimated chemical and radiological emissions from the existing tank farms. The release parameters associated with the tanks are indicated along with the type of ventilation. Passive ventilation refers to tank ventilation that occurs as a result of changes in atmospheric pressure as opposed to active ventilation where an exhauster is used to continually ventilate the tank.

Evaporator:
The operating emissions for the 232-A evaporator are provided in the attached spreadsheet for Tank Farm Emissions.

Fill and Cap:
The emissions from filling a tank with gravel were estimated using the current tank farm emissions. The emissions during the fill operation were estimated to be ten times higher on an hourly basis than routine emissions. The filling of a tank with gravel would take approximately 3 days of actual operations to complete. Estimated emissions on a tank farm by tank farm basis are provided in the attached spreadsheet titled Fill and Cap.

In Situ Vitrification:
The emissions during operations for the In Situ Vitrification alternative are provided in the attached spreadsheet titled ISV emissions.

Intermediate Separations:
The emissions are provided in the attached spreadsheet titled High Level Emissions and Lowlevel emissions. The spreadsheets identify the constituents in the stack gas from the High Level vitrification plant and the Low Level vitrification plant. The VOC emissions released from the tanks during waste retrieval operations is estimated at 3 times the annual rates provided in the spreadsheet for emissions from current operations. The emissions associated with retrieval would apply to all of the alternatives with out of tank waste treatment.

Note: this is for retrieval and transfer of the wastes from the tanks to the treatment facilities and treatment of the wastes. The emissions from pretreatment and treatment are combined in the LLW vitrification plant and released from a single stack.

No Separations (vitrification):
The routine emissions from the No Separations (vitrification) plant would be released out of an elevated stack. The chemical constituents and the concentrations are provided in the attached spreadsheet titled

No Separations (calcination):
The routine emissions from the No Separations (calcination) plant would be released out of an elevated stack. The chemical emissions from the calcination would be essentially the same except for the N0x which would be 5 times the levels reported for the No Separations (vitrification) alternative.

Extensive Separations:
The emissions from extensive separations should be in the same general levels as the emissions from the Intermediate Separations alternative. A spread sheet of the stack emissions for the extensive separations emissions based on the material balance calculations has not been performed due to lack of time. If any individual components identified in the Intermediate Separations spreadsheet tables are of interest they can be provided on an as needed basis. Table 9-5 attached from the extensive separations data package provides a summary of the non radiological emissions. Any of the emissions identified can be converted to concentrations using the formula at the bottom of the table. The Extensive Separations alternative is assumed to have a single stack where the off-gasses from the LLW, Separations, and HLW processes would be combined prior to release.

In Situ/ Ex Situ Combination:
(comb. fill and cap, comb. vitrification, and comb. pretreatment)

This alternative is a combination of the Fill and Cap alternative for those tanks left in place and Intermediate Separations alternative for those wastes retrieved. The chemical constituents and concentrations released during operations should be similar to the two above mentioned alternatives.

WESF Storage Basin:
The emissions data provided for the WESF capsule storage basins was limited to radionuclides. No chemical emissions were reported and the nature of the activities associated with continued storage of the cesium and strontium capsules in water filled basins should result in minimal chemical emissions.

WESF Retrieval and Overpack:
Retrieval of the cesium and strontium capsules from the water basins and overpacking into canisters would result in negligible chemical emissions.

Staged Implementation (pretreatment and vitrification)

This alternative consists of building two Low Activity waste processing plants (20 mt/day capacity) and one HLW waste treatment facility (one mt/day capacity) to process approximately 10% of the tank waste. The waste types identified to date for retrieval and treatment during this phase are liquid DST wastes. These wastes are fairly well characterized and are considered the easiest wastes to process. The chemical constituents and concentrations released during operations of this alternative would be similar in type and concentration to the Intermediate Separations alternative.

Table 9-5. Nonradiological Operating Emissions. (2 sheets)

Item	Extensive Separation Alternative
Thermal release[1]	1.94×10^{16} J
Particulates[2]	3.08×10^{5} kg
PM-10 content, percent	0.003
VOC[3]	9.8×10^{3} kg
Fugitive dust	n/a
Toxic Air Pollutants[4]	
Formic Acid	1.54×10^{3} kg
Hydrofluoric Acid	1.26×10^{3} kg
Hydrogen Peroxide	2.8×10^{1} kg
Nitric Acid	2.16×10^{4} kg
Oxalic Acid	Negligible
Sodium Hydroxide	9.8×10^{1} kg
Hazardous Air Pollutants[4]	
Arsenic	Negligible
Beryllium	Negligible
Cadmium	Negligible
Chromium	4.48×10^{1} kg
Nickel	1.4 kg
Manganese	9.8 kg
Mercury	Negligible
Lead	Negligible

$$\text{RELEASE CONC.} = (\text{TOTAL EMISSION kg}) \times \left(\frac{1000\ g}{kg}\right) \times \left(\frac{1}{19\,yr \times 365\,day \times 24\,hr \times 60\,min \times 60\,sec}\right) \times \left(\frac{1}{18.05\ m^3/sec}\right) = \text{Emission Concentration } g/m^3$$

Table 9-5. Nonradiological Operating Emissions. (2 sheets)

NOx (as NO_2)[4]	1.47×10^7 kg
SOx (as SO_2)[4]	1.33×10^6 kg
CO[4]	2.44×10^6 kg

Notes:

n/a = not applicable

[1]Refer to calculation E/B-SD-W236B-CAL-PR-EIS-016.

[2]Particulate emission estimate assumes cooling tower emissions are 95 percent of total particulate emissions (i.e., cooling tower emissions/0.95 = total emissions). Particulate emissions are essentially PM_{10}. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

[3]VOC emissions are not presented in material balance but are estimated based on vapor liquid equilibrium during storage. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

[4]Emissions of Toxic Air Pollutants (TAP) Hazardous Air Pollutants (HAP) NOx, SO_2 and CO are not presented in the material balance but are estimated based on vapor liquid equilibrium during storage. Refer to calculation E/B-SD-W236-CAL-PR-EIS-004.

For additional information, see Appendix F, and also Jansen, G., 1995, *Backup Information for Data Tables in Extensive Separations Alternative Engineering Data Package*, WHC-SD-WM-DP-129, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

TPA STACK STREAMS								
SEPARATIONS AND LLW VITRIFICATION								
STREAMS								
907=702+706+434+522+645+903								
917=911+914								
factor=(200 ml/day/3.67E5)*91.8583lb/hr=4.747E-2							sum of streams	
	702	706	434	522	645	903		907
MT gas	1.39E+04	0	2.78E+06	0	2.61E+05	0		3.05E+06
MT solid	0	0	1.94E-03	0	1.55E-04	0		1.05E-06
Total MT	1.39E+04	0.00E+00	2.78E+06	0.00E+00	2.61E+05	0.00E+00	3.05E+06	3.05E+06
Factor	4.75E-02	4.75E-02	4.75E-02	4.75E-02	4.75E-02	4.75E-02		4.75E-02
mass flow rate (lb/hr)	659.033	0	131906.6	0	12369.67	0		144783.5
molecular weight	27.63	28.26	28.76	28.76	37.61			29.5
temperature deg F	177	130	438	442	150			420.4278
flow scfm	153.187		29433.64	0	2113.125		31699.95	31482.25
			HLW STREAMS					
TPA HLW STREAMS	702	706	340	522	645	903		907
MT gas	7.19E+02	0	1.80E+05	0	2.09E+04	0		2.02E+05
MT solid	0	0	1.26E-04	0	9.89E-06	0		6.78E-08
Total MT	7.19E+02	0.00E+00	1.80E+05	0.00E+00	2.09E+04	0.00E+00	2.02E+05	2.02E+05
Factor	7.32E-02	7.32E-02	7.32E-02	7.32E-02	7.32E-02	7.32E-02		7.32E-02
mass flow rate (lb/hr)	52.6308	0	13176	0	1529.88	0		14786.4
molecular weight	27.63	28.26	28.75	28.75	38.13			29.66229
Temperature deg F	180	130	447	447	150			423.7172
flow scfm	12.21878	0	2939.778	0	257.3708		3209.367	3197.618

TPA STACK STREAMS					
SEPARATIONS AND LLW VITRIFICATION					
STREAMS					
907=702+706+434+522+645+903					
917=911+914					
factor=(200 ml/day/3.67E5)*91.8583lb/hr=4.747E-2				total flow 907+917 scfm	total flow scfm
	911	914	917		
MT gas	0	4.87E+05	4.87E+05		
MT solid	0	3.92E+02	1.96E-01		
Total MT	0.00E+00	4.87E+05	4.87E+05		
Factor	4.75E-02	4.75E-02	4.75E-02		
mass flow rate (lb/hr)	0	23136.5	23117.9	167901.40	
molecular weight	29	29	29		
temperature deg F			150	302.64	
flow scfm		5117.624	5113.51	36595.76	58404
TPA HLW STREAMS	911	914	917		
MT gas	0	3.16E+04	3.16E+04		
MT solid	0	2.54E+01	1.27E-02		
Total MT	0.00E+00	3.16E+04	3.16E+04		
Factor	7.32E-02	7.32E-02	7.32E-02		
mass flow rate (lb/hr)	0	2314.979	2313.121	17099.52	
molecular weight	29	29	29		
Temperature deg F			150	305.96	
flow scfm	0	512.06	511.65	3709.26	5943

Note: the 150 deg F temp for streams 917 (both HLW and LLW) is a best estimate, no data was provided

TPA HLW stack flows								
LIQUID COMPONENTS								
	Regulated	stream						
		907	917	totals ml	ANNUAL AVE	24 hour avg.	peak hourly	peak conc.
VOLUME					TOTAL/23 year	ann ave/219	(daily ave/24)x2.6	peak hrly/stack flow
SP. GRAVITY				metric tons	kg/year	kg/ 24 hr	kg/hr	grams / cubic meter
Cs and Ba,(MCI)								
Sr and Y, (MCI)								
Tc, (MCI)								
Am, (MCI)								
Np, (MCI)								
Pu-239, (MCI)								
Pu-240, (MCI)								
Pu-241, (MCI)								
TRU, (MCI)								
Total MCI								
Total Mass Flow,(MT)		2.02E+05	3.16E+04	233600	1.02E+07	4.64E+04	5.02E+03	4.98E+02
Total Cr, (MT)								
Total Na, (MT)	WAC-460-160							
Total Si,(MT)	PP							
Total P, (MT)								
Total NO2-, (MT)								
Total NO3-, (MT)								
Ag+	WAC-460-130							
Al(OH)4-	WAC-460							
Am+3								
As+5	WAC-460							
B+3								
Ba+2	WAC-460 ?							
Be+2	40CFR/WAC460							
Bi+3								
C 14				4.54E-04	1.97E-02	9.01E-05	9.76E-06	9.67E-07
Ca+2								
Cd+2	WAC-460-130							
Ce+3								

HIGH LEVEL Emissions

Cl-									
Cl2	WAC-460-160	4.17E+00		4.17	1.81E+02	8.28E-01	8.97E-02	8.88E-03	← 4.4E-5 following treatment.
CO	WAC-460-160	2.03E+02		203	8.83E+03	4.03E+01	4.37E+00	4.32E-01	
CO2	WAC-460-160	1.69E+04		16900	7.35E+05	3.36E+03	3.63E+02	3.60E+01	
CO3-2	WAC-460-160								
Cr(OH)4-	WAC-460-160								
Cs+									
Cu+2	WAC-460-160								
F-									
F2	WAC-460-160	6.21E+01		62.1	2.70E+03	1.23E+01	1.34E+00	1.32E-01	← 6.6E-04 following treatment
Fe+3									
H2									
H2O		3.14E+03		3140	1.37E+05	6.23E+02	6.75E+01	6.69E+00	
H2S	WAC								
Hg	WAC-460-160								
Hg+2	WAC								
I-									
I2	WAC-460	2.14E+01		21.4	9.30E+02	4.25E+00	4.60E-01	4.56E-02	
K+									
Kerosene									
La+3									
Li+									
Mg+2									
MnO2	WAC-460-160								
Mo+6									
N2		1.42E+05	2.50E+04	167000	7.26E+06	3.32E+04	3.59E+03	3.56E+02	
Na+									
NH3	WAC-460-160	1.83E+01		18.3	7.96E+02	3.63E+00	3.94E-01	3.90E-02	
Ni+3	WAC-460-130								
NO	PP	9.98E-02		0.0998	4.34E+00	1.98E-02	2.15E-03	2.13E-04	
NO2	PP	4.28E+00		4.28	1.86E+02	8.50E-01	9.21E-02	9.12E-03	
NO2-									
NO3-									
Np+4									
O2		3.95E+04	6.63E+03	46130	2.01E+06	9.16E+03	9.92E+02	9.82E+01	
OH-									
Pb+4	WAC/40CFR								

PO4-3								
POLY								
Pu+4								
S								
Si+4								
SO2	PP	4.60E+00		4.6	2.00E+02	9.13E-01	9.89E-02	9.80E-03
SO4-2								
Sr+2								
S								
TcO2								
TcO4-								
TOC								
UO2+2	WAC-460							
V+5								
W+6	WAC460							
ZN+2								
Zr=4								
ZRO2:2H2O								
SOLIDS COMPONENTS								
Cs and Ba,(MCI)		1.69E-10	3.41E-05	3.41E-05	1.48E-03	6.77E-06	7.33E-07	7.26E-08
Sr and Y, (MCI)		2.64E-10	5.33E-05	5.33E-05	2.32E-03	1.06E-05	1.15E-06	1.14E-07
Tc, (MCI)		1.48E-14	2.99E-09	2.99E-09	1.30E-07	5.94E-10	6.43E-11	6.37E-12
Am, (MCI)		2.38E-13	4.81E-08	4.81E-08	2.09E-06	9.55E-09	1.03E-09	1.02E-10
Np, (MCI)		2.32E-16	4.70E-11	4.7E-11	2.04E-09	9.33E-12	1.01E-12	1.00E-13
Pu-239, (MCI)		6.17E-14	1.25E-08	1.25E-08	5.43E-07	2.48E-09	2.69E-10	2.66E-11
Pu-240, (MCI)		1.57E-14	3.18E-09	3.18E-09	1.38E-07	6.31E-10	6.84E-11	6.77E-12
Pu-241, (MCI)		1.83E-13	3.71E-08	3.71E-08	1.61E-06	7.37E-09	7.98E-10	7.90E-11
TRU, (MCI)		4.99E-13	1.01E-07	1.01E-07	4.39E-06	2.01E-08	2.17E-09	2.15E-10
Total MCI		4.33E-10	8.75E-05	8.75E-05	3.80E-03	1.74E-05	1.88E-06	1.86E-07
Total Mass Flow,(MT)		6.78E-08	1.27E-02	0.0127	5.52E-01	2.52E-03	2.73E-04	2.70E-05
Total Cr, (MT)		9.91E-11	2.00E-05	2E-05	8.70E-04	3.97E-06	4.30E-07	4.26E-08
Total Na, (MT)	WAC-460-160	6.29E-09	1.18E-03	0.00118	5.13E-02	2.34E-04	2.54E-05	2.51E-06
Total Si,(MT)	PP	1.57E-08	2.95E-03	0.00295	1.28E-01	5.86E-04	6.34E-05	6.28E-06
Total P, (MT)		7.33E-10	1.37E-04	0.000137	5.96E-03	2.72E-05	2.95E-06	2.92E-07
Total NO2-, (MT)								
Total NO3-, (MT)								

Ag+								
Ag2O		3.70E-12	7.48E-07	7.48E-07	3.25E-05	1.49E-07	1.61E-08	1.59E-09
Al+3								
Al2O3		4.68E-09	8.76E-04	0.000876	3.81E-02	1.74E-04	1.88E-05	1.87E-06
Am+3								
Am2O3		7.62E-14	1.54E-08	1.54E-08	6.70E-07	3.06E-09	3.31E-10	3.28E-11
As+5	WAC							
As2O5		1.92E-12	3.88E-07	3.88E-07	1.69E-05	7.70E-08	8.34E-09	8.26E-10
B+3								
B2O3	WAC-460-160	4.75E-09	8.89E-04	0.000889	3.87E-02	1.76E-04	1.91E-05	1.89E-06
Ba+2	?							
BaO	WAC	8.63E-12	1.76E-06	1.76E-06	7.65E-05	3.49E-07	3.79E-08	3.75E-09
Be+2	40CFR/WAC							
BeO		5.40E-14	1.09E-08	1.09E-08	4.74E-07	2.16E-09	2.34E-10	2.32E-11
Bi+3								
Bi2O3		5.47E-10	1.11E-04	0.000111	4.83E-03	2.20E-05	2.39E-06	2.36E-07
C 14								
Ca+2								
CANCRINITE								
CaO	WAC-460-160	5.11E-10	9.57E-05	9.57E-05	4.16E-03	1.90E-05	2.06E-06	2.04E-07
Cd+2	WAC-460-130							
CdO		2.27E-11	4.58E-06	4.58E-06	1.99E-04	9.09E-07	9.85E-08	9.75E-09
Ce+3								
Ce2O3		7.44E-10	1.39E-04	0.000139	6.04E-03	2.76E-05	2.99E-06	2.96E-07
Cl-								
CO3-2								
Cr+3	WAC-460-160							
Cr2O3		1.45E-10	2.93E-05	2.93E-05	1.27E-03	5.82E-06	6.30E-07	6.24E-08
Cs+								
Cs2O		2.40E-12	4.84E-07	4.84E-07	2.10E-05	9.61E-08	1.04E-08	1.03E-09
Cu	WAC-460-160							
Cu+2	WAC-460-160							
CuO		2.34E-12	4.72E-07	4.72E-07	2.05E-05	9.37E-08	1.02E-08	1.01E-09
CuSO4								
F-	WAC							
Fe+3								
Fe2O3	WAC-460-160	3.27E-09	6.13E-04	0.000613	2.67E-02	1.22E-04	1.32E-05	1.31E-06

Hg+2	WAC-460-160							
I-	WAC ?							
K+								
K2O		6.32E-11	1.28E-05	1.28E-05	5.57E-04	2.54E-06	2.75E-07	2.73E-08
La+3								
La2O3		6.16E-11	1.25E-05	1.25E-05	5.43E-04	2.48E-06	2.69E-07	2.66E-08
Li+								
Li2O		1.36E-09	2.54E-04	0.000254	1.10E-02	5.04E-05	5.46E-06	5.41E-07
Mg+2								
MgO	WAC-460-160	4.70E-11	9.51E-06	9.51E-06	4.13E-04	1.89E-06	2.05E-07	2.03E-08
MnO2	WAC-460-160	5.64E-10	1.06E-04	0.000106	4.61E-03	2.10E-05	2.28E-06	2.26E-07
Mo+6								
MoO3		3.04E-12	6.16E-07	6.16E-07	2.68E-05	1.22E-07	1.32E-08	1.31E-09
Na+								
Na2O		8.48E-09	1.59E-03	0.00159	6.91E-02	3.16E-04	3.42E-05	3.39E-06
Ni+3	WAC-460-160							
Ni2FeCN6								
Ni2O3		2.32E-11	4.69E-06	4.69E-06	2.04E-04	9.31E-07	1.01E-07	9.99E-09
NiO		6.12E-10	1.15E-04	0.000115	5.00E-03	2.28E-05	2.47E-06	2.45E-07
NO2-								
NO3-								
Np+4								
NpO2		3.74E-13	7.56E-08	7.56E-08	3.29E-06	1.50E-08	1.63E-09	1.61E-10
OH-								
P2O5		1.68E-09	3.14E-04	0.000314	1.37E-02	6.23E-05	6.75E-06	6.69E-07
P2O5:24H2O								
Pb+4	PP/WAC							
PbO2	WAC	9.48E-12	1.92E-06	1.92E-06	8.35E-05	3.81E-07	4.13E-08	4.09E-09
PO4-3								
Pu+4								
PuO2		1.21E-12	2.45E-06	2.45E-06	1.07E-04	4.86E-07	5.27E-08	5.22E-09
Si+4								
SiO2		3.37E-08	6.31E-03	0.00631	2.74E-01	1.25E-03	1.36E-04	1.34E-05
SO4-2								
Sr+2								
SrO		1.07E-10	2.17E-05	2.17E-05	9.43E-04	4.31E-06	4.67E-07	4.62E-08
Tc2O7		1.36E-12	2.76E-07	2.76E-07	1.20E-05	5.48E-08	5.94E-09	5.88E-10

TcO4-								
TOC								
UO2+2	WAC-460							
UO3	WAC-460	4.52E-09	8.46E-04	0.000846	3.68E-02	1.68E-04	1.82E-05	1.80E-06
V+5								
V2O5	WAC-460-160	8.39E-13	1.70E-07	1.7E-07	7.39E-06	3.38E-08	3.66E-09	3.62E-10
WO2		1.10E-12	2.23E-07	2.23E-07	9.70E-06	4.43E-08	4.80E-09	4.75E-10
WO3		5.16E-15	1.04E-09	1.04E-09	4.52E-08	2.06E-10	2.24E-11	2.22E-12
ZN+2	WAC-460-160							
ZNO	WAC-460-160	2.97E-12	6.00E-07	6E-07	2.61E-05	1.19E-07	1.29E-08	1.28E-09
Zr+4								
ZRO2	WAC-460-160	1.86E-09	3.49E-04	0.000349	1.52E-02	6.93E-05	7.51E-06	7.43E-07
ZRO2:2H2O								
material balance based on TPA data package Rev B revcd. 3/16/95								
annual ave based on 23 year operations period								
24 hour ave. based on annual ave/number of operating days per year (365 days@60% OE=219 days)								
peak hourly rate based on plant capacity of 20 mt/operating day								

TPA LLW stack flows								
LIQUID COMPONENTS								
	Regulated	stream						
		907	917	totals mt	ANNUAL AVE	24 hour avg.	peak hourly	peak conc.
VOLUME					TOTAL/19	ann ave/219	(daily ave/24)x1.3	peak hourly/stack flow
SP. GRAVITY				metric tons	kg/year	kg/ 24 hr	kg/hr	grams/cubic meter
MASS FLOW MT		3.05E+06	4.87E+05	3.54E+06	1.86E+08	8.50E+05	4.60E+04	4.64E+02
Total Cr	WAC-460							
Total Na								
Total Si								
Total P	WAC-460-160							
Total NO2-,(MT)	PP							
Total NO3-, (MT)		2.05E+01		2.05E+01	1.08E+03	4.93E+00	2.67E-01	2.69E-03
Cs and Ba, (MCi)								
Sr and Y, (MCi)								
Tc, (MCi)								
Am, (MCi)								
Np, (MCi)								
Pu-239,(MCi)								
Pu-240,(MCi)								
Pu-241,(MCi)								
Total TRU, (MCi)								
Total (MCi)								
Ag+	WAC-460-130							
Al+3	WAC-460							
Am+3								
As+5	WAC-460							
B+3								
Ba+2	WAC-460 ?							
Be+2	40CFR/WAC460							
Bi+3								
C 14				7.46E-04	3.93E-02	1.79E-04	9.71E-06	9.79E-08
Ca+2								
Cd+2	WAC-460-130							
Ce+3								

Cl-									
Cl2	WAC-460-160	3.10E+02		3.10E+02	1.63E+04	7.45E+01	4.04E+00	4.07E-02	←2.0E-4 following treatment
Cm+3									
CO	WAC-460-160	2.35E+03		2.35E+03	1.24E+05	5.65E+02	3.06E+01	3.08E-01	
CO2		1.89E+05		1.89E+05	9.95E+06	4.54E+04	2.46E+03	2.48E+01	
CO3-2	WAC-460-160								
Cr(OH)4-	?								
Cs+									
Cu+2	WAC-460-160								
DPCD									
F-									
F2	WAC-460-160	1.12E+03		1.12E+03	5.89E+04	2.69E+02	1.46E+01	1.47E-01	7.35E-4 following treatment
Fe+3									
H+		3.33E-01		3.33E-01	1.75E+01	8.00E-02	4.33E-03	4.37E-05	
H2									
H2O		5.83E+04		5.83E+04	3.07E+06	1.40E+04	7.59E+02	7.65E+00	
H2S	WAC								
Hg	WAC-460-160								
Hg+2	WAC								
I-									
I2	WAC-460	5.45E+02		5.45E+02	2.87E+04	1.31E+02	7.09E+00	7.15E-02	
K+									
Kerosene									
La+3									
Li+									
Mg+2									
MnO2	WAC-460-160								
Mo+6									
N2		2.21E+06	3.85E+05	2.60E+06	1.37E+08	6.24E+05	3.38E+04	3.40E+02	
Na+									
Nb+5									
NH3	WAC-460-160	1.63E+01		1.63E+01	8.58E+02	3.92E+00	2.12E-01	2.14E-03	
Ni+3	WAC-460-130	9.66E-02		9.66E-02	5.08E+00	2.32E-02	1.26E-03	1.27E-05	
NO	PP	3.11E+00		3.11E+00	1.64E+02	7.47E-01	4.05E-02	4.08E-04	
NO2	PP	1.39E+02		1.39E+02	7.32E+03	3.34E+01	1.81E+00	1.82E-02	
NO2-									
NO3-		2.05E+01		2.05E+01	1.08E+03	4.93E+00	2.67E-01	2.69E-03	

Np+4								
O2		5.95E+05	1.02E+05	6.97E+05	3.67E+07	1.68E+05	9.07E+03	9.14E+01
OH-								
OLIGIMER								
Pb+4	WAC/40CFR							
PO4-3								
POLY								
Pu+4								
Si+4								
SO2	PP	2.09E+02		2.09E+02	1.10E+04	5.02E+01	2.72E+00	2.74E-02
SO4-2								
Sr+2								
S								
TcO2								
TcO4-								
TOC								
UO2+2	WAC-460							
V+5								
W+6	WAC460							
ZN+2								
Zr+4								
ZRO2:2H2O								
SOLIDS COMPONENTS								
Cs and Ba, (MCI)		1.23E-12	2.49E-07	2.49E-07	1.31E-05	5.98E-08	3.24E-09	3.27E-11
Sr and Y, (MCI)		4.74E-12	9.59E-07	9.59E-07	5.05E-05	2.30E-07	1.25E-08	1.26E-10
Tc, (MCI)		6.48E-14	1.31E-08	1.31E-08	6.89E-07	3.15E-09	1.71E-10	1.72E-12
Am, (MCI)		2.15E-14	4.35E-09	4.35E-09	2.29E-07	1.05E-09	5.66E-11	5.71E-13
Np, (MCI)		2.58E-17	5.21E-12	5.21E-12	2.74E-10	1.25E-12	6.78E-14	6.83E-16
Pu-239, (MCI)		4.17E-17	8.43E-10	8.43E-10	4.44E-08	2.03E-10	1.10E-11	1.11E-13
Pu-240, (MCI)		1.03E-15	2.09E-10	2.09E-10	1.10E-08	5.02E-11	2.72E-12	2.74E-14
Pu-241,(MCI)		3.71E-15		3.71E-15	1.95E-13	8.92E-16	4.83E-17	4.87E-19
Total TRU,(MCI)		3.04E-14	5.41E-09	5.41E-09	2.85E-07	1.30E-09	7.04E-11	7.10E-13
Total MCI		6.07E-12	1.23E-06	1.23E-06	6.47E-05	2.96E-07	1.60E-08	1.61E-10
Total Mass Flow (MT)		1.05E-06	1.96E-01	1.96E-01	1.03E+01	4.71E-02	2.55E-03	2.57E-05
Total Cr (MT)	WAC460-160	3.89E-10	7.28E-05	7.28E-05	3.83E-03	1.75E-05	9.48E-07	9.55E-09
Total Na (MT)		1.94E-07	3.63E-02	3.63E-02	1.91E+00	8.72E-03	4.73E-04	4.76E-06

Total Si (MT)		2.89E-07	5.41E-02	5.41E-02	2.85E+00	1.30E-02	7.04E-04	7.10E-06
Total P (MT)	WAC460-160	3.65E-09	6.83E-04	6.83E-04	3.59E-02	1.64E-04	8.89E-06	8.96E-08
Total NO2-, (MT)	PP							
Total NO3-, (MT)								
Ag+	WAC460-160							
Ag2O	WAC460-160	8.79E-13	1.78E-07	1.78E-07	9.37E-06	4.28E-08	2.32E-09	2.33E-11
Al+3								
Al2O3		5.23E-08	9.79E-03	9.79E-03	5.15E-01	2.35E-03	1.27E-04	1.28E-06
Am+3								
Am2O3		6.89E-15	1.39E-09	1.39E-09	7.32E-08	3.34E-10	1.81E-11	1.82E-13
As+5	WAC							
As2O5		2.95E-12	5.96E-07	5.96E-07	3.14E-05	1.43E-07	7.76E-09	7.82E-11
B+3								
B2O3	WAC-460-160	4.17E-12	8.43E-07	8.43E-07	4.44E-05	2.03E-07	1.10E-08	1.11E-10
Ba+2	?							
BaO	WAC	2.20E-12	4.46E-07	4.46E-07	2.35E-05	1.07E-07	5.81E-09	5.85E-11
Be+2	40CFR/WAC							
BeO		5.67E-13	1.15E-07	1.15E-07	6.05E-06	2.76E-08	1.50E-09	1.51E-11
Bi+3								
Bi2O3		1.88E-10	3.80E-05	3.80E-05	2.00E-03	9.13E-06	4.95E-07	4.98E-09
C 14								
Ca+2								
CANCRINITE								
CaO	WAC-460-160	1.05E-07	1.96E-02	1.96E-02	1.03E+00	4.71E-03	2.55E-04	2.57E-06
Cd+2	WAC-460-130							
CdO		5.95E-12	1.20E-06	1.20E-06	6.32E-05	2.88E-07	1.56E-08	1.57E-10
Ce+3								
Ce2O3		6.97E-12	1.41E-06	1.41E-06	7.42E-05	3.39E-07	1.84E-08	1.85E-10
Cl-								
Co3-2								
Cr+3	WAC-460-160							
Cr2O3		5.68E-10	1.06E-04	1.06E-04	5.58E-03	2.55E-05	1.38E-06	1.39E-08
Cs+								
Cs2O		1.71E-14	3.45E-09	3.45E-09	1.82E-07	8.29E-10	4.49E-11	4.53E-13
Cu	WAC-460-160							
Cu+2	WAC-460-160							
CuO		5.53E-13	1.12E-07	1.12E-07	5.89E-06	2.69E-08	1.46E-09	1.47E-11

CuSO4								
F-	WAC							
Fe+3								
Fe2O3	WAC-460-160	5.14E-11	1.04E-05	1.04E-05	5.47E-04	2.50E-06	1.35E-07	1.36E-09
Hg+2	WAC-460-160							
I-	WAC ?							
K+								
K2O		6.62E-13	1.43E-07	1.43E-07	7.53E-06	3.44E-08	1.86E-09	1.88E-11
La+3								
La2O3		6.45E-13	1.30E-07	1.30E-07	6.84E-06	3.12E-08	1.69E-09	1.71E-11
Li+								
Li2O		3.10E-14	6.27E-09	6.27E-09	3.30E-07	1.51E-09	8.16E-11	8.22E-13
Mg+2								
MgO	WAC-460-160	4.00E-12	8.08E-07	8.08E-07	4.25E-05	1.94E-07	1.05E-08	1.06E-10
MnO2	WAC-460-160	5.41E-11	1.09E-05	1.09E-05	5.74E-04	2.62E-06	1.42E-07	1.43E-09
Mo+6								
MoO3		1.82E-11	3.69E-06	3.69E-06	1.94E-04	8.87E-07	4.80E-08	4.84E-10
Na+								
Na20		2.62E-07	4.90E-02	4.90E-02	2.58E+00	1.18E-02	6.38E-04	6.43E-06
Ni+3	WAC-460-160							
Ni2FeCN6								
Ni2O3		1.43E-11	2.89E-06	2.89E-06	1.52E-04	6.95E-07	3.76E-08	3.79E-10
NiO		3.74E-14	7.57E-09	7.57E-09	3.98E-07	1.82E-09	9.85E-11	9.93E-13
NO2-								
NO3-								
Np+4								
NpO2		4.15E-14	8.38E-09	8.38E-09	4.41E-07	2.01E-09	1.09E-10	1.10E-12
OH-								
P2O5		8.35E-09	1.56E-03	1.56E-03	8.21E-02	3.75E-04	2.03E-05	2.05E-07
P2O5:24H2O								
Pb+4	PP/WAC							
Pb02	WAC	5.65E-12	1.14E-06	1.14E-06	6.00E-05	2.74E-07	1.48E-08	1.50E-10
PO4-3								
Pu+4								
PuO2		8.15E-14	1.65E-08	1.65E-08	8.68E-07	3.97E-09	2.15E-10	2.16E-12
S								
Si+4								

SIO2		6.18E-07	1.16E-01	1.16E-01	6.11E+00	2.79E-02	1.51E-03	1.52E-05
SO4-2								
Sr+2								
SrO		1.00E-12	2.02E-07	2.02E-07	1.06E-05	4.85E-08	2.63E-09	2.65E-11
Tc2O7		5.98E-12	1.21E-06	1.21E-06	6.37E-05	2.91E-07	1.58E-08	1.59E-10
TcO4-								
TOC								
UO2+2	WAC-460							
UO3	WAC-460	2.26E-10	4.56E-05	4.56E-05	2.40E-03	1.10E-05	5.94E-07	5.98E-09
V+5								
V2O5	WAC-460-160	2.76E-13	5.59E-08	5.59E-08	2.94E-06	1.34E-08	7.28E-10	7.33E-12
WO2		7.27E-17		7.27E-17	3.83E-15	1.75E-17	9.46E-19	9.54E-21
WO3		2.35E-12	4.75E-07	4.75E-07	2.50E-05	1.14E-07	6.18E-09	6.23E-11
ZN+2	WAC-460-160							
ZNO	WAC-460-160	1.12E-11	2.25E-06	2.25E-06	1.18E-04	5.41E-07	2.93E-08	2.95E-10
Zr+4								
ZRO2	WAC-460-160	3.25E-09	3.28E-07	3.31E-07	1.74E-05	7.96E-08	4.31E-09	4.35E-11
ZRO2:2H2O								
material balance based on TPA data package Rev B recvd 3/16/95								
annual average based on 19 year operations period								
24 hour ave. based on annual ave/number of operationg days per year (365 days @ 60% OE=219 days)								
peak hourly rate based on plant capacity of 200 mt /operating day								

No Separations Stack Flows								
LIQUID COMPONENTS								
	Regulated	stream						
		907	917	totals mt	ANNUAL AVE	24 hour avg.	peak hourly	peak hourly concentration
VOLUME					TOTAL/14 year	ann ave/219	(daily ave/24)x1.7	peak hourly/stack flow rate
SP. GRAVITY				metric tons	kg/year	kg/ 24 hr	kg/hr	grams/ cubic meter
MASS FLOW MT		2.88E+06	4.63E+05	3.34E+06	2.39E+08	1.09E+06	7.72E+04	2.07E+03
Al	WAC-460-160							
Fe								
Cr	WAC-460							
Na								
Si								
P	WAC-460-160							
NO2, NO3	PP							
Cs and Ba								
Sr and Y								
Tc								
TRU								
Total MCi								
Ag+	WAC-460-130							
Al+3	WAC-460							
Am+3								
As+5	WAC-460							
B+3								
Ba+2	WAC-460 ?							
Be+2	40CFR/WAC460							
Bi+3								
C 14								
Ca+2								
Cd+2	WAC-460-130							
Ce+3								
Cl-								
Cl2	WAC-460-160	4.87E+02		4.87E+02	3.48E+04	1.59E+02	1.13E+01	3.02E-01
Cm+3								
CO	WAC-460-160	2.30E+03		2.30E+03	1.64E+05	7.50E+02	5.31E+01	1.43E+00

UNMITIGATED
1.5E-03
FOLLOWING
OFF GAS
Treatment.

CO+3	WAC-460-160							
CO2	WAC-460-160	1.82E+05		1.82E+05	1.30E+07	5.94E+04	4.20E+03	1.13E+02
CO3-2	WAC-460-160							
Cr+3	WAC-460-160							
Cs+								
Cu+2	WAC-460-160							
F-								
F2	WAC-460-160	1.17E+03		1.17E+03	8.36E+04	3.82E+02	2.70E+01	7.25E-01
Fe+3								
FeCn6-3								
H+								
H2								
H2O		4.81E+04		4.81E+04	3.44E+06	1.57E+04	1.11E+03	2.98E+01
H2S	WAC							
Hg	WAC-460-160							
Hg+2	WAC							
I-								
I2	WAC-460	2.36E-01		2.36E-01	1.69E+01	7.70E-02	5.45E-03	1.46E-04
K+								
Kerosene								
La+3								
Li+								
Mg+2								
MnO2	WAC-460-160							
Mo+6								
N2		2.10E+06	3.66E+05	2.47E+06	1.76E+08	8.04E+05	5.70E+04	1.53E+03
Na+								
Nb+5								
NH3	WAC-460-160	1.87E+01		1.87E+01	1.34E+03	6.10E+00	4.32E-01	1.16E-02
Ni+3	WAC-460-130							
NO	PP	3.52E+02		3.52E+02	2.51E+04	1.15E+02	8.13E+00	2.18E-01
NO2	PP	1.40E+02		1.40E+02	1.00E+04	4.57E+01	3.23E+00	8.68E-02
NO3-								
Np+4								
O2		5.48E+05	9.72E+04	6.45E+05	4.61E+07	2.10E+05	1.49E+04	4.00E+02
OH-								
Pb+4	WAC/40CFR							

Unmitigated 3.6E-03 following off-gas treatment.

Rb+								
Re+7								
Rh+3	WAC							
Ru+3								
Sb+5	WAC-460-160							
Se+6	WAC							
Si+4								
Sm+3								
Sn+4	WAC-460							
SO2	PP	1.27E+03		1.27E+03	9.07E+04	4.14E+02	2.93E+01	7.87E-01
SO4-2								
Sr+2								
S								
TcO2								
TcO4-								
Te+6	WAC-460-160							
Th+4								
Ti+4								
Ti+3								
TOC								
UO2+2	WAC-460							
V+5								
W+6	WAC460							
ZN+2								
ZRO2:2H2O								
SOLIDS COMPONENTS								
Total Mass Flow		9.94E-07	1.86E-01	1.86E-01	1.33E+01	6.07E-02	4.30E-03	1.15E-04
Al (summary)	WAC460-160	1.31E-08	2.45E-03	2.45E-03	1.75E-01	7.99E-04	5.66E-05	1.52E-06
Fe (summary)		2.21E-09	4.13E-04	4.13E-04	2.95E-02	1.35E-04	9.54E-06	2.56E-07
Cr (summary)	WAC460-160	4.45E-10	8.33E-05	8.33E-05	5.95E-03	2.72E-05	1.92E-06	5.16E-08
Na (summary)		1.84E-07	3.45E-02	3.45E-02	2.46E+00	1.13E-02	7.97E-04	2.14E-05
Si (summary)		2.49E-07	4.65E-02	4.65E-02	3.32E+00	1.52E-02	1.07E-03	2.88E-05
P (summary)	WAC460-160	5.09E-09	9.52E-04	9.52E-04	6.80E-02	3.11E-04	2.20E-05	5.90E-07
NO2, NO3	PP							
Cs and Ba (MCi)		2.50E-10	5.05E-05	5.05E-05	3.61E-03	1.65E-05	1.17E-06	3.13E-08
Sr and Y (MCi)		3.48E-10	7.03E-05	7.03E-05	5.02E-03	2.29E-05	1.62E-06	4.36E-08
Tc (MCi)		9.91E-14	2.00E-08	2.00E-08	1.43E-06	6.52E-09	4.62E-10	1.24E-11

TRU (MCi)		5.10E-13	1.03E-07	1.03E-07	7.36E-06	3.36E-08	2.38E-09	6.39E-11
Total MCi		6.11E-10	1.24E-04	1.24E-04	8.86E-03	4.04E-05	2.86E-06	7.69E-08
Ag+	WAC460-160							
Ag2O	WAC460-160	1.19E-12	2.40E-07	2.40E-07	1.71E-05	7.83E-08	5.54E-09	1.49E-10
Al+3								
Al2O3		2.47E-08	4.62E-03	4.62E-03	3.30E-01	1.51E-03	1.07E-04	2.86E-06
Am+3								
Am2O3		1.17E-13	2.36E-08	2.36E-08	1.69E-06	7.70E-09	5.45E-10	1.46E-11
As+5	WAC							
As2O5		3.23E-12	6.52E-07	6.52E-07	4.66E-05	2.13E-07	1.51E-08	4.04E-10
B+3								
B2O3	WAC-460-160	1.06E-07	1.98E-02	1.98E-02	1.41E+00	6.46E-03	4.57E-04	1.23E-05
Ba+2	?							
BaO	WAC	6.56E-12	1.33E-06	1.33E-06	9.50E-05	4.34E-07	3.07E-08	8.25E-10
Be+2	40CFR/WAC							
BeO		6.90E-14	1.40E-08	1.40E-08	1.00E-06	4.57E-09	3.23E-10	8.68E-12
Bi+3								
Bi2O3		7.86E-10	1.47E-04	1.47E-04	1.05E-02	4.79E-05	3.40E-06	9.11E-08
C 14								
Ca+2								
CANCRINITE								
CaO	WAC-460-160	8.17E-09	1.53E-03	1.53E-03	1.09E-01	4.99E-04	3.53E-05	9.49E-07
Cd+2	WAC-460-130							
CdO		3.02E-11	6.11E-06	6.11E-06	4.36E-04	1.99E-06	1.41E-07	3.79E-09
Ce+3								
Ce2O3		7.48E-10	1.40E-04	1.40E-04	1.00E-02	4.57E-05	3.23E-06	8.68E-08
Cl-								
Cm+3								
Cm2O3		6.51E-17		6.51E-17	4.65E-15	2.12E-17	1.50E-18	4.04E-20
Co+3								
Co2O3		2.86E-12	5.79E-07	5.79E-07	4.14E-05	1.89E-07	1.34E-08	3.59E-10
Co3-2								
Cr+3	WAC-460-160							
Cr2O3		6.51E-10	1.22E-04	1.22E-04	8.71E-03	3.98E-05	2.82E-06	7.56E-08
Cs+								
Cs2O		3.22E-12	6.52E-07	6.52E-07	4.66E-05	2.13E-07	1.51E-08	4.04E-10
Cu	WAC-460-160							

Cu+2	WAC-460-160							
CuO		3.07E-12	6.22E-07	6.22E-07	4.44E-05	2.03E-07	1.44E-08	3.86E-10
CuSO4								
F-	WAC							
Fe+3								
Fe2O3	WAC-460-160	3.16E-09	5.91E-04	5.91E-04	4.22E-02	1.93E-04	1.37E-05	3.66E-07
H+								
Hg+2	WAC-460-160							
I-	WAC ?							
K+								
K2O		4.32E-09	8.74E-04	8.74E-04	6.24E-02	2.85E-04	2.02E-05	5.42E-07
La+3								
La2O3		1.14E-10	2.30E-05	2.30E-05	1.64E-03	7.50E-06	5.31E-07	1.43E-08
Li+								
Li2O		3.78E-08	7.07E-03	7.07E-03	5.05E-01	2.31E-03	1.63E-04	4.38E-06
Mg+2								
MgO	WAC-460-160	7.58E-09	1.42E-03	1.42E-03	1.01E-01	4.63E-04	3.28E-05	8.80E-07
MnO2	WAC-460-160	5.75E-10	1.08E-04	1.08E-04	7.71E-03	3.52E-05	2.50E-06	6.70E-08
Mo+6								
MoO3		3.16E-11	6.39E-06	6.39E-06	4.56E-04	2.08E-06	1.48E-07	3.96E-09
Na+								
Na20		2.49E-07	4.65E-02	4.65E-02	3.32E+00	1.52E-02	1.07E-03	2.88E-05
Nb+5								
Nb2O5		2.39E-18		2.39E-18	1.71E-16	7.80E-19	5.52E-20	1.48E-21
Ni+3	WAC-460-160							
Ni2FeCN6								
Ni2O3		3.72E-11	7.52E-06	7.52E-06	5.37E-04	2.45E-06	1.74E-07	4.66E-09
NiO		6.10E-10	1.14E-04	1.14E-04	8.14E-03	3.72E-05	2.63E-06	7.07E-08
NO2-								
NO3-								
Np+4								
NpO2		1.35E-13	2.73E-08	2.73E-08	1.95E-06	8.90E-09	6.31E-10	1.69E-11
OH-								
P2O5		1.16E-08	2.18E-03	2.18E-03	1.56E-01	7.11E-04	5.04E-05	1.35E-06
P2O5:24H2O								
Pb+4	PPAWAC							
Pb02	WAC	9.23E-11	1.87E-05	1.87E-05	1.34E-03	6.10E-06	4.32E-07	1.16E-08

PO4-3								
Pu+4								
PuO2		7.26E-13	1.47E-07	1.47E-07	1.05E-05	4.79E-08	3.40E-09	9.11E-11
Rb+								
RbO2		2.23E-13	4.50E-08	4.50E-08	3.21E-06	1.47E-08	1.04E-09	2.79E-11
Re+7								
Re2O7		1.40E-13	2.83E-08	2.83E-08	2.02E-06	9.23E-09	6.54E-10	1.75E-11
Rh+3								
Rh2O3		1.36E-12	2.75E-07	2.75E-07	1.96E-05	8.97E-08	6.35E-09	1.70E-10
Ru+3								
Ru2O3		1.71E-12	3.46E-07	3.46E-07	2.47E-05	1.13E-07	7.99E-09	2.15E-10
Sb+5								
Sb2O5		6.20E-12	1.25E-06	1.25E-06	8.93E-05	4.08E-07	2.89E-08	7.75E-10
Se+6								
SeO3		9.56E-12	1.93E-06	1.93E-06	1.38E-04	6.29E-07	4.46E-08	1.20E-09
Si+4								
SiO2		5.32E-07	9.95E-02	9.95E-02	7.11E+00	3.25E-02	2.30E-03	6.17E-05
Sm+3								
Sm2O3		9.35E-14	1.89E-08	1.89E-08	1.35E-06	6.16E-09	4.37E-10	1.17E-11
Sn+4	WAC-460-160							
SnO2		6.19E-14	1.25E-08	1.25E-08	8.93E-07	4.08E-09	2.89E-10	7.75E-12
SO4-2								
Sr+2								
SrO		1.10E-10	2.22E-05	2.22E-05	1.59E-03	7.24E-06	5.13E-07	1.38E-08
Tc2O7		9.14E-12	1.85E-06	1.85E-06	1.32E-04	6.03E-07	4.27E-08	1.15E-09
TcO4-								
Te+6	WAC-460-160							
TeO3	WAC-460-160	8.63E-13	1.75E-07	1.75E-07	1.25E-05	5.71E-08	4.04E-09	1.08E-10
Th+4								
ThO2		3.89E-11	7.87E-06	7.87E-06	5.62E-04	2.57E-06	1.82E-07	4.88E-09
Ti+4								
TiO2		1.86E-12	3.76E-07	3.76E-07	2.69E-05	1.23E-07	8.69E-09	2.33E-10
Ti+3								
Ti2O3		1.54E-11	3.11E-06	3.11E-06	2.22E-04	1.01E-06	7.19E-08	1.93E-09
TOC								
UO2+2	WAC-460							
UO3	WAC-460	4.41E-09	8.26E-04	8.26E-04	5.90E-02	2.69E-04	1.91E-05	5.12E-07

V+5								
V2O5	WAC-460-160	2.15E-13	4.34E-08	4.34E-08	3.10E-06	1.42E-08	1.00E-09	2.69E-11
WO2		4.26E-11	8.61E-06	8.61E-06	6.15E-04	2.81E-06	1.99E-07	5.34E-09
WO3		1.03E-11	2.09E-06	2.09E-06	1.49E-04	6.82E-07	4.83E-08	1.30E-09
ZN+2	WAC-460-160							
ZNO	WAC-460-160	7.30E-12	1.48E-06	1.48E-06	1.06E-04	4.83E-07	3.42E-08	9.18E-10
ZRO2	WAC-460-160	2.06E-09	3.86E-04	3.86E-04	2.76E-02	1.26E-04	8.92E-06	2.39E-07
ZRO2:2H2O								
		material balance based on data package recvd. 11/8/94						
		annual ave based on 14 year operations period						
		24 hour ave. based on annual ave/number of operating days per year (365 days @ 60% OE)						
		peak hourly rate based on plant capacity of 200 mt /operting day						

ISV.EMM

ISV Emissions

	Operating Emissions			
Component	Total Emission	Annual Emissions	Average Hourly	Peak Hourly
	Curies	based on 5 yrs of ISV		
		Curies/year	Ci/hr	Ci/hr
Am-241	1.00E-06	2.00E-07	4.57E-12	6.85E-12
C-14	5.30E+03	1.06E+03	2.42E-02	3.63E-02
Cs-137	3.50E-04	7.00E-05	1.60E-09	2.40E-09
I-129	1.60E+01	3.20E+00	7.31E-05	1.10E-04
Pu-239,240	3.30E-07	6.60E-08	1.51E-12	2.26E-12
Ru-106	3.80E-13	7.60E-14	1.74E-18	2.60E-18
Sm-151	6.30E-06	1.26E-06	2.88E-11	4.32E-11
Sr-90	5.40E-04	1.08E-04	2.47E-09	3.70E-09
Tc-99	3.20E-07	6.40E-08	1.46E-12	2.19E-12
Zr-93	3.90E-08	7.80E-09	1.78E-13	2.67E-13
	kg	kilograms/year		
Particulate	6.00E+04	1.20E+04	2.74E-01	4.11E-01
S0x	0	0.00E+00	0.00E+00	0.00E+00
CO	0	0.00E+00	0.00E+00	0.00E+00
Hydrocarbons	11	2.20E+00	5.02E-05	7.53E-05
N0x	3.60E+05	7.20E+04	1.64E+00	2.47E+00
Aldehydes	N/A		0.00E+00	0.00E+00
Organic Acids	N/A		0.00E+00	0.00E+00
NH3	5.60E+04	1.12E+04	2.56E-01	3.84E-01

Assumptions: Each tank farm will have a confinement facility

There will be 4 vitrification systems in place with at least two in operation at all times

One stack for each Tank Farm Confinement Facility (may be conservative)

May have two systems operating in one tank farm or may vitrify tanks in different tank farms at the same time resulting in emissions from two stacks.

The WHC data package does not address this issue.

The radiological emissions are 100% PM10

Average hourly emissions based on 5 yrs operations @ 24 hrs per day with two ISV systems in operation

Peak hourly emissions based on 3 ISV systems in opertions simultaneously

Reference WHC-SD-WM-EV-101 In Situ Rev 0 (Public Release)

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-A (5 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation on existing tanks		Flow rate 30 cubic meters/min (1000 cfm)				
Tank Farm Emissions From Current Operations						
			Routine	Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hour)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hour)	Filling (g/m3)	
Carbon Monoxide	3.38E+00	3.38E+00	7.72E-05	7.72E-04	4.29E-04	
Nitrogen Oxide	2.04E-01	2.04E-01	4.65E-06	4.65E-05	2.58E-05	
1,3-Butadiene	1.47E-02	1.47E-02	3.36E-07	3.36E-06	1.87E-06	
2-Hexanone	2.67E-01	2.67E-01	6.10E-06	6.10E-05	3.39E-05	
2-Pentanone	4.24E-01	4.24E-01	9.68E-06	9.68E-05	5.38E-05	
Acetone	5.09E+00	5.09E+00	1.16E-04	1.16E-03	6.46E-04	
Acetonitrile	2.45E+00	2.45E+00	5.60E-05	5.60E-04	3.11E-04	
Benzene	1.17E-01	1.17E-01	2.66E-06	2.66E-05	1.48E-05	
Heptane	2.99E-01	2.99E-01	6.83E-06	6.83E-05	3.79E-05	
Methyl N-Amyl Ketone	2.89E-01	2.89E-01	6.61E-06	6.61E-05	3.67E-05	
N-Hexane	3.12E-01	3.12E-01	7.12E-06	7.12E-05	3.96E-05	
Nonane	1.63E-01	1.63E-01	3.71E-06	3.71E-05	2.06E-05	
Octane	1.70E-01	1.70E-01	3.89E-06	3.89E-05	2.16E-05	
Toluene	2.37E-02	2.37E-02	5.42E-07	5.42E-06	3.01E-06	
Ammonia	2.34E+01	2.34E+01	5.34E-04	5.34E-03	2.97E-03	
Phosphoric Acid, Tributyl Ester	6.12E-01	6.12E-01	1.40E-05	1.40E-04	7.77E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hour)	(Ci/hour)	(g/m3)	
Americium-241 Ci/yr	2.78E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	6.75E-02	2.90E-05	6.63E-10	6.63E-09	4.26E-14	
Plutonium-239 Ci/yr	1.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	1.78E+00	8.26E-04	1.88E-08	1.88E-07	7.53E-13	
Gravel filling a tank takes approx 3 days,						

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-AX (4 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	Filling (g/m3)	
Carbon Monoxide	2.52E+00	2.48E+00	7.08E-05	7.08E-04	3.93E-04	
Nitrogen Oxide	1.52E-01	1.52E-01	4.33E-06	4.33E-05	2.40E-05	
1,3-Butadiene	1.10E-02	1.03E-02	2.94E-07	2.94E-06	1.63E-06	
2-Hexanone	1.99E-01	1.99E-01	5.69E-06	5.69E-05	3.16E-05	
2-Pentanone	3.16E-01	2.80E-01	7.98E-06	7.98E-05	4.43E-05	
Acetone	3.80E+00	3.80E+00	1.08E-04	1.08E-03	6.02E-04	
Acetonitrile	1.83E+00	1.83E+00	5.22E-05	5.22E-04	2.90E-04	
Benzene	8.69E-02	8.69E-02	2.48E-06	2.48E-05	1.38E-05	
Heptane	2.23E-01	2.23E-01	6.36E-06	6.36E-05	3.54E-05	
Methyl N-Amyl Ketone	2.16E-01	2.16E-01	6.16E-06	6.16E-05	3.42E-05	
N-Hexane	2.32E-01	2.32E-01	6.63E-06	6.63E-05	3.69E-05	
Nonane	1.21E-01	1.21E-01	3.46E-06	3.46E-05	1.92E-05	
Octane	1.27E-01	1.27E-01	3.62E-06	3.62E-05	2.01E-05	
Toluene	1.77E-02	1.77E-02	5.05E-07	5.05E-06	2.80E-06	
Ammonia	1.74E+01	1.74E+01	4.98E-04	4.98E-03	2.76E-03	
Phosphoric Acid, Tributyl Ester	4.56E-01	4.56E-01	1.30E-05	1.30E-04	7.23E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)	
Americium-241 Ci/yr	2.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	5.03E-02	2.36E-05	6.73E-10	6.73E-09	4.33E-14	
Plutonium-239 Ci/yr	1.03E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	1.32E+00	6.71E-04	1.92E-08	1.92E-07	7.66E-13	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-B (16 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hr)	Filling (g/m3)	
Carbon Monoxide	9.62E+00	9.62E+00	6.86E-05	6.86E-04	3.81E-04	
Nitrogen Oxide	7.94E-01	5.79E-01	4.13E-06	4.13E-05	2.29E-05	
1,3-Butadiene	4.18E-02	4.18E-02	2.98E-07	2.98E-06	1.66E-06	
2-Hexanone	7.60E-01	7.60E-01	5.42E-06	5.42E-05	3.01E-05	
2-Pentanone	1.21E+00	1.21E+00	8.60E-06	8.60E-05	4.78E-05	
Acetone	1.45E+01	1.45E+01	1.03E-04	1.03E-03	5.74E-04	
Acetonitrile	6.98E+00	6.98E+00	4.98E-05	4.98E-04	2.77E-04	
Benzene	3.32E-01	3.32E-01	2.37E-06	2.37E-05	1.31E-05	
Heptane	8.51E-01	8.51E-01	6.07E-06	6.07E-05	3.37E-05	
Methyl N-Amyl Ketone	8.23E-01	8.23E-01	5.87E-06	5.87E-05	3.26E-05	
N-Hexane	8.87E-01	8.87E-01	6.33E-06	6.33E-05	3.52E-05	
Nonane	4.62E-01	4.62E-01	3.30E-06	3.30E-05	1.83E-05	
Octane	4.85E-01	4.85E-01	3.46E-06	3.46E-05	1.92E-05	
Toluene	6.75E-02	6.75E-02	4.82E-07	4.82E-06	2.68E-06	
Ammonia	6.65E+01	6.65E+01	4.75E-04	4.75E-03	2.64E-03	
Phosphoric Acid, Tributyl Ester	1.74E+00	1.74E+00	1.24E-05	1.24E-04	6.90E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	7.57E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	1.84E-01	9.07E-05	6.47E-10	6.47E-09	4.16E-14	
Plutonium-239 Ci/yr	3.78E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	4.84E+00	2.46E-03	1.75E-08	5.26E-08	2.10E-13	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-BX (12 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Filled (Kg/hr)	Filling (g/m3)	
Carbon Monoxide	7.56E+00	7.56E+00	7.19E-05	7.19E-04	4.00E-04	
Nitrogen Oxide	4.55E-01	4.55E-01	4.33E-06	4.33E-05	2.40E-05	
1,3-Butadiene	3.29E-02	3.29E-02	3.13E-07	3.13E-06	1.74E-06	
2-Hexanone	5.98E-01	5.98E-01	5.69E-06	5.69E-05	3.16E-05	
2-Pentanone	9.48E-01	9.48E-01	9.02E-06	9.02E-05	5.01E-05	
Acetone	1.14E+01	1.14E+01	1.08E-04	1.08E-03	6.02E-04	
Acetonitrile	5.49E+00	5.49E+00	5.22E-05	5.22E-04	2.90E-04	
Benzene	2.61E-01	2.61E-01	2.48E-06	2.48E-05	1.38E-05	
Heptane	6.69E-01	6.69E-01	6.36E-06	6.36E-05	3.54E-05	
Methyl N-Amyl Ketone	6.47E-01	6.47E-01	6.16E-06	6.16E-05	3.42E-05	
N-Hexane	6.97E-01	6.97E-01	6.63E-06	6.63E-05	3.69E-05	
Nonane	3.64E-01	3.64E-01	3.46E-06	3.46E-05	1.92E-05	
Octane	3.81E-01	3.81E-01	3.62E-06	3.62E-05	2.01E-05	
Toluene	5.31E-02	5.31E-02	5.05E-07	5.05E-06	2.80E-06	
Ammonia	5.23E+01	5.23E+01	4.98E-04	4.98E-03	2.76E-03	
Phosphoric Acid, Tributyl Ester	1.37E+00	1.37E+00	1.30E-05	1.30E-04	7.23E-05	
	(Ci/yr)	(Ci/yr)	(Ci/yr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	4.18E-01	2.11E-04	2.01E-09	2.01E-08	1.29E-13	
Plutonium-239 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Strontium-090 Ci/yr	1.06E-02	5.44E-06	5.18E-11	5.18E-10	2.07E-15	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-BY (12 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	filling (gm3)	
Carbon Monoxide	4.06E+00	4.06E+00	3.86E-05	3.86E-04	2.14E-04	
Nitrogen Oxide	2.51E-01	2.51E-01	2.39E-06	2.39E-05	1.33E-05	
1,3-Butadiene	1.76E-02	1.76E-02	1.68E-07	1.68E-06	9.31E-07	
2-Hexanone	3.24E-01	3.24E-01	3.08E-06	3.08E-05	1.71E-05	
2-Pentanone	5.16E-01	5.16E-01	4.91E-06	4.91E-05	2.73E-05	
Acetone	6.16E+00	6.16E+00	5.86E-05	5.86E-04	3.25E-04	
Acetonitrile	2.95E+00	2.95E+00	2.81E-05	2.81E-04	1.56E-04	
Benzene	1.42E-01	1.42E-01	1.35E-06	1.35E-05	7.49E-06	
Heptane	3.69E-01	3.69E-01	3.51E-06	3.51E-05	1.95E-05	
Methyl N-Amyl Ketone	3.50E-01	3.50E-01	3.33E-06	3.33E-05	1.85E-05	
N-Hexane	3.96E-01	3.96E-01	3.77E-06	3.77E-05	2.09E-05	
Nonane	1.97E-01	1.97E-01	1.88E-06	1.88E-05	1.04E-05	
Octane	2.09E-01	2.09E-01	1.99E-06	1.99E-05	1.11E-05	
Toluene	3.12E-02	3.12E-02	2.97E-07	2.97E-06	1.65E-06	
Ammonia	3.13E+01	3.13E+01	2.98E-04	2.98E-03	1.66E-03	
Phosphoric Acid, Tributyl Ester	7.33E-01	7.33E-01	6.97E-06	6.97E-05	3.87E-05	
	(Ci/yr)	(Ci/yr)	(Ci/yr)	(Ci/yr)	(g/m3)	
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium-137 Ci/yr	3.95E-02	2.36E-05	3.75E-07	3.75E-06	2.41E-11	
Plutonium-239 Ci/yr	1.18E-05	0.00E+00	1.12E-10	1.12E-09	1.01E-11	
Strontium-090 Ci/yr	4.55E-02	2.36E-05	4.32E-07	4.32E-06	1.73E-11	

Tank Farm Emissions From Current Operations		Gravel Filling Gas Treatment				
		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Tank Farm 241-C (13 Single-Shell tanks)		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
Passive Ventilation		Flow rate 30 cubic meters/min (1000 cfm)				
				Emissions Per	Conc. of	
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Tank Being	Emissions From	
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	filled (Kg/hr)	filling (g/m3)	
Carbon Monoxide	5.77E+00	5.77E+00	5.07E-05	5.07E-04	2.82E-04	
Nitrogen Oxide	3.95E-01	3.95E-01	3.47E-06	3.47E-05	1.93E-05	
1,3-Butadiene	2.51E-02	2.51E-02	2.20E-07	2.20E-06	1.22E-06	
2-Hexanone	4.56E-01	4.56E-01	4.01E-06	4.01E-05	2.23E-05	
2-Pentanone	7.24E-01	7.24E-01	6.36E-06	6.36E-05	3.53E-05	
Acetone	8.70E+00	8.70E+00	7.64E-05	7.64E-04	4.24E-04	
Acetonitrile	4.19E+00	4.19E+00	3.68E-05	3.68E-04	2.04E-04	
Benzene	1.99E-01	1.99E-01	1.75E-06	1.75E-05	9.70E-06	
Heptane	5.11E-01	5.11E-01	4.49E-06	4.49E-05	2.49E-05	
Methyl N-Amyl Ketone	4.93E-01	4.93E-01	4.33E-06	4.33E-05	2.41E-05	
N-Hexane	5.32E-01	5.32E-01	4.67E-06	4.67E-05	2.60E-05	
Nonane	2.78E-01	2.78E-01	2.44E-06	2.44E-05	1.35E-05	
Octane	2.91E-01	2.91E-01	2.55E-06	2.55E-05	1.42E-05	
Toluene	4.05E-02	4.05E-02	3.56E-07	3.56E-06	1.98E-06	
Ammonia	4.55E+01	4.55E+01	3.99E-04	3.99E-03	2.22E-03	
Phosphoric Acid, Tributyl Ester	1.05E+00	1.05E+00	9.18E-06	9.18E-05	5.10E-05	
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)	
Americium-241 Ci/yr	1.07E-04	0.00E+00	9.40E-10	9.40E-09	1.52E-12	
Cesium-137 Ci/yr	3.95E-03	0.00E+00	3.47E-08	3.47E-07	2.23E-12	
Plutonium-239 Ci/yr	1.28E-03	0.00E+00	1.13E-08	1.13E-07	1.01E-09	
Strontium-090 Ci/yr	4.63E-02	2.54E-05	4.06E-07	4.06E-06	1.62E-11	

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AN 8 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
7 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	per tank	Release Conc g/m^3)	
Nitrogen Oxide	3.63E-01	3.63E-01	5.92E-06	5.92E-05	3.29E-05	
1, 3-Butadiene	2.62E-02	2.62E-02	4.28E-07	4.28E-06	2.38E-06	
2-Hexanone	4.77E-01	4.77E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	7.58E-01	7.58E-01	1.24E-05	1.24E-04	6.86E-05	
Acetone	9.07E+00	9.07E+00	1.48E-04	1.48E-03	8.22E-04	
Acetonitrile	4.38E+00	4.38E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	2.08E-01	2.08E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	5.33E-01	5.33E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	5.16E-01	5.16E-01	8.42E-06	8.42E-05	4.68E-05	
N-Hexane	5.56E-01	5.56E-01	9.07E-06	9.07E-05	5.04E-05	
Nonane	2.90E-01	2.90E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	3.04E-01	3.04E-01	4.96E-06	4.96E-05	2.75E-05	
Toluene	4.24E-02	4.24E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Strontium-90		1.20E-07	1.96E-12	1.96E-11	7.82E-17	
Total Alpha		None Detected				

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AP 9 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
8 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	4.15E-01	4.15E-01	5.93E-06	5.93E-05	3.29E-05	
1, 3-Buladiene	2.99E-02	2.99E-02	4.27E-07	4.27E-06	2.37E-06	
2-Hexanone	5.45E-01	5.45E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	8.65E-01	8.65E-01	1.23E-05	1.23E-04	6.86E-05	
Acetone	1.04E+01	1.04E+01	1.49E-04	1.49E-03	8.27E-04	
Acetonitrile	5.01E+00	5.01E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	2.38E-01	2.38E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	6.10E-01	6.10E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	5.90E-01	5.90E-01	8.41E-06	8.41E-05	4.67E-05	
N-Hexane	6.36E-01	6.36E-01	9.07E-06	9.07E-05	5.04E-05	
Nonane	3.31E-01	3.31E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	3.47E-01	3.47E-01	4.96E-06	4.96E-05	2.75E-05	
Toluene	4.84E-02	4.84E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Strontium-90		6.60E-08	9.42E-13	9.42E-12	3.76E-17	

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AW 7 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
6 tanks		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	3.11E-01	3.11E-01	5.92E-06	5.92E-05	3.29E-05	
1, 3-Butadiene	2.25E-02	2.25E-02	4.28E-07	4.28E-06	2.38E-06	
2-Hexanone	4.09E-01	4.09E-01	7.78E-06	7.78E-05	4.32E-05	
2-Pentanone	6.50E-01	6.50E-01	1.24E-05	1.24E-04	6.87E-05	
Acetone	7.79E+00	7.79E+00	1.48E-04	1.48E-03	8.24E-04	
Acetonitrile	3.76E+00	3.76E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	1.79E-01	1.79E-01	3.40E-06	3.40E-05	1.89E-05	
Heptane	4.57E-01	4.57E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	4.43E-01	4.43E-01	8.42E-06	8.42E-05	4.68E-05	
N-Hexane	4.77E-01	4.77E-01	9.08E-06	9.08E-05	5.04E-05	
Nonane	2.49E-01	2.49E-01	4.73E-06	4.73E-05	2.63E-05	
Octane	2.60E-01	2.60E-01	4.95E-06	4.95E-05	2.75E-05	
Toluene	3.63E-02	3.63E-02	6.90E-07	6.90E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/hour	
Cesium-137		2.80E-08	5.33E-13	5.33E-12	3.43E-17	
Strontium-90		1.60E-07	3.04E-12	3.04E-11	1.22E-16	
Total Alpha		1.50E-08	2.85E-13	2.85E-12		

Tank Farm Emissions From Current Operations						
		Gravel Filling Gas Treatment				
296-AYAZ 5 Source Emissions Roll-Up		Avg Exit Velocity	9.15 m/sec (30fps)	Area 5 (sq. ft)		
Active Ventilation		Avg Exit Temperature 70 (F)		Height 3.05 m (10 ft)		
4 tanks DSTs		Flow rate 30 cubic meters/min (1000 cfm)				
				Gravel Filling		
	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Actual (Kg/hr)		
Emissions	Per Tank Farm	Per Tank Farm	Per Tank Farm	Per Tank	Release Conc g/m^3)	
Nitrogen Oxide	2.08E-01	2.08E-01	5.93E-06	5.93E-05	3.29E-05	
1, 3-Butadiene	1.50E-02	1.50E-02	4.27E-07	4.27E-06	2.37E-06	
2-Hexanone	2.73E-01	2.73E-01	7.79E-06	7.79E-05	4.33E-05	
2-Pentanone	4.33E-01	4.33E-01	1.23E-05	1.23E-04	6.86E-05	
Acetone	5.20E+00	5.20E+00	1.48E-04	1.48E-03	8.24E-04	
Acetonitrile	2.50E+00	2.50E+00	7.15E-05	7.15E-04	3.97E-04	
Benzene	1.19E-01	1.19E-01	3.39E-06	3.39E-05	1.88E-05	
Heptane	3.05E-01	3.05E-01	8.70E-06	8.70E-05	4.83E-05	
Methyl N-Amyl Ketone	2.95E-01	2.95E-01	8.41E-06	8.41E-05	4.67E-05	
N-Hexane	3.18E-01	3.18E-01	9.09E-06	9.09E-05	5.05E-05	
Nonane	1.66E-01	1.66E-01	4.74E-06	4.74E-05	2.63E-05	
Octane	1.74E-01	1.74E-01	4.97E-06	4.97E-05	2.76E-05	
Toluene	2.42E-02	2.42E-02	6.91E-07	6.91E-06	3.84E-06	
			Ci/hr	Ci/hr	grams/m^3	
Cesium-137		5.30E-05	1.51E-09	1.51E-08	9.73E-14	
Strontium-90		8.20E-06	2.34E-10	2.34E-09	9.35E-15	
Iodine-129		4.60E-05	1.31E-09	1.31E-08	4.14E-08	
Total Alpha		5.70E-09	1.63E-13	1.63E-12		

Tank Farm Emissions From Current Operations						
		Avg Exit Velocity .36 (ft/s)		Area 1.08 (ft2)		
241-S Tank Farm (12 Single-Shell Tanks)		Avg Exit Temperature 94.2 (F)		Height 3 (ft)		
Passive Ventilation				Gravel Filling		
		Actual per tank	Routine actual per	Actual (Kg/hr)		
Emissions	Potential (Kg/yr)	farm (Kg/yr)	tank (Kg/hr)	Per Tank	Conc. (g/m3)	
Carbon Monoxide	1.14E-02	1.14E-02	1.08E-07	1.08E-06		2.77E-05
Nitrogen Oxide	6.86E-04	7.44E-04	7.07E-09	7.07E-08		1.80E-06
1,3-Butadiene	4.96E-05	5.37E-05	5.11E-10	5.11E-09		1.30E-07
2-Hexanone	9.01E-04	9.76E-04	9.29E-09	9.29E-08		2.37E-06
2-Pentanone	1.43E-03	1.55E-03	1.47E-08	1.47E-07		3.76E-06
Acetone	1.72E-02	1.86E-02	1.77E-07	1.77E-06		4.51E-05
Acetonitrile	8.27E-03	8.96E-03	8.52E-08	8.52E-07		2.17E-05
Benzene	3.94E-04	4.26E-04	4.06E-09	4.06E-08		1.04E-06
Heptane	1.01E-03	1.09E-03	1.04E-08	1.04E-07		2.65E-06
Methyl N-Amyl Ketone	9.76E-04	1.06E-03	1.01E-08	1.01E-07		2.57E-06
N-Hexane	1.05E-03	1.14E-03	1.08E-08	1.08E-07		2.76E-06
Nonane	5.48E-04	5.94E-04	5.65E-09	5.65E-08		1.44E-06
Octane	5.75E-04	6.23E-04	5.92E-09	5.92E-08		1.51E-06
Toluene	8.00E-05	8.67E-05	8.25E-10	8.25E-09		2.10E-07
Ammonia	7.88E-02	8.54E-02	8.13E-07	8.13E-06		2.07E-04
Phosphoric Acid, Tributyl Ester	1.91E-03	2.24E-03	2.13E-08	2.13E-07		5.43E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)	
Americium-241	9.36E-07	0.00E+00	0.00E+00	0.00E+00		
Cesium 137	2.28E-04	8.20E-08	7.80E-13	7.80E-12		
Plutonium-239	4.68E-07	0.00E+00	0.00E+00	0.00E+00		
Strontium-090	6.00E-03	2.41E-06	2.29E-11	2.29E-10		

Tank Farm Emissions From Current Operations					
				Area 2 (ft2)	
241-SX Tank Farm (2 Single-Shell Tanks)		Avg Exit Velocity .014 (ft/s)		Height 3 (ft)	
Passive Ventilation		Avg Exit Temperature 76.5 (F)		Gravel Filling	
			Routine actual per	Actual (Kg/hr)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank (Kg/hr)	Per Tank	Conc (g/m3)
Carbon Monoxide	8.78E-04	8.78E-04	5.01E-08	5.01E-07	1.78E-04
Nitrogen Oxide	5.28E-05	5.28E-05	3.01E-09	3.01E-08	1.07E-05
1,3-Butadiene	3.82E-06	3.82E-06	2.18E-10	2.18E-09	7.73E-07
2-Hexanone	6.94E-05	6.94E-05	3.96E-09	3.96E-08	1.40E-05
2-Pentanone	1.10E-04	1.10E-04	6.29E-09	6.29E-08	2.23E-05
Acetone	1.32E-03	1.32E-03	7.56E-08	7.56E-07	2.68E-04
Acetonitrile	6.38E-04	6.38E-04	3.64E-08	3.64E-07	1.29E-04
Benzene	3.02E-05	3.02E-05	1.72E-09	1.72E-08	6.11E-06
Heptane	7.78E-05	7.78E-05	4.44E-09	4.44E-08	1.57E-05
Methyl N-Amyl Ketone	7.52E-05	7.52E-05	4.29E-09	4.29E-08	1.52E-05
N-Hexane	8.10E-05	8.10E-05	4.62E-09	4.62E-08	1.64E-05
Nonane	4.22E-05	4.22E-05	2.41E-09	2.41E-08	8.53E-06
Octane	4.42E-05	4.42E-05	2.52E-09	2.52E-08	8.94E-06
Toluene	6.16E-06	6.16E-06	3.52E-10	3.52E-09	1.25E-06
Ammonia	6.08E-03	6.08E-03	3.47E-07	3.47E-06	1.23E-03
Phosphoric Acid, Tributyl Ester	1.59E-04	1.59E-04	9.08E-09	9.08E-08	3.22E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(Ci/hr)	(g/m3)
Americium-241	1.74E-05	8.00E-09	4.57E-13	4.57E-12	
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	4.60E-04	2.40E-07	1.37E-11	1.37E-10	
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Tank Farm Emissions From Current Operations					
241-T Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0246 (ft/s)		Area 16 (ft2)	
Passive Ventilation		Avg Exit Temperature 65.2 (F)		Height 3 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Routine actual per tank (Kg/hr)	Gravel filling actual (kg/hr) per tank	Conc (g/m3)
Carbon Monoxide	1.21E-02	1.21E-02	8.66E-08	8.66E-07	2.18E-05
Nitrogen Oxide	7.30E-04	7.30E-04	5.21E-09	5.21E-08	1.31E-06
1,3-Buladiene	5.28E-05	5.28E-05	3.76E-10	3.76E-09	9.48E-08
2-Hexanone	9.59E-04	9.59E-04	6.84E-09	6.84E-08	1.72E-06
2-Pentanone	1.52E-03	1.52E-03	1.08E-08	1.08E-07	2.73E-06
Acetone	1.83E-02	1.83E-02	1.30E-07	1.30E-06	3.28E-05
Acetonitrile	8.80E-03	8.80E-03	6.28E-08	6.28E-07	1.58E-05
Benzene	4.19E-04	4.19E-04	2.99E-09	2.99E-08	7.52E-07
Heptane	1.07E-03	1.07E-03	7.66E-09	7.66E-08	1.93E-06
Methyl N-Amyl Ketone	1.04E-03	1.04E-03	7.41E-09	7.41E-08	1.87E-06
N-Hexane	1.12E-03	1.12E-03	7.98E-09	7.98E-08	2.01E-06
Nonane	5.84E-04	5.84E-04	4.16E-09	4.16E-08	1.05E-06
Octane	6.12E-04	6.12E-04	4.36E-09	4.36E-08	1.10E-06
Toluene	8.52E-05	8.52E-05	6.08E-10	6.08E-09	1.53E-07
Ammonia	8.39E-02	8.39E-02	5.99E-07	5.99E-06	1.51E-04
Phosphoric Acid, Tributyl Ester	3.75E-03	2.20E-03	1.57E-08	1.57E-07	3.95E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	1.68E-04	7.60E-08	8.68E-12	8.68E-11	
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	3.84E-05	2.30E-08	2.63E-12	2.63E-11	
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Tank Farm Emissions From Current Operations					
241-TX Tank Farm (18 Single-Shell Tanks)		Avg Exit Velocity .1816 (ft/s)		Area 5.82 (ft2)	
Passive Ventilation		Avg Exit Temperature 72.3 (F)		Height 3 (ft)	Conc. of Emiss
			Routine actual per	Emissions per tank	form filling (g/m3)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank (Kg/hr)	being filled (kg/hr)	
Carbon Monoxide	1.06E-02	1.06E-02	6.74E-08	6.74E-07	6.33E-06
Nitrogen Oxide	6.91E-04	6.91E-04	4.38E-09	4.38E-08	4.11E-07
1,3-Butadiene	4.58E-05	4.58E-05	2.90E-10	2.90E-09	2.73E-08
2-Hexanone	8.32E-04	8.32E-04	5.28E-09	5.28E-08	4.96E-07
2-Pentanone	1.32E-03	1.32E-03	8.37E-09	8.37E-08	7.86E-07
Acetone	1.59E-02	1.59E-02	1.01E-07	1.01E-06	9.44E-06
Acetonitrile	7.64E-03	7.64E-03	4.85E-08	4.85E-07	4.55E-06
Benzene	3.63E-04	3.63E-04	2.30E-09	2.30E-08	2.16E-07
Heptane	9.32E-04	9.32E-04	5.91E-09	5.91E-08	5.55E-07
Methyl N-Amyl Ketone	9.01E-04	9.01E-04	5.72E-09	5.72E-08	5.37E-07
N-Hexane	9.71E-04	9.71E-04	6.16E-09	6.16E-08	5.78E-07
Nonane	5.06E-04	5.06E-04	3.21E-09	3.21E-08	3.01E-07
Octane	5.31E-04	5.31E-04	3.36E-09	3.36E-08	3.16E-07
Carbon Tetrachloride	3.91E-06	3.91E-06	2.48E-11	2.48E-10	7.59E-08
Ethyl Butyl Ketone	1.31E-05	1.31E-05	8.31E-11	8.31E-10	2.54E-07
Methyl Chloride	5.78E-07	5.78E-07	3.67E-12	3.67E-11	1.12E-08
Tetrahydrofuran	1.01E-06	1.01E-06	6.41E-12	6.41E-11	1.96E-08
Toluene	3.91E-06	3.91E-06	2.48E-11	2.48E-10	2.33E-09
Ammonia	1.31E-05	1.31E-05	8.31E-11	8.31E-10	7.80E-09
Phosphoric Acid, Tributyl Ester	5.78E-07	5.78E-07	3.67E-12	3.67E-11	3.44E-10
	(Ci/yr)	(Ci/yr)	(Ci/hr)	Ci/hr	
Americium-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cesium 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Plutonium-239	7.08E-05	7.08E-05	4.49E-10	4.49E-09	
Strontium-090	6.98E-02	6.98E-02	4.43E-07	4.43E-06	

Tank Farm Emissions From Current Operations					
241-TY Tank Farm (6 Single-Shell Tanks)		Avg Exit Velocity .0253 (ft/s)		Area 5.79 (ft2)	
Passive Ventilation		Avg Exit Temperature 66.0 (F)		Height 3 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Routine actual per tank (Kg/hr)	Emissions per tank being filled (kg/hr)	Concentration (g/m
Carbon Monoxide	4.68E-03	4.68E-03	8.90E-08	8.90E-07	6.02E-05
Nitrogen Oxide	2.82E-04	2.82E-04	5.36E-09	5.36E-08	3.62E-06
1,3-Butadiene	2.03E-05	2.03E-05	3.87E-10	3.87E-09	2.62E-07
2-Hexanone	3.70E-04	3.70E-04	7.04E-09	7.04E-08	4.76E-06
2-Pentanone	5.86E-04	5.86E-04	1.12E-08	1.12E-07	7.54E-06
Acetone	7.04E-03	7.04E-03	1.34E-07	1.34E-06	9.06E-05
Acetonitrile	3.39E-03	3.39E-03	6.46E-08	6.46E-07	4.37E-05
Benzene	1.61E-04	1.61E-04	3.07E-09	3.07E-08	2.08E-06
Heptane	4.14E-04	4.14E-04	7.87E-09	7.87E-08	5.32E-06
Methyl N-Amyl Ketone	4.00E-04	4.00E-04	7.62E-09	7.62E-08	5.15E-06
N-Hexane	4.31E-04	4.31E-04	8.21E-09	8.21E-08	5.55E-06
Nonane	2.25E-04	2.25E-04	4.28E-09	4.28E-08	2.90E-06
Octane	2.36E-04	2.36E-04	4.49E-09	4.49E-08	3.03E-06
Toluene	3.28E-05	3.28E-05	6.25E-10	6.25E-09	4.23E-07
Ammonia	3.24E-02	3.24E-02	6.16E-07	6.16E-06	4.16E-04
Phosphoric Acid, Tributyl Ester	8.47E-04	8.47E-04	1.61E-08	1.61E-07	1.09E-05
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	4.00E-04	4.00E-04	7.62E-09	7.62E-08	
Cesium 137	4.31E-04	4.31E-04	8.21E-09	8.21E-08	
Plutonium-239	2.25E-04	2.25E-04	4.28E-09	4.28E-08	
Strontium-090	2.36E-04	2.36E-04	4.49E-09	4.49E-08	

Tank Farm Emissions From Current Operations					
241-U Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0236 (ft/s)		Area 16.0 (ft2)	
Passive Ventilation		Avg Exit Temperature 75.6 (F)		Height 3 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Routine actual kg/hr per tank	emissions per tank being filled kg/hr	Concentration (g/m
Carbon Monoxide	1.16E-02	1.16E-02	8.29E-08	8.29E-07	2.18E-05
Nitrogen Oxide	7.00E-04	7.00E-04	4.99E-09	4.99E-08	1.31E-06
1,3-Butadiene	5.05E-05	5.05E-05	3.61E-10	3.61E-09	9.49E-08
2-Hexanone	9.19E-04	9.19E-04	6.56E-09	6.56E-08	1.73E-06
2-Pentanone	1.46E-03	1.46E-03	1.04E-08	1.04E-07	2.73E-06
Acetone	1.75E-02	1.75E-02	1.25E-07	1.25E-06	3.29E-05
Acetonitrile	8.43E-03	8.43E-03	6.02E-08	6.02E-07	1.58E-05
Benzene	1.08E-03	1.08E-03	7.71E-09	7.71E-08	2.03E-06
Heptane	1.03E-03	1.03E-03	7.34E-09	7.34E-08	1.93E-06
Methyl N-Amyl Ketone	9.95E-04	9.95E-04	7.10E-09	7.10E-08	1.87E-06
N-Hexane	1.07E-03	1.07E-03	7.65E-09	7.65E-08	2.01E-06
Nonane	5.59E-04	5.59E-04	3.99E-09	3.99E-08	1.05E-06
Octane	5.86E-04	5.86E-04	4.18E-09	4.18E-08	1.10E-06
Toluene	7.49E-05	7.49E-05	5.35E-10	5.35E-09	1.41E-07
Ammonia	8.04E-02	8.04E-02	5.74E-07	5.74E-06	1.51E-04
Phosphoric Acid, Tributyl Ester	2.10E-03	2.10E-03	1.50E-08	1.50E-07	3.95E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)		(g/m3)
Americium-241	1.08E-03	1.08E-03	1.23E-07	1.23E-06	
Cesium 137	1.03E-03	1.03E-03	1.17E-07	1.17E-06	
Plutonium-239	9.95E-04	9.95E-04	1.14E-07	1.14E-06	
Strontium-090	1.07E-03	1.07E-03	1.22E-07	1.22E-06	

Tank Farm Emissions From Current Operations					
296-SX 14 Source Emissions Roll-Up		Avg Exit Velocity 10.6 (ft/s)		Area 9.62 (ft2)	
Passive Ventilation		Avg Exit Temperature 165 (F)		Height 15 (ft)	
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	routine actual (kg/h per tank	emissions per tank being filled kg/hr	Conc. of emissions from filling g/m3
Carbon Monoxide	2.24E-01	2.24E-01	1.70E-06	1.70E-05	1.66E-06
Nitrogen Oxide	7.43E-04	7.43E-04	5.65E-09	5.65E-08	5.50E-09
1,3-Butadiene	5.36E-05	5.36E-05	4.08E-10	4.08E-09	3.97E-10
2-Hexanone	9.77E-04	9.77E-04	7.44E-09	7.44E-08	7.23E-09
2-Pentanone	1.55E-03	1.55E-03	1.18E-08	1.18E-07	1.15E-08
Acetone	1.86E-02	1.86E-02	1.42E-07	1.42E-06	1.38E-07
Acetonitrile	8.96E-03	8.96E-03	6.82E-08	6.82E-07	6.63E-08
Benzene	4.26E-04	4.26E-04	3.24E-09	3.24E-08	3.15E-09
Heptane	1.09E-03	1.09E-03	8.30E-09	8.30E-08	8.07E-09
Methyl N-Amyl Ketone	1.06E-03	1.06E-03	8.07E-09	8.07E-08	7.85E-09
N-Hexane	1.14E-03	1.14E-03	8.68E-09	8.68E-08	8.44E-09
Nonane	5.94E-04	5.94E-04	4.52E-09	4.52E-08	4.40E-09
Octane	6.23E-04	6.23E-04	4.74E-09	4.74E-08	4.61E-09
Toluene	8.67E-05	8.67E-05	6.60E-10	6.60E-09	6.42E-10
Ammonia	4.17E+00	4.17E+00	3.17E-05	3.17E-04	3.09E-05
Phosphoric Acid, Tributyl Ester	2.24E-03	2.24E-03	1.70E-08	1.70E-07	1.66E-08
Total Alpha		None Detected			
Total Beta		9.10E-08	6.93E-13	6.93E-12	

Tank Farm Emissions From Current Operations					
296-SY 4 Source Emissions Roll-Up		Avg Exit Velocity 33.3 (ft/s)		Area .35 (ft2)	
Passive Ventilation		Avg Exit Temperature 110 (F)		Height 11 (ft)	conc of emissions
			routine actual per	emissions per tank	per tank being filled
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	tank kg/hr	being filled kg/hr	g/m3
Carbon Monoxide	5.16E-02	5.16E-02	1.96E-06	1.96E-05	1.67E-05
Nitrogen Oxide	1.72E-04	1.72E-04	6.54E-09	6.54E-08	5.57E-08
1,3-Butadiene	1.24E-05	1.24E-05	4.72E-10	4.72E-09	4.02E-09
2-Hexanone	2.25E-04	2.25E-04	8.56E-09	8.56E-08	7.29E-08
2-Pentanone	3.58E-04	3.58E-04	1.36E-08	1.36E-07	1.16E-07
Acetone	4.30E-03	4.30E-03	1.64E-07	1.64E-06	1.39E-06
Acetonitrile	2.07E-03	2.07E-03	7.88E-08	7.88E-07	6.70E-07
Benzene	9.83E-05	9.83E-05	3.74E-09	3.74E-08	3.18E-08
Heptane	2.52E-04	2.52E-04	9.59E-09	9.59E-08	8.16E-08
Methyl N-Amyl Ketone	2.44E-04	2.44E-04	9.28E-09	9.28E-08	7.90E-08
N-Hexane	2.63E-04	2.63E-04	1.00E-08	1.00E-07	8.52E-08
Nonane	1.37E-04	1.37E-04	5.21E-09	5.21E-08	4.44E-08
Octane	1.44E-04	1.44E-04	5.48E-09	5.48E-08	4.66E-08
Toluene	2.00E-05	2.00E-05	7.61E-10	7.61E-09	6.48E-09
Ammonia	9.63E-01	9.63E-01	3.66E-05	3.66E-04	3.12E-04
Phosphoric Acid, Tributyl Ester	5.15E-04	5.16E-04	1.96E-08	1.96E-07	1.67E-07
Total Alpha		8.10E-09	3.08E-13	3.08E-12	

200 East

Tank Farm Emissions From Current Operations				
Tank Farm 241-A (5 Single-Shell tanks)		Avg Exit Velocity .0242 (ft/sec)		Area 5 (sq. ft)
Passive Ventilation		Avg Exit Temperature 138 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	3.38E+00	3.38E+00	3.86E-04	3.13E-02
Nitrogen Oxide	2.04E-01	2.04E-01	2.32E-05	1.88E-03
1,3-Butadiene	1.47E-02	1.47E-02	1.68E-06	1.36E-04
2-Hexanone	2.67E-01	2.67E-01	3.05E-05	2.47E-03
2-Pentanone	4.24E-01	4.24E-01	4.84E-05	3.92E-03
Acetone	5.09E+00	5.09E+00	5.81E-04	4.71E-02
Acetonitrile	2.45E+00	2.45E+00	2.80E-04	2.27E-02
Benzene	1.17E-01	1.17E-01	1.33E-05	1.08E-03
Heptane	2.99E-01	2.99E-01	3.42E-05	2.77E-03
Methyl N-Amyl Ketone	2.89E-01	2.89E-01	3.30E-05	2.68E-03
N-Hexane	3.12E-01	3.12E-01	3.56E-05	2.89E-03
Nonane	1.63E-01	1.63E-01	1.86E-05	1.51E-03
Octane	1.70E-01	1.70E-01	1.95E-05	1.58E-03
Toluene	2.37E-02	2.37E-02	2.71E-06	2.20E-04
Ammonia	2.34E+01	2.34E+01	2.67E-03	2.17E-01
Phosphoric Acid, Tributyl Ester	6.12E-01	6.12E-01	6.99E-05	5.67E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	2.78E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	6.75E-02	2.90E-05	3.31E-09	3.11E-12
Plutonium-239 Ci/yr	1.39E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.78E+00	8.26E-04	9.42E-08	5.50E-11

Tank Farm Emissions From Current Operations				
Tank Farm 241-AX (4 Single-Shell tanks)		Avg Exit Velocity .0225 (ft/sec)		Area 4 (sq. ft)
Passive Ventilation		Avg Exit Temperature 105.25 (F		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	2.52E+00	2.48E+00	2.83E-04	3.08E-02
Nitrogen Oxide	1.52E-01	1.52E-01	1.73E-05	1.89E-03
1,3-Butadiene	1.10E-02	1.03E-02	1.18E-06	1.28E-04
2-Hexanone	1.99E-01	1.99E-01	2.27E-05	2.48E-03
2-Pentanone	3.16E-01	2.80E-01	3.19E-05	3.48E-03
Acetone	3.80E+00	3.80E+00	4.33E-04	4.72E-02
Acetonitrile	1.83E+00	1.83E+00	2.09E-04	2.28E-02
Benzene	8.69E-02	8.69E-02	9.92E-06	1.08E-03
Heptane	2.23E-01	2.23E-01	2.55E-05	2.77E-03
Methyl N-Amyl Ketone	2.16E-01	2.16E-01	2.46E-05	2.68E-03
N-Hexane	2.32E-01	2.32E-01	2.65E-05	2.89E-03
Nonane	1.21E-01	1.21E-01	1.38E-05	1.51E-03
Octane	1.27E-01	1.27E-01	1.45E-05	1.58E-03
Toluene	1.77E-02	1.77E-02	2.02E-06	2.20E-04
Ammonia	1.74E+01	1.74E+01	1.99E-03	2.17E-01
Phosphoric Acid, Tributyl Ester	4.56E-01	4.56E-01	5.21E-05	5.68E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	2.07E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	5.03E-02	2.36E-05	2.69E-09	3.40E-12
Plutonium-239 Ci/yr	1.03E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.32E+00	6.71E-04	7.66E-08	6.01E-11

Tank Farm Emissions From Current Operations				
Tank Farm 241-B (16 Single-Shell tanks)		Avg Exit Velocity .1938 (ft/sec)		Area 5.78 (sq. ft)
Passive Ventilation		Avg Exit Temperature 66.94 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	9.62E+00	9.62E+00	1.10E-03	9.61E-03
Nitrogen Oxide	7.94E-01	5.79E-01	6.61E-05	5.79E-04
1,3-Butadiene	4.18E-02	4.18E-02	4.77E-06	4.18E-05
2-Hexanone	7.60E-01	7.60E-01	8.68E-05	7.60E-04
2-Pentanone	1.21E+00	1.21E+00	1.38E-04	1.21E-03
Acetone	1.45E+01	1.45E+01	1.65E-03	1.45E-02
Acetonitrile	6.98E+00	6.98E+00	7.97E-04	6.98E-03
Benzene	3.32E-01	3.32E-01	3.79E-05	3.31E-04
Heptane	8.51E-01	8.51E-01	9.72E-05	8.51E-04
Methyl N-Amyl Ketone	8.23E-01	8.23E-01	9.40E-05	8.23E-04
N-Hexane	8.87E-01	8.87E-01	1.01E-04	8.87E-04
Nonane	4.62E-01	4.62E-01	5.28E-05	4.62E-04
Octane	4.85E-01	4.85E-01	5.53E-05	4.84E-04
Toluene	6.75E-02	6.75E-02	7.71E-06	6.75E-05
Ammonia	6.65E+01	6.65E+01	7.60E-03	6.65E-02
Phosphoric Acid, Tributyl Ester	1.74E+00	1.74E+00	1.99E-04	1.74E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	7.57E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	1.84E-01	9.07E-05	1.04E-08	1.05E-12
Plutonium-239 Ci/yr	3.78E-04	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.84E+00	2.46E-03	2.81E-07	1.77E-11

Tank Farm Emissions From Current Operations				
Tank Farm 241-BX (12 Single-Shell tanks)		Avg Exit Velocity .1595 (ft/sec)		Area 6.12 (sq. ft)
Passive Ventilation		Avg Exit Temperature 67.75 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	7.56E+00	7.56E+00	8.63E-04	8.67E-03
Nitrogen Oxide	4.55E-01	4.55E-01	5.19E-05	5.22E-04
1,3-Butadiene	3.29E-02	3.29E-02	3.75E-06	3.77E-05
2-Hexanone	5.98E-01	5.98E-01	6.82E-05	6.86E-04
2-Pentanone	9.48E-01	9.48E-01	1.08E-04	1.09E-03
Acetone	1.14E+01	1.14E+01	1.30E-03	1.31E-02
Acetonitrile	5.49E+00	5.49E+00	6.26E-04	6.29E-03
Benzene	2.61E-01	2.61E-01	2.98E-05	2.99E-04
Heptane	6.69E-01	6.69E-01	7.64E-05	7.67E-04
Methyl N-Amyl Ketone	6.47E-01	6.47E-01	7.39E-05	7.42E-04
N-Hexane	6.97E-01	6.97E-01	7.96E-05	8.00E-04
Nonane	3.64E-01	3.64E-01	4.15E-05	4.17E-04
Octane	3.81E-01	3.81E-01	4.35E-05	4.37E-04
Toluene	5.31E-02	5.31E-02	6.06E-06	6.09E-05
Ammonia	5.23E+01	5.23E+01	5.97E-03	6.00E-02
Phosphoric Acid, Tributyl Ester	1.37E+00	1.37E+00	1.56E-04	1.57E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	4.18E-01	2.11E-04	2.41E-08	2.81E-12
Plutonium-239 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	1.06E-02	5.44E-06	6.21E-10	4.49E-14

Tank Farm Emissions From Current Operations				
Tank Farm 241-BY (12 Single-Shell tanks)		Avg Exit Velocity .06996 (ft/sec)		Area 7.94 (sq. ft)
Passive Ventilation		Avg Exit Temperature 95.83 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	4.06E+00	4.06E+00	4.63E-04	8.18E-03
Nitrogen Oxide	2.51E-01	2.51E-01	2.87E-05	5.06E-04
1,3-Butadiene	1.76E-02	1.76E-02	2.01E-06	3.55E-05
2-Hexanone	3.24E-01	3.24E-01	3.70E-05	6.53E-04
2-Pentanone	5.16E-01	5.16E-01	5.89E-05	1.04E-03
Acetone	6.16E+00	6.16E+00	7.03E-04	1.24E-02
Acetonitrile	2.95E+00	2.95E+00	3.37E-04	5.95E-03
Benzene	1.42E-01	1.42E-01	1.62E-05	2.86E-04
Heptane	3.69E-01	3.69E-01	4.21E-05	7.43E-04
Methyl N-Amyl Ketone	3.50E-01	3.50E-01	4.00E-05	7.06E-04
N-Hexane	3.96E-01	3.96E-01	4.52E-05	7.98E-04
Nonane	1.97E-01	1.97E-01	2.25E-05	3.98E-04
Octane	2.09E-01	2.09E-01	2.39E-05	4.22E-04
Toluene	3.12E-02	3.12E-02	3.57E-06	6.30E-05
Ammonia	3.13E+01	3.13E+01	3.58E-03	6.32E-02
Phosphoric Acid, Tributyl Ester	7.33E-01	7.33E-01	8.37E-05	1.48E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	3.95E-02	2.36E-05	2.69E-09	5.50E-13
Plutonium-239 Ci/yr	1.18E-05	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.55E-02	2.36E-05	2.69E-09	3.42E-13

Tank Farm Emissions From Current Operations				
Tank Farm 241-C (13 Single-Shell tanks)		Avg Exit Velocity .01854 (ft/sec)		Area 12.79 (sq. ft)
Passive Ventilation		Avg Exit Temperature 78.08 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Carbon Monoxide	5.77E+00	5.77E+00	6.59E-04	3.09E-02
Nitrogen Oxide	3.95E-01	3.95E-01	4.51E-05	1.87E-03
1,3-Butadiene	2.51E-02	2.51E-02	2.87E-06	1.35E-04
2-Hexanone	4.56E-01	4.56E-01	5.21E-05	2.45E-03
2-Pentanone	7.24E-01	7.24E-01	8.26E-05	3.88E-03
Acetone	8.70E+00	8.70E+00	9.93E-04	4.66E-02
Acetonitrile	4.19E+00	4.19E+00	4.78E-04	2.25E-02
Benzene	1.99E-01	1.99E-01	2.27E-05	1.07E-03
Heptane	5.11E-01	5.11E-01	5.83E-05	2.74E-03
Methyl N-Amyl Ketone	4.93E-01	4.93E-01	5.63E-05	2.64E-03
N-Hexane	5.32E-01	5.32E-01	6.08E-05	2.85E-03
Nonane	2.78E-01	2.78E-01	3.17E-05	1.49E-03
Octane	2.91E-01	2.91E-01	3.32E-05	1.56E-03
Toluene	4.05E-02	4.05E-02	4.62E-06	2.17E-04
Ammonia	4.55E+01	4.55E+01	5.19E-03	2.15E-01
Phosphoric Acid, Tributyl Ester	1.05E+00	1.05E+00	1.19E-04	5.60E-03
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m^3)
Americium-241 Ci/yr	1.07E-04	0.00E+00	0.00E+00	0.00E+00
Cesium-137 Ci/yr	3.95E-03	0.00E+00	0.00E+00	0.00E+00
Plutonium-239 Ci/yr	1.28E-03	0.00E+00	0.00E+00	0.00E+00
Strontium-090 Ci/yr	4.63E-02	2.54E-05	2.90E-09	9.79E-13

Tank Farm Emissions From Current Operations				
296-AN 8 Source Emissions Roll-Up		Avg Exit Velocity 18.2 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 14.92 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	3.63E-01	3.63E-01	4.14E-05	4.13E-05
1, 3-Butadiene	2.62E-02	2.62E-02	2.99E-06	2.99E-06
2-Hexanone	4.77E-01	4.77E-01	5.45E-05	5.44E-05
2-Pentanone	7.58E-01	7.58E-01	8.65E-05	8.63E-05
Acetone	9.07E+00	9.07E+00	1.04E-03	1.03E-03
Acetonitrile	4.38E+00	4.38E+00	5.00E-04	4.99E-04
Benzene	2.08E-01	2.08E-01	2.37E-05	2.37E-05
Heptane	5.33E-01	5.33E-01	6.09E-05	6.08E-05
Methyl N-Amyl Ketone	5.16E-01	5.16E-01	5.89E-05	5.88E-05
N-Hexane	5.56E-01	5.56E-01	6.35E-05	6.34E-05
Nonane	2.90E-01	2.90E-01	3.31E-05	3.31E-05
Octane	3.04E-01	3.04E-01	3.47E-05	3.46E-05
Toluene	4.24E-02	4.24E-02	4.84E-06	4.83E-06
		Ci/yr	Ci/hr	grams/m^3
Strontium-90		1.20E-07	1.37E-11	9.84E-17
Total Alpha		None Detected		

ɲk Farm Emissions From Current Operations				
296-AP 9 Source Emissions Roll-Up		Avg Exit Velocity 35.8 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 13.33 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	4.15E-01	4.15E-01	4.74E-05	2.41E-05
1, 3-Butadiene	2.99E-02	2.99E-02	3.42E-06	1.73E-06
2-Hexanone	5.45E-01	5.45E-01	6.22E-05	3.16E-05
2-Pentanone	8.65E-01	8.65E-01	9.88E-05	5.01E-05
Acetone	1.04E+01	1.04E+01	1.19E-03	6.04E-04
Acetonitrile	5.01E+00	5.01E+00	5.72E-04	2.90E-04
Benzene	2.38E-01	2.38E-01	2.71E-05	1.38E-05
Heptane	6.10E-01	6.10E-01	6.96E-05	3.53E-05
Methyl N-Amyl Ketone	5.90E-01	5.90E-01	6.73E-05	3.42E-05
N-Hexane	6.36E-01	6.36E-01	7.26E-05	3.68E-05
Nonane	3.31E-01	3.31E-01	3.78E-05	1.92E-05
Octane	3.47E-01	3.47E-01	3.97E-05	2.01E-05
Toluene	4.84E-02	4.84E-02	5.53E-06	2.81E-06
		Ci/yr	Ci/hr	grams/m^3
Strontium-90		6.60E-08	7.53E-12	2.75E-17

ık Farm Emissions From Current Operations				
296-AW 7 Source Emissions Roll-Up		Avg Exit Velocity 30 (ft/sec)		Area .54 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 15.75 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	3.11E-01	3.11E-01	3.55E-05	2.15E-05
1, 3-Butadiene	2.25E-02	2.25E-02	2.57E-06	1.56E-06
2-Hexanone	4.09E-01	4.09E-01	4.67E-05	2.83E-05
2-Pentanone	6.50E-01	6.50E-01	7.42E-05	4.49E-05
Acetone	7.79E+00	7.79E+00	8.90E-04	5.39E-04
Acetonitrile	3.76E+00	3.76E+00	4.29E-04	2.60E-04
Benzene	1.79E-01	1.79E-01	2.04E-05	1.24E-05
Heptane	4.57E-01	4.57E-01	5.22E-05	3.16E-05
Methyl N-Amyl Ketone	4.43E-01	4.43E-01	5.05E-05	3.06E-05
N-Hexane	4.77E-01	4.77E-01	5.45E-05	3.30E-05
Nonane	2.49E-01	2.49E-01	2.84E-05	1.72E-05
Octane	2.60E-01	2.60E-01	2.97E-05	1.80E-05
Toluene	3.63E-02	3.63E-02	4.14E-06	2.51E-06
		Ci/yr	Ci/hr	grams/m^3
Cesium-137		2.80E-08	3.20E-12	2.24E-17
Strontium-90		1.60E-07	1.83E-11	7.96E-17
ıl Alpha (Pu-239)		1.50E-08	1.71E-12	1.68E-14

nk Farm Emissions From Current Operations				
296-AYAZ 5 Source Emissions Roll-Up		Avg Exit Velocity 31.91 (ft/sec		Area 1.77 (sq. ft)
Active Ventilation		Avg Exit Temperature 110 (F)		Height 50 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m^3)
Nitrogen Oxide	2.08E-01	2.08E-01	2.37E-05	4.12E-06
1, 3-Butadiene	1.50E-02	1.50E-02	1.71E-06	2.97E-07
2-Hexanone	2.73E-01	2.73E-01	3.12E-05	5.41E-06
2-Pentanone	4.33E-01	4.33E-01	4.94E-05	8.58E-06
Acetone	5.20E+00	5.20E+00	5.93E-04	1.03E-04
Acetonitrile	2.50E+00	2.50E+00	2.86E-04	4.96E-05
Benzene	1.19E-01	1.19E-01	1.36E-05	2.36E-06
Heptane	3.05E-01	3.05E-01	3.48E-05	6.04E-06
Methyl N-Amyl Ketone	2.95E-01	2.95E-01	3.37E-05	5.85E-06
N-Hexane	3.18E-01	3.18E-01	3.64E-05	6.31E-06
Nonane	1.66E-01	1.66E-01	1.90E-05	3.29E-06
Octane	1.74E-01	1.74E-01	1.99E-05	3.45E-06
Toluene	2.42E-02	2.42E-02	2.77E-06	4.80E-07
		Ci/yr	Ci/hr	grams/m^3
Cesium-137		5.30E-05	6.05E-09	1.22E-14
Strontium-90		8.20E-06	9.36E-10	1.17E-15
ne-129		4.60E-05	5.25E-09	5.18E-09
al Alpha (Pu-239)		5.70E-09	6.51E-13	1.83E-15

Tank Farm Emissions From Current Operations								
242A 6 Source Emissions Roll-UP		Avg Exit Velocity 37.8 (ft/sec)		Area 9.62 (sq. ft)				
Active Ventilation		Avg Exit Temperature 117 (F)		Height 22 (ft)				
					Operating release			
	Continuous Ops	Periodic Ops	Periodic Ops	Continuous	Concentration			
Emissions	Potential (tons/yr)	Actual (tons/yr)	Actual (kg/hr)	Actual (kg/hr)	g/m^3	Area (ft^2)	Velocity (ft/s)	
2-Hexanone	3.80E-04	2.88E-05	2.98E-06	3.94E-05	1.06E-06	9.62	37.8	
Acetone	1.06E-01	7.98E-03	8.27E-04	1.10E-02	2.97E-04	9.62	37.8	
Methyl Isobutyl Ketone	7.25E-03	5.44E-04	5.64E-05	7.51E-04	2.03E-05	9.62	37.8	
N-Butyl Alcohol	8.00E-01	6.00E-02	6.22E-03	8.29E-02	2.24E-03	9.62	37.8	
Ammonia	1.00E-01	7.51E-03	7.78E-04	1.04E-02	2.80E-04	9.62	37.8	
	Ci/yr	Ci/yr		Ci/hr	grams/m^3			
Total Alpha (Ci) (Pu)	1.41E-04	2.10E-05		1.61E-08	7.00E-12	9.62	37.8	
Total Beta (Ci) (Sr-90)	8.04E-05	1.20E-05		9.18E-09	1.78E-15	9.62	37.8	

note: total alpha and beta taken from WHC-SD-WM-EV-099 and are from 1987 evaporator operations (11 MM gal run, Capacity=73.6 MM gal/yr so continuous ops =6.7 times periodic)

note: evaporator emissions are the sum of the building ventilation and the vessel vent systems which each have a stack. The shorter stack was chosen as the release point for all emissions.

200 West

Tank Farm Emissions From Current Operations				
		Avg Exit Velocity .36 (ft/s)		Area 1.08 (ft2)
241-S Tank Farm (12 Single-Shell Tanks)		Avg Exit Temperature 94.2 (F)		Height 3 (ft)
Passive Ventilation				
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.14E-02	1.14E-02	1.30E-06	3.28E-05
Nitrogen Oxide	6.86E-04	7.44E-04	8.49E-08	2.14E-06
1,3-Butadiene	4.96E-05	5.37E-05	6.13E-09	1.55E-07
2-Hexanone	9.01E-04	9.76E-04	1.11E-07	2.81E-06
2-Pentanone	1.43E-03	1.55E-03	1.77E-07	4.46E-06
Acetone	1.72E-02	1.86E-02	2.12E-06	5.35E-05
Acetonitrile	8.27E-03	8.96E-03	1.02E-06	2.58E-05
Benzene	3.94E-04	4.26E-04	4.87E-08	1.23E-06
Heptane	1.01E-03	1.09E-03	1.25E-07	3.15E-06
Methyl N-Amyl Ketone	9.76E-04	1.06E-03	1.21E-07	3.04E-06
N-Hexane	1.05E-03	1.14E-03	1.30E-07	3.28E-06
Nonane	5.48E-04	5.94E-04	6.78E-08	1.71E-06
Octane	5.75E-04	6.23E-04	7.11E-08	1.79E-06
Toluene	8.00E-05	8.67E-05	9.90E-09	2.50E-07
Ammonia	7.88E-02	8.54E-02	9.75E-06	2.46E-04
Phosphoric Acid, Tributyl Ester	1.91E-03	2.24E-03	2.55E-07	6.44E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	9.36E-07	0.00E+00	0.00E+00	0.00E+00
Cesium 137	2.28E-04	8.20E-08	9.36E-12	2.73E-15
Plutonium-239	4.68E-07	0.00E+00	0.00E+00	0.00E+00
Strontium-090	6.00E-03	2.41E-06	2.75E-10	4.99E-14

Tank Farm Emissions From Current Operations				
241-SX Tank Farm (2 Single-Shell Tanks)		Avg Exit Velocity .014 (ft/s)		Area 2 (ft2)
Passive Ventilation		Avg Exit Temperature 76.5 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	8.78E-04	8.78E-04	1.00E-07	3.51E-05
Nitrogen Oxide	5.28E-05	5.28E-05	6.03E-09	2.11E-06
1,3-Butadiene	3.82E-06	3.82E-06	4.36E-10	1.53E-07
2-Hexanone	6.94E-05	6.94E-05	7.92E-09	2.78E-06
2-Pentanone	1.10E-04	1.10E-04	1.26E-08	4.41E-06
Acetone	1.32E-03	1.32E-03	1.51E-07	5.30E-05
Acetonitrile	6.38E-04	6.38E-04	7.28E-08	2.55E-05
Benzene	3.02E-05	3.02E-05	3.45E-09	1.21E-06
Heptane	7.78E-05	7.78E-05	8.88E-09	3.11E-06
Methyl N-Amyl Ketone	7.52E-05	7.52E-05	8.58E-09	3.01E-06
N-Hexane	8.10E-05	8.10E-05	9.25E-09	3.24E-06
Nonane	4.22E-05	4.22E-05	4.82E-09	1.69E-06
Octane	4.42E-05	4.42E-05	5.05E-09	1.77E-06
Toluene	6.16E-06	6.16E-06	7.03E-10	2.46E-07
Ammonia	6.08E-03	6.08E-03	6.94E-07	2.43E-04
Phosphoric Acid, Tributyl Ester	1.59E-04	1.59E-04	1.82E-08	6.36E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.74E-05	8.00E-09	9.13E-13	9.33E-14
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	4.60E-04	2.40E-07	2.74E-11	1.55E-10
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tank Farm Emissions From Current Operations				
241-T Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0246 (ft/s)		Area 16 (ft2)
Passive Ventilation		Avg Exit Temperature 65.2 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.21E-02	1.21E-02	1.39E-06	3.45E-05
Nitrogen Oxide	7.30E-04	7.30E-04	8.34E-08	2.08E-06
1,3-Butadiene	5.28E-05	5.28E-05	6.02E-09	1.50E-07
2-Hexanone	9.59E-04	9.59E-04	1.09E-07	2.73E-06
2-Pentanone	1.52E-03	1.52E-03	1.74E-07	4.32E-06
Acetone	1.83E-02	1.83E-02	2.09E-06	5.19E-05
Acetonitrile	8.80E-03	8.80E-03	1.01E-06	2.50E-05
Benzene	4.19E-04	4.19E-04	4.78E-08	1.19E-06
Heptane	1.07E-03	1.07E-03	1.23E-07	3.05E-06
Methyl N-Amyl Ketone	1.04E-03	1.04E-03	1.19E-07	2.95E-06
N-Hexane	1.12E-03	1.12E-03	1.28E-07	3.18E-06
Nonane	5.84E-04	5.84E-04	6.66E-08	1.66E-06
Octane	6.12E-04	6.12E-04	6.98E-08	1.74E-06
Toluene	8.52E-05	8.52E-05	9.72E-09	2.42E-07
Ammonia	8.39E-02	8.39E-02	9.58E-06	2.39E-04
Phosphoric Acid, Tributyl Ester	3.75E-03	2.20E-03	2.51E-07	6.24E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.68E-04	7.60E-08	8.68E-12	6.30E-14
Cesium 137	3.60E-08	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	3.84E-05	2.30E-08	2.63E-12	1.06E-12
Strontium-090	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tank Farm Emissions From Current Operations				
241-TX Tank Farm (18 Single-Shell Tanks)		Avg Exit Velocity .1816 (ft/s)		Area 5.82 (ft2)
Passive Ventilation		Avg Exit Temperature 72.3 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.06E-02	1.06E-02	1.21E-06	1.13E-05
Nitrogen Oxide	6.91E-04	6.91E-04	7.89E-08	7.32E-07
1,3-Butadiene	4.58E-05	4.58E-05	5.23E-09	4.85E-08
2-Hexanone	8.32E-04	8.32E-04	9.50E-08	8.82E-07
2-Pentanone	1.32E-03	1.32E-03	1.51E-07	1.40E-06
Acetone	1.59E-02	1.59E-02	1.81E-06	1.68E-05
Acetonitrile	7.64E-03	7.64E-03	8.73E-07	8.10E-06
Benzene	3.63E-04	3.63E-04	4.15E-08	3.85E-07
Heptane	9.32E-04	9.32E-04	1.06E-07	9.88E-07
Methyl N-Amyl Ketone	9.01E-04	9.01E-04	1.03E-07	9.55E-07
N-Hexane	9.71E-04	9.71E-04	1.11E-07	1.03E-06
Nonane	5.06E-04	5.06E-04	5.78E-08	5.37E-07
Octane	5.31E-04	5.31E-04	6.06E-08	5.62E-07
Carbon Tetrachloride	3.91E-06	3.91E-06	4.46E-10	1.35E-07
Ethyl Butyl Ketone	1.31E-05	1.31E-05	1.50E-09	4.53E-07
Methyl Chloride	5.78E-07	5.78E-07	6.60E-11	2.00E-08
Tetrahydrofuran	1.01E-06	1.01E-06	1.15E-10	3.49E-08
Toluene	3.91E-06	3.91E-06	4.46E-10	4.14E-09
Ammonia	1.31E-05	1.31E-05	1.50E-09	1.39E-08
Phosphoric Acid, Tributyl Ester	5.78E-07	5.78E-07	6.60E-11	6.13E-10
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Plutonium-239	7.08E-05	7.08E-05	8.08E-09	1.21E-09
Strontium-090	6.98E-02	6.98E-02	7.97E-06	5.32E-10

Tank Farm Emissions From Current Operations				
241-TY Tank Farm (6 Single-Shell Tanks)		Avg Exit Velocity .0253 (ft/s)		Area 5.79 (ft2)
Passive Ventilation		Avg Exit Temperature 66.0 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	4.68E-03	4.68E-03	5.34E-07	3.57E-05
Nitrogen Oxide	2.82E-04	2.82E-04	3.21E-08	2.15E-06
1,3-Butadiene	2.03E-05	2.03E-05	2.32E-09	1.55E-07
2-Hexanone	3.70E-04	3.70E-04	4.22E-08	2.82E-06
2-Pentanone	5.86E-04	5.86E-04	6.69E-08	4.48E-06
Acetone	7.04E-03	7.04E-03	8.04E-07	5.38E-05
Acetonitrile	3.39E-03	3.39E-03	3.87E-07	2.59E-05
Benzene	1.61E-04	1.61E-04	1.84E-08	1.23E-06
Heptane	4.14E-04	4.14E-04	4.72E-08	3.16E-06
Methyl N-Amyl Ketone	4.00E-04	4.00E-04	4.57E-08	3.06E-06
N-Hexane	4.31E-04	4.31E-04	4.92E-08	3.29E-06
Nonane	2.25E-04	2.25E-04	2.57E-08	1.72E-06
Octane	2.36E-04	2.36E-04	2.69E-08	1.80E-06
Toluene	3.28E-05	3.28E-05	3.75E-09	2.51E-07
Ammonia	3.24E-02	3.24E-02	3.69E-06	2.47E-04
Phosphoric Acid, Tributyl Ester	8.47E-04	8.47E-04	9.67E-08	6.47E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	4.00E-04	4.00E-04	4.57E-08	8.91E-10
Cesium 137	4.31E-04	4.31E-04	4.92E-08	3.81E-11
Plutonium-239	2.25E-04	2.25E-04	2.57E-08	2.78E-08
Strontium-090	2.36E-04	2.36E-04	2.69E-08	1.30E-11

Tank Farm Emissions From Current Operations				
241-U Tank Farm (16 Single-Shell Tanks)		Avg Exit Velocity .0236 (ft/s)		Area 16.0 (ft2)
Passive Ventilation		Avg Exit Temperature 75.6 (F)		Height 3 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	1.16E-02	1.16E-02	1.33E-06	3.45E-05
Nitrogen Oxide	7.00E-04	7.00E-04	7.99E-08	2.08E-06
1,3-Butadiene	5.05E-05	5.05E-05	5.77E-09	1.50E-07
2-Hexanone	9.19E-04	9.19E-04	1.05E-07	2.73E-06
2-Pentanone	1.46E-03	1.46E-03	1.66E-07	4.33E-06
Acetone	1.75E-02	1.75E-02	2.00E-06	5.20E-05
Acetonitrile	8.43E-03	8.43E-03	9.63E-07	2.51E-05
Benzene	1.08E-03	1.08E-03	1.23E-07	3.21E-06
Heptane	1.03E-03	1.03E-03	1.17E-07	3.05E-06
Methyl N-Amyl Ketone	9.95E-04	9.95E-04	1.14E-07	2.96E-06
N-Hexane	1.07E-03	1.07E-03	1.22E-07	3.18E-06
Nonane	5.59E-04	5.59E-04	6.38E-08	1.66E-06
Octane	5.86E-04	5.86E-04	6.69E-08	1.74E-06
Toluene	7.49E-05	7.49E-05	8.55E-09	2.23E-07
Ammonia	8.04E-02	8.04E-02	9.18E-06	2.39E-04
Phosphoric Acid, Tributyl Ester	2.10E-03	2.10E-03	2.40E-07	6.25E-06
	(Ci/yr)	(Ci/yr)	(Ci/hr)	(g/m3)
Americium-241	1.08E-03	1.08E-03	1.23E-07	9.36E-10
Cesium 137	1.03E-03	1.03E-03	1.17E-07	3.54E-11
Plutonium-239	9.95E-04	9.95E-04	1.14E-07	4.77E-08
Strontium-090	1.07E-03	1.07E-03	1.22E-07	2.29E-11

Tank Farm Emissions From Current Operations				
296-SX 14 Source Emissions Roll-Up		Avg Exit Velocity 10.6 (ft/s)		Area 9.62 (ft2)
Passive Ventilation		Avg Exit Temperature 165 (F)		Height 15 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	2.24E-01	2.24E-01	2.56E-05	2.46E-06
Nitrogen Oxide	7.43E-04	7.43E-04	8.48E-08	8.16E-09
1,3-Butadiene	5.36E-05	5.36E-05	6.12E-09	5.89E-10
2-Hexanone	9.77E-04	9.77E-04	1.12E-07	1.07E-08
2-Pentanone	1.55E-03	1.55E-03	1.77E-07	1.70E-08
Acetone	1.86E-02	1.86E-02	2.12E-06	2.04E-07
Acetonitrile	8.96E-03	8.96E-03	1.02E-06	9.84E-08
Benzene	4.26E-04	4.26E-04	4.86E-08	4.68E-09
Heptane	1.09E-03	1.09E-03	1.24E-07	1.20E-08
Methyl N-Amyl Ketone	1.06E-03	1.06E-03	1.21E-07	1.16E-08
N-Hexane	1.14E-03	1.14E-03	1.30E-07	1.25E-08
Nonane	5.94E-04	5.94E-04	6.78E-08	6.52E-09
Octane	6.23E-04	6.23E-04	7.11E-08	6.84E-09
Toluene	8.67E-05	8.67E-05	9.90E-09	9.52E-10
Ammonia	4.17E+00	4.17E+00	4.76E-04	4.58E-05
Phosphoric Acid, Tributyl Ester	2.24E-03	2.24E-03	2.56E-07	2.46E-08
Total Alpha		None Detected		
Total Beta		9.10E-08	1.04E-11	

Tank Farm Emissions From Current Operations				
296-SY 4 Source Emissions Roll-Up		Avg Exit Velocity 33.3 (ft/s)		Area .35 (ft2)
Passive Ventilation		Avg Exit Temperature 110 (F)		Height 11 (ft)
Emissions	Potential (Kg/yr)	Actual (Kg/yr)	Actual (Kg/hr)	Concentration (g/m3)
Carbon Monoxide	5.16E-02	5.16E-02	5.89E-06	4.96E-06
Nitrogen Oxide	1.72E-04	1.72E-04	1.96E-08	1.65E-08
1,3-Butadiene	1.24E-05	1.24E-05	1.42E-09	1.19E-09
2-Hexanone	2.25E-04	2.25E-04	2.57E-08	2.16E-08
2-Pentanone	3.58E-04	3.58E-04	4.09E-08	3.44E-08
Acetone	4.30E-03	4.30E-03	4.91E-07	4.13E-07
Acetonitrile	2.07E-03	2.07E-03	2.36E-07	1.99E-07
Benzene	9.83E-05	9.83E-05	1.12E-08	9.44E-09
Heptane	2.52E-04	2.52E-04	2.88E-08	2.42E-08
Methyl N-Amyl Ketone	2.44E-04	2.44E-04	2.79E-08	2.34E-08
N-Hexane	2.63E-04	2.63E-04	3.00E-08	2.53E-08
Nonane	1.37E-04	1.37E-04	1.56E-08	1.32E-08
Octane	1.44E-04	1.44E-04	1.64E-08	1.38E-08
Toluene	2.00E-05	2.00E-05	2.28E-09	1.92E-09
Ammonia	9.63E-01	9.63E-01	1.10E-04	9.25E-05
Phosphoric Acid, Tributyl Ester	5.15E-04	5.16E-04	5.89E-08	4.96E-08
Total Alpha		8.1E-09	9.25E-13	
Total Beta		7.00E-07	7.99E-11	

Request Number 89

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Arrie Bachrach

Date: 9/20/95

Phone Number:

Fax Number:

Request Information: Identification, location and parameters (length, width, acerage disturbed) for new roads associated with all alternatives (including borrow sites). Provoked by Ecology comment. Need for cultural and biological resources and land use disturbance.

Need Date: ASAP

Response: see attached

Data Source/Accuracy:

Prepared By: Colin Henderson

Date Sent/Faxed: Rev 1 10/17/95

Concurrence:
Marc Nelson - Project Manager

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ENGINEERING INFORMATION REQUEST 89

Borrow Sites

1. Pit 30

Pit 30 is an existing borrow pit and has existing access roads established. No new roads would be associated with borrow site activities associated with the TWRS EIS alternatives.

2. McGee Ranch

The McGee Ranch borrow site is not a currently established borrow site. The area maps show the proposed boundry touching SR 24 in the South Eastern corner of the proposed Area A. The estimate used to date for the disturbed area at the borrow sites is based on volume of material required divided by a constant removal depth of 3 meters. I propose using a length of 750 meters by a width of 20 meters to establish an access road into the McGee Ranch area. This would be an area 15,000 square meters or 1.5 hectares.

Review of WHC-SD-EN-SE-002 Rev. 0 identifies that characterization work at McGee Ranch Site (Area A in the area maps) contains approximately 4.5 million cubic yards of fine-textured soils. This report also notes (pg. 8) that a number of closure plans and Part B permit applications have been submitted to WDOE containing commitments for McGee ranch soils as a component of a surface barrier.

3. Vernita Quarry

The Vernita quarry is an existing quarry located near SR 24. This quarry has been used in the past, approximately 10,700 cubic meters were removed in March of 1994 (Ref. BHI-00005 Rev. 00 Candidate Basalt Quarry Sites). Assume that the existing access roads into the quarry would be utilized for borrow site activities associated with TWRS. Roads may require some improvements to support the level of activity required for barrier construction.

Tanks

1. No Action- No new roads would be constructed

2. Long-Term Management- No new roads would be constructed. Access roads to the replacement tank farms would be constructed and are included in the disturbed area estimates.

3. In Situ Fill and Cap- No new roads outside of the area identified as temporarily disturbed would be constructed.

4. In Situ Vitrification- No new roads outside of the area identified as temporarily disturbed would be constructed.

5. Ex Situ Intermediate Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

6. Ex Situ No Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

7. Ex Situ Extensive Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

8. Ex Situ/In Situ Combination- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

9. Staged Implementation-TBD

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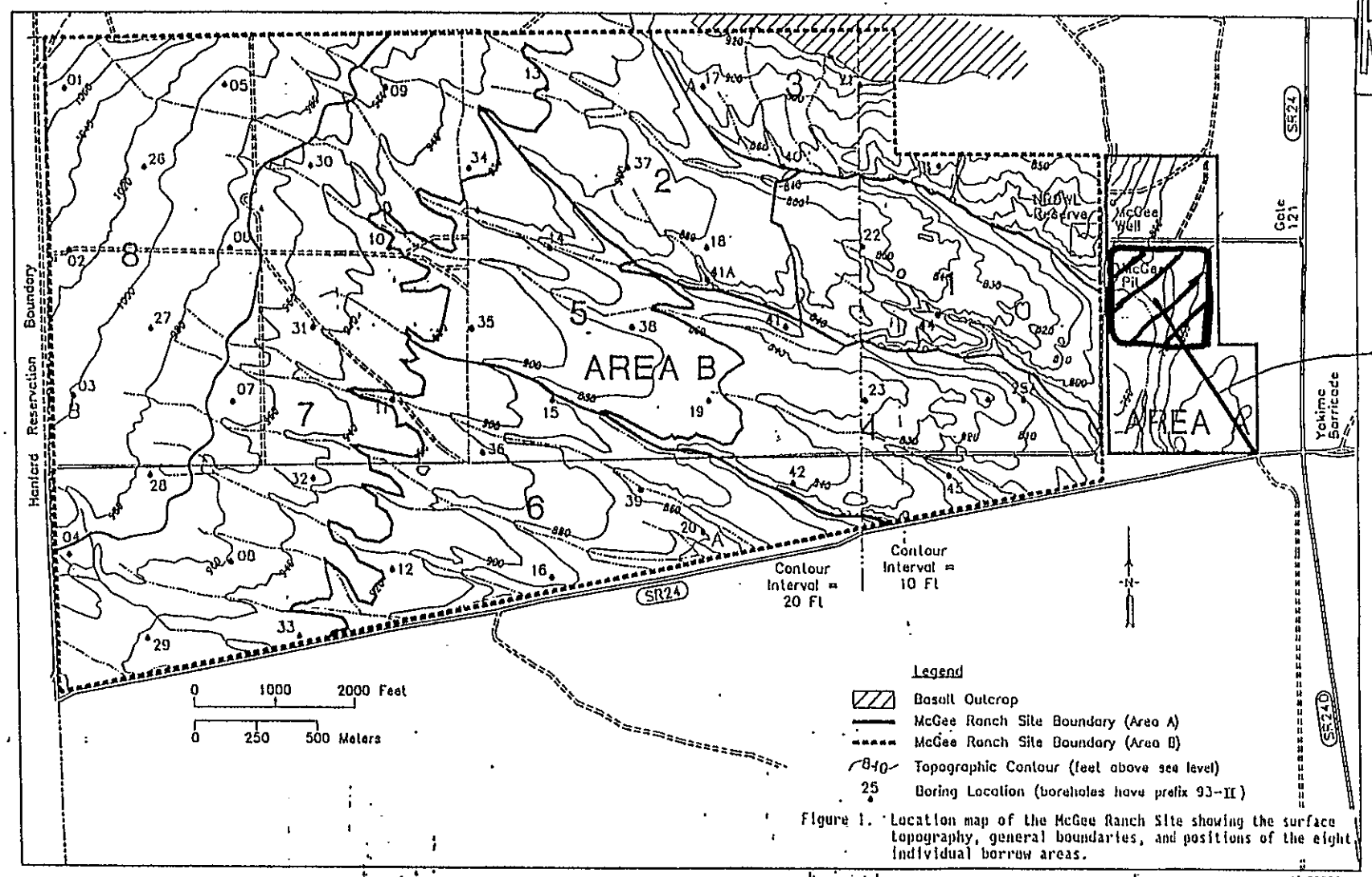

Figure 1. Location map of the McGee Ranch Site showing the surface topography, general boundaries, and positions of the eight individual borrow areas.

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Rev 1 10/17

ENGINEERING INFORMATION REQUEST 89

Borrow Sites

1. Pit 30

Pit 30 is an existing borrow pit and has existing access roads established. No new roads would be associated with borrow site activities associated with the TWRS EIS alternatives.

2. McGee Ranch

The McGee Ranch borrow site is not a currently established borrow site. The area maps show the proposed boundry touching SR 24 in the South Eastern corner of the proposed Area A. The estimate used to date for the disturbed area at the borrow sites is based on volume of material required divided by a constant removal depth of 3 meters. I propose using a length of 1000 ~~750~~ meters by a width of 20 meters to establish ~~an~~ A new access road into the McGee Ranch area. This would be an area 20,000 ~~15,000~~ square meters or 2.0 ~~1.5~~ hectares.

THE EXISTING 500m long Single lane Access Road would require improvement and would require an additional 10 m of width to add an additional lane.

Review of WHC-SD-EN-SE-002 Rev. 0 identifies that characterization work at McGee Ranch Site (Area A in the area maps) contains approximately 4.5 million cubic yards of fine-textured soils. This report also notes (pg. 8) that a number of closure plans and Part B permit applications have been submitted to WDOE containing commitments for McGee ranch soils as a component of a surface barrier.

3. Vernita Quarry

The Vernita quarry is an existing quarry located near SR 24. This quarry has been used in the past, approximately 10,700 cubic meters were removed in March of 1994 (Ref. BHI-00005 Rev. 00 Candidate Basalt Quarry Sites). Assume that the existing access roads into the quarry would be utilized for borrow site activities associated with TWRS. Roads may require some improvements to support the level of activity required for barrier construction.

Tanks

1. No Action- No new roads would be constructed

2. Long-Term Management- No new roads would be constructed. Access roads to the replacement tank farms would be constructed and are included in the disturbed area estimates.

3. In Situ Fill and Cap- No new roads outside of the area identified as temporarily disturbed would be constructed.

4. In Situ Vitrification- No new roads outside of the area identified as temporarily disturbed would be constructed.

5. Ex Situ Intermediate Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

6. Ex Situ No Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

7. Ex Situ Extensive Separations- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

8. Ex Situ/In Situ Combination- Access roads to each of the processing and support facilities would be constructed. There would be no new road construction outside of the existing site layout which is included in the disturbed area estimates.

9. Staged Implementation-TBD

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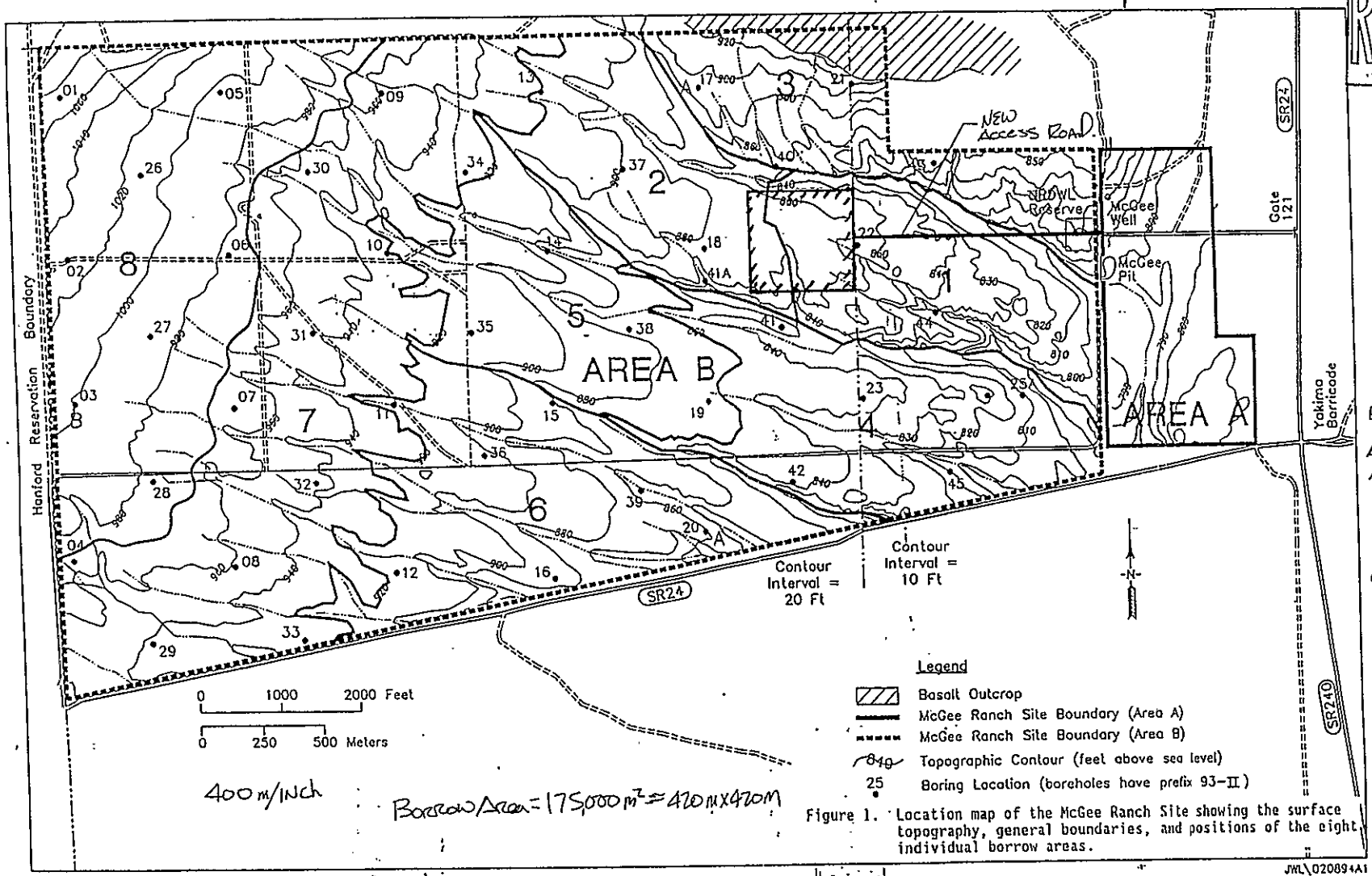

Figure 1. Location map of the McGee Ranch Site showing the surface topography, general boundaries, and positions of the eight individual borrow areas.

NEW ROAD = 1000M
EXISTING ROAD = 800M (Single Lane)
ACCESS ROAD DISTURBED AREA =
1000M(20M) + 800M(10M)
= 2.8 ha.
OR 28,000 m²

Request Number 090

Jacobs Engineering Group
Engineering Information Request - TWRS EIS

Requested By: Mike Harker

Date: 10/4/95

Phone Number:

Fax Number:

Request Information: Need: 1) How many construction person-year.

2) Miles traveled onsite and miles traveled offsite in transporting materials for construction.

Need Date: 10/09/95

Response: 144 person year Rad Waker, 19 person-year non rod 2. See Attached.

Data Source/Accuracy:

Prepared By: Colin Henderson CH

Date Sent/Faxed: 10/9/95

Concurrence: Marc C Nelson
Marc Nelson - Deputy Project Manager

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TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / W314 transportation data

ORIGINATOR Colin Henderson DATE 10/9/95

REVISION NO. 0

OBJECTIVE Estimate the Construction staffing and number of trips associated with the W-314 waste transfer system upgrades project.

METHODOLOGY Use data provided by WHC

ASSUMPTIONS Noted as applicable

(Continue on another sheet if necessary)

SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

W314 Transportation:

- For construction matl. assume same basis as No Separations i.e., 30,000 lb average load on a 45,000 lb trailer.

- Borrow materials load volume 6.1 m^3.

- Steel Req. = 422,000 kg Steel (2.205 lb/kg) = 930,500 lb.

Pipe = 22,828 m, 50% 3" 50% 6"

SCH40 3" = 7.58 lb/ft, sch 10 6" = 9.3 lb/ft.
= 25 lb/m sch 10 6" = 30.5 lb/m.

Pipe = 11,414 m (25 lb/m) + 11,414 (30.5 lb/m) = 633,000 lb.
Conduit = 7,053 m (3.28 ft/m) (.7 lb/ft) = 16,200 lb.

Total Steel = 16,200 +633,000 + 930,500 lb = 1.58E6 lb.~ 1.6E6 lb.

$$\# \text{ Trips} = \frac{1.6E6 \text{ lb}}{30{,}000 \text{ lb/trip}} = 53 \text{ trips (Portland/Seattle)}$$

Assume Misc. = 100% of # trips Req. for Hauling Steel/Pipe
Misc. is from Kennewick/Steel Pipe is from Portland/Seattle

Borrow = 6,345 m^3 = 1,040 trips @ 6.1 m^3/trip.
Concrete = 4,000 m^3 = 30% Cement, 70% Sand Gravel.

Cement = 1,200 m^3 @ 12 m^3/trip = 100 trips Tri-Cities
Sand/Aggregate = 2,100 m^3 @ 6.1 m^3/trip = 3444 trips onsite.

TOTAL TRIPS		
53	Trips	(Seattle/Portland)
53	Trips	(Tri-Cities) Misc.
100	Trips	(Tri-Cities) Cement
1,384	Trips	(Onsite) Pit 30 to Tank Farms.

Portland Seattle Round Trip = 800 km.
Onsite Pit 30 Round Trip = 10 km.
Tri-Cities Round Trip = 140 km.

Total Distance= 77,660 km.
Travel Onsite = 13,840 km
Travel Offsite = 63,820 km.