This document was too large to scan as a whole document; therefore, it is required break into smaller sections.

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SECTION 2 OF

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation table SHEET NO. 160 OF 383

BY RDW CHKD. JOB NO. 01K47101

8.11.0.3. operation Concrete Calcine HLW shield cask 9.8E+05
= (980000)(1.31)
= 1283800
@ 8 yds^3 = 160475 trips

4. Closure Concrete tank stab 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds^3 = 867.88

5. Closure Concrete anc Equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds^3 = 2243.38

H. Ex Situ, Exhumation Separations, exhumation Retrieval, vitrification
1. Construction Concrete WRAT 5.9E+04
= (59000)(1.31)
= 77290
@ 8 yds^3 = 9661.25 trips

2. Construction concrete vitrifi 4.4E+05
= (440000)(1.31)
= 576400
@ 8 yds^3 = 72050

3. operation Concrete vitrifi LLW vaults 3.81E+05
= (381000)(1.31)
= 499110
@ 8 yds^3 = 62388.75

4. operation concrete vitrifi HLW shield Cask 8.11E+03
= (8110)(1.31)
= 10624.1
@ 8 yds^3 = 1328.013

8. N.H.5. Closure concrete tank Stab 5.3E+03
=(5300)(1.31)
= 6943
@ 8 yds^3 = 867.88 trips

6. Closure Concrete anc Equip 1.37E+04
=(13700)(1.31)
= 17947
@ 8 yds^3 = 2243.38 trips

I. Ex Situ, Intermediate Separations, Extension Retrieval, vitrification
1. Construction Concrete WRAT 5-9E+04
=(59000)(1.31)
= 77290
@ 8 yds^3 = 9661.25 trips

2. Construction Concrete vitrifi 4.82E+05
=(482000)(1.31)
= 631420
@ 8 yds^3 = 78927.5 trips

3. operation Concrete vitrifi LLW vaults 3.0E+05
=(300000)(1.31)
= 393000
@ 8 yds^3 = 49125 trips

4. operation concrete vitrifi HLW Shield Casks 1.75E+05
=(175000)(1.31)
= 229250
@ 8 yds^3 = 28656.25 trips

5. Closure Concrete tank Stab 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds^3 = 867.88 trips

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BY RDW CHKD. JOB NO. 01K4701

8. N. S. 6. Closure Concrete and Equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds³ = 2243.38 trips

J. Ex Situ/In Situ Combination, Intermediate Stabilization, 70 of 177 Tanks

1. Construction Concrete w R+T 2.95E+04
= (29500)(1.31)
= 38645
@ 8 yds³ = 4830.63 trips

2. Construction Concrete vitrifi 2.41E+05
= (241000)(1.31)
= 315710
@ 8 yds³ = 39463.75 trips

3. Operation Concrete vitrifi LLW vaults 1.29E+05
= (129000)(1.31)
= 168990
@ 8 yds³ = 21123.75 trips

4. Operation Concrete vitrifi HLW Shield Casks 8.5E+04
= (85000)(1.31)
= 111350
@ 8 yds³ = 13918.75 trips

5. Closure Concrete Tank stab 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds³ = 867.88 trips

6. Closure Concrete and Equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds³ = 2243.38 trips

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BY RDW CHKD. _____ JOB NO. 01K47101

8. N.K. Ex Situ/In Situ Combination Low, Intermediate separations, 25 of/177 tanks.

1. Construction concrete WR&T 2.07E+04
= (20700)(1.31)
= 27117
@ 8 yds^3 = 3389.63 trips

2. Construction Concrete vitrifi 1.69E+05
= (169000)(1.31)
= 221390
@ 8 yds^3 = 27673.75 trips

3. operation Concrete vitrifi L&W vaults 1.03E+05
= (103000)(1.31)
= 134930
@ 8 yds^3 = 16866.25 trips

4. operation Concrete vitrifi H&W shield Casks 5.0E+04
= (50000)(1.31)
= 65500
@ 8 yds^3 = 8187.5 trips

5. Closure Concrete Tank slab 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds^3 = 867.88 trips

6. Closure Concrete one Equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds^3 = 2243.38 trips

2. Phased Implementation - phase I.

1. Construction concrete vitrifi 2.4E+04
= (24000)(1.31)
= 31440
@ 8 yds^3 = 3930 trips

8. M. I. 2. operation Concrete vitrifi HLW Shield Cells 6.07E+03
= (6070)(1.31)
= 7951.7
@ 8 yds^3 = 993.96 trips

M. Phased Implementation - phase II
1. Construction Concrete WRAP 5.09E+04
= (50900)(1.31)
= 77290
@ 8 yds^3 = 9661.25 trips

2. Construction Concrete vitrifi 6.56E+05
= (656000)
= 859360
@ 8 yds^3 = 107420 trips

3. operation Concrete vitrifi LLW vaults 2.41E+05
= (241000)(1.31)
= 315710
@ 8 yds^3 = 39463.75 trips

4. operation Concrete vitrifi HLW Shield Cells 1.66E+05
= (166000)(1.31)
= 217460
@ 8 yds^3 = 27182.5 trips

5. Closure Concrete tank stab. 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds^3 = 867.88 trips

6. Closure Concrete onc equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds^3 = 2243.38 trips

9. Develop new land use numbers for spread sheet and for Table B. 11. 0. 3.

A. Ex Situ Intermediate Separations

1. Retrieval annexe no change. 3 ha
2. Vit plant - change in HLW storage pads and change in number of vaults.

Change in storage pad area for HLW = (8350 - 3030)
= (5320)(6.6) = 35112 m^2
= 3.5 hectares decrease

Change in vault area = (83 - 66) (555) = 9435
(17) (555) = 1 hectare decrease

Vit Plant 88 - 3.5 = 84.5 ha.

temporary commitment = 84.5 + 3 = 87.5 ha.

Long term permanent commitment = 37 - 1 = 36 ha.
Closure = 12 - 1 = 11 ha.

Permanent total = 47 = 36 + 11 = 47 ha

temporary total = 87.5 + 24 = 111.5 ha

B. Ex Situ No Separations Calcination

Change occurs in storage pad requirement.
Previously 27097 HMPCs & Shield casks.
now 10,300 HMPCs and Shield Casks.
Decrease in area = 29097 - 10,300 = 16 797
= (16 797)(6.6) = 110, 860 m^2
= 11 hectare decrease
temporary commitment = 81 - 11 = 70 ha
total = 20 + 70 = 90 ha.

C. Ex Situ No Separations Vitrification calculation - Supports 41 and 42 of this calculation.

9.D. Ex Situ Extensive Separations alternative.
Changes occur in vault construction and in HLW storage pad size.
Temporary commitment for HLW pad.
decrease = (old − new cells) (6.6)
= (393 − 143) = (250)(6.6) = 1604 m²
Change is negligible.

vaults = (82 − 66) = (16) (555) = 8,880 m² ≃ 1 hectare

Construction/operation permanent commitment = 34 − 1 = 33 ha

Closure = tank farm + vaults = 8 ha + (?)
= 8 + (6.6)(555) = 8 + 3.7 ha. ≃ 12 ha
= no change.

E. Ex Situ / In Situ Combination
vault change (42 − 40) = 2
number of shield cells (4175 − 1500)
= 2675

area for vault change = (2)(555) = 1110 m²
negligible change in this item.

area for storage pad change = (2675)(6.6) = 17655 m²
= 1.8 ha decrease
≃ 2 ha
Temporary commitment of land = 87 − 2 = 85 ha.
total = 85 + 22 = 107 ha.

F. Phased Implementation - phase I no change.

G. Ex Situ / In Situ Combination Low

Permanent commitment = (31) (10,000) − (42)(555)
= (286690)(0.7) = 200683
= 200683 + (24)(555)
= 214003 ≃ 21.5 ha.

9. b. vaults = (24)(555) = 13320 = 1.3 ha.
Closure = 8 + 1.3 = 9.3 ha

total = 9.3 + 21.5 = 30.8 ha.

temporary change commitment (87)(10000) − (6.6)(9175)
= 870000 − 27555
= 842445 (0.7)
= 589711.5

new area = 589711.5 + 9200 = 599611.5 m²
= 60 ha.

total = 60 + 22 = 82 ha

9. Phased Implementation - Phase II.

permanent commitment of land cost/operation

Intermediate separations = 36 ha

= 360,000 m² − vault area (36630) and − annexes
= (360,000) − (36630) − (30,000)
= 293370 − fraction for HLW = (0.056565) = 16595
= 276775 (0.7) 16595 (0.7)
= 193742.5 (2) 11617
= 387485
= (387485) + (11617) + (36630) + (30,000)
Σ = 465732
= 47 ha.

Closure commitment assumed same.

total = 59 hectares

temporary land commitment Construction and operations

Intermediate separations = 87.5 annexes = 3.0
87.5 − 3 = 84.5

9. H.

84.5 (0.06) = 5
79.5 (0.7) 5
55.65 (2) 3.5
111.3
Σ 111.3 + 3.5 + 3 = 118

Closure remained the same @ 24 ha
Σ = 118 + 24 = 142

10. Calculate the Borrow Site silt (m^3) for the Ex Situ alternatives

A. Ex Situ no Separations with
Barrier silt = 8 hectares 2 meters thick
= 3.77E+05 m^3

(8 ha) = 80,000 meters^2 1 meter depth
= 80,000 m^3 @ 1.46 gm/cm^3 = mg/m^3
= 116800 mg (0.15)
= 17520 mg pea gravel @ 2 mg/m^3
= 8760 m^3 pea gravel.

Number of trips = (~~80,000~~ 3.77E+05)(1.31) + (8760)(1.3)
= ~~116275.6~~ 493870
@16 yds^3 = ~~7267.23~~ 30866.88 trips. = 6550 + 717.23
30866.88

B. Ex Situ No Separations Calcination

Barrier Silt = 3.77E+05 m^3 pea gravel = 8760 m^3
@16 yds^3 = ~~6550~~ 30866.88 trips + 717.23 trips.

C. Ex Situ Extension Separations
Barrier silt = (12)(10,000) = 120,000 @ 1m thick
= 120,000 m^3
+1 more meter = 240,000 m^3 @1.46 gm = 175200 @15% = 26280 mg
= (240000)(1.31) @ 2 gm/cm = 13140 m^3 pea gravel.
= 314400 @1.31 = 17213.4
@16 yds^3 = 19650 trips @ 16 yds^3 = 1076 trips

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10. C. apply factor to Cubic meter numbers 377000 $m^3 \div 160000 m^3$

Factor = 2.36

= (240 000 m^3)(2.36)(1.31)

= (566400)(1.31)

= 741984 = 5.66E+05 m^3

@16 yds^3 = 46374 Trips. 1.3 m^3 per gravel.

D. Ex Situ Intermediate separations

Barrier Silt = 11 hectares = 110 000 m^2

= 220,000 meters^3

= (220 000)(2.36)(1.31)

= (519200)(1.31)

= 680152

@16 yds^3 = 42510 Trips

110,000

~~(30 000 m^3)(1.46)(6.5)~~

~~= 43800~~

~~= 6570 ÷ 2~~

~~= 3285 m^3~~

~~@16 yds^3 = 205~~

= 160600 @15%

= 24090 ÷ 2

= 12045

@16 yds^3 = 753 Trips

E. Ex Situ In Situ Combination

Barrier Silt = 10 hectares = 100 000 m^2

= (200 000 m^3)(2.36)(1.31)

= 472000 (1.31)

= 618320

@16 yds^3 = 38645 Trips

@1.46

146000 @15%

21900 ÷ 2

10950

@16 yds^3 = 685 Trips

F. Ex Situ In Situ Combination Low

Barrier Silt = 9 hectares = 90000 m^2

= (180000)(2.36)(1.31)

= 424800 (1.31)

= 556488

@16 yds^3 = 34781 Trips

(90 000)(1.46) @15%

131400

19700 ÷ 2

9855

@16 yds^3 = 616 trips

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10. G. Phased Implementation Phase I
not applicable

H. phased Implementation phase II

Barrier Silt = 12 hectares = 120,000 m^2
= 240,000 (2.36)(1.31
= 566400 (1.31
= 741984
16 yds^3 = 46374 trips = 8.3 m^3 pea gravel
= 1076 trips

10 Determine the quantity of basalt in (m^3) and number of trips.

A. Ex Situ No Separations vit
Basalt factor = (80 000)(1.5) = ~~120 m^3~~ 120,000 m^3
= 638000 m^3/120000 = 5.32

= 638000 m^3 (1.31)
= 482080
@16 yds^3 = ~~30130~~ trips
52236.25

B. Ex Situ no Separations Calcination

Barrier Basalt = 6.38E+05 m^3
= (638000)(1.31
= 482080
@16 yds^3 = 52236.25 trips

C. Ex Situ extensive separations
Basalt = 12 hectares
= (120,000)(1.5)(5.32)(1.31)
= 180000
= 957600 m^3
= 1254456
@16 yds^3 = 78404 trips

10. D. Ex Situ Intermediate separations

Basalt = 11 hectares = 110 000 m^2
= (110 000)(1.5)(5.32)(1.31)
= 165 000
= 877800 m^3
= 1149918
@16 yds^3 = 71870 trips

E. Ex Situ Insitu Combination

Basalt = 10 hectares = 100 000 m^2
= (100000)(1.5)(5.32)(1.31)
= 150000
= 784500 m^3
= 1027695
@16 yds^3 = 64231 trips

F. Ex Situ Insitu Combination Low

Basalt = 9 hectares = 90,000
= (90 000)(1.5)(5.32)(1.31
= 135000
= 718200 m^3
= 940842
@16 yds^3 = 58803 trips

G. phased Implementation phase II

Basalt = 12 hectares = 120,000 m^2
= (120,000)(1.5)(5.32)(1.31)
= 180 000
= 957600 m^3
= 1254456
@16 yds^3 = ~~78074~~ 78404

11. determine the amount of barrier asphalt required in (m^3)

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11. A. Ex Situ no Separations Intrinsic

asphalt = 8 hectares = 80 000 m^2

= (80000)(0.25)(3.13)(1.31)

= 20000 factor = 62500 ÷ 20000

= 6.2600 m^3 = 3.13

= 82006

@ 16 yds^3 = 5125 trips

B. Ex Situ no Separations calcination

= (80000)(0.25)(3.13)(1.31)

= 20000

= 62600 m^3

= 82006

@ 16 yds^3 = 5125 tipp

C. Ex Situ Extension Separations

asphalt = 12 hectares = 120,000

= (120 000)(0.25)(3.13)(1.31)

= 30000

= 93900 m^3

= 123009

@ 16 yds^3 = 7688 trips

D. Ex Situ Intermediate separations

asphalt = 11 hectares = 110 000 m^2

= (110 000)(0.25)(3.13)(1.31)

= 27500

= 86075 m^3

= 112758

@ 16 yds^3 = 7048 trips.

E. Ex Situ In Situ Combination

asphalt = 10 hectares = 100 000 m^2

= (100000)(0.25)(3.13)(1.31)

= 25000

= 78250 m^3

= 102508

@ 16 yds^3 = 6407

FORM 01.005.1 (4/81)

11. F. Ex Situ In Situ Combustion for
asphalt = 9 hectares = 90,000 m^2
= (90,000)(0.25)(3.13)(1.31)
= 22500
= 70425 m^3
= 92257
@ 16 yds^3 = 5766 Trips

G. Phased Implementation - Phase II.
asphalt = 12 hectares = 120,000 m^2
= 120,000 (0.25)(3.13)(1.31)
= 30000
= 93900 m^3
= 123009
@ 16 yds^3 = 7688 Trips

12 Determine the sand and gravel used for construction and operation.

A. Ex situ no separations vitrification.

1. Sand and gravel for Construction (m^3)

	Sand	Gravel	
WR&T	4.0E+04	2.46E+04	
vitrifi	1.46E+05	8.59E+04	
Σ	1.86E+05	1.11E+05	= 2.97E+05

2. Sand and gravel for operation (m^3)

HLW shield	1.67E+06	9.82E+05	
Σ	1.67E+06	9.82E+05	= 2.65E+06

B. Ex situ no separations calcination (m^3)

1. Construction Sand and gravel

	Sand	Gravel	
~~WR&T~~			
WR&T	3.98E+04	2.34E+04	
vitrifi	1.4E+05	8.2E+04	
Σ	1.8E+05	1.05E+05	= 2.85E+05

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12.B.2. operation Sand and gravel

	sand	gravel	
HLW Shield Casks	6.61E+05	3.88E+05	
Σ	6.61E+05	3.88E+05	= 1.05E+06

C. Ex Situ Extension separation

1. Construction Sand and gravel (m^3)

	sand	gravel	
WR&T	3.98E+04	2.34E+04	
vitrifi	2.97E+05	1.742E+05	
Σ	3.37E+05	1.98E+05	= 5.35E+05

2. operation Sand and gravel (m^3)

LLW vaults	2.57E+05	1.51E+05	
HLW Shields	5.47E+03	3.21E+03	
Σ	2.63E+05	1.54E+05	= 4.17E+05

D. Ex Situ Intermediate Separation

1. Construction Sand and gravel (m^3)

	sand	gravel	
~~WR&T~~			
WR&T	3.98E+04	2.34E+04	
vitrifi	3.25E+05	1.91E+05	
Σ	3.65E+05	2.15E+05	= 5.8E+05

2. operation Sand and gravel (m^3)

LLW Vaults	2.02E+05	1.19E+05	
HLW Shields Casks	1.18E+05	6.93E+04	
Σ	3.2E+05	1.88E+05	= 5.08E+05

E. Ex Situ Insitu Combination

1. Construction Sand and gravel (m^3)

	sand	gravel	
WR&T	1.99E+04	1.17E+04	
vitrifi	1.63E+05	9.54E+04	
Σ	1.83E+05	1.07E+05	= 2.9E+05

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12. E. 2. operation sand and gravel (m³)

	Sand	Gravel
LLW vaults	8.7E+04	5.11E+04
HLW Shields	5.73E+04	3.37E+04
Σ	1.44E+05	8.48 E+04 = 2.29E+05

F. Ex-Situ In-Situ Combination Low

1. Construction sand and gravel (m³)

	Sand	gravel
WR&T	1.4 E+04	8.2 E+03
Vitrifi	1.14E+05	6.7E+04
Σ	1.28E+05	7.52 E+04 = 2.03E+05

2 operation sand and gravel (m³)

LLW vaults	6.94E+04	4.08E+04
HLW Shields	3.4 E+04	2.0E+04
Σ	1.034E+05	6.08E+04 = 1.642E+05

G. Phased Implementation - phase II

1. Construction sand and gravel

	Sand	Gravel
WR&T	3.98E+04	2.34E+04
Vitrifi	4.42E+05	2.6 E+05
Σ	4.82 E+05	2.834E+05 = 7.65E+05

2. operation sand and gravel

	Sand	Gravel
LLW vaults	1.63E+05	9.54E+04
HLW Shield Casks	1.12E+05	6.57E+04
Σ	2.75E+05	1.61E+05 = 4.36E+05

13. Determine the Closure quantity of sand and gravel required

A Ex Situ no separations vitrification

1. Barrier area determination from document WHC-SD-WM-EV-107 Rev 0 = 17.4495 hectares

13. A. 1. Components of for this calculation are

1. Road base = 5.42E+03 m^3
2. Base Grading = 1.81E+05 m^3
3. Base Course = 3.2E+04 m^3
4. drainage + filter sand & gravel = 1.97E+05 m^3

Σ = 4.15E+05 m^3

area = 174495 m^2

Cu meters of material / meter of area = 415000/174495
= 2.38 m^3/m^2

Tank farm barrier only, no LLW vaults
= 4.15E+05 m^3 = 33978 Trips
+ per gravel = 8.760 m^3 = 717 Trips
Σ = 4.24E+05 m^3 = 34695 trips

B. Ex Situ No-Separations Calcination

Tank farm barrier only no LLW vaults
= 4.15E+05 m^3 + 8.760E+03 m^3 (per gravel)
= 4.24E+05 m^3
@16 yds^3 = 34695 Trips

C. Ex Situ Extensive Separations
tank farm barrier = 4.15E+05 m^3
per gravel = ~~8.760E+04~~ 1.3 m^3

LLW vaults = (Area) (2.38 m^3/m^2)

Barrier AREA = 66 vaults each assumed 15 x 37 meters
block of vaults = 7 x 8 + 5 x 2
= 7 x 39 = 273+18 = 291 Long
= 8 x 20 = 160+18 = 178 wide
= 5 x 39 = 95+18 = 213 Long
= 2 x 20 = 40+18 = 58 wide

Area = (291)(178) + (213)(58) = 51798 + 12354
= 64152 m^2 = 6.42 hectares.

13. C.

$$\text{material} = (64152\ m^2)(2.38\ m^3/m^2)$$

$$= 152682.\ m^3 \quad (1.31) = 1.53E+05\ m^3.$$

$$= 200013.1$$

$$@16\ yd^3 = 12500.82 \text{ trips.}$$

$$\text{total material} = (4.15E+05) + (1.53E+05) + (1.3E+04\ m^3)$$

$$= 5.81E+05\ m^3$$

$$\Sigma \text{trips} = (12500.82)(1076) + (33978)$$

$$= 47555 \text{ trips.}$$

D. Exclusive Intermediate Separations.
tank farm + 66 vaults.

	amount	trips
tank farm	= 4.15E+05 m^3	33978
pea gravel	= 1.2E+04 m^3	753
LLW vaults (66)	= 1.53E+05 m^3	12501
Σ	= 5.8E+05 m^3	= 47232 @ 16 yd^3

E. Exclusive In Situ Consolidation 70/177
tank farm + 40 vaults. = block of (4 X 10)

$$\text{vault area} = (10)(20) = 200 + 18 = 218$$

$$= (4)(39) = 156 + 18 = 174$$

$$= (218)(174) = 37932\ m^2 = 3.8 \text{ hectares}$$

$$(37932)(2.38) = 90278.16\ m^3$$

	material	trips
tank farm	4.15E+05	33978 at 16 yd^3
pea gravel	1.1E+04	685 at 16 yd^3
LLW vaults	9.03E+04	7393 @ 16 yd^3
Σ	5.16E+05	42056

13. F. Ex Situ In Situ combination Low
tank farm + LLW vaults.

area = 242 vaults. Block = 6 wide x 4 long.
area = 4 x 39 = 156+18 = 174
= 6 x 20 = 120 + 18 = 138
= (174)(138) = 24012 m^2

material = (24012)(2.38) = 57148.56 m^3
= 74864.613
@ 16 yds^3 = 4679 trips.

	material	trips
tank farm	4.15E+05	33978
pea gravel	9.86E+03	~~98~~ 616
LLW vaults	5.72E+04	4679
Σ	4.82E+05	39273

G. Phased Implementation phase II.

tank farm + LLW vaults. (66 vaults)

	material	trips
tank farm	4.15E+05	33978
pea gravel	1.3E+04	1076
LLW vaults	1.53E+05	12501
Σ	5.81E+05	47555

14 Determine truck trips for gravel fill of tank farm.
fill quantity = 7.58 E+05 m^3
= (758000)(1.31)
= 992980
@ 16 yds^3 = 62062 trips.

1. Ex Situ no Separations vit.
2. Ex Situ no Separations Calci.
3. Ex Situ Extension Separations
4. Ex Situ Intermediate Sep.
5. Ex Situ/In Situ Combination
6. Ex Situ/In Situ Combination Low
7. Phased Implementation phase II

15 Verify 17.4 hectares and Calculate tank farm minus 18 meter apron

Tank	m x m	m²	m x m (-18)	m²
A	93 x 63.1	5868.3	75 x 45.1	3382.5
AH	63.7 x 63.1	4019.47	45.7 x 45.1	2061.07
AP	123.5 x 115.3	14239.55	105.5 x 97.3	10265.15
AW	125.3 x 93	11652.9	107.3 x 75	8047.5
AX	123.5 x 93	11485.5	105.5 x 75	7917.5
AY	125.3 x 116.5	14597.45	107.3 x 98.5	10569.05
AZ	125.3 x 94.2	11803.26	107.3 x 76.2	8176.26
B	123.5 x 115.3	14239.55	105.5 x 97.3	10265.15
BX	156.4 x 94.2	14732.88	138.4 x 76.2	10546.08
BY	94.2 x 63.1	5944.02	76.2 x 45.1	3436.62
C	156.4 x 125.3	19596.92	138.4 x 107.3	14850.32
S	123.5 x 112.2	13856.7	105.5 x 94.2	9938.1
SX	97.3 x 97.3	9467.29	79.3 x 79.3	6288.49
SY	129.9 x 64.6	8391.54	111.9 x 46.6	5214.54
T	97.3 x 64.6	6285.58	79.3 x 46.6	3696.17
TX	64.6 x 32.0	2067.2	46.6 x 14	652.4
TY	64.6 x 32.0	2067.2	46.6 x 14	652.4
U	64.6 x 64.6	4173.16	46.6 x 46.6	2171.56

Σ 174495 = 17.4495 hectares

Σ 118130.86 = 11.81 hectares

16. Determine the quantity and number trips for the following items for the alternatives where applicable
   1. Construction grub and clear of land area.
   2. Construction consumables
   3. Barrier sheeting - Geotextile filter fabric
   4. Trash to burial ground. (Solid Waste)
      a. Continued operation
      b. Remediation plant operations
      c. Estimate construction waste

A. No action alternative
   1 Grub and clear - NA
   2. Construction Consumables - NA
   3. Barrier Sheeting - Geotextile Filter Fabric - NA

16. A. 4. Solid waste to burial ground.

a. Continued operation

= 300 m³ × 100 yrs

= 30,000 m³ (1.31) = 39300

@ 8 yds³ = 4913 trips ten miles/RT

b. Remediation plant operation - NA

c. Construction waste - NA.

B. Long-term management

1. Grub and clear @ 20-10 cu yds/acre

= (120 acres) (20) (10) = 24,000 yds³

= 1.83E+04 @ 8 yds³ = 3000 trips 10 miles per round trip.

2 x during period = 3.66E+04

= 6000 trips

2. Construction Consumables

assumed 2 trucks per day @ 200 days per year for 3 years at 2 periods during the alternative. assumed each truck equivalent to about 16 cu yds of Material.

WR&T = (2)(200)(3)(2) = 2400 (16) ÷ 1.31

38400 yds³ = 2.93E+04 m³

= 2400 trips

Vitrifi = NA

Closure = NA

3. Barrier Geotextile Filter Fabric sheeting = NA

4. Solid waste to burial ground.

a. Continued operation

average generation 300 m³/yr over 100 yrs

= (300)(100) = 30000 m³ = 3.0E+04

= 39300

@ 8 yds³ = 4913 trips.

16. B. 4. b. Remediation plant operation = NA

c. Construction waste
assumed construction waste is equivalent to the
Construction Consumables
= (2)(200)(3)(2) = 2400 Trips @ 16 yds³ per t
= (2400)(16) = 38400 ÷ 1.31 = 2.93E+04 m
trips = ~~2400 ÷ 8 yds³~~ = 38400 yds³ ÷ 8 yds³/trip =
trips = 4800

c. In Situ fill and Cap
1. Grub and clear @ 20 - 10 cu yd³ ~~yd³~~ per acre
= (90)(200) = 18000 yds³
@ 8 yds³ = 2250
= 13741 m³ = 1.37E+04

2. Construction Consumables
2 per day 200 days/year and 17 years.
= (2)(200)(17) = ~~6800~~ 1200 trips
@ 16 yds³/truck = ~~108800~~ yds³ 19200 -
= ~~43053.435~~ 14657 = ~~4.3~~ E+04 m
= 1.47 E+04

3. Barrier Geotextile Filter Fabric Sheeting
Each roll average (4.6 meters wide by 229 meters long.)
assumed truck will transport 146 rolls/trip @ 2481
each.
(4.6)(229) = 1053.4 m²/roll.
17.445 hectares = 174450 m²
= 166 rolls + 4 rolls wastage
= 170 rolls
@ 146 Rolls/truck = 2 trips.

4. Solid waste to burial ground
a. Continued operation
assumed average 300 cu m/year over 100 years
= (300)(100) = 30,000 m³ = 3.0E+0
= 39300
@ 8 yds³ = 4913 trips

16. C. 4. b. Remediation operations plant waste = NA

c. Construction wastes

(2) (200) (~~19~~ 3) (16) = ~~108800~~ 19200 yds^3

= ~~8.3~~ 1.47E+04 m^3

@ 8 yds^3 = ~~13600~~ 2400

D. In Situ Vitrification

1. Grub and clear @ 200 yds^3/acre

(275) (200) = 55000 yds^3

@ 8 yds^3 = 6875 trips

(÷1.31) 55000 = 41985 = 4.20E+04 m^3

2. Construction consumables

3 trips/day at 200 days/yr. at 15 yrs.

= (3) (200) (15) = 9000 Trips

@ 16 yds^3 = 144000 yds^3

÷1.31 = 109924 = 1.10E+05 m^3

3. Barrier Geotextile filter fabric Shelling

(4.6) (229) = 1053.4 m^2/roll

17.445 ha = 174450 m^2

= 166 rolls add 4 rolls wastage

= 170 rolls.

@ 146/km = 2 trips

4. Solid waste to burial ground

a. Continual operation

= (300) (100) = 30000 m^3 = 3.0E+04

= 39300

@ 8 yds^3 = 4913 Trips

b. Remediation plant operation waste = NA.

c. Construction waste

= 144000 yds^3

@ 8 yds^3 = 18000 trips

÷1.31 = 1.10E+05 m^3

16. C. W-314 upgrades

1. Grub and clear

$(13.7)(200) = 2740\ yds^3$

$@8\ yds^3 = 343$ trips

$\div 1.31 = 2.09E+03\ m^3$

2. Construction Consumables

WR&T 3 trucks @ 16 yds^3 equivalent

$(3)16 = 48\ yds^3$

$= 3$ trips

$\div 1.31 = 3.66E+01\ m^3$

3. Barrier Geotextile filter fabric sheeting = NA

4. Solid waste to Burial ground.

1. Continual operations - NA
2. Remediation plant operation NA
3. Construction waste

$= 48\ yds^3 + 1\%$ of Construction materials.

$= 48\ yds^3 + 1\%$ of (C m)

$= 48\ yds^3 + (0.01)(3920\ m^3) + (0.01)(782/7) + (0.01)(602/8)$

$= 36.6 + 39.2 + 1.1 + 0.75$

$= 77.65\ m^3$

$= 101.72\ yds^3$

$@8\ yds^3 = 12.7$ trips

3. Barrier Geotextile filter fabric Sheeting = NA

5. In Situ Vitrification

1. Grub and clear

$= (170)(200) = 34000\ yds^3$

$@8\ yds^3 = 4250$ trips

$\div 1.31 = 2.6E+04\ m^3$

2. Construction consumables

a. WR&T 3 trucks/day @ 16 yds^3 each for 200 days/year for 4 years

16.F.2 a. (3)(200)(4) = 2400 trips
@16yds³ = 38400
÷1.31 = 2.93E+04 m³

b. Vitrifi 5/day at 200 drums/m @ 6 yrs.
(5)(200)(6) = 6000
@16yds³ = 96000
÷1.31 = 7.33E+04 m³

Σ = 7.33 + 2.93 = 1.03E+05 m³

3. Barrier Geotextile Filter Fabric
(4.6)(229) = 1053.4 m²/roll
17.445 ha = 174450 m²
= 166 rolls add 4 rolls waste
= 170 rolls
@146/truck = 2 trips

4. Solid waste to Burial
a. Continual operation waste
(300)(100) = 30000 = 3.0E+04 m³
= 39300 yds³
@8yds³ = 4913 trips

b. Remediation plant operation waste
assumed 400 cum per of operation 22 years
(400)(22) = 8.800E+03 m³
= 11528
@8yds³ = 1441 trips

c. Construction waste
= 1.03E+05 m³
= 134930 yds³
@8yds³ = 16866 trips

waste total = Σ 1.03E+05 + 8.8E+03 + 3.0E+04 = 1.42E+05

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BY RDW CHKD. _____ JOB NO. 01K47101

16.B. C4 Site, No Separations, Calcination.

1. Clear and Grub

(170) (200) = 34000 yds³

@8yds³ = 4250 trips

÷1.31 = 2.6 E+04 m³

2. Construction Consumables

a. w R&T

(3) (200) (4) = 2400 Trips

@16yds³ = 38400 yds³

÷1.31 = 2.93 E+04 m³

b. Calcination

(5) (200) (6) = 6000 Trips

@ 16yd³ = 96000

÷1.31 = 7.33 E+04 m³

Σ = 7.33E+04 + 2.93 E+04 = 1.03 E+05 m³

3. Barrier Geotextile Filter Fabric Sheeting

(46)(229) = 1053.4 m²

17.4450 ha = 174450 m²

= 166 rolls + 4 rolls overlap

= 170 rolls

@ 146/TRK = 2 Trips

4. Solid Waste to burial

a. Continual operation

(300)(100) = 30,000 = 3.0E+04 m³

= 39300

@8yds³ = 4913 Trips

b. Remediation plant operation waste

(460)(22) = 8.8E+03 m³

= 11528

@ 8yds³ = 1441 Trips

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16. B.H.C. Construction waste

$= 1.03E+05\ m^3$

$= 134930$

@ $8\ yds^3$ $= 16866$ trips.

H. Ex Situ Extensive Separations

1. ~~Clear &~~ Grub and Clear

$(330)(200) = 66000\ yds^3$

@ $8\ yds^3$ $= 8250$ trips

$\div 1.31 = 50381.679 = 5.04E+04\ m^3$

2. Construction Consumables

a. WRT

$(3)(200)(4) = 2400$ trips

@ $16\ yds^3$ $= 38400$

$\div 1.31 = 2.93E+04\ m^3$

b. Vitrifi

$= (5)(200)(4) + (3)(200)(5)$

$= 4000 + 3000$

$= 7000$ trips

@ $16\ yds^3 = 112000$

$\div 1.31 = 8.55E+04\ m^3$

3. Barrier Geotextile Filter Fabric sheeting.

Roll $= 1053.4\ m^2$

tank farm $= 174450\ m^2$

66 vaults $= 64200\ m^2$

$\Sigma = 238650\ m^2$

$= 227$ Rolls $+ 5$ rolls Wastage

$= 232$

@ 146/truck $= 2$

4. ~~Debris~~ Waste to Burial

a. Continuous operation Waste

$(300)(100) = 30000 = 3.0E+04\ m^3$

$= 3.0E+04\ m^3$

$= 39300$ @ $8\ yd^3 = 4913$ trips

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16. H. 4. b. Remediation operation plant waste

= (400)(25) = 10,000 m^3 = 1.0E+04 m^3

= 13100

@8 yds^3 ≐ 1638 trips

c. Construction waste

= 1.15E+05 m^3

= 115000 m^3

= 150650

@ 8 yds^3 = 18832

J. Ex Situ Intermediate Separations

1. Grub and Clear

(220)(200) = 44000 yds^3

@8 yds^3 = 5500 trips

÷1.31 = 3.36E+04

2. Construction Consumables

a WR&T

(3)(200)(4) = 2400 trips

@16 yds^3 = 38400

÷1.31 = 2.93E+04 m^3

b. Vitrified

= (3)(200)(4) + (5)(200)(5)

= 4000 + 5000

= 9000 trips

@ 16 yds^3 = 144000 yds^3

÷1.31 = 109923.66 = 1.10E+05 m^3

3. Barrier Geotextile Filter Fabric Sheeting

Roll = 1053.4 m^2

Tower Footer = 17445 m^2

66 vaults = 64200 m^2

Σ = 238650 m^2

= 227 rolls + 5 rolls wastage

= 232 rolls

@146/truck = 2 trips

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K. I. 4 Solid waste to Burial

a. Continued operation waste

= (300)(100) = 3.0E+04

= 39300

@8 yds³ = 4913 Trips

b. Remediation plant operation waste

= (400) (24) = 9600 m³ = 9.6E+03 m³

= 12576

@8 yds³ = 1572 trips

c. Construction waste

= 1.393E+05 m³

= 139300

= 182483 yds³

@8 yds³ = 22811 trips

J. Ex Situ Insitu Combination 70 tanks

1. Grub and Clear

(210) (200) = 42000 yds³ @

@ 8 yds³ = 5250 trips

÷1.31 = 3.21E+04 m³

2. Construction Consumables

a. w R&T

(3)(200)(3) = 1800 trips

@16 yds³ = 28800

÷ 1.31 = 21984732 = 2.2E+04 m³

b. vitrification

= (4)(200)(4) + (3)(200)(4)

= 3200 + 2400

= 5600 trips

@16 yds³ = 89600

÷1.31 = 68396.946 = 6.84E+04 m³

16. J. 3. Barrier Geotextile Filter Fabric Sheeting

Roll = 1053.4 m^2
tank farm = 174450 m^2
40 vaults = 38000 m^2
Σ = 212450 m^2
= 202 rolls + 5 rolls wastage
= 207 rolls
@ 146/truck = 2 trips

4. Solid waste to Burial
a. Continual operations waste
(300)(100) = 30000 = 3.0E+04 m^3
= 39300
@8 yds^3 = 4913 trips

b. Remediation plant operation waste
(400)(25) = 10000 m^3 = 1.0E+04 m^3
= 13160
@8 yds^3 = 1645

c. Construction waste
= 9.0E+04 = 90000 m^3
= 117900
@8 yds^3 = 14738 trips

K. Ex Situ In Situ Combination Low 25 Tanks
1. Grub and Clear
= (148)(200) = 29600 yds^3
@8 yds^3 = 3700 trips
÷1.31 = 22595.419 = 2.26E+04 m^3

2. Construction Consumables
a. WR&T = (2)(200)(3) =
= (2)(200)(3) = 1200 trips
@16 yds = 19200
÷1.31 = 14656.488 = 1.47E+04 m^3

16. K. 2. b. Vitrifi.

$= (3)(200)(4) + (2)(200)(4)$
$= 2400 + 1600$
$= 4000$ trips
@ 16 yds $= 64000$
$\div 1.31 = 48854.961 = 4.89E+04\ m^3$

3. Barrier Geotextile Filter Fabric Sheeting

area/roll $= 1053.4\ m^2$
tank farm $= 174450\ m^2$
24 vaults $= 24012\ m^2$
$\Sigma = 198462\ m^2$
$= 189$ rolls + 4 rolls wastage
$= 193$ rolls
@ 146/truck $= 2$

4. Solid Waste to Burial

a. Continual operations waste

$= (300)(100) = 30000 = 3.0E+04\ m^3$
$= 39300$
@ 8 yds^3 $= 4913$ trips

b. Remedial plant operation waste

$= (400)(24) = 9600\ m^3$
$= 12576$
$= 1572$

c. Construction waste

$= 6.36E+04\ m^3$
$= 63600\ m^3$
$= 83316$ yds^3
@ 8 yds^3 $= 10415$ trips

5. L. Phased Implementation Phase I

1. Grub and clear

$(32)(200) = 6400$ yds^3
@ 8 yds^3 $= 800$ trips
$\div 1.31 = 4886 = 4.89E+03\ m^3$

16. L. 2. Construction Consumables.

a. NA

b. Vitrification

(3)(200)(3) = 1800 trips

@ 16 yds³ = 28800

÷1.31 = 21985 = 2.2E+04 m³

3. Barrier Geotextile Liner fabric = NA.

4. Solid waste to Burial

a. continual operations

= (300)(100) = 30000 = 3E+04 m³

= 39300

@8³ = 4913 trips

b. Remediation Plant operation waste

= (400)(10) = 4000 m³ 4.03E+03 m³

= 5240

@8 yds³ = 655 trips

c. Construction waste

= 2.2E+04 m³

= 22000

= 28820 yds³

@8 yds = 3603 trips

M. Phased Implementation - Phase II

1 Grub and clear

= (290)(200) = 58000 cu yds.

@8 yds³ = 7250 trips

÷1.31 = 44274809 = 4.43E+09 m³

2. Construction Consumables

a. WR&T (3)(200)(4)

= (3)(200)(4) = 2400 trips

@16 yds³ = 38400

÷1.31 = 2.93E+04 m³

16. M. 2. b. Vitrifi

$= (5)(200)(4) + (3)(200)(5)$
$= 4000 + 3000$
$= 7000$ trips
@16 yds^3 = 112000
÷ 1.31 = 85496.183 = 8.56E+04 m^3

3 Barrier Geotextile Filter Fabric Sheeting.

Rollarm = 1053.4 m^2
tank form = 174450 m^2
66 vaults = 64200 m^2
Σ = 238650 m^2
= 227 rolls + 5 rolls wastage
= 232 Rolls
@14 L/truck = 2 trips

4. Solid waste to burial ground.

a. Continued operation waste
= (300)(100) = 30000 m^3 = 3.0E+04 m^3
= 39300
@8 yds^3 = 4913 trips

b. Remediation plant operation waste
= (400)(24) = 9600 m^3
= 12576
@8 yds^3 = 1572 trips

c. Construction waste
= 1.15E+05 m^3
= 115000
= 150650
@ 8 yds^3 = 18832

17. Determine the disturbed areas for the potential borrow sites.

a. McGee Ranch
b. Pit 30
c Vernita Quarry.

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17. A. In Situ fill and Cap.

1. Mc Gee Ranch

silt = 3.77 E+05

÷3 = 12.6 = 13 hectares

add 3 hectares for access road and pit access.

3+13=16

B. Ex Situ no Separations vitrification

1. Mc Gee Ranch

silt = 3.77 E+05 m^3

÷3 = 12.6 = 13 ha + 3 ha for access to pit.

= 16 hectares

2. Venita Quarry -

Basalt = 6.38 E+05 m^3

÷3 = 21 hectares

3. Pit 30

a. Construction

sand and gravel = 2.97 E+06 m^3

÷3 = 9.9 hectares

b. operation

sand and gravel = 2.65 E+06 m^3

÷3 = 88.3 hectares

c. Closure

sand and gravel = ~~3~~ 1.18 E+06 m^3

÷3 = 39.3 hectares

d. Σ = 137.6 = 138 hectares

C. Ex Situ No Separations Calcination

1. Mc Gee Ranch

silt = 3.77 E+05

÷3 = 13 hectares + 3 ha for access

= 16 hectares

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17. C. 2. Vernita Quarry

Basalt = 6.38E+05
÷ 3 = 212666.66
÷ 10,000 = 21.3 ha

3. Pit 30

a. Construction

sand and gravel = 2.85E+05 m^3
÷ 3 = 9.5 ha = 10 hectares

b. operation = 1.05E+06
sand + gravel = 1.05E+06
÷ 3 = 35 hectares

c. closure
Sand and gravel = 1.18E+06
÷ 3 = 39.3 hectares

Σ = 39.3 + 35 + 9.5 = 83.8 = 84 hectares

D. Eastern Extension Separations

1. McGee Ranch
Silt = 5.66E+05
÷ 3 = 18.86 hectares = 19 hectares

2. Vernita Quarry
Basalt = 9.85E+05
÷ 3 = 32.8 = 33 hectares

3. Pit 30

a. Construction
sand and gravel = 5.35E+05
÷ 3 = 17.8 hectares (Includes 1 for WR+T)
= 18 hectares

b. operation
Sand and gravel = 4.17E+05
÷ 3 = 13.9 hectares = 14 hectares

17. D. 3. c. Closure

Sand and gravel = 1.34 E+06
÷3 = 44.7 = 45 hectares

Σ = 45 + 14 + 18 = 77

E. Ex situ Intermediate separations

1. Mc Gee Ranch

silt = 5.19 E+05
÷3 = 17.3 hectares = 17 hectares

2. Vernita Quarry

Basalt = 8.78 E+05
÷3 = 29.3 hectares = 29 hectares

3. pit 30

a. Construction

Sand and gravel = 5.8 E+05
÷3 = 19.3 hectares (Include 1 for WR+T)
= 19 hectares

b. operation

sand and gravel = 5.08 E+05
÷3 = 16.93 hectares
= 17 hectares

c. Closure

Sand and gravel = 1.34 E+06
÷3 = 44.7 hectares
= 45 hectares

Σ = 45 + 17 + 19 = 81

F. Ex Situ In Situ Combination 70 tons

1. Mc Gee Ranch

silt = 4.72 E+05
÷3 = 15.7 hectares = 16 hectares ~~+3 hectares~~
= ~~19 hectares~~ 16 hectares

17. 7.2. Vernita Quarry

Basalt = 7.8E+05
÷3 = 26 hectares

3. Closure

a. Construction

Sand and gravel = 2.9 E+05
÷3 = 9.7 = 10 hectares Includes 1 for WRPT

b. Operation

Sand and gravel = 2.29E+05
÷3 = 7.63 = 8 hectares ~~Includes 1 for WRPT~~
= 8 hectares

c. Closure

Sand and gravel = 1.27E+06
÷3 = 42.3 hectares
= 42 ha

Σ = 42 + 8 + 10 = 60 hectares

g. Ex Situ In Situ Combination Low 25 Tanks

1. McGee Ranch

Silt = 4.25 E+05
÷3 = 14.2 hectares
= 14 hectares

2. Vernita Quarry

Basalt = 7.18 E+05
÷3 = 23.93 hectares
= 24 hectares

3. Closure

a. Construction

Sand and gravel = 2.03 E+05
÷3 = 6.7667 hectares
= 7 hectares

17. G. 3. b. operation

Sand and gravel = 1.642 E+05
÷3 = 5.47334 = 6 ha
= 6 hectares

c. closure

Sand and gravel = 1.24 E+06
÷3 = 41.3 ha
= 41 hectares

Fill 161 tanks
7.58 E+05 = fill
÷3 = 25.3 ha

Σ = 41 + 6 + 7 = 54 hectares

Barrier + 25 tanks fill =

average fill per tank = 578000 ÷ 161
= 3590.0621
for 25 TKS = (25)(3590.0621) =
= 89751.552 = 8.98 E+04 m³
= 8.98 E+04 m³

+ barrier = 4.82 E+05 + 8.98 E+04 + 2.03 E+04
= 5.92 E+05 m³
÷3 = 19.73 ha
= 20 hectares

Σ ~~54 +~~ 20 + 6 + 7 = 33

4. Phased Implementation Phase I
1. Ma Lee Ranch - NA
2. Vernita Quarry - NA
3. ~~Closure~~ Pit 30
a. Construction

Sand and gravel = 2.55 E+04 m³
÷3 = 0.85 ha = 1 hectare

b. operation

Sand and gravel = 6490
÷3 = 0.22 ha

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BY RDW CHKD. JOB NO. 01K 47101

17. J. Phased Implementation - Phase II

1. McGee Ranch

silt = 5.66 E+05

÷3 = 18.87 = 19 hectares

= 19 hectares

2. Vernita Quarry

Basalt = 9.58 E+05

÷3 = 31.94 ha

= 32 hectares

3. Pit 30

a. Construction

sand and gravel = 7.65 E+05

÷3 = 25.5 ha.

= 26 hectares

b. operation

sand and gravel = 4.36 E+05

÷3 = 14.53 ha

= 15 hectares

c. Closure

sand and gravel = 1.339 E+06

= 44.63 ha

= 45 hectares

Σ = 45 + 15 + 26 = 86

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BY RW CHKD. JOB NO. 01K47101

TABLE I values of Table B.11.0.3 broken down for spread entry and to determine changes to spread sheet for better detail to prepare transportation input.

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1 ITEMS TO BE TRANSPORTED	EX-SITU EXTENSIVE SEPARATIONS ALTERNATIVE	EX-SITU NO SEPARATIONS – VIT ALTERNATIVE	Ex-Situ Intermediate Separations alternative	Ex situ/In-Situ Combination alternative	EX Situ No Separations Calcination alternative (0.62 m³ Cons)	Calcination alternative (10 m³ Con
1 Gasoline (m³)						
Construction						
WR&T	330	330	330	1.98 E+02	3.3 E+02	3.3 E+02
vitrifi	9400	4800	7300	4.38 E+03	4.8 E+03	4.8 E+03
Fill & Cap				6.79 E+01		
operation						
Vault Const.	54.6		54.6	2.0 E+01		
Closure						
Tank Stab	40.1	40.1	4.01 E+01	4.01 E+01	4.01 E+01	4.01 E+01
Barrier	350	260	3.50 E+02	2.96 E+02	2.60 E+02	2.6 E+02
anc. Equip	1.2	1.2	1.20 E+00	1.20 E+00	1.2 E+00	1.2 E+00
2. Diesel (m³)						
Construction						
WR&T	1000	1.0 E+03	1.00 E+03	6.02 E+02	1.00 E+03	1.0 E+03
Vitrifi	28000	1.09 E+04	2.00 E+04	1.2 E+04	1.09 E+04	1.09 E+04
Fill & Cap				9.1 E+02		
operation						
WR&T	1200	1.02 E+03	1.02 E+03	5.1 E+02	1.02 E+03	1.02 E+03
Vitrifi	22800	1.3 E+04	6.51 E+03	9.22 E+03	1.66 E+03	
Fill & Cap				3.66 E+03		
Closure						
Tank Stab	63800	6.38 E+03	6.38 E+03	6.38 E+03	6.38 E+03	6.38 E+03
Barrier	60000	4.5 E+04	5.90 E+04	5.06 E+04	4.5 E+04	4.5 E+04
anc. Equip	802	8.02 E+02	8.02 E+02	8.02 E+02	8.02 E+02	8.02 E+0
3. Propane (m³)						
Construction						
WR&T	1200	1200	1200	600	1.2 E+03	1.2 E+03
4. Kerosene (m³)						
operations						
vitrifi	2.34 E+05	1.06 E+05	9.86 E+04	4.93 E+04	1.05 E+04	1.05 E+04

2	Items to be TRANSPORTED	EX-SITU EXTENSIVE SEPARATIONS ALTERNATIVE	EX-SITU NO SEPARATIONS ALTERNATIVE	Ex-Situ Intermediate Separations alternative	Ex-Situ In Situ Combination alternative	Ex-Situ No Separation Calcination alternative	Ex-Situ Calcination alternative
5.	materials - Concrete	m^3				0.62 m^3 conc.	10 m^3 conc.
	Construction						
	WR&T						
	total	5.9E+04	5.9E+04	5.9E+04	2.95E+04	5.9E+04	5.9E+04
	sand	4.0E+04	4.0E+04	4.0E+04	1.99E+04	3.98E+04	3.98E+04
	gravel	2.46E+04	2.46E+04	2.46E+04	1.17E+04	2.34E+04	2.34E+04
	Cement (MT)	1.48E+04	1.48E+04	1.48E+04	7.38E+03	1.48E+04	1.48E+04
	Vitrifi						
	total	4.4E+05	3.73E+05	4.89E+05	2.444E+05	2.29E+05	2.07E+05
	sand	2.97E+05	2.51E+05	3.3E+05	1.65E+05	1.54E+05	1.4E+05
	gravel	1.74E+05	1.48E+05	1.94E+05	9.68E+04	9.1E+04	8.2E+04
	Cement (MT)	1.1E+05	9.33E+04	1.22E+05	6.11E+04	5.73E+04	5.18E+04
	Operations						
	LSW Vaults						
	total	3.98E+05		5.37E+05	1.75E+05		
	sand	2.68E+05		3.62E+05	1.18E+05		
	gravel	1.58E+05		2.13E+05	6.93E+04		
	Cement (MT)	9.95E+04		1.343E+05	4.38E+04		
	HSW Shield Casks						
	total	1.8E+04	9.17E+06	4.83E+05	1.93E+05	1.93E+06	9.8E+05
	sand	1.21E+04	6.18E+06	3.26E+05	1.3E+05	1.3E+06	6.61E+05
	gravel	7.13E+03	3.63E+06	1.91E+05	7.64E+04	7.65E+05	3.88E+05
	Cement (MT)	4.5E+03	2.3E+06	1.21E+05	4.83E+04	4.83E+05	2.45E+05
	Closure						
	Tank Stab.						
	total	5.3E+03	5.3E+03	5.3E+03	5.3E+03	5.3E+03	5.3E+03
	sand	3.6E+03	3.6E+03	3.6E+03	3.6E+03	*3.6E+03	3.6E+03
	gravel	2.1E+03	2.1E+03	2.1E+03	2.1E+03	2.1E+03	2.1E+03
	Cement (MT)	1.33E+03	1.33E+03	1.33E+03	1.33E+03	1.33E+03	1.33E+03
m^3	gravel fill (61 SST&DST)	7.58E+05	7.58E+05	7.58E+05	7.54E+05	7.58E+05	7.58E+05
	Barrier						
*	See PIT 30 ENTRY Later in tabulation.						
	anc. Equip						
	total	1.37E+04	1.37E+04	1.37E+04	1.37E+04	1.37E+04	1.37E+04

Items to Be Transported	Ex-Situ Extensive Separations alternative	Ex Situ no Separations alternative	Ex-Situ Intermediate Separations alternative	Ex-Situ / In-Situ Combination alternative	Ex Situ Cam Pope no Separation Calcination alternative	2024 393 Calcinatio (10m3 Can
Sand	9.2 E+03	9.2 E+03	9.2E+03	9.2 E+03	9.2E+03	9.2E+03
gravel	5.4 E+03	5.4 E+03	5.4E+03	5.4E+03	5.4E+03	5.4E+0
Cement (MT)	3.4 E+03	3.4E+03	3.4E+03	3.4E+03	3.4E+03	3.4E+0
6. Carbon Steel (MT)						
Construction						
WR&T	10000	1.0 E+04	1.00E+04	5.0E+03	1.00E+04	1.00E+0
Vitrifi	130000	5.72E+04	9.74E+04	4.871E+04	5.22E+04	5.12E+0
operation						
SLW Vaults	4.6E+04		4.6E+04	2.05E+04		
HLW Casks	1.54E+03	9.62E+05	5.4E+04	2.72E+04	1.77E+05	7.04E+0
LLW Boxes	1.26E+05		1.26E+05	5.35E+04		
Closure						
7. Stainless Steel (MT)						
Construction						
WR&T	4000	4.0E+03	4.0E+03	2.0E+03	4.0E+03	4.0E+03
Vitrifi	17000	8.41E+03	1.5E+04	7.5E+03	8.61E+03	8.61E+03
Operations						
SS Canisters	1200	4.4E+05	2.51E+04	1.25E+04	1.25E+05	5.84E+0
Closure						
8. Hastelloy / Inconel (MT)						
Construction						
WR&T						
Vitrifi	1.80E+03	1.51E+03	2.30E+03	1.15E+03	1.51E+03	1.51E+0
operation						
Closure						

Items to be transported	Ex-Situ Extensive Separations alternative	Ex-Situ No Separation-Vit alternative	Ex-Situ Intermediate Separations alternative	In Situ Combustion alternative	Ex-Situ Page no. Separations Calcination alternative	203 of 393 Calcination alternative
9. Flux (MT) – [Glass Formers (MT)]					0.62 m³ Con	10 m³ Con
alumina		1.87 E+04	2.07 E+04	1.11 E+04		
Borax	1.44 E+05		2.9 E+03	1.53 E+03		
Bulk Frit			8.3 E+01	4.42 E+01		
Calcium oxide	1.07 E+04	6.65 E+04	6.21 E+04	3.32 E+04		
Ferric oxide	1.07 E+02					
Limestone						
Lithium oxide	5.2 E+03		7.96 E+02	4.26 E+02		
Mg oxide	1.07 E+04					
Silica	7.18 E+05	3.82 E+05	3.82 E+05	2.04 E+05		
10. Process chemicals (MT)						
aluminum nitrate	1.12 E+02		1.12 E+02	5.6 E+01		
ammonia	9.24 E+03	4.98 E+03	8.8 E+03	4.4 E+03	3.61 E+04	3.61 E+0
antifoam						
APM	1.00 E+01					
CMPO	5.00 E+00		5.00 E+00	2.5 E+00		
Crown Ether	2.84 E+02					
Decon Chemicals	1.40 E+04		5.3 E+03	2.65 E+03		
Floc	1.50 E+02		8.5 E+01	4.25 E+01		
Formic acid	1.47 E+03					
FSA	4.72 E+03		4.72 E+03	2.36 E+03		
Glycolic acid	7.70 E+03		3.5 E+03	1.75 E+03		
HF	7.40 E+02					
HNO_3, 50%	4.65 E+05	6.30 E+02	4.2 E+03	2.1 E+03	6.3 E+02	6.3 E+0
Hydroxylamine	9.50 E+01					
NaOH, 50%	1.50 E+06	2.66 E+02	2.44 E+04	1.30 E+04	2.66 E+02	2.66 E+0
Na_3 DTPA	1.96 E+02					
NPH	7.03 E+02		7.03 E+02	3.52 E+02		
Oxalic acid	1.2 E+04	3.20 E+01			3.2 E+01	3.2 E+01
Oxygen	7.68 E+05	3.46 E+05	3.46 E+05	1.63 E+05	2.34 E+05	2.34 E+05
peroxide	6.4 E+03					
$KMnO_4$		1.70 E+01			1.70 E+01	1.70 E+0
Sodium Bicarb	1.25 E+04					
Sodium Carbonate	1.80 E+02					
Sodium Nitrate	2		5.4 E+01	2.7 E+01		
Sodium Oxalate	2.09 E+04					
TBP	7.55 E+02		7.55 E+02	3.78 E+02		

5	Items to be Transported	Ex-Situ Extensive Separations alternative	Ex-Situ No Separations - vit alternative	Ex Situ Intermediate Separations alternative	Ex Situ In Situ Combination alternative	Calc. 0.62m³	Calc. 6m³
	TSP		1.90E+03			1.9E+03	1.9E+03
	Zinc Nitrate	4.70E+01					
	Sugar					3.3E+04	3.3E+04
11.	Sulfur Cement (MT)						
	Sulfur	4.25E+05		2.21E+05	1.11E+05		
	Dicyclopentadiene (DCPD	1.12E+04		5.78E+03	2.89E+03		
	Oligomer (DCP)	1.12E+04		5.78E+03	2.89E+03		
12.	Ion Exchange Resin (m³)						
	operations	4.9E+03		2.2E+02	1.1E+02		
A.	Land (Long-term)						
	Const/operation	34	19	37	31	19	19
	closure	12	8	12	10	8	8
B.	Land (temporary)				87		
	Construct/operation	88	146	91		81	63
	closure	24	20	24	22	20	20
C	Borrow Pit destined area						
	McGee Ponds						
	pit 30						
	Vernita Quarry						

5	Items to be transported	Cesium separation	No Separation Vitrification	Intermediate separations	Combination	No separation Calcination 0.62 m³	Calcination 10 m³
7	Excavation (m³)						
	Construction	1.8E+06					
	Operation						
	Closure						
21	Backfill (m³)						
	Construction	8.5E+05					
	Operation						
	Closure						
22	Borrow silt site (m³) McGee Ranch						
	Closure						
	Barrier	6.45E+05	3.77E+05	6.45E+05	5.11E+05	3.77E+05	3.77E+0
23.	Borrow site sand and gravel (m³) (Pit 30)						
	Construction						
	Closure						
	gravel (fill) tank slab.	7.54E+05	7.54E+05	7.54E+05	7.54E+05	7.54E+05	7.54E+0
	Barrier	7.46E+05	4.16E+05	7.46E+05	4.91E+05	4.16E+05	4.16E+0
24.	Borrow site Bassett Venita Quarry (m³)						
	Closure						
	Barrier	9.31E+05	6.38E+05	9.31E+05	7.85E+05	6.38E+05	6.38E+0
25.	asphalt (m³)						
	Closure	8.16E+04	6.25E+04	8.07E+04	6.98E+04	6.25E+04	6.25E+

1.	ITEMS to be TRANSPORTED	PHASED IMPLEMENTATION PHASE I	PHASED IMPLEMENTATION PHASE II				
	Gasoline (m^3)						
	Construction						
	WR+T	2.2E+02	3.93E+02				
	Vitrifi	6.28E+03	1.08E+04				
	operation						
	Vault Const.		7.55E+01				
	Closure						
	Tank Slab		4.01E+01				
	Barrier		3.50E+02				
	Misc Equip		1.2E+00				
	Dismantle	3.3E+02					
2.	Diesel (m^3)						
	Construction						
	WR+T	6.43E+02	4.64E+02				
	Vitrifi	1.74E+04	1.25E+04				
	operation						
	WR+T						
	Vitrifi	2.0E+02	1.463E+04				
	Closure						
	Tank Slab		6.38E+03				
	Barrier		5.90E+04				
	Misc Equip		8.02E+02				
	Dismantle	1.8E+04					
3.	Propane (m^3)						
	Construction						
	WR+T		1.2E+03				
	Kerosene (m^3)						
	operation						
	Vitrifi	9.8E+02	5.1E+04				

2. Items to be Transported	Phased Implementation Phase I	Phased Implementation Phase II
Materials - Concrete (m^3)		
Construction		
WK&T		
total	3.22E+03	3.89E+03
sand	2.17E+03	2.62E+03
gravel	1.28E+03	1.54E+03
Cement (MT)	8.05E+02	9.73E+02
Vitrifi		
total	2.08E+04	3.39E+04
Sand	1.40E+04	2.29E+04
gravel	8.24E+03	1.34E+04
Cement (MT)	5.2E+03	8.48E+03
operation		
LLW vault		
total		3.57E+05
sand		2.41E+05
gravel		1.41E+05
cement (MT)		8.93E+04
HLW Shield Cells		
total	4.4E+02	4.73E+05
Sand	2.97E+02	3.19E+05
gravel	1.74E+02	1.87E+05
Cement (MT)	1.1E+02	1.18E+05
closure		
Tank Slab		
total		5.3E+03
Sand		3.6E+03
gravel		2.1E+03
Cement (MT)		1.33E+03
* (m^3) gravel fill 161 SST+DST		7.58E+05
Barrier		

* See pit 30 Entry Later in tabulation

3. Items to be Transported	Phased Implementation Phase I	Phased Implementation Phase II
5. Conc Equip		
Total		1.37E+04
Sand		9.2E+03
Gravel		5.4E+03
Cement (MT)		3.4E+03
6. Carbon Steel (MT)		
Construction		
WR&T	6.4E+03	4.5E+03
Vitrifi	7.66E+04	5.44E+04
operations		
LLW Vaults		4.2E+04
HLW Casks	2.9E+02	5.43E+04
LLW Boxes	8.23E+03	1.06E+05
Closure		
7. Stainless Steel		
Construction		
WR&T	2.83E+03	5.05E+03
Vitrifi	1.22E+04	2.15E+04
operations		
SS Canisters.	4.54E+01	2.51E+04
8. Hastelloy/Inconel (MT)		
Construction		
vitrifi	2.6E+03	1.15E+04
9. Flux (MT) – Glass Formers (MT)		
Total	1.3E+05	4.76E+05
Silica	1.06E+05	3.64E+05

4. Items to be transported	Phase I	Phase II
Process chemicals (mT)		
Total	5.8E+04	4.75E+05
oxygen	3.9E+04	3.2E+05
ammonia	9.9E+02	8.12E+03
50% HNO_3	4.73E+02	3.9E+03
50% NaOH	2.97E+02	2.44E+03
~~[illegible]~~		
11. Sulfur Cement (mT)		
Sulfur	1.45E+04	2.04E+05
Dicyclopentadiene (DCPD)	3.74E+02	5.78E+03
oligomer (DCP)	3.74E+02	5.78E+03
12 Ion Exchange Resin (m^3)		
operation	1.4E+01	1.4E+02
A Land (Long Term)		
Construct/operation	0	40
closure	0	12
B. Land (Temporary)		
Const./operation	32	123
closure	0	24
C. Borrow Pit Disturbed area.		
McGee Ranch		
Pit 30		
Vernita Quarry.		

5	Items to be transported	Phase I	Phase II				
20.	Excavation (m^3)						
	construction						
	operation						
	closure						
21	Backfill (m^3)						
	Construction						
	operation						
	closure						
22	Borrow site Silt (m^3)						
	mc Lee Ranch						
	Closures						
	Barrier		6.45E+05				
23	Borrow Site Sand and gravel (m^3)						
	pit 30						
	Construction						
	operation						
	closure						
	(fill 161) Tank Slab		7.54E+05				
	Barrier		7.46E+05				
24.	Borrow Site Basalt (m^3) Vernita Quarry						
	closure						
	Barrier		9.31E+05				
25	Asphalt (m^3)						
	Closure						
	Barrier		8.07E+04				

1. Item	No action alternative	In situ vitrification	Fill & cap.	Long-term management	W-314 upgrades	Pop 211 of 393
Land (ha)						
Const / operation	0	17	17	8	2.6	
closure	17	8	8	17		
2. Land, temp (ha)						
Const / op	0	91	1	50	2.93	
closure	0	20	20	0		
3. Borrow Pit (ha)						
McGee Ranch	0	16	16	0		
pit 30	0	34	39	0		
Vernita Quarry	0	21	21	0		
water (m^3)	1.52E+06	1.71E+08	2.43E+06	1.52E+06	1.5E+03	
5. Sanitary water (m^3)	0	1.7 E+08 1.2 E+06 3.8 E+04	5.9E+05 1.8E+06 4.13E+04			
6. Raw Water (m^3)						
Construction	1.70E+04			1.7E+04	1.5E+03	
operation	1.50E+06			1.5E+06		
7. Energy, Electrical (Gwh)						
Construction	4.40E+01	5.6E+01	1.8 E+00	4.4 E+01		
operation	1.10E+03	4.4E+03	9.5E+02	1.1 E+03		
closure						
8 Gasoline (m^3)						
Construction		1.5E+04	9.7E+01	8.6E+04		
operation						
Closure						
tank Stab		4.01E+01	4.01E+01			
Barrier		2.6 E+02	2.60 E+02			
[illegible]			1.20E+00			

2.		no action	In Situ vit.	Fill + Cap	Long-term management	W-314 upgrades
	Propane					
	Construction	7.5E+03	1.1E+04		7.5E+03	
10	Diesel					
	Construction	6.3E+04	2.00E+04	1.3E+03	6.3E+04	
	operation	2.2E+04	6.10E+03	6.10E+03	2.2E+04	
	closure tank stab			6.38E+03		
	Barrier		4.5E+04	4.50E+04		
	anc Equip			8.02E+02		
11	Kerosene					
12	Materials Concrete (M^3)					
	Construction					
	total	3.5E+05	1.3E+05		3.5E+05	3.92E+02
	Sand	2.36E+05	8.76E+04		2.36E+05	2.46E+03
	Gravel	1.39E+05	5.15E+04		1.39E+05	1.55E+03
	Cement (MT)	8.75E+04	3.25E+04		8.75E+04	9.8E+02
	operation					
	closure					
	tank stab			~~5.3E~~		
	total			5.3E+03		
	sand			3.6E+03		
	gravel			2.1E+03		
	Cement (MT)			1.33E+03		
(M^3)	gravel fill 161 SST + DST	(see tank stab under pit 30 entry later)				
	Barrier					
	anc Equip					
	total			1.37E+04		
	sand			9.2E+03		
	gravel			6.4E+03		
	Cement (MT)			3.4E+03		

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Item	no action	In Situ vit	fill & Cap	Long term Management	W-314 upgrades	Page 213 393
Carbon steel (MT)						
Construction	1.39E+04	2.6E+05		1.3E+04	7.82E+02	
operation				1.0E+03		
closure						
14. Stainless Steel (MT)						
Construction				2.2E+01	6.02E+02	
operation						
Closure						
15. Hastelloy/Inconel (MT)						
. Flux (MT) - (Glass Formers)						
Limestone (MT)		1.1E+04				
17. Process Chemicals (MT)						
ammonia		6.8E+03				
18 Sulfur Cement						
Sulfur						
DCPD						
DCP						
19. IX Resin						
7. Excavation (M^3)						
Construction	2.7E+06	1.18E+06	6.9E+05	2.7E+06	1.1E+04	
operation						
closure						

4.		no action	In Situ vit	Fill + Cap	Long term management		
	Backfill (m^3)						
	Construction	2.6E+06			2.6E+06	1.68E+04	
	operation						
	Closure						
22.	Borrow Site Silt McGee Ranch.						
	Closure						
	Barrier		3.77E+05	3.77E+05			
23.	Sand/Gravel (m^3)	Pit (30)					
	Construction						
	Closure						
Fill tanks 161TKS	Tank Stab	5.9E+05	5.9E+05	7.54E+05	5.9E+05		
	Barrier		4.15E+05	4.15E+05			
24.	Borrow Site Basalt	Rip Rap - Vernita Quarry. (m^3)					
	Closure						
	Barrier		6.38E+05	6.38E+05			
25.	asphalt (m^3)						
	Closure						
	Barrier		6.25E+04	6.25E+04			

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 215 of 393

BY RDW CHKD. _____ JOB NO. 01K 47101

table II Calculation Results for the TWRS FEIS draft to the latest criteria for canisters etc in handling the final vitrified glass product.

Numbers are broken down to put everything on the same basis for transportation and to establish common points of origin for transportation.

Items were added that had not previously been considered in the resource table for the spread sheets

Pages 216 through 246

10300	246363
29100	623233

Revised numbers for Combination 1 & 2 generated 7-5 & 7-6, 1996

RDW

$(370\ m^3)(0.4) \simeq 150\ m^3$

$\times 264 \simeq 39600$ gallons

$\div 5000 = 8$ trips

FORM 91-005-1 (4/81)

Item	No action	Long-term management	In situ fill and cap	In situ Vitrification	W-314 upgrades	Page 216 of 393
1. Land Permanently Committed (hectares)						
total	17	25	25	25	2.6	
m^2	1.7E+05	2.5E+05	2.5E+05	2.5E+05	2.6E+04	
Construction/ope.						
total	0	8	17	17	2.6	
m^2		8.0E+04	1.7E+05	1.7E+05	2.6E+04	
WR&T						
Vitrifi						
Closure						
Total	17	17			0	
m^2	1.7E+05	1.7E+05				
Barrier			8	8		
m^2			8.0E+04	8.0E+04		
2. Land Temporarily committed (hectares)						
total	0	50	21	111	2-93	
m^2		5.0E+05	2.1E+05	1.11E+06	2-93E+04	
Construction/ope.						
total	0	50	1	91	2-93	
m^2		5.0E+05	1.0E+04	9.1E+05	2-93E+04	
WR&T						
Vitrifi						
Closure						
total	0	0	20	20	0	
m^2			2.0E+05	2-0E+05		
Barrier						
3. Borrow Pit Disturbed area (hectares) [Based on 3 meters depth]						
McGee Ranch	NA	NA	16	16	NA	
m^2			1.6E+05	1.6E+05		
Pit 30	NA	16	39	37	NA	
m^2		1.6E+05	3.9E+05	3.4E+05		
Vernita Quarry	NA	NA	21	21	NA	
m^2			2.1E+05	2.1E+05		

Item	no action	Long-term management	In Situ fill+cap	In Situ vitrification	W-314 upgrade	Page 217 of 393
4. Water total m^3						
total	1.5E+06	1.5E+06	2.43E+06	1.71E+08	1.5E+03	
WR&T	NA					
Vitrifi	NA					
Closure	N/A					
5. Sanitary water, m^3						
Total	N/A	NR	2.43E+06	1.71E+08	NR	
WR&T						
vitrifi						
Closure						
Construction						
WR&T						
vitrifi						
total	NA	NR	5.9E+05	1.7E+08		
operation						
WR&T						
vitrifi						
total	N/A	NA	1.8E+06	1.2E+06		
Closure						
tank Slab						
Barrier						
onc Equip						
total	N/A	NA	4.13E+04	3.8E+04		
6. Raw water, m^3						
total	1.5E+06	1.5E+06	N/R	N/R	1.5E+03	
Construction						
WR&T						
Vitrifi						
total	NA	NA	NR	NR	1.5E+03	
operation	1.5E+06	1.5E+06	NR	NR	NR	
Vitrifi						
closure	NA	NA	NR	NR	NR	

13	Item	No action	Long-Term management	In Situ Fill + Cap	In Situ Vitrification	W-314 upgrades.	Page 215 of 393
7.	Energy Electrical	(Gwh)					
	Total	1.1E+03	1.1E+03	9.5E+02	4.46E+03	NR	
	WR&T						
	Vitrifi.						
	Closure						
	Construction						
	total		4.4E-01	1.8E+00	5.6E+01	NR	
	WR&T						
	Vitrifi						
	operation						
	total	1.1E+03	1.1E+03	9.5E+02	4.4E+03	NR	
	WR&T						
	Vitrifi						
	Closure						
	Total	NA	NA	NA	NA	NA	
8.	Gasoline (m^3)						
	total	NA	8.6E+04	3.98E+02	1.53E+04	NR	
	WR&T			NA	NA		
	Vitrifi			NA	NA		
	Closure			3.01E+02	3.0E+02		
	Construction						
	total	NA	8.6E+04	9.7E+01	1.5E+04	NR	
	WR&T						
	Vitrificat						
	operation						
	total	NA	NA	NA	NA	NR	
	WR&T						
	Vitrifi.						
	closure						
	total	NA	NA	3.01E+02	3.0E+02	NA	
	tank Stab			4.01E+01	4.01E+01		
	Barrier			2.6E+02	2.6E+02		
	anc-Equip			1.2E+00	NR		

14	Item	no action	Long-Term management	In Situ fill & cap	In Situ vitrification	W-314 upgrades
9.	Diesel Consumption (m^3)					
	total	2.2E+04	8.5E+04	5.96E+04	7.11E+04	NR
	WR+T					
	vitrifi					
	closure			5.22E+04	4.5E+04	
	Construction					
	total	NR	6.3E+04	1.3E+03	2.0E+04	NR
	WR+T					
	vitrifi					
	operation					
	total	2.2E+04	2.2E+04	6.10E+03	6.10E+03	NR
	WR+T					
	vitrifi					
	closure					
	total	NR	NR	5.22E+04	4.5E+04	NR
	rails tab			6.38E+03		
	Barrier			4.5E+04	4.5E+04	
	anc Equip			8.02E+02		
10.	Kerosene (m^3)					
	operation					
	total	NA	NA	NA	NA	NA
	vitrifi					
11.	Materials - Concrete (m^3)					
	total	NR	3.5E+05	1.9E+04	1.3E+05	3.92E+03
	WR+T		3.5E+05			3.92E+03
	vitrifi				1.3E+05	NA
	Closure	NR	NA	1.9E+04		NA
	Construction					
	total	NA	3.5E+05	NR	1.3E+05	3.92E+03

15	Item	No action	Long-term management	In Situ fill + cap	In Situ Vitrification	W-314 rep grades	page 220 of 393
	Construction						
	WR&T						
	total		3.5E+05			3.92E+03	
	Sand		2.36E+05			2.42E+03	
	gravel		1.39E+05			1.55E+03	
	Cement (MT)		8.75E+04			9.8E+02	
	Vitrifi						
	total				1.3E+05		
	Sand				8.76E+04		
	gravel				5.15E+04		
	Cement (MT)				3.25E+04		
	Operation						
	total	NA	NR	NR	NR	NA	
	WR&T						
	total						
	Vitrifi						
	total						
	S SW Vaults						
	total						
	Sand						
	gravel						
	cement						
	HSW Shield Cocks						
	total						
	Sand						
	gravel						
	Cement						
	Closure						
	total	NA	NR	1.9E+04	NR	NA	
	Tanks/Slab						
	total			5.3E+03			
	Sand			3.6E+03			
	gravel			2.1E+03			
	Cement (MT)			1.33E+03			

		no action	Long-term management	In Situ fill + cap	In Situ vitrification	W-314 upgrade	Page 22/04 393
	Barrier						
	one Equip						
	total			1.37E+04			
	sand			9.2E+03			
	gravel			5.4E+03			
	cement			3.4E+03			
12	Carbon Steel (MT)						
	Total	1E+03	1.4E+04	NR	2.6E+05	7.82E+02	
	WR+T					7.82E+02	
	Vitrifi						
	closure	NR	NR	NR	NR		
	Construction						
	total	NR	1.3E+04	NR	2.6E+05	7.82E+02	
	WR+T					7.82E+02	
	Vitrifi						
	operation						
	total	10E+03	1.0E+03	NR	NR	NA	
	LLW drums						
	HLW drums						
	LLW boxes						
	closure	NR	NR	NR	NR	NR	
13	Stainless Steel (MT)						
	total	NA	2.2E+01	NR	NR	6.02E+02	
	WR+T		2.2E+01			6.02E+02	
	Vitrifi						
	closure						
	Construction						
	total	NA	2.2E+01	NR	NR	6.02E+02	
	WR+T		2.2E+01			6.02E+02	
	Vitrifi						

17	Item	no action	Long-term management	In Situ fill + cap	In Situ Vitrification	w-314 upgrades.	Page 222 of 393
	operations total	NA	NR	NR	NR	NR	
	SS Connection						
	closure	NA	NA	NA	NA	NA	
14	Hastelloy / Inconel	(MT)					
	total	NA	NA	NA	NA	NA	
	Construction total	NA	NA	NA	NA	NA	
	vitrifi						
15	Glass formers	[1 line]	(MT)				
	total	NA	NA	NA	1.1E+04	NA	
	operations						
	alumina						
	Borax						
	Bulk fill						
	Calcium oxide						
	Ferric oxide						
	Lime stone				1.1E+04		
	Lithium oxide						
	Magnesium oxide						
	Silica						
	Na_2O						
16	Process chemicals	(MT)					
	total	NA	NA	NA	6.8E+03	NA	
	aluminum nitrate						
	ammonia				6.8E+03		
	antifoam						

18	Item	no action	Long-Term management	In Situ fill & cap	In Situ vitrification	W-234 upgrades	page 223 of 393
16	Process chemicals FeSA						
	Sugar						
17	Sulfur Cement (MT) operation	NA	NA	NA	NA	NA	
	Sulfur Dicyclopentadiene oligomer						
18	Ion Exchange Resin (m^3) operation	NA	NA	NA	NA	NA	
19.	Borrow site fill (m^3)		We See Ranch.				
	total	NA	NA	3.77E+05	3.77E+05	NA	
	Closure total	NA	NA	3.77E+05	3.77E+05		
	Barrier			3.77E+05	3.77E+05		

19	Item	no action	Long-term management	In Situ fill + cap	In Situ vitrification	W-314 upgrades	Page 224 of 393
20	Borrow Site Sand and Gravel (m^3)			(Pit-30)			
	total	NA	NA	1.18E+06	1.104E+06	NA	
	Construction						
	total	NA	3.75E+05		1.39E+05	NA	
	sand		2.36E+05				
	gravel		1.39E+05				
	operation						
	sand				5.4E+05		
	gravel						
	total	NA	NA	NA	5.4E+05	NA	
	closure						
	total	NA	NA	1.18E+06		NA	
	total tank tank slab						
	sand			2.03E+04			
	gravel			9.54E+05			
	total			7.64E+05			
	Barrier						
	total			4.24E+05	4.24E+05		
	sand						
	add pea gravel gravel			4.24E+05	4.24E+05		
21	Borrow site Basalt (m^3)		Vernita Quarry				
	Total	NA	NA	6.38E+05	6.38E+05	NA	
	closure						
	total			6.38E+05	6.38E+05		
	Barrier			6.38E+05	6.38E+05		
22.	asphalt (m^3)						
	total	NA	NA	6.25E+05	6.25E+05	NA	
	closure						
	total			6.25E+05	6.25E+05		
	Barrier			6.25E+05	6.25E+05		

20	Item	no action	Long-term management	In situ fill + cap	In situ vitrification	W-314 upgrades.	Page 225 of 393
23	Excavation (m^3)						
	Construction	NA	2.7E+06	NA	NA	1.1E+04	
	operation	NA	NA	NA	NA	NA	
	closure	NA	NA	NA	NA	NA	
24	Backfill (m^3)						
	Construction	NA	2.6E+06	NA	NA	1.68E+04	
	operation	NA	NA	NA	NA	NA	
	Closure	NA	NA	NA	NA	NA	
25	Grub and Clear (m^3)	NA	3.66 E+04	1.37E+04	4.2E+04	2.09E+03	
26	Construction Consumables ($\approx m^3$)						
	total	NA					
	WR&T		2.93E+04				
	vitrifi				1.1E+05	3.66E+01	
	Closure			1.47E+04			
27.	Closure. Barrier Rolls (Rolls)						
	Geotextile fdtn fabric.	NA	NA	170	170	NA	
28.	Solid Waste (m^3						
	total						
	Continued operations	3.0E+04	3E+04	3.0E+04	3.0E+04		
	construction		2.93E+04	1.47E+04	1.10E+05	7.77E+01	
	Plant operations						

1	Item	Ex Situ no Separations Vit	Ex Situ no Separations Calcination	Ex Situ Extensive Separations HLW + LLW	Ex Situ Intermediate Separations HLW + LLW
1.	Land Permanently committed (hectares)				
	total	27 ha	27	45	47
	M^2	2.7E+05	2.7E+05	4.5E+05	4.7E+05
	Construction/ops.				
	total	19 ha	19	33	36
	M^2	1.9E+05	1.9E+05	3.3E+05	3.6E+05
	WR+T	5.43 ha			
	M^2	5.43E+04			
	Vitrifi	13.57 ha			
	M^2	1.357E+05			
	closure				
	total	8 ha	8	12	11
	M^2	8.0E+04	8.0E+04	1.2E+05	1.1E+05
	Barrier	8 ha			
	M^2	8.0E+04			
2.	Land temporarily Committed (hectares)				
	total	88 ha	90	112	111.5
	M^2	8.8E+05	9.0E+05	1.12E+06	1.12E+06
	Construction/ops.				
	Total	68 ha	70	88	87.5
	M^2	6.8E+05	7.0E+05	8.8E+05	8.75E+05
	WR+T	3.4 ha			
	M^2	3.4E+04			
	vitrifi	64.6 ha			
	M^2	6.46E+05			
	closure				
	total	20	20	24	24
	M^2	2.0E+05	2.0E+05	2.4E+05	2.4E+05
	Barrier	20	20	24	24
	M^2	2.0E+05	2.0E+05	2.4E+05	2.4E+05
3.	Borrow Pit Disturbed area (hectares) [Based on 3 meters depth]				
	McGee Ranch	16	16	19	17
	Pit 30	138	84	77	81
	Verniola Quarry	21	21	32	29

2. Stem	Ex-Site no Separations vit	Calcination	Ex-Site Calcination Separation LLW+HLW	Ex-Site Intermediate Separation MLW+SLW
4. Water, total (m^3)				
total	4.05E+06	2.45E+06	6.7E+07	1.86E+07
WR&T	2.01E+06	2.01E+06	2.01E+06	2.01E+06
vitrifi	2.0 E+06	3.1E+05	6.49E+07	1.65E+07
Closure	4.13E+04	4.13E+04	4.33E+04	6.33E+04
5. Sanitary water total (m^3)				
total (m^3)	3.36E+06	2.36E+06	7.0E+06	6.37E+06
Construction				
WR&T	9.4E+03	9.4E+03	9.4E+03	9.4E+03
vitrifi	2.3E+05	2.3E+05	8.20E+05	4.926E+05
Total	2.39E+05	2.39E+05	8.29E+05	5.02E+05
operation				
WR&T	2.0E+06	2.0E+06	2.0E+06	2.0E+06
vitrifi	1.08E+06	8.0E+04	4.42E+06	3.8E+06
total	3.08E+06	2.08E+06	6.42E+06	5.8E+06
Closure				
Tank Stab	NR	NR	NR	NR
Barrier	3.80E+04	3.80E+04	4.0E+04	6.0E+04
assc. Equip	3.30E+03	3.30E+03	3.30E+03	3.3E+03
Total	4.13E+04	4.13E+04	4.33E+04	6.33E+04
6. Raw water (m^3				
total (m^3)	6.91E+05	8.58E+04	6.0E+07	1.22E+07
Construction	NR	NR	NR	NR
WR&T				
vitrifi				
total	NR	NR	NR	NR
operation				
vitrifi	6.91E+05	8.58E+04	6.0E+07	1.22E+07
Closure	NR	NR	NR	NR

3	Item	Ex-Situ no Separations unit	Excination	Ex-Situ Extensive Separations HLW + SSW	Ex-Situ Intermediate separation HSW + SSW
7.	Electrical Energy (Gwh)				
	total	7.05E+03	4.72E+03	3.33E+04	1.09E+04
	WR+T	1.36E+00	1.36E+00	1.36E+00	1.36E+00
	Vitrifi	7.05E+03	4.72E+03	3.33E+04	1.09E+04
	Closure	NR	NR	NR	NR
	Construction				
	total	3.0E+01	3.0E+01	8.9E+01	7.38E+01
	WR+T	7.6E-01	7.6E-01	7.6E-01	7.6E-01
	vitrifi	3.0E+01	3.0E+01	8.9E+01	7.3E+01
	operation				
	total	7.02E+03	4.69E+03	3.32E+04	1.08E+04
	WR+T	6.0E-01	6.0E-01	6.0E-01	6.6E-01
	vitrifi	7.02E+03	4.69E+03	3.32E+04	1.08E+04
	closure				
	total	NR	NR	NR	NR
8.	Gasoline				
	total (m^3)	5.43E+03	5.43E+03	1.02E+04	8.1E+03
	WR+T	3.3E+02	3.3E+02	3.3E+02	3.3E+02
	vitrifi	4.8E+03	4.8E+03	9.45E+03	7.4E+03
	Closure	3.01E+02	3.01E+02	4.09E+02	4.12E+02
	Construction				
	total	5.13E+03	5.13E+03	9.73E+03	7.63E+03
	WR+T	3.3E+02	3.3E+02	3.3E+02	3.3E+02
	vitrifi	4.8E+03	4.8E+03	9.4E+03	7.3E+03
	operation				
	total	NR	NR	4.4E+01	5.1E+01
	WR+T				
	vitrifi			4.4E+01	5.1E+01
	Closure				
	total	3.013E+02	3.013E+02	4.09E+02	4.12E+02
	tank Stat	4.01E+01	4.01E+01	4.01E+01	4.01E+01
	Barriers	2.60E+02	2.6E+02	3.68E+02	3.71E+02

4	Item	Ex Situ no Separation Vit.	Calcination	Ex Situ Extensive Separations LLW+HLW	Ex Situ Intermediate Separation HLW+SW
9.	Diesel consumption (m^3)				
	Total	6.55E+04	6.51E+04	1.08E+05	9.95E+04
	WR&T	2.02E+03	2.02E+03	2.02E+03	2.02E+03
	Vitrifi	1.13E+04	1.09E+04	3.52E+04	2.724E+04
	closure	5.22E+04	5.22E+04	7.08E+04	7.02E+04
	Construction				
	Total	1.19E+04	1.19E+04	2.9E+04	2.11E+04
	WR&T	1.0E+03	1.0E+03	1.0E+03	1.0E+03
	vitrifi	1.09E+04	1.09E+04	2.8E+04	2.01E+04
	operation				
	Total	1.39E+03	1.02E+03	8.17E+03	8.16E+03
	WR&T	1.02E+03	1.02E+03	1.02E+03	1.02E+03
	Vitrifi	3.7E+02	1.5E+02	7.15E+03	7.14E+03
	closure				
	total	5.22E+04	5.22E+04	7.08E+04	7.02E+04
	Tank Stab	6.38E+03	6.38E+03	6.38E+03	6.4E+03
	Barrier	4.50E+04	4.50E+04	6.36E+04	6.3E+04
	anc Equip	8.02E+02	8.02E+02	8.02E+02	8.02E+02
10.	Kerosene (m^3)				
	operations				
	total	8.48E+04	1.05E+04	1.872E+05	6.58E+04
	vitrifi	8.48E+04	1.05E+04	1.872E+05	6.58E+04
11.	Materials - Concrete (m^3)				
	Total	2.78E+06	1.26E+06	9.08E+05	1.04E+06
	WR&T	5.9E+04	5.9E+04	5.9E+04	5.9E+04
	Vitrifi	2.70E+06	1.19E+06	8.29E+05	9.57E+05
	Closure	1.90E+04	1.90E+04	1.90E+04	1.90E+04
	Construction				
	total	2.76E+05	2.66E+05	5.0E+05	5.41E+05

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Item	Ex Situ no Separations Vit	Calcination	Ex Situ Extensive Separations HLW + SSW	Ex Situ Intermediate Separations HLW + SSW
Construction				
WR&T				
total m^3	5.9E+04	5.9E+04	5.9E+04	5.9E+04
sand m^3	4.0E+04	3.98E+04	3.98E+04	3.98E+04
gravel m^3	2.46E+04	2.34E+04	2.34E+04	2.34E+04
Cement MT	1.48E+04	1.48E+04	1.48E+04	1.48E+04
Vitrifi				
total	2.07E+05	2.07E+05	4.4E+05	4.82E+05
sand	1.46E+05	1.4E+05	2.97E+05	3.25E+05
gravel	8.52E+04	8.2E+04	1.742E+05	1.91E+05
Cement (MT	5.48E+04	5.48E+04	1.1 E+05	1.21E+05
~~total~~				
operations				
Total	2.48E+06	9.8E+05	3.89E+05	4.75E+05
WR&T	NA		NA	
total				
Vitrifi				
total	2.48E+06	9.8E+05	3.89E+05	4.75E+05
SSW vaults				
total	NA	NA	3.81E+05	3.0 E+05
sand			2.57E+05	2.02E+05
gravel			1.51E+05	1.19E+05
Cement (MT)			9.53E+04	7.5E+04
HLW Shield Casks				
total	2.48E+06	9.8E+05	8.11E+03	1.75E+05
sand	1.67E+06	6.61E+05	5.47E+03	1.18E+05
gravel	9.82E+05	3.88E+05	3.21E+03	6.93E+04
Cement (MT)	6.2E+05	2.45E+05	2.03E+03	4.4E+04
Closure				
total	1.9E+04	1.9E+04	1.9E+04	1.9E+04
tank Slab				
total	5.3E+03	5.3E+03	5.3E+03	5.3E+03
sand	3.6E+03	3.6E+03	3.6E+03	3.6E+03
gravel	2.1E+03	2.1E+03	2.1E+03	2.1E+03
Cement (MT)	1.33E+03	1.33E+03	1.33E+03	1.33E+03

	Item	Ex Situ no separations	Calcination	Ex Situ Extensive separations HLW + SLW	Ex Situ Intermediate separation HLW + SLW.
	Barrier	NA	NA	NA	NA
	anc Equip				
	total	1.37E+04	1.37E+04	1.37E+04	1.37E+04
	sand	9.2E+03	9.2E+03	9.2E+03	9.2E+03
	gravel	5.4E+03	5.4E+03	5.4E+03	5.4E+03
	Cement	3.4E+03	3.4E+03	3.4E+03	3.4E+03
12	Materials - Carbon Steel (MT)				
	total	2.58E+05	1.32E+05	3.02E+05	2.69E+05
	WR&T	1.0E+04	1.0E+04	1.0E+04	1.0E+04
	Utilities	2.49E+05	1.22E+05	2.92E+05	2.59E+05
	Closure	NR	NR	NR	NR
	Construction				
	total	6.17E+04	6.12E+04	1.4E+05	1.07E+05
	WR&T	1.0E+04	1.0E+04	1.0E+04	1.0E+04
	Utilities	5.17E+04	5.12E+04	1.3E+05	9.71E+04
	operation				
	total	1.96E+05	7.64E+04	1.62E+05	1.62E+05
	SLW vaults			4.4E+04	3.3E+04
	HLW HNPCC	1.96E+05	7.04E+04	9.3E+03	1.97E+04
	SLW boxes			1.09E+05	1.09E+05
	Closure	NR	NR	NR	NR
13	Stainless Steel (MT)				
	Total	1.78E+05	7.1E+04	2.16E+04	3.26E+04
	WR&T	4.0E+03	4.0E+03	4.0E+03	4.0E+03
	Utilities	1.74E+05	6.7E+04	1.76E+04	2.86E+04
	Closure	NR	NR	NR	NR
	Construction				
	Total	1.26E+04	1.26E+04	2.1E+04	1.9E+04
	WR&T	4.0E+03	4.0E+03	4.0E+03	4.0E+03
	Utilities	8.61E+03	8.61E+03	1.7E+04	1.5E+04

7	Item	Ex Situ no Separations Vit	Calculation	Ex Situ Extreme Separation LLW + HLW	Ex Situ Intermediate separation LLW + HLW.
	operations				
	Total	1.65E+05	5.84E+04	6.41E+02	1.36E+04
	SS Canisters	1.65E+05	5.84E+04	6.41E+02	1.36E+04
	closure	NR	NR	NR	NR
14.	Hastelloy/Inconel (MT)				
	total	1.51E+03	1.51E+03	1.8E+03	2.3E+03
	Construction				
	total	1.51E+03	1.51E+03	1.8E+03	2.3E+03
	vitrifi	1.51E+03	1.51E+03	1.8E+03	2.3E+03
15.	Glass Forming [Flux]	MT			
	Total	4.29E+05	NR	5.233E+05	5.65E+05
	operations				
	alumina	1.72E+04		2.3E+04	2.53E+04
	Borax			1.83E+02	3.32E+03
	Bulk Frit				
	Calcium oxide	6.11E+04		7.57E+04	7.44E+04
	ferric oxide				
	Limestone				
	Lithium oxide			2.0E+01	9.5E+02
	Magnesite				
	Silica	3.51E+05		4.25E+05	4.6E+05
	Nd_2O			3.7E+01	
16.	Process chemicals (MT)			1.07E+06	
	Total	2.87E+05	3.06E+05	1.07E+06	2.71E+05
	aluminum nitrate			1.12E+02	1.12E+02
	ammonia	6.98E+03	3.61E+04	9.24E+03	8.8E+03
	antifoam				
	APM			1.0E+01	
	CMPO			5E+00	5E+00
	Crown Ether			2.84E+02	
	Decon Chemicals				5.3E+03
	Floc			1.5E+02	8.5E+01
	Formic acid			1.47E+03	

8	Item	Ex Situ no Separations	Calcination	Ex Situ Extensive Separations LLW + HLW	Ex Situ Intermediate Separations LLW + HLW
16	Process chemicals				
	FeSA			4.72E+03	4.72E+03
	Glycolic acid			7.7E+03	3.5E+03
	HF			7.4E+02	
	HNO_3, 50%	6.30E+02	6.30E+02	4.66E+05	4.2E+03
	Hydroxylamine			9.5E+01	
	NaOH, 50%	2.66E+02	2.66E+02	1.5E+05	2.6E+04
	Na_3 DTPA			1.96E+02	
	NPH			7.03E+02	7.63E+02
	Oxalic acid	3.20E+01	3.2E+01	1.2E+04	
	Oxygen	2.77E+05	1.34E+05	3.7E+05	2.17E+05
	Peroxide			6.4E+03	
	$KMnO_4$	1.70E+01	1.70E+01		
	Sodium Bicarbonate			1.25E+04	
	Sodium Carbonate			1.8E+02	
	Sodium nitrate				5.4E+01
	Sodium oxalate			2.09E+04	
	TBP			7.55E+02	7.55E+02
	TSP	1.90E+03	1.90E+03		
	Zirconium Nitrate			4.7E+01	
	Sugar		3.3E+04		
17.	Sulfur Cement (mT)				
	operation				
	Sulfur	NA	NA	2.83E+05	1.48E+05
	Dicyclopentadiene	NA	NA	7.42E+03	3.86E+03
	Oligomer	NA	NA	7.42E+03	3.86E+03
18.	Ion Exchange media (m^3)				
	operation	NA	NA	4.9E+03	2.2E+02
19.	Barrow site fill (m^3) McGee Ranch.				
	total	3.77E+05	3.77E+05	5.66E+05	5.19E+05
	Closure				
	total	3.77E+05	3.77E+05	5.66E+05	5.19E+05
	Barrier	3.77E+05	3.77E+05	5.66E+05	5.19E+05

9	Item	Ex Situ no Separations	Calcination	Ex Situ Extension Separations HSW + SSW	Ex Situ Intermediate Separations LLW + HSW
20.	Borrow Sites Sand and Gravel (m^3)				
	total	4.13E+06	2.52E+06 2.54	2.29E+06 2.31	2.43E+06
	Construction				
	total	2.97E+05	2.85E+05	5.35E+05	5.8E+05
	Sand	1.86E+05	1.8E+05	3.37E+05	3.65E+05
	Gravel	1.11E+05	1.05E+05	1.98E+05	2.15E+05
	operation				
	Sand	1.67E+06	6.61E+05	2.63E+05	3.2E+05
	gravel	9.82E+05	3.88E+05	1.54E+05	1.88E+05
	total	2.65E+06	1.05E+06	4.17E+05	5.08E+05
	closure	1.2	1.2	1.36	
	total	1.18E+06	1.18E+06	1.34E+06	1.34E+06
	Vault Stab.				
	Sand.	2.03E+04	2.03E+04	2.03	
	gravel	7.58E+05	7.58E+05	7.58E+05	7.58E+05
	total	7.58E+05	7.58E+05	7.58E+05	7.58E+05
	Barrier				
	total	4.24E+05	4.24E+05	5.81E+05	5.8E+05
	Sand.				
	gravel.	4.24E+05	4.24E+05	5.81E+05	5.8E+05
21.	Borrow Site Basalt m^3 Vernita Quarry.				
	total	6.38E+05	6.38E+05	9.58E+05	8.78E+05
	Closure				
	total	6.38E+05	6.38E+05	9.58E+05	8.78E+05
	Barrier	6.38E+05	6.38E+05	9.58E+05	8.78E+05
22.	asphalt (m^3)				
	total	6.26E+04	6.26E+04	9.39E+04	8.6E+04
	Closure				
	total	6.26E+04	6.26E+04	9.39E+04	8.6E+04
	Barrier	6.26E+04	6.26E+04	9.39E+04	8.6E+04

10	Item	Ex Situ Mo Separations	Calcination	Ex Situ Extension Separations HLW + LLW	Ex Situ Intermediate Separations HLW - LLW
23.	Excavation (m^3)				
	Construction	7.95E+05	7.95E+05	1.8E+06	1.7E+06
	operation	NA	NA	2.44E+06	2.44E+06
	closure				
24	Backfill (m^3)				
	Construction	5.73E+05	5.73E+05	8.5E+05	1.2E+06
	operation	NA	NA	1.19E+06	1.19E+06
	closure	NA	NA	NA	NA
25.	Grub and Clear (m^3)	2.6E+04	2.6E+04	5.04E+04	3.36E+04
26.	Construction Consumables (m^3)				
	total	1.03E+05	1.03E+05	1.15E+05	1.393E+05
	WR&T	2.93E+04	2.93E+04	2.93E+04	2.93E+04
	Vitrifi	7.33E+04	7.33E+04	8.55E+04	1.10E+05
	closure				
27.	Closure Barrier (Rolls)				
	Geotextile Filter Fabric	170	170	232	232
28	Solid waste (m^3)				
	total	1.42E+05	1.42E+05	1.55E+05	1.79E+05
	Continual operations	3.0E+04	3.0E+04	3.0E+04	3.0E+04
	Construction	1.03E+05	1.03E+05	1.15E+05	1.393E+05
	plant operation	8.8E+03	8.8E+03	1.0E+04	9.6E+03

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Item	Ex Situ/ In Situ Combination 70 of 177 TKS	Ex Situ/ In Situ Combination 25 of 177 TKS	Phased Implementation phase I (2) 20 T/d + (1) 1 T/d	Phased Implementation Phase II (2) 100 T/d (1) 5 T/d	page Revised 70/177	236 of 393 Revised 25/177
1 Land Permanently committed (hectares)						
Total	41	31	3	59		
m^2	4.1E+05	3.1E+05		5.9E+05		
Construction/opr						
total	31	22	3	47		
m^2	4.1E+05	2.2E+05		4.7E+05		
WR+T						
Vitrifi						
Closure						
total	10	9	0	12		
m^2	1.0E+05	9.0E+04		1.2E+05		
Barrier	10	9	0	12		
m^2	1.0E+05	9.0E+04		1.2E+05		
2. Land temporarily committed (hectares)						
total	107	82	32	142		
m^2	1.07E+06	8.2E+05	3.2E+05	1.42E+06		
Construction/opr						
total	85	60	32	118		
m^2	8.5E+05	6.0E+05	3.2E+05	1.18E+06		
WR+T						
Vitrifi						
Closure						
total	22	22	0	24		
m^2	2.2E+05	2.2E+05		2.4E+05		
Barrier	22	22	0	24		
m^2	2.2E+05	2.2E+05		2.4E+05		
3. Borrow Pit Disturbed area (hectares) [Based on 3 meters depth]						
McGee Ranch	16	14	NA	19		
Pit 30	60	54	1	86	63	55
Vernita Quarry	26	24	NA	32		

Item	Ex Situ / In Situ / Combination 70 of 177 Tks	Ex Situ / In Situ Combination 25 of 177 Tks	Phased Implementation Phase I	Phased Implementation Phase 2	Page Revised 70/177	237 of 393 Revised 25/177
4. Water, total (m^3)						
total	1.24E+07	7.25E+06	2.81E+06	1.85E+07	1.31E+07	7.38E+06
WR&T	1.01E+06	5.85E+05	NA	2.01E+06		
Vitrifi	1.13E+07	6.62E+06	2.81E+06	1.64E+07		
closure	6.09E+04	4.95E+04	NA	6.33E+04		
5. Sanitary water, total (m^3)						
Total	4.81E+06	2.863E+06	6.1E+05	6.48E+06	5.35E+06	2.91E+06
Construction						
total	4.21E+05	2.93E+05	3.9E+05	6.78E+05	4.22E+05	2.95E+0
WR&T	9.4E+03	5.45E+03	NA	9.4E+03		
Vitrifi	4.11E+05	2.88E+05	3.9E+05	6.69E+05	4.12E+05	2.991E+0
operation						
total	4.34E+06	2.52E+06	2.2E+05	5.74E+06	4.42E+06	2.56E+06
WR&T	1.0E+06	5.8E+05	NA	2.0E+06		
vitrifi	3.34E+06	1.94E+06	2.2E+05	3.74E+06	3.42E+06	1.98E+06
Closure						
Tank Stor	NR	NR	NA	NR		
Basin	4.76E+04	4.62E+04	NA	6.0E+04		
onc Equip	3.3E+03	3.3E+03	NA	3.3E+03		
total	5.09E+04	4.95E+04	NA	6.33E+04		
6. Raw Water, total	(m^3)					
total	7.56E+06	4.39E+06	2.2E+06	1.2E+07	7.71E+06	4.47E+0
Construction						
WR&T						
vitrifi						
total	NR	NR	NR	NR		
operation						
vitrifi	7.56E+06	4.39E+06	2.2E+06	1.2E+07	7.71E+06	4.47E+
total	7.56E+06	4.39E+06	2.2E+06	1.2E+07	7.71E+06	4.47E+
closure						
Total	NR	NR	NR	NR		

23	Item	Ex Situ/ In Situ Combination 70 of 177 TKS	Ex Situ In Situ Combination 25 of 177 TKS	Phased Implementation Phase I	Phased Implementation Phase II	Removed 70/177	Remained 25/177
7.	Electrical Energy	(Joule)					
	total	9.85E+03	6.16 E+03	1.65E+03	1.07E+04	1.006E+04	7.57E+03
	WR+T	1.76E+00	1.194E+00	NA	1.36E+00		
	vitrifie	9.85E+03	6.16E+03	1.65E+03	1.07E+04		
	closure	NR	NR	NR	NR		
	Construction						
	total	3.7E+03	2.59E+03	5.0 E+01	1.0 E+02	3.72E+03	2.60E+03
	WR+T	1.46E+00	1.02E+00	NA	7.6 E-01		
	Vitrifie	3.7E+03	2.59E+03	5.0E+01	9.93 E+01	3.72E+03	2.66E+03
	operation						
	total	6.15E+03	3.57E+03	1.6E+03	1.06E+04	6.34E+03	4.97E+03
	WR+T	3.0E-01	1.74E-01	NA	6.0E-01		
	vitrifie	6.16E+03	3.57E+03	1.6 E+03	1.06E+04	6.34E+03	4.97E+03
	closure						
	total	NR	NR	NR	NR		
8.	Gasoline (m^3)						
	Total	5.03E+03	3.54E+03	6.5E+03	1.09E+04	5.26E+03	3.55E+03
	WR+T	2.0E+02	1.4E+02	NA	3.3E+02		
	vitrifi	4.48E+03	3.14E+03	6.5E+03	1.02E+04	4.91E+03	
	closure	3.5E+02	2.57E+02	NA	4.12E+02		
	Construction						
	Total	4.65E+03	3.26E+03	6.5E+03	1.043E+04	4.88E+03	3.268E+03
	WR+T	2.0E+02	1.4 E+02	NA	3.3 E+02		
	Vitrifi	4.45E+03	3.12E+03	6.5E+03	1.01E+04	4.68E+03	3.128E+03
	operation						
	Total	2.73E+01	2.18E+01	NA	5.01E+01		
	WR+T				NA		
	Vitrifi	2.73E+01	2.18E+01		5.01E+01		

Item	Ex Situ/ In Situ Combination 70/177	Ex Situ In Situ-Low Combination 25/177	Phased Implementation Phase I	Phased Implementation Phase II	Page Revision 70/177	239 of 393 Revision 25/177
8. Closure						
Total	3.5E+02	2.57E+02	NA	4.12E+02		
Tank Slab	4.01E+01	4.01E+01		4.01E+01		
Barrier	3.09E+02	2.15E+02		3.71E+02		
anc Equip	1.2E+00	1.2E+00		1.2E+00		
9. Diesel Consumption (m^3)						
Total	9.01E+04	7.83E+04	1.8E+04	1.07E+05	9.65E+04	7.83E+04
WR&T	4.87E+03	2.9E+03	NA	5.04E+03		
Vitrifi	2.6E+04	1.7E+04	1.8E+04	3.54E+04		
Closure	6.0E+04	5.84E+04	NA	6.97E+04		
Construction						
total	2.29E+04	1.6E+04	1.8E+04	2.84E+04	3.13E+04	1.61E+04
WR&T	6.00E+02	4.2E+02	NA	1.02E+03		
vitrifi	2.23E+04	1.56E+04	1.8E+04	2.83E+04	3.07E+04	1.54E+04
operation						
total	7.17E+03	3.83E+03	NA	9.14E+03		
WR&T	4.27E+03	2.48E+03		1.02E+03		
Vitrifi	2.9E+03	1.35E+03		8.12E+03		
Closure						
Total	6.0E+04	5.84E+04	NA	6.97E+04		
Tank Slab	6.38E+03	6.38E+03		6.38E+03		
Barrier	5.28E+04	5.12E+04		6.254E+04		
anc Equip	8.02E+02	8.02E+02		8.02E+02		
10. Kerosene (m^3)						
operations						
total	3.97E+04	2.3E+04	9.8E+02	6.48E+04	4.04E+04	2.34E+04
Vitrifi	3.97E+04	2.3E+04	9.8E+02	6.48E+04	4.04E+04	2.34E+04
11. Materials - Concrete (m^3)						
total	5.04E+05	3.62E+05	3.01E+04	1.14E+06	5.76E+05	3.83E+04
WR&T	2.95E+04	2.07E+04	NA	5.09E+04		
Vitrifi	4.55E+05	3.224E+05	3.01E+04	1.063E+06		
Closure	1.9E+04	1.9E+04	NA	1.9E+04		

Item	Ex Situ In Situ Combination 70/177	Ex Situ In Situ Combination 25/177	Phased Implementation Phase I	Phased Implementation Phase II	Page 240 of 393 Revised 70/177	Revised 25/177
11 Construction (m^3)						
Total	2.71 E+05	1.9E+05	2.4 E+04	7.15E+05	3.07E+05	1.91E+05
WR&T						
total	2.95 E+04	2.07E+04	NA	5.09E+04		
Sand	1.99E+04	1.4E+04		3.98E+04		
gravel	1.17E+04	8.2E+03		2.34E+04		
Cement (MT)	7.38E+03	5.2E+03		1.48E+04		
Vitrifi						
total	2.41 E+05	1.69E+05	2.4E+04	6.56E+05	2.77E+05	1.70E+05
Sand	1.63E+05	1.14E+05	1.62E+04	4.42E+05	1.87E+05	1.15E+05
gravel	9.54 E+04	6.7E+04	9.3E+03	2.6E+05	1.10E+05	6.72E+04
Cement (MT)	6.03E+04	4.23E+04	6.0E+03	1.64E+05	6.93E+04	4.24E+04
operations						
Total	2.14E+05	1.53E+05	6.07E+03	4.07E+05		
WR&T						
total			NA	NA		
Vitrifi						
Total	2.14E+05	1.53E+05	6.07E+03	4.07E+05	2.50E+05	1.73E+05
LLW vaults						
total	1.29E+05	1.03E+05	NA	2.41E+06		
Sand	8.7E+04	6.94E+04		1.63E+05		
gravel	5.11E+04	4.08E+04		9.54E+04		
(MT) cement	3.23E+04	2.58E+04		6.03E+04		
HLW Shields						
total	8.5E+04	5.0E+04	6.07E+03	1.66E+05	1.21E+05	7.0E+0
Sand	5.73E+04	3.4E+04	4.09E+03	1.12E+05	8.17E+04	4.72E+0
gravel	3.37E+04	2.0E+04	2.4E+03	6.57E+04	4.80E+04	2.77E+0
(MT) Cement	2.13E+04	1.26E+04	1.52E+03	4.15E+04	3.03E+04	1.75E+04
Closure						
Total	1.9E+04	1.9E+04	NA	1.9E+04		

	item	Ex Situ In Situ Combination 70/177	Ex Situ In Situ Combin - Low 25/177	Phased Implementation phase I	Phased Implementation phase II	Page 241 of 393 Revised 70/177	Revised 25/177
11	Tank Stab						
	total	5.3 E+03	5.3 E+03	NA	5.3 E+03		
	Sand	3.6 E+03	3.6 E+03		3.6 E+03		
	gravel	2.1 E+03	2.1 E+03		2.1 E+03		
	Cement (MT)	1.33 E+03	1.33 E+03		1.33 E+03		
	Barrier	NA	NA	NA	NA		
	anc Equip						
	total	1.37 E+04	1.37 E+04	NA	1.37 E+04		
	Sand	9.2 E+03	9.2 E+03		9.2 E+03		
	gravel	5.4 E+03	5.4 E+03		5.4 E+03		
	Cement (MT)	3.4 E+03	3.4 E+03		3.4 E+03		
12.	Carbon Steel (MT)						
	total	1.45 E+05	9.51 E+04	8.64 E+04	2.92 E+05	1.49 E+05	9.733 E+04
	WR+T	5.0 E+03	3.5 E+03	NA	1.0 E+04		
	vitrifi	1.4 E+05	9.16 E+04	8.64 E+04	2.82 E+05		
	Closure	NA	NA	NA	NA		
	Construction						
	total	5.36 E+04	3.75 E+04	8.3 E+04	1.42 E+05		
	WR+T	5.0 E+03	3.5 E+03	NA	1.0 E+04		
	Vitrifi	4.86 E+04	3.4 E+04	8.3 E+04	1.32 E+05		
	operation						
	Total	9.10 E+04	5.76 E+04	3.43 E+03	1.55 E+05	9.52 E+04	5.983 E+04
	SSW vaults	1.5 E+04	1.2 E+04	NA	2.8 E+04		
	HLW HMPCs	9.75 E+03	5.77 E+03	7.0 E+02	1.9 E+04	1.39 E+04	8.03 E+03
	LLW Boxes	6.62 E+04	3.98 E+04	2.73 E+03	1.08 E+05		
	Closure	NA	NA	NA	NA		
13.	Stainless Steel (MT)						
	total	1.63 E+04	1.07 E+04	1.55 E+04	3.76 E+04	1.91 E+04	
	WR+T	2.0 E+03	1.4 E+03	NA	4.0 E+03		
	Vitrifi	1.43 E+04	9.29 E+03	1.55 E+04	3.36 E+04		
	Closure	NA	NA	NA	NA		

Item	Ex Situ In Situ Combination 70/177	Ex Situ In Situ Combo - Low 25/177	Phased Implementation Phase I	Phased Implementation Phase II	Revised 70/177	Revised 25/177
13. Construction						
total	9.5E+03	6.65E+03	1.5E+04	2.44E+04		
WR+T	2.0E+03	1.4E+03	NA	4.0E+03		
vitrifi	7.5E+03	5.25E+03	1.5E+04	2.04E+04		
operation						
total	6.76E+03	4.0E+03	4.8E+02	1.32E+04	9.62E+03	5.56E+03
SS Canisters	6.76E+03	4.0E+03	4.8E+02	1.32E+04	9.62E+03	5.56E+03
closure	NA	NA	NA	NA		
14 Hastelloy/Inconel	(MT)					
total	1.15E+03	8.05E+02	2.6E+03	3.13E+03		
Construction						
total	1.15E+03	8.05E+02	2.6E+03	3.13E+03		
vitrifi	1.15E+03	8.05E+02	2.6E+03	3.13E+03		
15 Glass Formers	[Flux]	(MT)				
total	3.4E+05	1.98E+05	1.3E+05	5.58E+05	3.47E+05	2.02E+05
operation						
alumina	1.54E+04	8.97E+03	4.2E+03	2.5E+04		
Borax	1.59E+03	9.35E+02	2.52E+03	3.25E+03	2.42E+03	1.38E+0
Bulk fit						
Calcium oxide	4.53E+04	2.63E+04	1.23E+04	7.34E+04		
Ferric oxide						
Limestone						
Lithium oxide	4.55E+02	2.67E+02	7.2E+02	9.3E+02	6.91E+02	3.95E+0
mag oxide						
Silica	2.77E+05	1.62E+05	1.103E+05	4.55E+05	2.83E+05	1.65E+0
NaO						
16. Process chemicals	(MT)					
total ($pC+O_2$)	1.58E+05	9.17E+04	1.64E+04	2.67E+05	1.6E+05	9.3E+0
alumin nitrate	5.6E+01	3.3E+01	2.24E+01	1.1E+02		
ammonia	4.4E+03	2.55E+03	1.78E+03	8.67E+03		
anti foam						

Item	Ex Situ In Situ Combination 70/177	Ex Situ In Situ Combo-Low 25/177	Phased Implementation Phase I	Phased Implementation Phase II	Revised 70/177	Revised 25/177
APW						
CMPO	2.5E+00	1.46E+00	1.0E+00	4.93E+00		
Crown Ether						
Decon Chemicals	2.65E+03	1.54E+03	1.07E+03	5.22E+03		
Floc	4.25E+01	2.47E+01	1.72E+01	8.4E+01		
Formic acid						
FeSA	2.36E+03	1.37E+03	9.53E+02	4.65E+03		
Glycolic acid	1.75E+03	1.02E+03	7.07E+02	3.45E+03		
HF						
HNO_3, 50%	2.1E+03	1.22E+03	8.48E+02	4.14E+03		
Hydroxylamine						
NaOH, 50%	1.3E+04	7.54E+03	5.25E+03	2.56E+04		
Na_3 DTPA						
KPH	3.52E+02	2.04E+02	1.42E+02	6.93E+02		
Oxalic acid						
Oxygen	1.31E+05	7.6E+04	2.23E+03	2.14E+05	1.33E+05	7.73E+04
peroxide						
$KMnO_4$						
Sodium Bicarbonate						
Sodium Carbonate						
Sodium nitrate	2.7E+01	1.57E+01	1.09E+01	5.3E+01		
Sodium oxalate						
TBP	3.78E+02	2.19E+02	1.53E+02	7.44E+02		
TSP						
Zinc Nitrate						
Sugar						
17. Sulfur Cement	(mT)					
operation						
Sulfur	8.91E+04	5.17E+04	2.96E+04	1.46E+05		
Dicyclopentadiene	2.33E+03	1.35E+03	7.72E+02	3.81E+03		
Oligomer	2.33E+03	1.35E+03	7.72E+02	3.81E+03		
18. Ion Exchange media	(m^3)					
operation						
total	1.1E+02	6.38E+01	4.4E+01	2.17E+02		

29	Item	Ex Situ Insitu Combination 70/177	Ex Situ Insitu Combo-Low 25/177	Phased Implementation phase I	Phased Implementation phase II	Revised 70/177	Revised 25/177
19	Barrow site soil (m³)		Mc Lee	Ranch.			
	total	4.72E+05	4.25E+05	NA	5.66E+05		
	Closure						
	total	4.72E+05	4.25E+05	NA	5.66E+05		
	Barrier	4.72E+05	4.25E+05		5.66E+05		
20	Barrow site sand and gravel (m³)			pit-30			
	total	1.81E+06	1.65E+06	3.20E+04	2.56E+06	1.89E+06	1.65E+06
	Construction						
	total	2.9E+05	2.03E+05	2.95E+04	7.65E+05	3.29E+05	2.04E+05
	sand	1.83E+05	1.28E+05	1.62E+04	4.82E+05	2.07E+05	1.29E+05
	gravel	1.07E+05	7.52E+04	9.3E+03	2.834E+05	1.22E+05	7.54E+04
	operation						
	total	2.29E+05	1.642E+05	6.49E+03	4.36E+05	2.68E+05	1.86E+05
	sand	1.44E+05	1.03E+05	4.09E+03	2.75E+05	1.69E+05	1.17E+05
	gravel	8.48E+04	6.08E+04	2.4E+03	1.61E+05	9.91E+04	6.85E+04
	Closure	2.03E+4	2.03E+04		5.03E+04		
	total	1.27E+06	1.24E+06		1.36E+06		
	% tank/tub	1.89	1.26				
	sand						
	gravel	7.58E+05	7.58E+05		7.58E+05		
	total	7.58E+05	7.58E+05	NA	7.58E+05		
	Barrier						
	total	5.16E+05	4.82E+05		5.81E+05		
	sand						
	gravel	5.16E+05	4.82E+05		5.81E+05		
21.	Barrow site Basalt (m³)			Vernita Quarry.			
	total	7.85E+05	7.18E+05	NA	9.58E+05		

Item	Ex Situ In Situ Combination 70/177	Ex Situ In Situ Combo-Focus 25/177	Phased Implementation phase I	Phased Implementation phase II	Revised 70/177	Revised 25/177
21. Closure						
total	7.85E+05	7.18E+05	NA	9.58E+05		
Barrier	7.85E+05	7.18E+05		9.58E+05		
22. Asphalt (m^3)						
total	7.83E+04	7.04E+04		9.39E+04		
Closure						
total	7.83E+04	7.04E+04		9.39E+04		
Barrier	7.83E+04	7.04E+04		9.39E+04		
23. Excavation (m^3)						
Construction	1.26E+06	8.83E+05	2.754E+05	2.31E+06	(1695 m^3) added.	
operation	1.31E+06	7.32E+05	NA	2.44E+06		
Closure	NR	NR	NA	NA		
24. Backfill (m^3)						
Construction	6.0E+05	4.2E+05	4.01E+04	1.63E+06 m^3		
operation	6.38E+05	5.02E+05	NA	1.19E+06		
Closure	NR	NR	NA	NA		
25. Grub and Clear (m^3)	3.21E+04	2.26E+04	4.89E+03	4.43E+04		
26. Construction Consumables (m^3)						
Total	9.0E+04	6.36E+04	2.2E+04	1.15E+05		
WR&T	2.2E+04	1.47E+04		2.93E+04		
Vitrifi	6.84E+04	4.89E+04	2.2E+04	8.56E+04		
Closure						
27. Closure Barrier (Rolls)						
Geotextile filter fabric	207	193	NA	232		

	Item	Ex Situ/In Situ Combination 70 of 177	Ex Situ / In Situ Combination 25 of 177	Phased Implementation phase I	Phased Implementation phase II	Page Decimal 70/177	246 of 393 Decimal 25/177
28	Solid Waste (m^3)						
	total	1.3E+05	1.63E+05	5.6E+04	1.54E+05		
	continued operation	3.0E+04	3.0E+04	3.0E+04	3.0E+04		
	Construction	9.0E+04	6.36E+04	2.2E+04	1.15E+05		
	plant operation	1.0E+04	9.6E+03	4.0E+03	9.6E+03		

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and Transportation Tables SHEET NO. 247 of 393

BY RDW CHKD. JOB NO. 01K4710(

Table III

Table is a tabulation of the number of trips required by vehicle chosen in the calculation that supports the tabulated results.

This information is used to generate Table IV.

Pages 248 through 259

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 248 of 393

BY RDe CHKD. _____ JOB NO. 01K47101

Number of trips Item transported	no action	Long-Term management	In Situ Fill and Cap	In situ vitrification	W-314 upgrades	Ex Situ No Separation vitrifi
I Construction						
A. WR&T						
Gasoline		4541	5.12			17.4
Diesel		3327	68.64			52.8
Propane						
Concrete		48126			641.9	9661.25
Sand		19323			198.14	3275
gravel		11381			127	2014.13
Cement		962.5			10.28	162.8
Carbon Steel		220		4400	13.24	169.23
Stainless Steel		3.72			10.14	68
Hastelloy/Inc.						
B. Vitrification						
Gasoline				792		253.44
Diesel				1056		575.52
Concrete				21287.5		35533.75
Sand				7172.3		11954
gravel				4216.6		7033
cement				357.5		594
Carbon Steel						874.92
Stainless Steel						144
Hastelloy/Inc						25.6
C. Excavation		442125			2293	130,181.25
D. Backfill		425750			2751	93829
II Operation						
A. WR&T						
Diesel	1162	1162	322.08	322.08		53.86

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and ~~OIK47101~~ Transportation Tables SHEET NO. 249 of 393

BY RDA CHKD. _____ JOB NO. 01K47101

Item transported	No action	Long-Term management	In Situ fill and cap	In Situ vitrification	W-314 upgrades	Ex Situ No-Separations Vitrifi
II. operation						
B. Vitrification						
Gasoline						
Diesel						19.54
Kerosene						4477.44
Concrete						
SSW Vaults						
sand						
gravel						
Cement						
HLW Cells						406100
sand						136731.3
gravel						80401.3
Cement						6820
Carbon Steel	74	74				
SSW Vaults						
HLW Cells						3317
SSW Boxes						
Stainless Steel						
SS Cans						2792.3
flux (Glass)						
Silica						13063
other Mat.				121		861.3
process chem.						
ammonia			Truck →	299.2		76.8
HNO_3, 50%				74.8		307.12
NaOH, 50%						28
Sugar						12
other Chem.						33
Sulfur Cement						
Sulfur						
DCPD						
Oligomer						

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and Transportation Tables SHEET NO. 250 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

Item Transported	No action	Long-Term Management	In Situ Fill and Cap	In Situ Vitrification	W-314 upgrades.	Ex Situ No Separation Vitrif
II.B. Son Ruins						
C. Excavation						
D. Backfill.						
III Closure						
Gasoline						
Tank Stab			2.12	2.12		2.12
and Equip			0.063	0.063		0.063
Diesel						
Tank Stab			336.86			336.86
and Equip			42.35			42.35
Concrete						
Tank slab			867.88			867.88
Sand			294.75			294.75
gravel			171.94			171.94
Cement			14.63			14.63
and Equip			2243.38			2243.38
Sand			753.25			753.25
gravel			442.13			442.13
Cement			37.4			37.4
161 gravel fill HKS			61734	23798		62062
IV Barrier						
Gasoline			13.73	13.73		13.73
Diesel			2376	2376		2376
Silt			30867	30867		30867
sand/gravel			34695	34695		34695
Basalt			52236	52236		52236
asphalt.			5117.2	5117.2		5125
Geotextile						
Filter Fabric			2	2		2

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary Table B.11.0.3 and transportation tables SHEET NO. 251 of 393

BY RDW CHKD. JOB NO. 01K47101

Item transported.	No action	Long-term management	In situ fill and cap	In situ vitrification	W-314 upgrades	Ex Situ no separation vitrifi.
Construction Grab & Clear		6000	2250	6875	343	4250
Consumables.						
WR&T		2400			3	2400
vitrifi				9000		6000
closure			1200			
total		2400	1200	9000	3	8400
waste		4800	2400	18000	13	16866
operation						
total	4913	4913	4913	4913	NA	6354
Waste						
plant						1441
Contained	4913	4913	4913	4913		4913

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and Transportation table SHEET NO. 25208 393

BY PDW CHKD. JOB NO. 01K47601

Item Transported	Ex Situ No Separation Calcination	Ex Situ Extensive Separation SSW - HSW	Ex Situ Intermediate Separations HSW - SSW	Ex Situ In Situ Combination 70 tons	Ex Situ In Situ Combination Low 25 tons	Phased Implementation Phase I (2) 20 ½ + (1) 17 ½
I Construction						
A WR&T						
Gasoline	17.4	17.42	17.42	10.56	7.39	
Diesel	52.8	52.8	52.8	31.68	22.18	
propane						
Concrete	9661.25	9661.25	9661.25	4830.63	3389.63	
sand	3259	3259	3259	1629.3	1146.25	
gravel	1916	1916	1916	957.94	671.38	
Cement	162.8	162.8	162.8	81.18	57.2	
Carbon Steel	169.23	169.23	169.23	55	59.23	
stainless steel	67.7	67.69	67.69	33.85	23.69	
Westinghouse						
B. Vitrification						
Gasoline	258.44	496.32	385.44	234.96	164.74	343.2
Diesel	575.52	1478.4	1061.3	1177.44	823.68	950.4
Concrete	33896.25	72050	78927.5	39463.75	27673.75	3930
Sand	11463	24317	26609.38	13345.63	9333.75	1326.28
gravel	6714	14,263	15638.13	7810.88	5485.63	761.44
Cement	678.58	1210	1331	663.3	465.3	66
Carbon Steel	866.5	2200	1643.23	822.46	575.39	1404.62
stainless steel	145.71	287.69	253.85	126.92	88.85	253.85
Westinghouse	25.6	30.46	38.92	19.46	13.62	44
C. Excavation	130181.3	294750	278375	206325	144591.25	45031.25
D. Backfill	93828.75	139188	196500	98250	68775	5513.75
II Operation						
A. WR&T						
Diesel	53.9	53.86	53.86	225.46	131	
				53.9	53.9	

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary Table B.11.0.3 and Transportation Tables SHEET NO. 253 of 393

BY RDW CHKD. JOB NO. 01K47101

Item Transported	Ex Situ No Separations Calcination	Ex Situ Extensive Separations LLW + HLW	Ex Situ Intermediate Separations LLW - HLW	Ex Situ In Situ Combination 70 tanks	In Situ Ex Situ Combination Low 25 tanks	Phased Implementation phase I
II operation						
B. Vitrification						
Gasoline		2.32	2.69	1.44	1.15	
Diesel		377.5	376.992	153.12	71.3	
Kerosene	554.4	9884.16	3474.24	2096.16	1214.4	51.744
Concrete						
LLW Vaults		62388.75	49125	21123.75	16866.25	
Sand		21042	16538.75	7123.13	5682.13	
gravel		12363.13	9743.13	4183.813	3340.5	
Cement		1048.3	982.5	355.3	283.8	
HLW Casks	160475	1328.013	28656.25	13918.75	8187.5	993.96
Sand	54119.38	448	9661.25	4691.44	2783.75	334.87
gravel	31767.5	263	5674	2759.19	1637.5	196.5
Cement	2695	22.33	484	234.3	138.6	16.72
Carbon steel						
LLW vaults		744.62	558.46	253.85	203.1	
HLW HMPCs	1192	157.38	333.39	165	97.65	11.85
LLW Boxes		1844.62	1844.62	1120.31	673.64	46.2
Stainless steel						
SS Cans.	988.31	10.85	230.15	114.4	67.69	8.12
flux (glass former)			17119.32			
Silica		15817	17119.32	10308.81	6029	4104.92
Other Mat.		1090	1146	692	403	464
Process Chem.						
ammonia	397.1 1588.4	406.56	437.62	193.6	129.93	78.32
HNO_3, 50%	27.72	20460	184.8	92.4	53.68	37.31
NAOH, 50%	11.7	6600	1144	572	331.76	231
Sugar	1012 253					98.12 [O_2]
other Chems.	33	1226	257.81	129	74.93	52.1
Sulfur cement						
Sulfur		3113	1628	980.1	568.7	325.6
DCPD		81.62	42.46	25.63	14.85	8.49
Oligomer		125.57	65.32	39.43	22.85	13.1

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-1.0.3 and transportation tables SHEET NO. 254 of 393

BY RDW CHKD. JOB NO. 01K4710/

Item transported	Ex Situ No Separations Calcination	Ex Situ Extensive Separations LGW + HGW	Ex Situ In Intermediate Separations LGW - HGW	Ex Situ In Situ Combination 70 Tanks	Ex Situ In Situ Combination LGW 25 Tanks	Phased Implementation phase I
II B Iron Reins		56	2.48	1.24	0.72	0.42
C. Excavation		399550	399550	214513	119865	
D Backfill		194863	194863	104473	82202.5	
III Closure						
Gasoline						
tank Slab	2.12	2.12	2.12	2.12	2.12	
conc Equip	0.063	0.063	0.063	0.063	0.63	
Diesel						
tank Slab	337	337	337.92	336.86	336.86	
conc Equip	42.35	42.35	42.35	42.35	42.35	
Concrete						
tank Slab	867.88	867.88	867.88	867.88	867.88	
sand	294.75	295	295	295	295	
gravel	172	172	172	172	172	
Cement	14.63	14.63	14.63	14.63	14.63	
conc Equip	2243.38	2243.38	2243.38	2243.38	2243.38	
sand	753.25	753.25	753.25	753.25	753.25	
gravel	442.13	442.13	442.13	442.13	442.13	
Cement	37.4	37.4	37.4	37.4	37.4	
161 gravel fill TKS	62062	62062	62062	62062	62062	
VI Barrier						
Gasoline	13.73	19.43	19.59	16.32	11.41	
Diesel	2376	3358	3326.4	2787.84	2703.36	
Silt	30867	46374	42510	38645	34781	
Sand/gravel	34695	47558	47232	42056	39273	
Basalt	52236	78404	71870	64231	58803	
asphalt	5125	7688	7048	6407	5766	
Polystyrene						
filter fabric	2	2	2	2	2	

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JACOBS ENGINEERING GROUP INC.

DATE 6-20-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 255 of 393

BY RDW CHKD. JOB NO. 01K4710/

Item transported	Ex Situ No-Separation Calcination	Ex Situ Extraction Separations LSW-HSW	Ex Situ Intermediate separation HSW-SSW	Ex Situ In Situ Combustion 70 Tanks	Ex Situ In Situ Combination LSW 25 Tanks	Phased Implementation Phase I (2) 20 T/d-(1) 1 T/d
Construction Hub & Clean	4250	8250	5500	5250	3700	800
Consumables						
WR&T	2400	2400	2400	1800	1200	
Utilities	6000	7000	9000	5600	4000	1600
Cleanup						
total	8400	9400	11400	7400	5200	1600
waste	16866	18832	22811	14738	10415	3603
Operation						
total	6354	6551	6485	6564	6485	5578
waste						
applicat	1441	1638	1572	1638	1572	665
Cont. ops.	4913	4913	4913	4913	4913	4913

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-86 SUBJECT Resource summary table B.11.0.3 and Transportation Tables SHEET NO. 256 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

Item transported	Phased implementation phase II LLW & HLW	Revised 70/177	Revised 25/177			
I. Construction						
A. WR+T						
Gasoline	17.4					
Diesel	53.86					
Propane						
Concrete	9661.25					
Sand	3258.63					
gravel	1915.88					
cement	162.8					
Carbon Steel	169.23					
Stainless Steel	67.69					
Hastelloy/Inc						
3. Vitrification						
Gasoline	533.28	247	165			
Diesel	1441.44	1621	826			
Concrete	107420	45,359	27835			
Sand	36188.75	15,311	9416			
gravel	21287.5	9006	5502			
cement	1804	763	466.4			
Carbonsteel	2233.86					
Stainlesssteel	345.23					
Hastelloy/Inc	52.97					
C. Excavation	378262.5	206604	144667			
D. Backfill	266912.5					
II operation						
4. WRT						
Diesel	53.86					

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B.11.0.3 and Transportation tables SHEET NO. 257 of 393

BY RDW CHKD. JOB NO. 01K47101

Item Transported	Phased Implementation phase II LLW - HLW	Revised 70/177				
II. operation						
B. Vitrification						
Gasoline	2.65					
Diesel	428.72	446	224			
Kerosene	3421.44	2133.12	1236			
Concrete						
LLW Vaults	39463.75					
Sand	13345.63					
gravel	7810.88					
cement	663.3					
HLW Scarbs	27182.5	19813.75	11463			
Sand	9170	6690	3865			
gravel	5379.19	3932	2268			
Cement	456.5	334	193			
Carbon Steel						
LLW Vaults	473.85					
HLW Hyper	321.54	236	136			
LLW Boxes	1827.69					
Stainless Steel						
SS Cans.	223.39	163	95			
Flux (Glass formers)						
Silica	16933.24	11585	6755			
other Metals	1130	703	410			
Process Chemical						
ammonia	431.2					
HNO_3, 50%	182.2					
NAOH, 50%	1126.4					
Sugar						
other Chems.	254					
Sulfur Cement						
Sulfur	1606					
DCPD	41.91					
oil gamma	64.48					

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 258 of 393

BY ADW CHKD. JOB NO. 01K 47101

Item Transported	Phased Implementation phase II HW - HLW	Revised 70/177
II B Ion Resins	2.451	
C Excavation	399550	
D. Backfill	194862.5	
III Closure		
Gasoline		
Tank Stab	2.12	
anc Equip	0.63	
Diesel		
tank Stab	336.86	
anc Equip	42.35	
Concrete		
Tank Stab	867.88	
Sand	294.75	
gravel	172	
Cement	14.63	
anc Equip	2243.38	
Sand	753.25	
gravel	442.13	
Cement	37.4	
161 gravel fill TKS	62062	
IV Barrier		
Gasoline	19.59	
Diesel	3302.11	
Silt	46374	
Sand/gravel	47555	
Basalt	78404	
asphalt	7688	
Geo-textile		
Filter Fabric	2	

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11-0.3 and Transportation tables SHEET NO. 259 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

Item transported	Planned Implementation Phase II LLW+HLW	Revised 70/177				
Construction						
Hub+clean	7250					
Consumables						
WRT	2400					
Vitrifi	7000					
closure						
total	9400					
waste	18832					
Operation						
total	6485					
waste						
op plant	1572					
Cont ops	4913					

FORM 01.005.1 (4/89)

Table ~~XX~~ IV

Transportation Summary for the Resources transported to support the various phases of the numerous alternatives.

Transportation data input for the analyses performed and the results presented in Appendix E.

Pages 261 through 295

all Rail traffic originates in Portland/Seattle to form the estimated 28 car trains or portions thereof. all rail traffic also assumed to terminate at a point in 200 West area.

Page 261 is a tabulation of the number of trains and trucks estimated for each alternative

The HLW trains are only 10 car trains or portions thereof for shipment of the HLW waste to the repository. (assumed to be Yucca Mountain, Nevada).

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 261 of 393

BY _____ CHKD. _____ JOB NO. _____

ALTERNATIVE	TRAINS (TRIPS)	TRICITIES TRUCKS	S/P TRUCKS	HLW TRAINS	HLW & LLW ONSITE TRUCKS
I	0	1236	0	0	0
II	1307	11507	0	0	0
III	38	9488	2	0	0
IV	291	18981	2	0	0
V	601	45033	1769	303	0
VI	832	34817	350	2916	0
VII	401	17811	1631	1030	0
VIII	720	49092	27469	15	0
IX	360	33077	861	214	0
X	224	23312	518	124	0
XI	172	7056	348	0	717 107 HLW 610 LLW *
XII	634	43690	1744	305	717 107 HLW 610 LLW *

NOTE TRAINS Composed as Follows

1. Some Considered as Single car trains
2. Some Considered as 20 car trains
3. others Considered are partial 20 car trains.

Wor Review 7-6-96. RLW.

HLW trains.

1. Considered as 10 car trains
2. Some are only partial 10 car trains (Remainder of Shipment)

* CORRECTION 7-29-96 6100 3 box trips each way for LLW

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and Transportation tables SHEET NO. 262 of 393

BY RDW CHKD. _____ JOB NO. 01K4701

I No action alternative	type of carrier	Point of Origin	total trips
Retrieval waste transport			
Construction			
Routine Construction			
Operation			
offsite truck diesel fuel	5000 gallon tanker	TRI-CITIES	1162
steel	flat bed truck	TRI-CITIES	74
onsite truck waste to burial	8 cu yd dump 10 mi Round trip	10 mi R. trip	4913

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B.11.0.3 and Transportation Tables SHEET NO. 263 of 393

BY RDW CHKD. JOB NO. 01K47101

1 Long term management		Type of Carrier	Point of origin	total trips
Retrieval				
waste transport				
Construction (W-314)				
→ Insert next page here				
Routine				
Construction				
On site truck.				
Excavation	(1 mi R.T)	8 cu yd dump	4 Km	442125
Backfill	(1 mi R.T)	8 cu yd Dump	4 Km	425750
Sand + gravel		16 cu yd dump	6 Km PIT 30	30704
Concrete	(3 mi R.T)	8 cu yd bandl	Batch Plant	48125
Grub + clear	(10 mi R.T.)	8 cyd Dump	10 mi R. Trip	6000
waste to burial	(10 mi R.T)	8 cyd Dump	10 mi R trip	4800
Off site truck.				
Diesel + Gasolene		5000 gal tank TRK	tri-cities	7868
Construction Consumables		truck	Tri-cities	2400
off site Rail	20 cars/train	100 HOPPERS		~~84~~ 48 Trains
Cement ~~and~~		65 Ton eff Rail cars	S/P	~~60 trains~~
Steel			S/P	12 trains
			Changed to *	963 + 298 trips single car trains
Operation				
Offsite truck				
Diesel fuel		5000 gal tank TRK	tri-cities	1162
Steel		7 lat bed 15 Ton eff	TRI-cities	74
ONSITE TRUCK				
waste to burial	(10 mi R.T.)	8 Cyd Dump.	10 mi R. trip	4913
			* (963 ÷ 2)(÷ 3 yrs)	298 ÷ 4 = 37.25 ÷ 12 = 3.1 cars/month
			481 ÷ 3 = 161	
one Train = 20 cars.			160.5 ÷ 52 =	
one train = 1 R.T.			3 cars/WK.	at 40 yrs + 90 yrs.
				in schedule.

FORM 91-005-1 (4/81)

II Long Term Management continued

Insert for Previous Page

Construction (W-314)			
on site truck			
Sand and gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd Dump	4 Km	2293
Backfill	8 cyd Dump	4 Km	2751
Grub and clear	8 cyd Dump	10 mi R. Trip	343
Concrete	8 cyd Barrel	6 Km Batch Plant	642
Waste to burial	8 cyd Dump	10 mi R. Trip	13
offsite truck			
Construction Consumables	truck	truck	3
offsite Rail			
Cement	11 - 100 Ton Hoppers	S/P	2 trains
Steel (Carbon & Stainless)	24 - 65 Ton Cars	S/P	Changed to 35 Trips - Single Car Trains

JACOBS ENGINEERING GROUP INC.

DATE 6-3-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 265 of 393

BY ROW CHKD. _____ JOB NO. 01K 47/01

II In Situ Fill and Cap	Type of Carrier	Point of origin or (mi)	Total Trips
Retrieval			
waste transport			
Construction (W-314)			
on site truck			
Sand & Gravel	16 cyl dump	Pit 30	325
Excavation	8 cyl dump	4 Km	~~2293~~ 2293
Backfill	8 cyl dump	4 Km	2751
Grub and Clear	8 cyl dump	10 mi Round trip	343
waste to burial	8 cyl dump	10 mi " "	13
Concrete	8 cyl Barrel	4 Km Batch Plant	642
Off site Truck			
Construction Consumables	truck	tri cities	3
Offsite Rail			
Cement	11-100 ton Hoppers	S/P	2 trains
steel (Carbon + Stainless)	24-65 ton Cars	S/P	changed to 35 trips - Single car trains
Remediation (Fill + Cap)			
Construction			
onsite truck			
grub and Clear	8 cyl dump	10 mi R.Trip	2250
waste to burial	8 cyl Dump	10 mi R-Trip	2400
off site Truck			
Gasoline and Diesel	5000 gallon Tank	Tri Cities	74
Construction Consumables	truck	tri cities	1200
Operation			
onsite Truck			
Sand and Gravel tank fill	16 cyl dump	P-30	61734
~~waste to burial~~			
off site Truck			
Diesel	5000 gal tank	Tri Cities	322

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-86 SUBJECT Resource Summary table B.1.1.0.3 and transportation table SHEET NO. 266 of 383

BY RDW CHKD. _____ JOB NO. 01K47101

II In Situ Fill and Cap continued

Closure			
~~OHS~~			
Grout holes + misc. equip.			
onsite trucks			
Sand and gravel	16 cyd dump	Pit 30 6 km	1662
Concrete	8 cyd barrel	batch plant	3111
Offsite truck			
Gasoline and Diesel	5000 gal tanker	tri cities	382
offsite Rail			
Cement	53-100 Ton Hoppers	S/P	3 Trains
Barrier			
onsite truck			
Silt	16 cyd dump	McGee Ranch	30867
Sand and gravel	16 cyd dump	P-30	34695
Basalt - Rip Rap	16 cyd dump	Vernita Quarry	52236
waste to burial	8 cyd dump	10 mi R Trip	4913
off site truck			
Gasoline and Diesel	5000 gal tanker	Tri Cities	2390
asphalt mix	16 cyd dump	Tri Cities	5117
Geotextile filter fabric	TRUCK	S/P	2

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 12-30-96 SUBJECT Resource Summary table B-11.0.3 and Transportation tables SHEET NO. 267 of 343

BY RDW CHKD. _____ JOB NO. 01K47101

	Type of Carrier	Point of origin (mi)	total trips
I In Situ Vitrification			
~~Waste transport~~			
Retrieval			
Waste Transport			
Construction (W-314)			
on Site Truck			
Sand and gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd dump	4 Km	2293
Backfill	8 cyd dump	4 Km	2751
Grub and clear	8 cyd dumps	10 mi Round trip	343
Concrete	8 cyd Barrel	6 Km Batch Plant	642
Waste to burial	8 cyd dumps	10 mi Round trip	13
off site truck			
Construction Consumables	truck	tri Cities	3 ~~3 star~~ Changed
off site Rail			
Cement	11-100 Ton Hopper	S/P	~~2~~ trains
Steel (Carbon + Stainless)	24-65 ton Cars	S/P	changed to 36 trains - single car units.
Remediation (In situ vitrifi)			
Construction			
on site Truck			
Grub and clear	8 cyd dumps	10 mi Round trip	6895
Sand and gravel	16 cyd dumps	Pit-30	465 ~~19390~~ 35188
Concrete	8 cyd barrel	6 Km Batch Plant	21288
waste to burial	8 cyd dump	10 mi Round trip	18000
off site Truck			
Gasoline + Diesel	5000 gal tanker	tri Cities	1848
Construction Consumables	truck	tri Cities	9000
off site Rail			
Cement (594)	100 T Hopper	S/P	250 trains
Carbon Steel (4400)	65 ton Cars	S/P	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B 11-0.3 and Transportation tables SHEET NO. 268 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

IV In Situ vitrification Continued

Remediation			
operation			
onsite truck			
waste to burial	8cyd Dump	10 mi R. trip	4913
Sand & Gravel	16cyd Dump	Pit-30	23798
Offsite Truck			
Diesel	5000gal Tanker Truck	tri Cities	322
ammonia	25 Ton tanker truck	tri Cities	300
offsite Rail			
Glassforma-Limestone (121)	100 ton Hopper Cars	S/P	6 Trains
Closure			
Grout mixers + onc Equipment.			
Barrier			
onsite truck			
Silt	16cyd Dump	Mc Gee Ranch	30867
Sand and Gravel	16cyd Dump	Pit 30	34695
Basalt	16cyd Dump	Vernita Quarry	52236
offsite trucks			
asphalt mix	16cyd Dump	tri Cities	5118
Gasoline and Diesel	5000gal tanker truck	tri Cities	2390
Geotextile Filter Fabric	truck	S/P	2

FORM 91.005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B.11.0.3 and Transportation table SHEET NO. 269 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

V Ex Situ Intermediate Separation	Type of Carrier	Point of origin or (mi RT)	total trips
Retrieval			
Waste Transport			number as now in table
onsite truck			1.25E+04 total Km
offsite truck - Diesel	5000 gal tank truck	Tri Cities	54
Construction (W314)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd Dump	4 Km	2293
Backfill	8 cyd Dump	4 Km	2751
Grub and clear	8 cyd Dump	10 mi R. Trip	343
Concrete	8 cyd Barrel	6 Km Batch Plant	642
Waste to Burial	8 cyd dump	10 mi R. trip	13
offsite truck			
Construction Consumables	truck	Tri Cities	3
offsite rail			
Cement	11-100 Ton Hopper cars	S/P	2 Trains
Steel (Carbon and stainless)	24-65 Ton cars	S/P	35 trains - single car units
Construction (annexes)			
onsite trucks			
Sand and gravel	16 cyd dump	Pit 30	5175
Concrete	8 cyd Barrel	6 Km Batch Plant	9663
Off Site trucks			
Diesel and Gasoline	5000 gal tank truck	Tri Cities	71
Construction Consumables	truck	Tri Cities	2400
offsite Rail			
Cement (163)	100T Hoppers	S/P	20 Trains
Steel (Carbon + Stainless) (238)	65 Ton Car	S/P	
Remediation - Vitrifi Plant			
Construction			

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B11-0-3 and Transportation table SHEET NO. 270 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

V Ex Site Intermediate separation Continued-			
Construction			
on Site Truck			
Grub and Clear	8 cyd dump	10 mi R-trip	5500
Excavation	8 cyd Dump	4 Km	278375
Backfill	8 cyd Dump	4 Km	196500
Sand and gravel	16 cyd Dump	6 Km Pit 30	42249
Concrete	8 cyd barrel	Batch Plant	78928
Waste to burial	8 cyd Dump	10 mi R-trip	22811
Off Site Truck			
Gasoline and Diesel	5000 gal tank truck.	tri cities	1448
Construction Consumables	Truck	tri Cities	9000
Off Site Rail			
Cement (1331)	100 Ton Hopper car	S/P	164 trains
Steel (CS, SS, Hastelloy) (1937)	65 Ton Cars	S/P	
operation			
on Site truck			
Excavation	8 cyd Dump	4 Km	399550
Backfill	8 cyd Dump	4 Km	194863
Waste to burial	8 cyd Dump	10 mi R trip	6485
Sand and gravel	16 cyd Dump	6 Km Pit 30	41618
Concrete	8 cyd barrel	Batch Plant	77882
offsite truck			
Gasoline and Diesel	5000 gal Tank Truck	tri Cities	380
Kerosene	5000 gal tank truck	tri cities	3775
Glass former - Sand (SiO_2)	16 cyd Dumps	tri cities	17120
Ion Exchange Resins	truck	tri Cities	3
Process chemicals - NH_3	25 Ton Tank truck	S/P	438
Process chemicals - HNO_3, 50%	25 Ton tank truck	S/P	185
Process Chemicals - NaOH, 50%	25 Ton tank truck	S/P	1144

FORM 91.005.1 (4/91)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation table SHEET NO. 271 of 393

BY RDW CHKD. _____ JOB NO. 01K 47101

V Ex Situ Intermediate Separations, Continued				
operation				
Off Site Rail				
Cement	(1467)	100 T hopper car	S/P	379 trains
Carbon Steel	(2738)	65 Ton Cars	S/P	
Stainless Steel	(231)	65 Ton Cars	S/P	
Glass forms, other materials		100 Ton Hoppers	(1146) S/P	
Process Chemicals, other Chemicals		65 Ton Car	(258) S/P	
Sulfur	(1628)	100 Ton Tank Car	S/P	
Dicyclopentadiene	(43)	100 Ton Tank Car	S/P	
Oligomer	(66)	65 ton Car	S/P	
Closure				
Brout ancillary Equipment Tank Domes.				
onSite Truck				
Sand and gravel		16 cyd dump	6 km P-30	1664
Concrete		8 cyd barrel	Batch plant	3112
Off Site Truck				
Gasoline and Diesel		5000 gal tank truck	Tri Cities	384
Off Site Rail				
Cement	(52)	100 Ton Hopper Cars	S/P	3 Trains
Gravel Fill for tanks				
gravel		16 cyd dumps	Pit 30	62062
Barrier				
OFFSITE TRUCK				
Gasoline and Diesel		5000 gal Tank Truck	Tri Cities	3347
Asphalt mix		16 cyd Dumps	Tri Cities	7048
Geotextile filter fabric		truck	S/P	2
Onsite Truck				
Silt		16 cyd dumps	McGee Ranch	42510
Sand and gravel		16 cyd dumps	Pit 30	47232
Basalt		16 cyd dumps	Vernita Quarry	71870
Vitrified HLW Transport — Yucca Mountain		Rail - 10 Cask trains		303 Trains

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B.11.0.3 and transportation tables SHEET NO. 272 of 393

BY RDW CHKD. JOB NO. 01K47101

VI Ex Situ No Separations - Vitrification	Type of Carrier	Point of origin or (mi per R. Trip)	total trips
Retrieval			
Waste transfer		(1.25E+04)	use as before
onsite truck			1.25E+04
offsite truck			
Diesel	5000 gal tank truck	tri cities	54
Construction (W 314)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd Dump	4 Km	2293
Back fill	8 cyd Dump	4 Km	2751
Grub and Clear	8 cyd Dump	10 mi Round trip	343
Concrete	8 cyd barrel	6 Km Batch Plant	642
Waste to buried	8 cyd dump	10 mi Round trip	13
offsite truck			
Construction Consumables	truck	tri cities	3
off Site Rail			
Cement 11	100 Ton Hopper Cars	S/P	2 trains
Steel (Carbon and Stainless) 24	65 Ton Cars	S/P	changed to 35 single car trains.
Construction (annexes)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit-30	5361
Concrete	8 cyd barrel	Batch Plant 6 Km	9662
off Site Truck			
Gasoline and Diesel	5000 gal Tank truck	tri cities	71
Construction Consumables	truck	tri cities	2460
off Site Rail			
Cement (163)	100 Ton Hopper Cars	S/P	20 trains
Steel (Carbon and Stainless) (238)	65 Ton Cars	S/P	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11-0.3 and transportation tables SHEET NO. 273 of 393

BY RDW CHKD. JOB NO. 01K47101

VI Ex Situ no separations - vitrification Continued

Remediation - Vitrifi Plant

Construction			
on site truck			
Grub and clear	8 cyd dump	10 mi Round trip	4250
Excavation	8 cyd Dump	4 Km	130182
Backfill	8 cyd dump	4 Km	93829
Sand and gravel	16 cyd dump	Pit 30	18987
Concrete	8 cyd Barrel	Batch plant 6 Km	35534
waste to burial	8 cyd Dump	10 mi Round trip	16866
off site truck			
Gasoline and Diesel	5000 gal tank truck	Tri Cities	830
Construction Consumables	truck	Tri Cities	6000
off site Rail			
Cement (594)	100 Ton Hopper Cars	S/P	82 trains
Steel (SS, CS, Hastelloy) (1047)	65 ton Cars	S/P	
operation			
on site truck			
Sand and gravel	16 cyd Dump	Pit-30	217134
Concrete	8 cyd Barrel	Batch Plant 6 Km	406100
Waste to Burial	8 cyd Dump	10 mi Round trip	6354
off site truck			
Gasoline and Diesel	5000 gal tank Truck	Tri Cities	20
Kerosene	5000 gal tank truck	Tri Cities	4478
Glass formers (SiO_2 sand)	16 cyd Dump	Tri Cities	13063
Process chemicals, NH_3	25 ton Tank truck	P/S	308
Process Chemicals, HNO_3, 50%	25 ton tank truck	P/S	28
Process Chemicals, NaOH, 50%	25 Ton Tank Truck	P/S	12
off site Rail			
Cement (6820)	100 Ton Hopper	P/S	692 trains
Carbon Steel (3317)	65 ton Cars	P/S	
Stainless Steel (2793)	65 Ton Cars	P/S	
Glass formers (other material)	100 Ton Hopper	(862) P/S	
Process chemicals (other Chem)	65 ton Car	(33) P/S	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 274 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

II E4 Site No Separations - Vitrification Continued			
Closure			
Grout one Equipment around Waste			
on Site Truck			
Sand and gravel	16 cyd dump	Pit-30 6Km	1663
Concrete	8 cyd barrel	Batch plant	3112
offsite truck			
Gasoline and Diesel	5000 gal tank truck	tri-Cities	383
offsite Rail			
Cement (53)	100 Ton Hopper	P/S	3 trains
Gravel fill 161 tanks			
onsite truck			
Gravel	16 cyd Dump	Pit-30	62062
Barrier			
on site truck			
Silt	16 cyd dump	Mc Gee Ranch	30867
Sand and gravel	16 cyd Dump	Pit-30	34695
Basalt	16 cyd Dump	Granite Quarry	52236
Offsite truck			
Gasoline and Diesel	5000 gal tank truck	tri-Cities	2390
Geotextile filter fabric	truck	P/S	2
Asphalt mix	16 cyd dump	tri Cities	5125
Vitrified HLW transport			
offsite Rail			
Waste to Yucca mountain	10 car Trains	To Yucca mountain	2910 Trains

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11.0.3 and Transportation Tables SHEET NO. 275 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

III C4 Site No Separations & Calcination	Type of Carrier	Point of origin (or mi Round Trip)	total trips
Retrieval			
waste transport			
on site truck		see as (1.25E+04)	before
offsite truck			
Diesel	5000 gal tank truck	Tri-Cities	54
Construction (W 314)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit-30	325
Excavation	8 cyd Dump	4 Km	2293
Backfill	8 cyd Dump	4 Km	2751
Grub and clear	8 cyd Dump	10 mi Round Trip	343
Concrete	8 cyd Barrel	6 Km Batch Plant	642
Waste to burial	8 cyd Dump	10 mi Round Trip	13
offsite truck			
Construction Consumables	truck	Tri Cities	3
offsite Rail			
cement (11)	100 Ton Hoppers	S/P	2 trains
Steel (Carbon & Stainless) (24)	65 Ton Cars	S/P	Charged to 35 single car trains.
Construction (annex)			
on site truck			
Sand and gravel	16 cyd Dump	Pit 30	5175
Concrete	8 cyd Dump	6 Km Batch Plant	9662
offsite truck			
Gasoline and Diesel	5000 gal tank truck	Tri Cities	71
Construction Consumables	truck	tri cities	2400
offsite Rail			
Cement (163)	100 Ton Hopper	S/P	20 trains
Steel (Carbon and Stainless) (238)	65 Ton cars	S/P	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-86 SUBJECT Resource Summary table B-11-03 and Transportation tables SHEET NO. 276 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

III Ex Situ No Separations Calcination - Continued

Remediation - Calcination Plant			
Construction			
on site Truck			
Brush and clear	8 cyd Dump	10 mi Round Trip	4250
Excavation	8 cyd Dump	4 Km	130182
Backfill	8 cyd Dump	4 Km	93829
Sand and gravel	16 cyd Dump	Pit-30	18177
Concrete	8 cyd barrel	6 Km Batch Plant	33897
Waste to burial	8 cyd Dump	10 mi Round Trip	16866
off site Truck			
Gasoline and Diesel	5000 gal tank truck	tri cities	830
Construction Consumables	truck	tri cities	6000
off site Rail			
Cement (679)	100 Ton Hopper	S/P	86 Trains
Steel (CS, SS, Hastelloy) (1039)			
operation			
on site Truck			
Sand and gravel	16 cyd Dump	Pit-30	85888
Concrete	8 cyd Barrel	6 Km Batch Plant	160475
Waste to burial	8 cyd Dump	10 mi Round Trip	6354
off site Truck			
Kerosene	5000 gal tank truck	tri Cities	555
Process Chemicals, ammonia	25 Ton Tank Truck	P/S	1589
Process Chemicals, HNO_3, 50%	25 Ton Tank Truck	P/S	28
Process Chemicals, NaOH, 50%	25 Ton Tank truck	P/S	12
Gasoline Diesel	5000 gal tank truck	tri cities	8
off site Rail			
Cement	100 Ton Hopper	(2645) S/P	257 Trains
Carbon Steel	65 Ton Car	(1182) S/P	
Stainless steel	65 Ton Car	(359) S/P	
Process Chemicals, other chem	65 Ton Car	(33) S/P	
Process chemical, Sugar	100 Ton Hoppers	(253) SP	
		(5132)	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.1.1.0.3 and transportation tables SHEET NO. 277 OF 393

BY RDW CHKD. JOB NO. 01K47101

III In Situ No Separations Calcination - Continued			
Closure			
Grouting onc. Equipment and plugs.			
on site truck			
Sand and Gravel	16 cyd Dump	Pit-30 6 Km	1663
concrete	8 cyd Barrel	Batch Plant	3112
offsite truck			
Gasoline and Diesel	5000 gal tank truck	tri cities	383
offsite Rail			
Cement (52)	100 Ton Hoppers	S/P	3 trains
Gravel fill 161 tanks			
onsite truck			
gravel	16 cyd Dump	Pit-30	6.062
Barrier			
onsite truck			
Silt	16 cyd Dump	McGee Ranch	30867
Sand and gravel	16 cyd Dump	Pit-30	34695
Basalt	16 cyd Dump	Vernita Quarry	52236
offsite truck			
Gasoline and Diesel	5000 gal tank truck	tri Cities	2390
asphalt mix	16 cyd Dump	tri cities	5125
Geotextile Filter fabric	truck	S/P	2
Calcined HLW transfer			
offsite Rail			
Calcined Waste (10300)	1 cask/car 10 car train	to Yucca Mountain	1030 trains

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-11-0-3 and transportation tables SHEET NO. 278 of 393

BY RDW CHKD. JOB NO. 01K 47101

III Ex Situ Extensive Separations	type of Carrier	Point of origin or (mi RT)	total trips.
Retrieval			
waste transport		use as before	
onsite truck		(1.25E+04)	
offsite truck			
Diesel	5000 gal tank truck	tri cities	54
Construction (W-314)			
onsite truck			
Sand and gravel	16 cyd Dump	pit - 30	325
Excavation	8 cyd Dump	4 Km	2293
Backfill	8 cyd Dump	4 Km	2751
Grub and Clear	8 cyd Dump	10 mi Round trip	343
Concrete	8 cyd Barrel	6 Km Batch Plant	642
waste to burial	8 cyd Dump	10 mi Round trip	13
offsite Truck			
Construction Consumables	truck	tri cities	3
offsite Rail			
Cement	100 Ton hoppers	(11) S/P	2 trains
Steel (Carbon and Stainless)	65 Ton Car	(24) S/P	changed to 35 single car trains
Construction (annexes)			
onsite trucks			
Sand and gravel	16 cyd Dump	Pit 30	5175
Concrete	8 cyd Barrel	6 Km Batch Plant	9662
offsite trucks			
Gasoline and Diesel	5000 gal tank truck	tri cities	71
Construction Consumables	truck	tri cities	2400
offsite Rail			
Cement	100 ton Hoppers	(163) S/P	20 trains
Steel (Carbon and Stainless	65 Ton Car	(238)	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.1.0.3 and Transportation table SHEET NO. 279 of 393

BY RPW CHKD. _____ JOB NO. 01K4701

III Ex Situ Extraction Separations Remediation ~~Plant~~ Extraction Construction	Continued separations vitrification		
on site trucks			
Brush and clear	8cyd Dump TK	10 mi Round trip	8250
Sand and gravel	16cyd Dump	pit 30	38580
Excavation	8cyd Dump	4Km	294750
Backfill	8cyd Dump	6Km 4Km	139188
Concrete	8cyd Barrel	Batch Plant	72050
Waste to burial	8cyd Dump	10 mi Round Trip	18832
offsite truck			
Gasoline and Diesel	5000gal tank TK	Tri Cities	1976
Construction Consumables	truck	Tri cities	7000
offsite Rail			
Cement	100ton Hopper	(1210) S/P	187 Trains
Carbon Steel	65 Ton Car	(2200) S/P	
Stainless Steel	65 Ton Car	(288) S/P	
Hastelloy	65 ton Car	(31) S/P	
operation			
on site trucks			
Concrete	8cyd Barrel	6Km Batch Plant	63717
Sand and gravel	16cyd Dump	pit 30	34117
Excavation	8cyd Dump	4Km	399550
Backfill	8cyd Dump	4Km	194863
Waste to burial	8cyd dump	10mi Round trip	6551
offsite truck			
Gasoline and Diesel	5000gal tank TK	Tri Cities	381
Kerosene	5000gal tank TK	Tri Cities	9885
Glass forming sand (SiO_2)	16cyd Dump	Tri Cities	15817
Process Chemicals, ammonia	25 ton tank TK	S/P	467
Process chemicals, HNO_3, 50%	25 ton tank TK	S/P	20460
Process Chemicals $NaOH$, 50%	25 ton tank TK	S/P	6600
Ion Exchange Resins	truck	Tri Cities	56

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource summary tables B.11.0.3 and transportation tables SHEET NO. 280 of 393

BY RPW CHKD. _____ JOB NO. 01K47101

III Ex Situ Extraction Separations - Continued				
operation				
offsite Rail				
Cement	100 ton Hopper	(1072)	S/P	475 Trains
Carbon Steel	65 Ton Car	(2748)	S/P	
Stainless Steel	65 Ton Car	(11)	S/P	
Glass formers - other Material	100 Ton Hopper	(1090)	S/P	
Process Chemicals - other chem	65 ton Car	(1226)	S/P	
Sulfur	100 Ton tank Car	(3113)	S/P	
Dicyclopentadiene (DCPD)	100 Ton tank Car	(82)	S/P	
Oligomer	65 ton Car	(126)	S/P	
Closure				
Grout and Equip and plugs				
onsite truck				
Sand and gravel	16 cyd Dump	Pit 30		1663
Concrete	8 cyd Barrel	6 Km Batch Plant		3112
offsite truck				
Gasoline and Diesel	5000 gal tank TK	Tri Cities		383
offsite Rail				
Cement	100 Ton Hopper	(52	S/P	3 Trains
Gravel fill 161 Tanks				
onsite truck				
gravel	16 cyd Dump	Pit 30		62062
Barrier				
onsite truck				
Silt	16 cyd Dump	McGee Ranch		46 374
Sand and gravel	16 cyd Dump	Pit-30		47 555
Basalt	16 cyd Dump	Vernita Quarry		78404
offsite truck				
Gasoline and Diesel	5000 gal tank TK	Tri Cities		3378
Asphalt mix	16 cyd Dump	Tri Cities		7688
Geotextile Filter fabric	Truck	S/P		2

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-11-0-3 and transportation tables SHEET NO. 281 of 393

BY RDW CHKD. JOB NO. 01K47101

III Ex Situ Explosive Separation - Continued

~~STP~~

Vitrified HW Transport offsite Rail Yucca Mountain	C143	1 cask/car 10 car train	to Yucca Mountain	15 Trains

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-11-0-3 and transportation tables SHEET NO. 282 of 393

BY RDW CHKD. JOB NO. 01K 47101

X Ex Situ Combination Insitu Retrieval	(70 Tanks) Type of Carrier	Point of origin or mi per K-T.	total Trips.
Waste Transport			
on site truck			
Construction (W-314)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit-30	325
Excavation	8 cyd dump	4 Km	2293
Backfill	8 cyd dump	4 Km	2751
Grub and clear	8 cyd Dump	10 mi Round trip	343
concete	8 cyd Barrel	6 Km Batch plant	642
waste to burial	8 cyd dump	10 mi Round trip	13
offsite truck			
Construction Consumables	truck	tri cities	3
offsite Rail			
Cement	100 Ton Hopper	(11) S/P	2 trains
Steel (Carbon and Stainless	65 Ton Cars	(24) S/P	changed to 35 single car trains
Construction (annexes)			
onsite truck			
Sand and gravel	16 cyd dump	Pit-30	2588
concrete	8 cyd Barrel	6 Km Batch plant	4831
offsite truck			
gasoline and Diesel	5000 gal tank TK	tri cities	43
Construction Consumables	truck	tri cities	1800
offsite Rail			
cement	100 Ton Hopper	(82) S/P	9 trains
Steel (Carbon and Stainless)	65 Ton Car	(89) S/P	
Remediation Plant - Insitu/Exsitu combination			
Construction			
onsite trucks			

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-86 SUBJECT Resource Summary table and transportation tables B.11-0-3 SHEET NO. 283 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

IX Ex situ Combustion Insitu (70 tons) - Continued

onsite trucks			
sand and gravel	16 cyd Dump	6 Km Pit-30	~~21167~~ 24317
Concrete	8 cyd Barrel	Batch Plant	~~39464~~ 45359
Excavation	8 cyd Dump	4 Km	~~206325~~ 206604
Backfill	8 cyd Dump	4 Km	98250
Grub and Clear	8 cyd Dump	10 mi Round trip	5250
waste to burial	8 cyd Dump	10 mi Round trip	14738
offsite Truck			
Gasoline and Diesel	5000 gal tank TK	Tri Cities	~~1413~~ 1868
Construction Consumables	truck	Tri cities	5600
Off site Rail			
Cement	100 Ton Hopper	(~~664~~) 763 S/P	~~82~~ 87 trains
Carbon Steel	65 Ton Cars	(823) S/P	
Stainless Steel	65 Ton Cars	(127) S/P	
Hastelloy	65 Ton Car	(20) Σ=1733 S/P	
operation			
onsite truck			
Sand and gravel	16 cyd dump	6 Km Pit-30	~~18758~~ 21928
Concrete	8 cyd Barrel	Batch plant	~~35043~~ 40938
Excavation	8 cyd Dump	4 Km	119865
Backfill	8 cyd Dump	4 Km	82203
Waste to burial	8 cyd dump	10 mi Round trip	6564
Offsite truck			
Gas and Diesel	5000 gal tank truck	Tri Cities	~~156~~ 448
Kerosene	5000 gal tank truck	Tri cities	~~2097~~ 2133
Glass Former, Silica (SiO_2)	16 cyd Dump	Tri cities	~~10309~~ 11585
Process Chemicals, ammonia	25 Ton tank truck	S/P	194
process Chemicals, HNO_3, 50%	25 Ton tank truck	S/P	93
Process Chemicals, NaOH, 50%	25 Ton tank truck	S/P	572
Ion Exchange Resin	truck	tri cities	2.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary Table B.11.0.3 and transportation tables SHEET NO. 284 of 393

BY RDW CHKD. JOB NO. 01K47101

IX Exsitu Combination In Situ (70 Tanks) Continued				
Off site Rail				
Cement	100 Ton Hopper	~~(541)~~ (691)	S/P	226 ~~206~~ trains
Carbon Steel	65 Ton Car	~~(1540)~~ (1776)	S/P	
Stainless steel	65 Ton Car	~~(115)~~ (163)	S/P	
Glass formers - other Materials	100 Ton Hopper	~~(692)~~ (703)	S/P	
Process chemical - other chem	65 Ton Car	(129)	S/P	
Sulfur	100 Ton tank Car	(981)	S/P	
Dicyclopentadiene (DCPD)	100 Ton tank Car	(26)	S/P	
Oligomer	65 Ton Car	(40) Σ4509	S/P	
Closure				
Grout and Equipment and plugs				
on site truck				
concrete	8 cyd Barrel	6 Km Batch Plant		3112
Sand and Gravel	16 cyd Dump	Pit 30		1664
off site truck				
gasoline and Diesel	5000 gal tank truck	tri Cities		383
off site Rail	100 Ton Hopper	(53)	P/S	3 trains
Cement				
gravel fill 161 Tanks				
on site truck				
gravel	16 cyd Dump	P-30		62062
Barrier				
on site truck				
Silt	16 cyd Dump	McGee Ranch		38645
Sand and Gravel	16 cyd Dump	Pit-30		42056
Basalt	16 cyd Dump	Vernita Quarry		64231
off site Truck				
Gasoline and Diesel	5000 gal tank truck	tri Cities		2805
asphalt mix	16 cyd Dump	tri Cities		6407
Geotextile Filter fabric	Truck	S/P		2

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary tables B.11-0-3 and transportation tables SHEET NO. 285 of 393

BY RDW CHKD. JOB NO. 01K4201

I Exsitu Combination Insitu (70 Tons) Continued			
Vitrified HLW transport offsite Rail ~~(1500)~~ Waste to Yucca mountain (2137)	1 cask per car 10 car train	to Yucca Mountain	150 trains 214

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11-0.3 and transportation tables SHEET NO. 286 of 393

BY RAW CHKD. JOB NO. 01K47101

X. Ex Situ Combination Insitu Low (25 Tanks)	Type of Carrier	Point of origin or mi per R.T.	total trips
Retrieval			
Waste Transport			
onsite truck			
Construction (W-314)			
onsite truck			
Sand and gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd Dump	4Km	2293
Backfill	8 cyd Dump	4Km	2751
Grub and Clear	8 cyd Dump	10 mi Round Trip	343
Concrete	8 cyd Barrel	6Km Batch Plant	642
Waste to burial	8 cyd Dump	10 mi Round Trip	13
offsite truck			
Construction Consumables	truck	Tri Cities	3
offsite Rail			
Cement	100 Ton Hopper	(11) S/P	2 Trains
Steel (Carbon and Stainless)	65 ton Car	(24) S/P	Changed to 35 single Car trains
Construction (annexes)			
onsite truck			
Concrete	8 cyd Barrel	6Km Batch plant	3390
Sand and gravel	16 cyd Dump	Pit-30	1819
offsite truck			
Gasoline and Diesel	5000 gal tank truck	Tri Cities	31
Construction consumables	truck	Tri cities	1200
offsite Rail			
Cement	100 Ton Hopper	(58) S/P	7 Trains
Steel (Carbon and Stainless)	65 ton Car	(83) S/P	

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table and Transportation Tables B-11-0-3 SHEET NO. 287 of 393

BY RDW CHKD. _____ JOB NO. 01K 4716/

X Exsitu Combination Insitu Low (25 times) Continued

Remediation plant Exsitu Insitu Combination Low

Construction			
onsite truck			
Concrete	8cyd Barrel	6Km Batch Plant	27838 ~~27674~~
Sand and gravel	16cyd Dump	Pit-30	14918 ~~14820~~
Excavation	8cyd Dump	4Km	~~144592~~ 144667
Backfill	8cyd Dump	4Km	68775
Waste to burial	8cyd dump	10 mi Round trip	10415
Grub and clear	8cyd dump	10 mi Round trip	3700
offsite truck			
Gasoline and Diesel	5000 gal tank truck	tri cities	~~989~~ 991
Construction Consumables	truck	tri cities	4000
offsite rail			
Cement	100 Ton Hopper	(467) ~~(466)~~ S/P	58 Trains
Steel (SS, CS, Hastelloy)	65 ton car	(678) S/P	
operation			
on site truck			
Concrete	8cyd Barrel	6Km Batch plant	28330 ~~25055~~
Sand and gravel	16cyd Dump	Pit-30	~~13446~~ 15156
Excavation	8cyd Dump	4Km	119865
Backfill	8cyd Dump	4Km	82203
Waste to Burial	8cyd dump	10 mi Round trip	6485
Offsite Trucks			
Gasoline and Diesel	5000 gal tank TK	tri cities	226 ~~94~~
Kerosene	5000 gal tank TK	tri Cities	~~1215~~ 1236
Glass former, sand (SiO_2)	16 cyd Dump	Tri cities	~~6029~~ 6755
Process chemical, ammonia	25 Ton tank truck	S/P	130
Process Chemical, HNO_3, 50%	25 Ton Tank truck	S/P	54
Process Chemical, NaOH, 50%	25 Ton tank truck	S/P	332
Ion Exchange resins	truck	tri Cities	1

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 288 of 393

BY RW. CHKD. JOB NO. 01K4701

X Exsitu Combination Waste Low (25 Tons) Continued				
offsite Rail				121
Cement	100 Ton Hopper	(477) ~~(423)~~	S/P	115 trains
Carbon Steel	65 Ton Car	~~(275)~~ (1013)	S/P	
Stainless Steel	65 Ton Car	~~(68)~~ (95)	S/P	
Glass Forms - other Materials	100 Ton Hopper	~~(407)~~ (410)	S/P	
Process Chemical - other chem	65 Ton Car	(75)	S/P	
Sulfur	100 Ton Tank Car	(326)	S/P	
Dicyclopentadiene (DCPD)	100 Ton Tank Car	(9)	S/P	
Oligomer	65 Ton Car	(13) E2418	S/P	
Closure				
Grout and Equipment and plugs				
on site Truck				
Sand and gravel	16 cyd Dump	Pit 30		1663
Concrete	8 cyd Barrel	6 km batch plant		3112
offsite truck				
Gasoline and Diesel	5000 gal tank truck	tri cities		383
offsite Rail				
Cement	100 Ton Hopper	(53)	S/P	3 Trains
Gravel fill 161 Tanks				
on site Truck				
gravel	16 cyd dump	Pit-30		62062
Barrier				
on site truck				
Silt	16 cyd Dump	McGee Rock		34781
Sand and gravel	16 cyd Dump	Pit 30		39273
Basalt	16 cyd Dump	Vernita Quarry		58803
offsite truck				
Gasoline and Diesel	5000 gal tank truck	tri cities		2716
asphalt mix	16 cyd dump	tri cities		5766
Geotextile filter fabric	Truck	S/P		2

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-11-03 and transportation Tables SHEET NO. 289 of 393

BY RDW CHKD. JOB NO. 01K47101

X Exsitu Combination Insitu Low (25 tanks) Continued.

Vitrified HLW transport off site Rail waste	~~(888)~~ 1235	1 car/car 10 car train	to yucca mount.	~~89~~ Trains 124

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11-0.3 and transportation tables SHEET NO. 290 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

XI Phase I Implementation	Type of Carrier	Point of Origin or mi in R-T.	total trips.
Retrieval			
Waste transport			
Construction (W-314)			
onsite truck			
Sand & gravel	16 cyd Dump	Pit 30	325
Excavation	8 cyd dump	4 Km	2293
Backfill	8 cyd dump	4 Km	2751
Grub and clear	8 cyd dump	10 mi Round trip	343
concrete	8 cyd Barrel	6 Km Batch plant	642
Waste to burial	8 cyd dump	10 mi Round trip	13
off Site truck			
Construction Consumables	Truck	tri cities	3
offsite Rail			
Cement	100 Ton Hopper	(11) S/P	2 trains
Steel (Carbon and Stainless	65 Ton Car	(24) S/P	Changed to 36 single car trains.
Construction (annexes)			
Remediation Plant(s) Phase I			
Construction			
onsite truck			
concrete	8 cyd Barrel	6 Km Batch Plant	3930
Sand and gravel	16 cyd Dump	Pit 30	2089
Excavation	8 cyd dump	4 Km	45032
Backfill	8 cyd dump	4 Km	5514
Grub and clear	8 cyd dump	10 mi Round trip	800
Waste to burial	8 cyd dump	10 mi Round Trip	3603
off Site Truck			
Gasoline and Diesel	5000 gal tank truck	tri cities	1295
Construction Consumables	Truck	tri cities	1600
off site Rail			
Cement	100 Ton Hopper	(66) S/P	89 trains
Steel (CS, SS, Hastelloy)	65 Ton Car	(1703) S/P	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-86 SUBJECT Process Summary table B.11.0.3 and transportation tables SHEET NO. 291 of 393

BY RDW CHKD. _____ JOB NO. 01K4701

XI Phase I Implementation continued			
operation			
onsite truck		6Km	
Concrete	8cyd Barrel	Batch Plant	994
Sand and gravel	16cyd Dump	Pit 30	532
waste to burial	8cyd Dump	10 mi Round Trip	665
offsite truck			
Kerosene	5000 gal tank TK	Tri Cities	52
Glass form sand (SiO_2)	16cyd dump	Tri Cities	4105
process chemical, ammonia	25ton tank truck	S/P	79
process chemical, HNO_3, 50%	25ton tank truck	S/P	38
process chemical, NaOH, 50%	25ton tank truck	S/P	231
Ion Exchange Resins	truck	Tri Cities	1
offsite Rail			
Cement	100T hopper	(17) S/P	48 trains
steel (Carbon and Stainless	65Ton Car	(66) S/P	
Glass former, other material	100Ton Hopper	(164) S/P	
Process Chemicals, other chems	65Ton Car	(53) S/P	
Sulfur	100Ton tank car	(326) S/P	
Dicyclopentadiene (DCPD)	100ton tank car	(9) S/P	
Oligomer	65ton car	(13) S/P	
Vitrified HLW Transport			
offsite Rail			
Waste	NA	NA	NA
onSite TRUCK			
HLW	TRUCK	10Km Round TRIP	107
Vitrified LAW transport			
onSite TRUCK			
Waste	TRUCK	2Km Round trip	610
		Converted	6100 Trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 292 of 393

BY RDW CHKD. JOB NO. 01K47101

XII Total Alternative Phased Implementation Retrieval	Type of Carrier	Phase II Point of origin or mi/R.T. use as before	Total trips
Waste transport			
onsite truck		(1.25 E+04)	
offsite truck			
Diesel	5000 gal tank truck	Tri Cities	54
Construction (W-314)			
onsite truck			
Sand and gravel	16 cyd dump	Pit 30	325
Excavation	8 cyd dump	4 Km	2293
Backfill	8 cyd dump	4 Km	2751
Grub and clear	8 cyd dump	10 mi Round trip	343
concrete	8 cyd Barrel	6 Km Batch plant	642
Waste to burial	8 cyd dump	10 mi Round Trip	13
offsite truck			
Construction Consumables	Truck	Tri cities	3
offsite Rail			
Cement	100 Ton hopper	(11) S/P	2 trains
Steel (Carbon and Stainless)	65 Ton Car	(24) S/P	Changed to 35 single car trains.
Construction (Annexes)			
offsite truck			
gasoline and Diesel	5000 gal Tank Truck	Tri Cities	72
Construction Consumables	truck	Tri Cities	2400
onsite truck			
Sand and gravel	16 cyd dump	Pit 30	5175
Concrete	8 cyd barrel	6 Km Batch plant	9662
offsite Rail			
Cement	100 Ton Hopper	(163) S/P	20 trains
Steel (Carbon and Stainless)	65 Ton Car	(238)	

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 293 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

VI Total alternative Phase Implementation - Phase II Continued

Remediation plant(s) - Phase II

Construction

onsite trucks			
Concrete	8 cyd Barrel	6 Km Batch Plant	107420
Sand and gravel	16 cyd Dump	Pit 30	57447
Excavation	8 cyd dump	4 Km	378263
Backfill	8 cyd dump	4 Km	266913
Grub and Clear	8 cyd dump	10 mi Round trip	7250
Waste to burial	8 cyd dump	10 mi Round Trip	18832
off site truck			
Gasoline and Diesel	5000 gal tank TK	Tri Cities	1976
Construction Consumables	Truck	Tri Cities	7000
off site Rail			
Cement	100 Ton Hopper	1804 P/S	222 trains
Carbon Steel	65 ton Car	2234 P/S	
Stainless Steel	65 ton Car	346 P/S	
Hastelloy	65 ton Car	53 P/S	
operation			
on site truck			
Concrete	8 cyd Barrel	6 Km Batch Plant	66647
Sand and gravel	16 cyd Dump	Pit-30	35707
Excavation	8 cyd dump	4 Km	399550
Backfill	8 cyd dump	4 Km	194863
Waste to burial	8 cyd Dump	10 mi Round Trip	6486
off site truck			
Gasoline and Diesel	5000 gal tank truck	tri Cities	432
Kerosene	5000 gal tank truck	tri Cities	3422
Flux sand SiO_2	16 cyd Dump	tri Cities	16934
Process chemicals, ammonia	25 Ton tank truck	S/P	432
Process chemicals, HNO_3, 50%	25 Ton tank truck	S/P	183
Process chemicals, NaOH, 50%	25 Ton tank truck	SP	1127
Ion Exchange Resins	truck	tri Cities	3

FORM 01.005.1 (4/89)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table and transportation tables. B.11.0.3 SHEET NO. 294 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

III Total alternative Phased Implementation - phase II - Continued.				
Off Site Rail				
Cement	100 Ton Hopper	1121	S/P	354 trains
Carbon Steel	65 ton Car	2624	S/P	
Stainless Steel	65 ton Car	224	S/P	
Flux, other metals	100 Ton Hopper	1130	S/P	
Process Chemicals, other chem.	65 ton Car	254	S/P	
Sulfur	100 ton tank Car	1606	S/P	
OCPD	100 Ton tank Car	42	S/P	
Oligomer	65 ton Car	65	S/P	
Closure				
Grouting and Equipment and plugs				
on site truck				
Concrete	8 cyd Barrel	6 Km Batch plant		3112
Sand and gravel	16 cyd Dump	pit 30		1613
off site truck				
Gasoline and Diesel	5000 gal tank truck	Tri Cities		383
off site Rail				
Cement	100 Ton Hopper	53	S/P	3 Trains
Gravel fill 16 L tanks				
on site truck				
gravel	16 cyd. Dump	pit-30		62062
Barrier				
on site truck				
Silt	16 cyd Dump	McGee Ranch		46374
Sand and gravel	16 cyd Dump	pit-30		47555
Basalt	16 cyd dump	Vernita Quarry		78404
Off site truck				
Gasoline and Diesel	5000 gal tank TK	Tri Cities		3323
asphalt mix	16 cyd dump	Tri Cities		7688
Geotextile filter fabric	truck	S/P		2

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XII Total Alternative Phased Implementation - Phase II Continued

Vitrified HSW transport offsite Rail Waste	3050	1 Con per Car 10 Cars/train	To Yucca Mountain	305 trains
onsite TRUCK Waste		TRUCK	8 Km RT	107
Vitrified LAW transport onsite TRUCK Waste		TRUCK	4 Km Round trip	610 Cancelled 6100 trips

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JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11-03 and transportation tables. SHEET NO. 296 OF 293

BY RDW CHKD. JOB NO. 01K 47101

Plant layouts for the Ex Situ / In Situ Combination 2 alternative was developed showing general location within 200 East area in relation to the existing Purex Separations Facility.

A new plant layout was developed for the Phased Implementation (total alternative) Phase 2 facility again with relation to the existing Purex Separation facility and the location of the Phase 1 plant locations.

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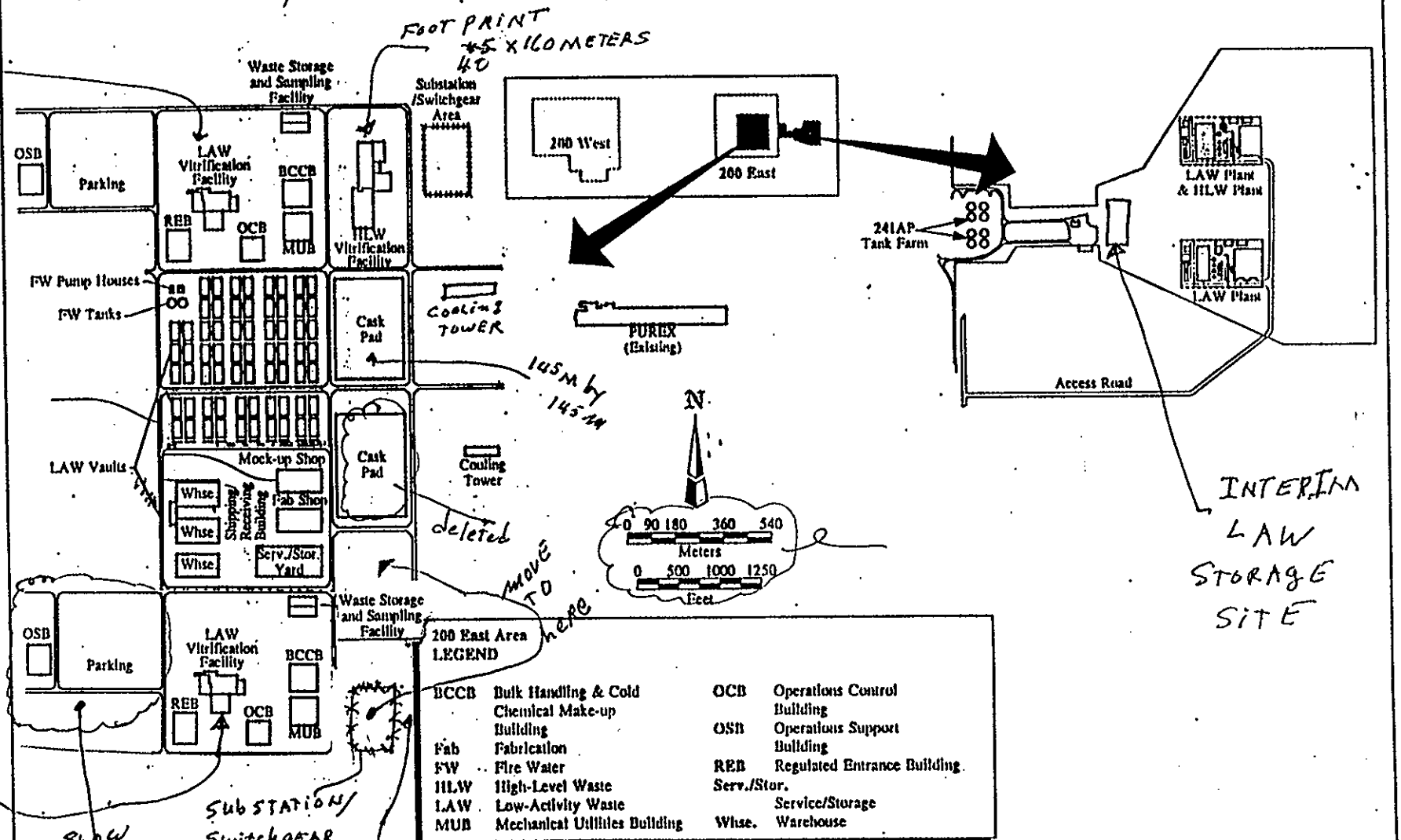
FOOT PRINT
40 METERS X 120 METERS
EACH LAW Facility

Figure B.3.9.3 Phased Implementation (Total Alternative) Facility Layout



SOURCE: Adapted from WHC 1995j

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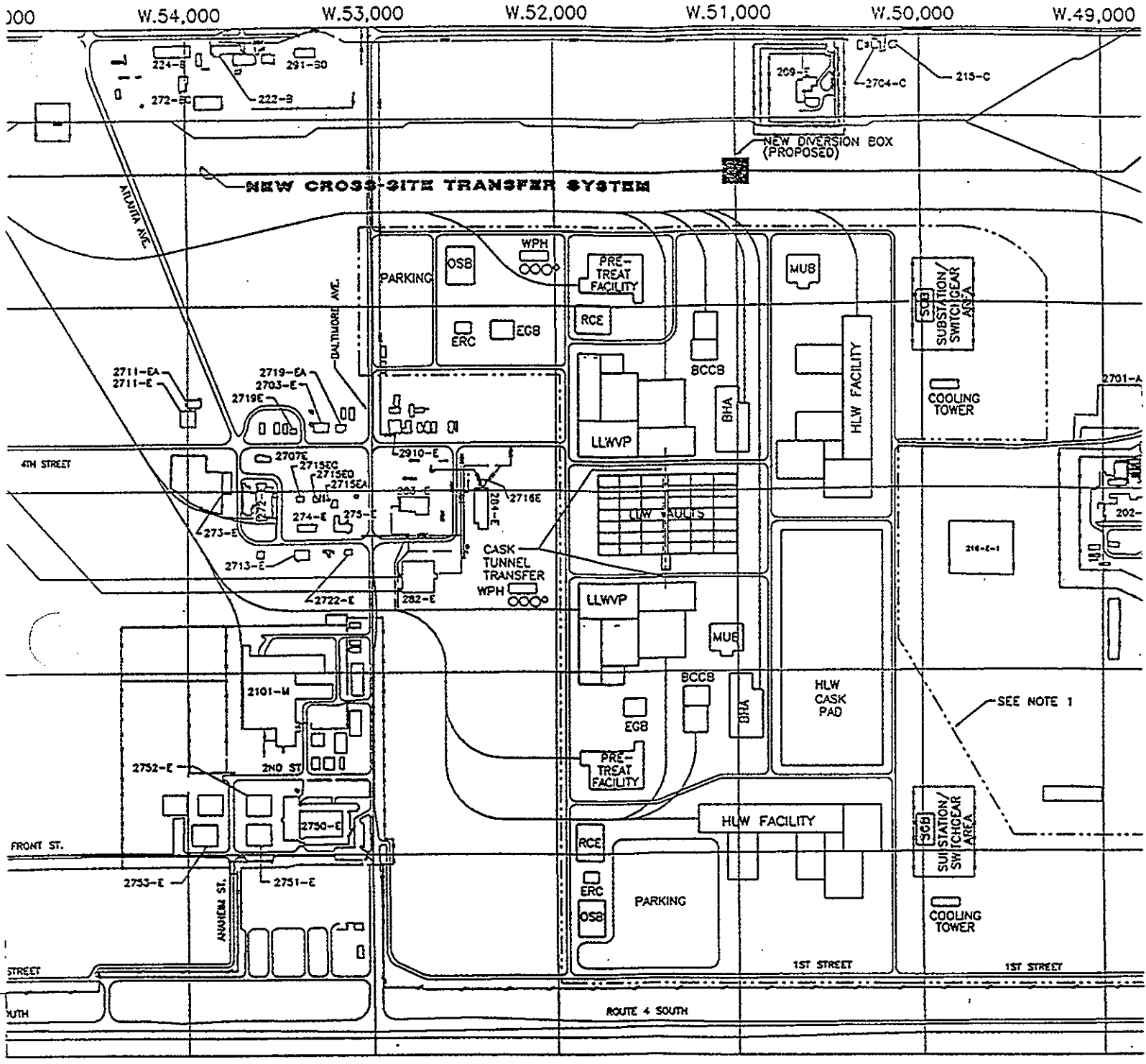
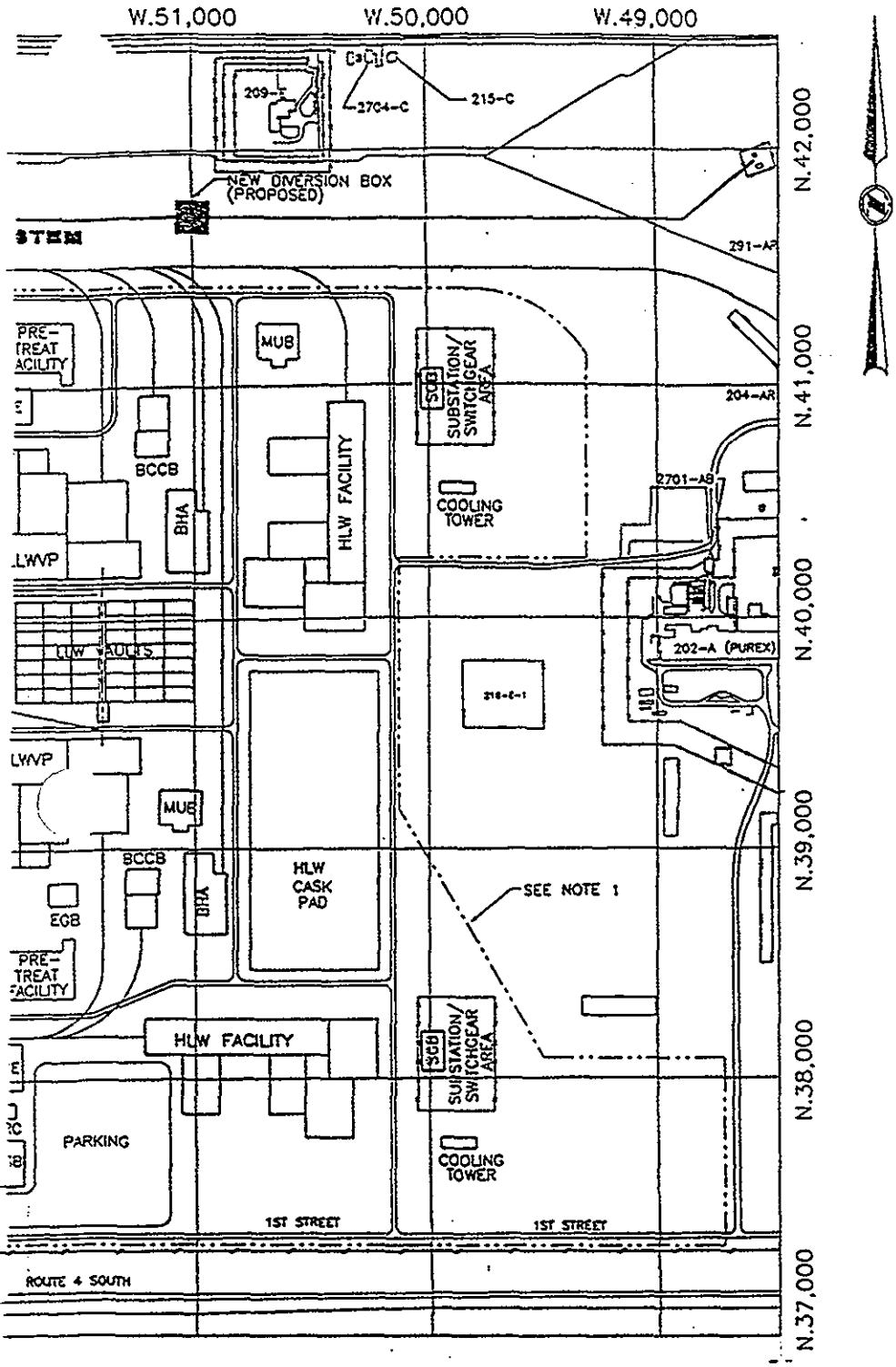


200 EAST AREA

PRIVATIZATION

PHASE II

Figure C-1. 200 East Area Privatizati
Phase II.



LEGEND

BCCB	BULK COLD CHEMICAL BUILDING
BHA	BULK HANDLING AREA
EGB	EMERGENCY GENERATOR BUILDING
HLWVP	HLW VITRIFICATION BUILDING
	CONTACT FILTER/BLOWER ROOM ANNEX
	CONDENSATE COLLECTION ANNEX
	CANISTER/CASK HANDLING ANNEX
	FAN/FILTER ANNEX
	REGULATED FACILITY ENTRY ANNEX
LLWVP	LLW VITRIFICATION BUILDING
	CONTACT FILTER/BLOWER ROOM ANNEX
	CONDENSATE COLLECTION ANNEX
	CONTAINER STAGING ANNEX
	FAN/FILTER ANNEX
	REGULATED FACILITY ENTRY ANNEX
MUB	MECHANICAL UTILITY BUILDING
OSB	OPERATIONS SUPPORT BUILDING
RCE	REGULATED COMPLEX ENTRY
SGB	SWITCHGEAR BUILDING
WPH	WATER PUMPHOUSE
ERC	EMERGENCY RESPONSE CENTER

FACILITIES NOT PROVIDED:

FAS	FABRICATION & ASSEMBLY SHOP
SERV/STOR	SERVICE/STORAGE YARD
WHSE	WAREHOUSE

NOTE:

1. OVERALL AREA OF THE TWRS PHASE II TREATMENT COMPLEX IS 250 ACRES.

0 100 200 300 400 500
GRAPHIC SCALE IN METERS

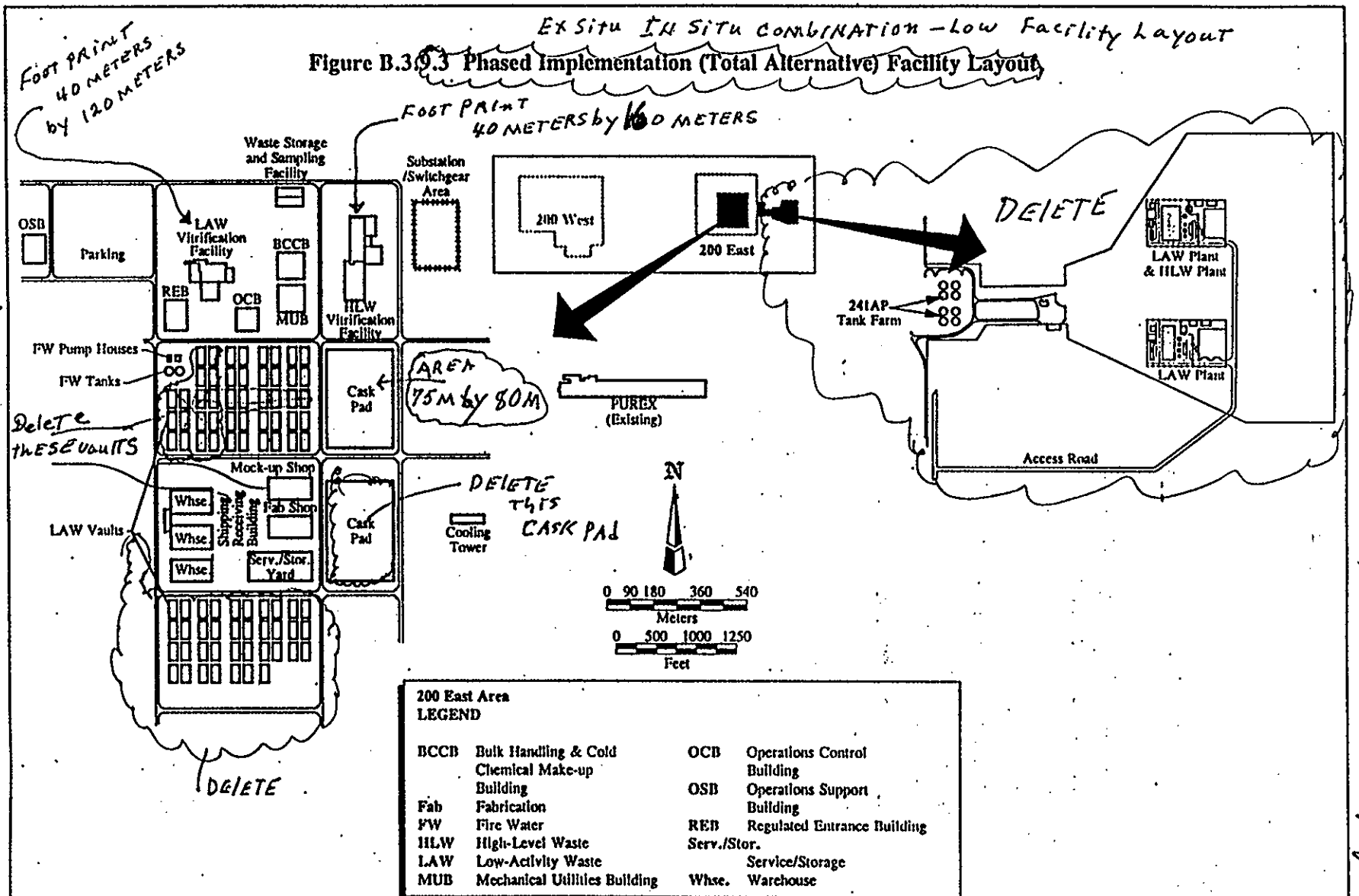
0 100 400 700 1000 1300 1600
GRAPHIC SCALE IN FEET

D0500101 (9-26-95)

REA
TION

Ex Situ In Situ Combination – Low Facility Layout

Figure B.3.9.3 Phased Implementation (Total Alternative) Facility Layout



SOURCE: Adapted from WHC 1995j

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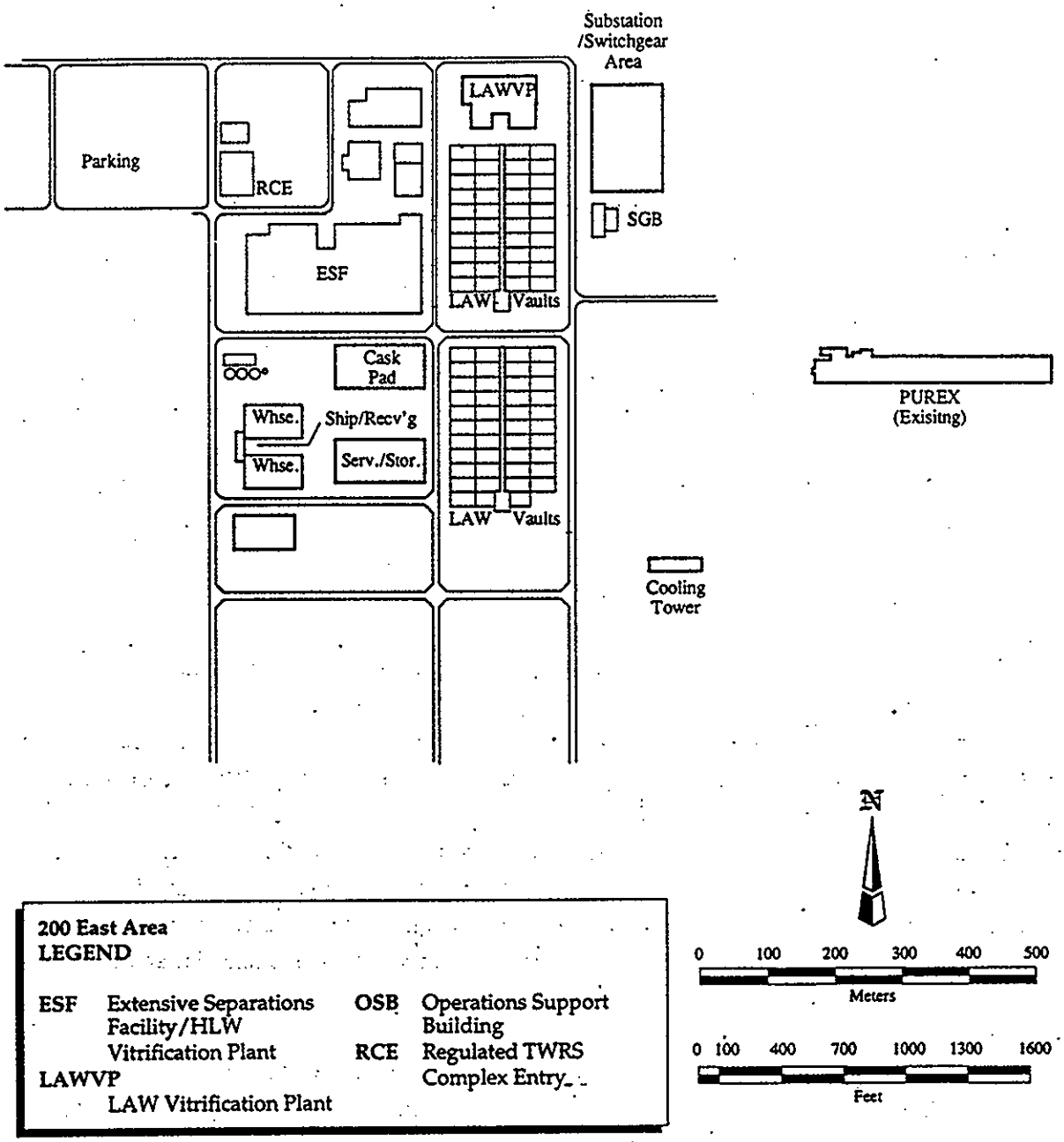
Figure B.3.7.1 Ex Situ Extensive Separations Facility Layout



SOURCE: Adapted from WHC 1995c

18. Determine the values for Table 5.16.1.
The values used herein are obtained from Table II of this calculation. The following definition of activity divisions apply:
1. Construction and filling of tanks with sand or gravel is considered remediation for the In Situ operations
2. For the Ex Situ operations the tank filling with gravel is a function of the closure operation.
3. With the combination processes filling the empty tanks is a part of closure whereas filling the liquid tanks not retrieved is an operation function.

A. Determine the commitment of sand, gravel, silt, and rip rap (Basalt) Resources for the alternatives.
1. No action
None are applicable

2. Long-Term Management
a. Remediation
(1) Sand and gravel = 3.8 E+05 m^3

b. Total =
(1) Sand and gravel = 3.8 E+05 m^3

3. In Situ Fill and Cap
a. Remediation
(1) Fill tanks with sand/gravel = 7.54 E+05 m^3

b. Total
(1) Fill tanks = 7.54 E+05 m^3 sand/gravel
(2) Tank stab and must, pass equip = 2.03 E+04 m^3 sand/gravel
(3) Barrier = 4.24 E+05 m^3 sand/gravel
(4) Silt = 3.77 E+05 m^3
(5) Rip Rap (Basalt) = 6.38 E+05 m^3

Σ = 2.21 E+06 m^3

8. A. ~~4.~~ In Situ Vitrification

a. Remediation

(1) Construction sand and gravel 1.39 E+05 m^3
(2) fill tanks with sand 5.4 E+05 m^3

Σ = 6.79 E+05 m^3

b. Total

(1) Construction sand and gravel 1.39 E+05 m^3
(2) fill tank w ith sand 5.4 E+05 m^3
(3) Barrier sand and gravel 4.24 E+05 m^3
(4) ~~Barrier~~ silt 3.77 E+05 m^3
(5) Barrier rip rap (basalt) 6.38 E+05 m^3

Σ = 2.12 E+06 m^3

5. Intermediate Separations

a. Remediation

(1) Construction sand and gravel 1.148 E+06 m^3
(2) operations sand and gravel 5.1 E+05 m^3

Σ = 1.66 E+06 m^3

b. Total

(1) Construction sand and gravel 1.148 E+06 m^3
(2) operation sand and gravel 5.1 E+05 m^3
(3) Musts, tank slab, misc equip. sand and gravel 2.03 E+04 m^3
(4) Tank fill gravel 7.58 E+05 m^3
(5) Barrier sand and gravel 5.8 E+05 m^3
(6) Barrier silt 5.19 E+05 m^3
(7) Barrier riprap (basalt) 8.78 E+05 m^3

Σ = 3.88 E+06 m^3

6. Ex Situ No Separation Vitrification

a. Remediation

(1) Construction sand and gravel 2.97 E+05
(2) operation sand and gravel 2.65 E+06

Σ = 2.95 E+06

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18. A. 6. b. Total

(1) Construction	Sand and Gravel	2.79 E+05 m^3
(2) Operation	Sand and Gravel	2.65 E+06
(3) Mixers, Tank Slab, and Equip	Sand and Gravel	2.03 E+04
(4) Tank Fill	gravel	7.58 E+05
(5) Barrier	Sand and gravel	4.24 E+05
(6) Barrier	Silt	3.77 E+05
(7) Rip rap Barrier	Basalt	6.38 E+05
	Σ = 5.2 E+06 m^3	

7. Ex Situ No Separations Calcination

a. Remediation

(1) Construction	Sand and gravel	2.85 E+05 m^3
(2) operations	Sand and gravel	1.05 E+06 m^3
	Σ = 1.332 E+06 m^3	

b. Total

(1) Construction	Sand and gravel	2.85 E+05 m^3
(2) operation	Sand and gravel	1.05 E+06 m^3
(3) Mixers, Tank Slab, and Equip	Sand and gravel	2.03 E+04 m^3
(4) Tank Fill	gravel	7.58 E+05 m^3
(5) Barrier	Sand and gravel	4.24 E+05
(6) Barrier	Silt	3.77 E+05
(7) Barrier	Rip rap (basalt)	6.38 E+05
	Σ =	3.55 E+06 m^3

8. Ex Situ Extensive Separations

a. Remediation

(1) Construction	Sand and gravel	5.344 E+05
(2) operation	sand and gravel	4.17 E+05
	Σ = 9.5 E+05 m^3	

b. Total

(1) Construction	sand and gravel	5.344 E+05
(2) operation	Sand and gravel	4.17 E+05
(3) Mixers, tank slab, and Equip	Sand and gravel	2.03 E+04
(4) tank Fill	gravel	7.58 E+05

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18. A. 8. b. (5) Barrier — Sand and gravel — 5.81E+05 m^3

(6) Barrier — Silt — 5.66E+05

(7) Barrier — Rip Rap (Basalt) — 9.58E+05

Σ = 3.84 E+06 3.84E+06

9. Ex Situ / In Situ Combination 1

a. Remediation

(1) Construction — Sand and gravel — 2.9E+05 m^3

(2) operation — sand and gravel — 2.29E+05 m^3

(3) In Situ tank fill — gravel — 4.28E+05 m^3

(3) S+G = (7.58E+05)(70/161) or (91/161)

Σ = 9.47 E+05 m^3

b. Total

(1) Construction — Sand and gravel — 2.9E+05

(2) operation — Sand and gravel — 2.29E+05

(3) In Situ tank fill — gravel — 4.28E+05

(4) Musts, tank Stab, anc Equip — Sand and gravel — 2.03E+04

(5) Tank fill, (Empty) — gravel — 3.3E+05 m^3

(6) Barrier — sand and gravel — 5.16E+05

(7) Barrier — silt — 4.72E+05

(8) Barrier — Rip Rap (basalt) — 7.85E+05

Σ = 3.07E+06

10. Ex Situ / In Situ Combination 2

a Remediation (1) Construction — Sand and gravel — 2.032E+05

(2) operation — Sand and gravel — 1.64E+05

(3) Tank fill 136/161 — gravel — 6.4E+05

Σ = 1.01 E+06

b. total

(1) Construction — Sand and gravel — 2.032E+05

(2) operation — Sand and gravel — 1.64E+05

(3) Tank fill 136/161 — gravel — 6.4E+05

(4) Musts, tank Stab, anc Equip — Sand and gravel — 2.03E+04

(5) Tank fill 25/161 — gravel — 1.18E+05

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18. A. 10. b. (6) Barrier	Sand and gravel	4.82E+05 m^3
(7) Barrier	Silt	4.25E+05
(8) Barrier	Rip Rap (Basalt)	7.18E+05
	Σ 2.77E+06 m^3	

11. Phased Implementation - Phase I

a. Remediation

(1) Construction	Sand and gravel	2.55E+04
(2) operation	Sand and gravel	6.49E+03
	Σ 3.2E+04 m^3	

b. Total

(1) Construction	Sand and gravel	2.55E+04
(2) operation	Sand and gravel	6.49E+03
	Σ 3.2E+04 m^3	

12. Phased Implementation - Phase II

a. Remediation

(1) Construction	Sand and gravel	7.65E+05 m^3
(2) operation	Sand and gravel	4.36E+05
	Σ = 1.2E+06 m^3	

b. Total

(1) Construction	Sand and gravel	7.65E+05 m^3
(2) operation	Sand and gravel	4.36E+05
(3) Mucks, Tank Stab, and Equip	Sand and gravel	2.03E+04
(4) tank fill	gravel	2.58E+05
(5) Barrier	Sand and gravel	5.81E+05
(6) Barrier	Silt	5.66E+05
(7) Barrier	Rip Rap (basalt)	9.58E+05
	Σ = 4.08E+06	

B. Steel in metric tons column was total carbon steel from Table II.

18. C. Column for Stainless Steel and alloy Steel (Hastelloy) was added. The data again was a summation from the data in Table II above.

D. Column for Concrete was entered from the data from Table II above. The quantities here consisted of a summation of: (1) operation; (2) Construction; and (3) Closure where applicable.

E. Total water usage as entered in this column was obtained from table II above.

F. The column for Electric Power was entered from data obtained from Table II above.

G. The Gasoline column data was obtained from table II above.

H. The Diesel column data was obtained from Table II above.

I. The Kerosene Column data was added and was transferred from table II above.

J. The Process chemicals column was added. The data was taken from Table II above and is a summation of the following: (1) process chemicals, (2) Glass formers, and (3) Sulfur cement materials.

K. The Cost column was taken from the analysis data contained in another calculation.

19. Determine the data for Table B.6.2.1. Data is taken from Table II above and from the break down used to generate a part of Table 5.16.1 above in item 18.

a. Long-term management

1. Sand and gravel = 3.8E+05 m^3 = 1.344 E+07 ft^3

cubic ft = ft^3 = (m^3)(1.31)(27) = (M^3)(35.37)

19. B. In Situ Fill and Cap
sand and aggregate = 7.54E+05 m^3 = 2.67 E+07 ft^3

C. In Situ vitrification &
Sand and aggregate = 6.79E+05 m^3 = 2.4 E+07 ft^3

D. Ex Situ Intermediate Separations
aggregate and Sand = 1.66 E+06 m^3 = 5.87 E+07 ft^3

E. Ex Situ No-Separation vitrification
aggregate and Sand = 2.95E +06 m^3 = 1.04E+08 ft^3

F. Ex Situ No Separations Calcination
aggregate and Sand = 1.332E+06 m^3 = 4.71E+07 ft^3

G. Ex Situ Extension Separations
aggregate and Sand = 9.5E+05 m^3 = 3.36 E+07 ft^3

H. Ex Situ / In Situ Combination 1
aggregate and Sand = 9.47E+05 m^3 = 3.35E+07 ft^3

I. Ex Situ / In Situ Combination 2
aggregate and Sand = 1.01E+06 m^3 = 3.57 E+07 ft^3

J. Phased Implementation Phase I
aggregate and Sand = 3.2E+04 m^3 = 1.13E+06 ft^3

K. Phased Implementation Phase II
aggregate and Sand = 1.2 E+06 m^3 = 4.24 E+07 ft^3

20. Determine the data for table B.6.2.2 Data is taken from Table II above and from the break-down used to generate a part of Table 5.16.1 above in item 18.

A. Ex Situ all aggregate = 7.58E+05 m^3 = 2.70E+07 ft^3

B. Ex Situ / In Situ Combination 1
aggregate = 3.30E+05 m^3 = 1.62E+07 ft^3

20. C. Ex Situ/In Situ Combination 2
aggregate = 1.18E+05 m^3 = 4.17E+06 ft^3

D. Phased Implementation - Phase II
aggregate = 7.58E+05 m^3 = 2.70E+07 ft^3

21. Determine the data for Table B-6-2.3. Data is taken from Table II above and from the breakdown used to generate a part of table 5-16-1 above in item 18.

A. In Situ Fill and Cap, In Situ vitrification or Ex Situ No Separations (vitrification or Calcination).
Silt = 3.77E+05 m^3 = 1.30E+07 ft^3
Riprap = 6.38E+05 m^3 = 2.30E+07 ft^3
aggregate and Sand = 4.24E+05 m^3 = 1.50E+07 ft^3
The increase from 4.15 to 4.24 includes the pea gravel needed to mix with one layer of silt in the Barrier Construction.

B. Ex Situ Intermediate Separations, Ex Situ Extensive Separations, or phased Implementation phase 2
Silt = 5.66E+05 m^3 = 2.0E+07 ft^3
Riprap = 9.85E+05 m^3 = 3.48E+07 ft^3
aggregate and Sand = 5.81E+05 m^3 = 2.06E+07 ft^3

C. Ex Situ/In Situ Combination 1
Silt = 4.72E+05 m^3 = 1.67E+07 ft^3
Riprap = 7.85E+05 m^3 = 2.8E+07 ft^3
aggregate and Sand = 5.16E+05 m^3 = 1.83E+07 ft^3

D. added a footnote to Table B.6.2.1
NOTE: 1. Includes material to fill tanks not emptied of radioactive waste.
applies to items 1. In Situ Fill and Cap
2. In Situ Vitrification
3. Ex Situ/In Situ Combination 1
4. Ex Situ/In Situ Combination 2.

21. E. Ex Situ / In Situ Combination 2

Silt = 4.25E+05 m^3 = 1.50E+07 ft^3 = McGee Ranch
RipRap = 7.18E+05 m^3 = 2.54E+07 ft^3 = Vernita Quarry
Aggregate and Sand = 4.82E+05 m^3 = 1.71E+07 ft^3 = Pit 30

22. Develop Numbers for Table 3.6.1

These numbers are identical with the numbers in Table B.6.2.1. See item 19 above.

23. Develop numbers for Table 3.6.2

These numbers are identical with the numbers in Table B.6.2.2. See item 20 above.

24. Develop numbers for Table 3.6.3

These numbers are identical with the numbers in Table B.6.2.3. See item 21 above

26. Determine the data for Table 5.1.1. Two alternatives are to be added to this tabulation of data.

A. No action Tank Waste alternative

1. Remediation
   a. Sand and gravel = NR
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil Disturbance
      (1) temporary = 0
      (2) Permanent = 0

2. total alternative (includes remediation and closure as landfill)
   a. Sand and gravel = NR
   b. Silt = NR
   c. Rip Rap = NR

25. A. 2. d. Soil Disturbance

Page 179 of this Calculation (1) Tank Farm Barren = 17.4495 ha
(2) Tank Farm = 11.8131 ha

(1) Temporary = 0
(2) Permanent = 17.449 ha = 43.12 acres

B. Long-Term management Tank Waste alternative

1. Remediation
a. Sand and gravel = 3.8E+05 m^3 = 5.0E+05 yd^3
b. Silt = NR
c. Rip Rap = NR
d. Soil Disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = To be determined by another calculation

2. Total alternative (Includes remediation and closure as land fill).
a. Sand and gravel = 3.8E+05 m^3 = 5.0E+05 yd^3
b. Silt = NR
c. RipRap = NR
d. Soil Disturbance
(1) Temporary = To be determined by another calculation
(2) permanent = To be determined by another calculation

C. In Situ Fill and Cap Tank Waste alternative

1. Remediation
a. Sand and gravel = 7.54E+05 m^3 = 9.88E+05 yd^3
b. Silt = NR
c. Riprap = NR
d. Soil disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = To be determined by another calculation

2. Total alternative (Includes remediation and closure as landfill).
a. Sand and gravel = 11.98E+05 = 1.2E+06 m^3 = 1.57E+06 yd^3
b. Silt = 3.77E+05 = 3.80E+05 m^3 = 5.0E+05 yd^3
c. Rip Rap = 6.38E+05 = 6.4E+05 m^3 = 8.40E+05 yd^3

25. C. 2. d. Soil Disturbance
(1) Temporary = to be determined by another calculation
(2) Permanent = to be determined by another calculation

D. In Situ vitrification Tank Waste alternative
1. Remediation
a. Sand and gravel = 6.79E+05 m^3 = 8.90E+05 yds^3
b. Silt = NR
c. Rip Rap = NR
d. Soil Disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = to be determined by another calculation

2. Total alternative (Includes remediation and closure as landfill).
a. Sand and gravel = 1.103E+06 m^3 = 1.44E+06 yds^3
b. Silt = 3.77E+05 m^3 = 3.80E+05 m^3 = 5.00E+05 yds^3
c. Rip Rap = 6.38E+05 m^3 = 6.40E+05 m^3 = 8.40E+05 yds^3
d. Soil disturbance
(1) Temporary = to be determined by another calculation
(2) Permanent = to be determined by another calculation

E. Ex Situ Intermediate Separations Tank waste alternative Extensive Retrieval
1. Remediation
a. Sand and Gravel = 1.66E+06 m^3 = 2.18E+06 yds^3
b. Silt = NR
c. Rip Rap = NR
d. Soil Disturbance
(1) Temporary = to be determined by another Calculation
(2) permanent = to be determined by another Calculation

2. Total alternative (Includes remediation and closure as landfill).
a. Sand and gravel = 3.02E+06 m^3 = 3.95E+06 yds^3
b. Silt = 5.19E+05 m^3 = 6.80E+05 yds^3
c. Rip Rap = 8.78E+05 m^3 = 1.15E+06 yds^3
d. Soil Disturbance
(1) Temporary = to be determined by another calculation
(2) Permanent = to be determined by another calculation

25. F. Ex Situ No Separations Vitrification Tank waste alternative
Extensive Retrieval
1. Remediation
a. Sand and gravel = 2.95 E+06 m^3 = 3.86 E+06 yds^3
b. Silt = NR
c. Rip Rap = NR
d. Soil Disturbance
(1) Temporary = To be determined by another calculation.
(2) Permanent = To be determined by another calculation.

2. Total alternative (Includes remediation and closure as Land fill.)
a. Sand and gravel = 4.15 E+06 m^3 = 5.44 E+06 yds^3
b. Silt = 3.77 E+05 = 3.80 E+05 m^3 = 5.00 E+05 yds^3
c. Rip Rap = 6.38 E+05 = 6.40 E+05 m^3 = 8.40 E+05 yds^3
d. Soil disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = To be determined by another calculation

G. Ex Situ No Separations Calcination Tank waste alternative
Extensive Retrieval
1. Remediation
a. Sand and Gravel = 1.33 E+06 m^3 = 1.74 E+06 yds^3
b. Silt = NR
c. Rip Rap = NR
d. Soil Disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = To be determined by another calculation

2. Total alternative (Includes remediation and Closure as Land Fill.)
a Sand and Gravel = 2.54 E+06 m^3 = 3.33 E+06 yds^3
b Silt = 3.77 E+05 = 3.80 E+05 m^3 = 5.00 E+05 yds^3
c Rip Rap = 6.38 E+05 = 6.4 E+05 m^3 = 8.4 E+05 yds^3
d Soil Disturbance
(1) Temporary = To be determined by another calculation
(2) Permanent = To be determined by another calculation

25. H. Ex Situ Extensive Separations Tank Waste alternative Extensive Retrieval

1. Remediation
   a. Sand and gravel = 9.51E+05 m^3 = 1.25E+06 yds^3
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil Disturbance
      (1) Temporary = To be determined by another calculation
      (2) Permanent = To be determined by another calculation

2. Total alternative (Includes Remediation and closure as Land fill.)
   a. Sand and Gravel = 2.31E+06 m^3 = 3.03E+06 yds^3
   b. Silt = 5.66E+05 m^3 = 7.42E+05 yds^3
   c. Rip Rap = 9.58E+05 m^3 = 1.26E+06 yds^3
   d. Soil Disturbance
      (1) Temporary = To be determined by another calculation.
      (2) Permanent = To be determined by another calculation.

I. Ex Situ / In Situ Combination 1 Tank waste alternative Extensive Retrieval of Liquid Waste/Solid Waste from 70 Tanks

1. Remediation
   a. Sand and Gravel = 9.47E+05 m^3 = 1.24E+06 yds^3
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil disturbance
      (1) Temporary = To be determined by another calculation
      (2) Permanent = To be determined by another calculation

2. Total alternative (Includes Remediation and closure as Land Fill.)
   a. Sand and gravel = 1.81E+06 m^3 = 2.38E+06 yds^3
   b. Silt = 4.72E+05 m^3 = 6.18E+06 yds^3
   c. Rip Rap = 7.85E+05 m^3 = 1.03E+06 yds^3
   d. Soil Disturbance
      (1) Temporary = To be determined in another calculation
      (2) permanent = To be determined in another calculation

16. J. Ex Situ/In Situ Combination 2 Tank Waste alternative Extensive Retrieval of Liquid Waste/Solid Waste from 25 Tanks

1. Remediation
   a. Sand and Gravel = 1.01 E+06 m^3 = 1.32 E+06 yd^3
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil Disturbance
      (1) Temporary = To be determined in another Calculation
      (2) Permanent = To be determined in another Calculation

2. Total alternative (Includes Remediation and Closure as Land fill)
   a. Sand and gravel = 1.63 E+06 m^3 = 2.13 E+06 yd^3
   b. Silt = 4.25 E+05 m^3 = 5.75 E+05 yd^3
   c. Rip Rap = 7.18 E+05 m^3 = 9.41 E+05 yd^3
   d. Soil Disturbance
      (1) Temporary = To be determined in another Calculation
      (2) Permanent = To be determined in another Calculation

K. Phased Implementation Phase I Tank Waste alternative

1. Remediation
   a. Sand and Gravel = 3.2 E+04 m^3 = 4.19 E+04 yd^3
   b. Silt = NR
   c. Rip Raps = NR
   d. Soil disturbance
      (1) Temporary = To be determined in another calculation
      (2) Permanent = To be determined in another calculation

2. Total alternative (Includes Remediation and Closure as Land fill.)
   a. Sand and gravel = 3.2 E+04 m^3 = 4.19 E+04 yd^3
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil Disturbance
      (1) Temporary = To be determined in another calculation
      (2) Permanent = To be determined in another Calculation

25. L. Phased Implementation Phase II Tank waste alternative

1. Remediation
   a. Sand and Gravel = 1.20E+06 m^3 = 1.57E+06 yds^3
   b. Silt = NR
   c. Rip Rap = NR
   d. Soil Disturbance
      (1) Temporary = To be determined in another Calculation
      (2) Permanent = To be determined in another Calculation

2. Total alternative (Includes Remediation and Closure as Land Fill.)
   a. Sand and gravel = 2.56E+06 m^3 = 3.35E+06 yds^3
   b. Silt = 5.66E+05 m^3 = 7.42E+05 yds^3
   c. Rip Rap = 9.58E+05 m^3 = 1.26E+06 yds^3
   d. Soil Disturbance
      (1) Temporary = To be determined in another Calculation
      (2) Permanent = To be determined in another Calculation

The data utilized throughout item 25 above can be found in Table II above and in the support information for Table 5.16.1 given in Item 18 above.

26. Determine the input for Table 3.7.1 for columns (1) onsite Disposal volume (m^3) and (2) offsite disposal volume (m^3). Develop the new column for insertion for the Ex Situ/In Situ Combination 2 alternative.

A. assumed that the values for no action, long-term management, In Situ Fill and Cap, and In Situ Vitrification did not change with this revision. However the value entered under Fill and Cap appears extremely low at 50,000 m^3 of onsite Waste Disposal Volume.

B. Ex Situ Intermediate Separations
1. onsite Disposal volume
volume of LLW glass produced from input sheets
$v = 351,000\ m^3$

2. offsite Disposal volume
volume of HLW glass produced from input sheets
$v = 14,200\ m^3$

C. Ex Situ no Separations - Vitrification
1. onsite Disposal volume
volume of LLW glass produced from Input Sheets
$v = 0$
2. offsite Disposal volume
volume of HLW glass produced from Input Sheets
$v = 291,000\ m^3$

D. Ex Situ no Separations - Calcination
1. onsite Disposal volume
volume of LLW glass produced from Input sheets
$v = 0$

2. offsite Disposal volume
volume of HLW calcined product from Input sheets
$v = 67,000\ m^3$

26.E. Ex Situ Extensive Separations

1. Onsite Disposal Volume

Volume of LLW glass produced from input sheets

$v = 349,000\ m^3$

2. offsite Disposal volume

volume of HLW glass produced from Input sheets

$v = 667\ m^3$

F. Ex Situ/InSitu Combination 1

1 Onsite Disposal Volume

volume equals the amount of LLW and the liquid remaining

Volume of LLW glass produced from Input Sheets

$LLW = 215000\ m^3$

according to Footnote 3 $105,600\ m^3$ of waste remained in the tanks.

Σ LLW + Remained $= v = 215,000 + 105,600$

$v = 320,600\ m^3$

2. offsite Disposal volume.

volume of HLW glass produced from the input sheets

$v = 7,030\ m^3$

G. Ex Situ/InSitu Combination 2

1. offsite Disposal volume

volume of HLW glass produced from the input sheets

$v = 4,160\ m^3$

2. Onsite Disposal volume

Volume of LLW glass produced from input sheets

$LLW = 125000\ m^3$ table AI from WHC-SD-WM-EV-107

waste volume remaining = total volume − volume of 25 tanks assumed as Fullest tanks.

25 tank Volume =	7 Tanks	$30694\ m^3$
	8	35078
	6	26309
	3	13154
	1	3780
	Σ 25	$109015\ m^3$

$475917 - 109015$

$= 366902\ m^3$

6.G.2. waste volume = LLW + Remainder
= 125000 + 366902
= 491902 m^3

H. Phased Implementation (1 and 2)
1. onsite Disposal Volume
volume of LLW glass product from input sheets
$v = 351,000\ m^3$

2. offsite Disposal Volume
volume of HLW glass produced from input sheet
$v = 14,300\ m^3$

27. Determine the new values as revised by the new criteria for canisters, etc. for the sensitivity analysis for the Ex Situ Intermediate Separations alternative for presentation in the revised Table B.8.2.1 of appendix B.

A. Ex Situ Intermediate case of LLW glass loading of 10 weight % sodium oxide and the HLW glass loading of 15 weight % waste oxides [Low Loading].

Determine the Ratio of LLW and HLW and the combined ratio for determining many of the values to be found in the Resource Summary Table and used for Table B.8.2.1.

Low Loading Mass of LLW glass = 9.68 E+05 mTons
Number of Vaults = 99

Mass of HLW glass = 5.81 E+04 mTons.
Number of 1.17 m^3 Canisters = 1.89 E+04
Number of HMPCs = 4725
Number of Shield Casks = 4725

Number of 10 car trains to Repository = 4725 ÷ 10 = 472.5
= 473 Trips

27-A. Reference loading is the base case of 20% + 15% loadings

Mass of HLW glass = 3.73 E+04 MT

Mass of LLW glass = 6.45 E+05 MT

$$\text{Combined ratio} = \frac{LLW + HLW}{LLW + HLW} = \frac{968000 + 58100}{645000 + 37300} = \frac{1026100}{682300}$$

$$= \frac{1026100}{682300} = 1.504$$

LLW ratio = 1.501

HLW ratio = 1.558

Determine the raw water usage

Construction = NR

Closure = NR

operations = (1.504)(1.22 E+07) = 1.835 E+07 m^3

B. Determine the sanitary water requirements.

1. Closure - the increase is for the increased basins needed for the vaults.

66 vaults = 6.42 hectares = 64,200 m^2

99 vaults = a block 9 x 11 vaults. or 10 x 10 block.

= (10)(39) = 390 m + 18 m = 408 meters

= (10)(20) = 200 m + 18 m = 218 meters

= (218)(408) = 88944 m^2

= 8.8944 hectares

$$\text{ratio} = \frac{17.4495 + 8.8944}{17.4495 + 64.152} = \frac{26.3439}{23.8647} = 1.104$$

H_2O = (6.0E+04)(1.104) = 6.624 E+04

17. B. 2. operation Sanitary water

vitrifi H_2O = (3.8 E+06)(1.504) = 5.72 E+06

WR+T use = 2.0 E+06

3. Construction

WR&T = 9.4 E+03

Vitrifi = (4.926 E+05)(0.06)

= 29559

= 492,600 − 29559 = 463041

H_2O = 463041 + 46683

= 509124

= 5.09 E+05 m^3

HLW pad area

(3030)(6.6) = 19998 m^2

(4725)(6.6) = 31185 m^2

Ratio 31185 / 19998 = 1.559

Ratio of HLW/LLW = 58100 / 968000

= 0.06

C. Calculate total water

H_2O = (1.835 E+07) + (8.31 E+06) = 2.67 E+07 m^3

D. Determine the Electrical requirements for this case

1. Construction

WR&T = 2.6 E-01

vitrifi = (7.3 E+01) = (73)(0.06)(1.559)

= 23 + 7 = 8.0 E+01

2. operation

WR&T = 6.0 E-01

vitrifi = (1.08 E+04)(1.504) = 1.624 E+04

3. Closure

total = NR

7. E. Determine the Gasoline requirements.

1. Construction

WR&T = 3.3 E+02

vitrifi = (7300)(0.06)(1.559)

= 7300 + 683

= 7.983 E+03

total = 8313 = 8.31 E+03

2. operation

WR&T = 0

vitrifi = 5.1 E+01

New value = 99-10 = (89)(240)(3.785)(10^-3) = 8.09 E+01

3. Closure

tank stab = 4.01 E+01

anc Equip = 1.2 E+00

Barrier = (3.71 E+02)(1.104)

= 4.10 E+02

F. Determine the Diesel Consumption for this case

1. Construction

WR&T = 1.0 E+03

vitrifi = (2.01 E+04)(0.06)(1.559) = (= 1880)

= (2.01 E+04)(1880)

= 21980 = 2.20 E+04 Pad increased area

2. operation

WR&T = 1.02 E+03

vitrifi = (1.734 E+03)(1.504) = 2.60 E+03

vaults = (89)(25530)(3.785)(10^-3) = 8.6 E+03

vitrifi = 8.6 E+03 + 2.6 E+03 = 1.12 E+04

total = 1.22 E+04

17.7.3. Closure

Tank Stab = 6.4E+03

one Equip = 8.02E+02

Barrier = (.164)(6.3+E04) = 6.96E+04

G. Determine the new Kerosene requirement

Kerosene = (.504)(6.58E+04) = 9.90E+04 m³

H. Determine the concrete usage, sand, gravel, and cement

1. Construction

WR&T ≡ no change = 5.9E+04 m³

Sand = 3.98E+04

gravel = 2.34E+04

Cement = 1.48E+04

Vitrifi = 4.82E+05 + Mercaul Pad = 2237 m³

= 482000 + 2237

= 4.842E+05 m³

Sand = 3.264E+05 m³

gravel = 1.917E+05 m³

Cement = 1.211E+05 MT

2. operation

WR&T = NA

vitrifi =

(1) LLW vaults = (89)(4300) = 382700 E+05 m³

Sand = 2.58E+05

gravel = 1.52E+05

Cement = 9.57E+04 MT

2. HLW Shield Casks

(90.7)(1/1.6)(4725) = 2.67848 E+05

Sand 1.81E+05

gravel 1.06E+05

Cement 6.7EE04

27 Q.3. Determin Concrete usage, Sand, gravel and cement

a. Construction

WR+T = no change

Vitrifi = 4.82E+05 − decreased storage Pad volume.

= 482000 − 1663

Concrete = 4.80E+05 m^3

Pad area (3070)(6.6)
new Pad area (1770)(6.6)
decrease = 8316 m^2
×0.2 = 1663 m^3

Sand = 3.24E+05 m^3
gravel = 1.90E+05 m^3
Cement = 1.20E+05 mT

b. Operation

WR+T = NA

Vitrifi =

(1) LLW vaults = (30)(4300) = 1.29E+05 m^3 Concrete
Sand = 8.70E+04 m^3
gravel = 5.12E+04 m^3
Cement = 3.23E+04 mT

(2) HLW shield Cells

= (90.7)(1/1.6)(1770) = 160337
= 1.0034E+05 m^3
Sand = 6.76E+04 m^3
gravel = 3.97E+04 m^3
Cement = 2.51E+04 mT

4. Determine the Carbon steel usage

decrease pad area = 92×92 m^2

a. Construction

Steel = (0.000123)(92)(2)(460)(7) = 74 mT
= 97100 − 74
= 97026 = 9.70E+04 mT

7. Q 4. b. operation steel

HMPCS = (6.5)(1770) = 1.1505 E+04

LLW vaults = (30)(500) = 1.50 E+04

LLW boxes = (13.076)(40)(1263) = 6.606 E+05

Σ = 6.87 E+05 mT

5. determine the stainless steel

a. operation = (7080)(1.125) = 7965 mTons

6. Σ of Steels

Fuel Core = 7.94 E+05 + 2.7 E+04 + 2.3 E+03
= 823300 = 8.23 E+05 mT steel total

Base Core = 1.73 E+06 + 3.26 E+04 + 2.3 E+03
= 1.76 E+06 mT steel total.

Low Core = 1.83 E+06 + 4.03 E+04 + 2.3 E+03
= 1.87 E+06 mT steel total.

7. determine the Barrow material required for the vault Barriers.

vault area for 48 vaults = 4 x 10 block of vaults.

Barrier area = (10)(39) = 390 + 18 = 408 meters
= (4)(20) = ~~80~~ 60 + 18 = ~~178~~ 98 meters

area = (408)(~~178~~ 98) = ~~72624~~ 39984 m^2
= ~~7.2624~~ 3.9984 hectares

Silt = 3.7~~7~~ E+05 m^3 + (2)(~~72624~~ 39984) m^3
= 3.77 + ~~145248~~ 79968
= ~~5.22~~ E+05 m^3 4.57

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27. Q. 8. Determine the Rip Rap requirement:

Tank Farm = 6.38 E+05 m^3

area of 402 vaults = 39984 m^2

x1.5 = 59976 m^3

x2.434 = 1,45982 E+05 m^3

Σ = 6.38 E+05 + 1.46 E+05

= 7.84 E+05

9. Develop the total Barrow site Sand and gravel.

a. Construction

	Sand	gravel
W.R&T	3.98E+04	2.34E+04
vitrifi	3.24E+05	1.90E+05
Σ	3.64E+05	2.13 E+05

Σ = 5.77 E+05

b. operation

	Sand	gravel
LLW vaults	8.70E+04	5.12E+04
HLW Shield Cell	6.76E+04	3.97 E+04
Σ =	1.55E+05	9.09E+04

Σ = 2.46 E+05

c. Closure

	Sand	Gravel
Tank Stab	3.6E+03	2.1E+03
Ave Equip	9.2E+03	5.4E+03

Barrow = 4.15E+05 m^3 Sand and gravel.

= 2.38 m^3/m^2

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BY RDW CHKD. JOB NO. 01K 47101

7. H. 3. Closure

no change in tank stab., anc. Equip and Barrier = NR

I. determine the carbon steel requirements.

1. Construction

WK&C = 1.0E+04 mT

Vitrifi = pad increase = 11187 m^2 = 106 X 106

use rebar 107 meters long. 106 ÷ 0.2 =

= (0.000123)(107)(530)(2)(7) = 97.6546 M Tons.

= 97100 + 98 = 9.72 E+04 mT

2. operation

Steel for HMPCs = (6.5)(4725) = 3.07 E+04 mT

LLW vaults = (89)(500) = 4.4500 E+04 mT

LLW Boxes = ~~(1.09E+05)(~~

= (13.076)(89)(1.263)

= ~~1.47 E+06 mT~~

= 1635 = 1.64E+06 mT

3. Closure not Required

J. Determine stainless steel requirements

1. Construct no change

2. operation = SS Canisters @ 1.17 m^3

= (1.125)(18900) = 2.13E+04 mT

K. Hastelloy alloy or Inconel

no change.

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M. L. Compute the glass forms required.

LLW ~~4.66E+04~~ 8.62E+05 mT HLW 4.66E+04 mT

alumina	1.32E+04	0.045	B_2O_3	1.75E+03	0.129
CaO	3.87E+04	0.138	Li_2O	5.00E+02	0.037
SiO_2	2.29E+05	0.815	SiO_2	1.13E+04	0.834
Σ = 280900			Σ = 13550		

alumina	3.88E+04	B_2O_3	6.01E+03
CaO	1.19E+05	Li_2O	1.72E+03
SiO_2	7.63E+05	SiO_2	3.89E+04

Σ SiO_2 = 7.42E+05

total Σ = 9.08E+05

M. Σ of Carbon Steel, Stainless Steel and alloy Steel.

Low = 1.87E+06 mT Base = 3.04E+05

N. Develop the amount of Barrow silt needed for the Low Case

Basin area for 99 vaults = 88944 m^2

silt is 2 meters thick

volume = 177,888 m^3

= 1.78E+05 m^3

amount for tank farm = 3.77E+05 m^3

Σ = 5.55E+05 m^3

O. Develop the amount of Barrow riprap needed for the low case

Basin for tank farm = 6.38E+05

(174495 m^2)(1.5 m)

= 261743 m^3

(638000) ÷ (261743) = 2.434

area of 99 vaults = 88944 m^2

×1.5 = 133416 m^3

×2.434 = 3.25E+05 m^3

Σ = 6.38E+05 + 3.25E+05 m^3

= 9.63E+05 m^3

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17. P. Determine Barrow site sand and gravel.

1. Construction

	sand	gravel
WR&T	3.98E+04	2.34E+04
Utilities	3.26E+05	1.917E+05
Σ =	3.66E+05	2.15E+05

Σ = 5.81E+05

2. operation

	Sand	gravel
SLW vaults	2.58E+05	1.52E+05
HLW Shield Cask	1.81E+05	1.06E+05
Σ	4.39E+05	2.58E+05

Σ 6.97E+05

3. Closure

	sand	gravel
Tank Slab	3.6E+03	2.1E+03
onc Equip	9.2E+03	5.4E+03

4. Barrier

Pea gravel = 8760 m³ per 8 hectares

~~for~~ = 19107 m³ per 17.4485 hectares

99 Vaults = 88944 m² = 8.8944 hectares

pea gravel = 9739.368 m³ for 8.8944 hectares.

Pea gravel = 19107 m³ + 9739.368 m³

= ~~1.165E+~~ 2.884E+04 m³

66 vaults = 64200 = 6.42

= 7030 m³ pea gravel

8760 + 7030

= 1.58E+04

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27. P. 4. Barrier gravel/sand
Cubic meters of material = 2.38 m^3/m^2

99 vaults = 88944 m^2
= 2.117 E+05 m^3

Σ 2.117 E+05 + 2.88 E+04
= 2.41 E+05 + 4.15 E+05
= 6.56 E+05

Q determine data for high case for table B.8.2.1.

[High Loading]

Mass of LLW glass = 387000 MT
Number of Vaults = 40

Mass of HLW glass = 21800 MT
Number of 1.17 m^3 Canisters = 7080
Number of HMPCs = 1770
Number of Shield Casks = 1770

Number of 10 car trains to Repository = 1770 ÷ 10 = 177

1. Determine ratio to the Base case
Mass of LLW = 6.45 E+05 MT
Mass of HLW = 3.73 E+04 MT

HLW ratio = 21800/37300 = 0.5845
LLW ratio = 387000/645000 = 0.6

overall ratio = 408800/682300 = 0.5992

2. Determine the Kerosene requirement.

m^3 = (6.58 E+04) (0.5992) = 3.943 E+04 m^3

7. Q. 9. C. Vault Barrier area = 3 9984 m^2

(2.38)(39984) =

pea gravel = 8.760 m^3 for 8 features

= (8760) 4/8 = 4380

add tank farm to both values.

= 4.15 E+05 + 9.52 E+04 5.10 E+05 m^3

= 19107 m^3 + 4380

= 2.35 E+04 m^3 pea gravel

10 Compute the glass formers required here

LLW = 281000 MT HLW = 10300 MT

alumina	0.045	B_2O_3	0.129
CaO	0.138	Li_2O	0.037
SiO_2	0.815	SiO_2	0.834

	alumina	12645.96	1.26E+04	B_2O_3	1328.7	1.33E+03
3.88E+04	CaO	~~126 46.96~~	38778.0	Li_2O	381.1	3.81E+02
	SiO_2	229015.0	E+05	SiO_2	8590.2	8.59E+03

ΣSiO_2 = 237605 = 2.38 E+05 MT

11. Permanent Land Commitment

Base Case ± Change in hectares for LLW Barrier.

Low Case = 46 + [8.8944 − 6.4200] = 49 ha

High Case = 46 − [6.4200 − 3.9984] = 43 ha

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table V

Calculation tabulation of Comparative data used to generate the revision to table B.8.2.1 on the Ex Situ Intermediate Separations process showing the sensitivity to loading of the waste oxides and/or sodium oxides in the glass.

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Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
1. Land Permanently Committed (Hectares)					
Total	49	46	43		
Construction/ops total					
WR&T					
Vitrifi					
Closure total					
Barrier					
2. Land Temporarily committed (Hectares)					
Total					
Construction/ops total					
WR&T					
Vitrifi					
Closure total					
Barrier					
3. Borrow Pit Disturbed area (Hectares) [based on 3 meter depth					
McGee Ranch					
Pit 30					
Vernita Quarry					

Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
4 Water, Total (m^3)					
total	2.67E+07	1.86E+07			
WR&T	2.01E+06	2.01E+06			
vitrifi	2.46E+07	1.26E+07			
Closure	6.95E+04	6.33E+04			
5. Sanitary water (m^3)					
total	8.31E+06	6.37E+06			
WR&T	2.01E+06	2.01E+06			
vitrifi	6.23E+06	4.29E+06			
Closure	6.95E+04	6.33E+04			
Construction					
total	5.68E+05	5.02E+05			
WR&T	9.4E+03	9.4E+03			
vitrifi	5.09E+05	4.926E+05			
operation					
total	7.72E+06	5.8E+06			
WR&T	2.0E+06	2.0E+06			
vitrifi	5.72E+06	3.8E+06			
closure					
Total	6.95E+04	6.33E+04			
Tank Stab	NR	NR	NR		
Barrier	6.624E+04	6.0E+04			
anc Equip	3.3E+03	3.3E+03			
6. Raw water (m^3)					
total					
Construction					
Total	NR	NR	NR		
WR&T					
vitrifi					
operation	1.835E+07	1.22E+07			
Closure	NR	NR	NR		

Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
7. Electrical Energy (kW-h)					
Total	1.63E+04	1.09E+04			
WR+T	1.36E+00	1.36E+00			
Vitrifi	1.63E+04	1.09E+04			
Closure	NR	NR			
Construction					
total	8.08E+01	7.38E+01			
WR+T	7.6E-01	7.6E-01			
Vitrifi	8.0E+01	7.3E+01			
operation					
total	1.62E+04	1.08E+04			
WR+T	6.0E-01	6.0E-01			
vitrifi	1.624E+04	1.08E+04			
closure					
total	NR	NR	NR		
8. Gasoline (m^3)					
Total	8.84E+03	8.1E+03			
WR+T	3.3E+02	3.3E+02			
vitrifi	8.06E+03	7.35E+03			
closure	4.51E+02	4.12E+02			
Construction					
total	8.13E+03	7.63E+03			
WR+T	3.3E+02	3.3E+02			
vitrifi	7.98E+03	7.3E+03			
operation					
total	8.09E+01	5.1E+01			
WR+T	0	0			
vitrifi	8.09E+01	5.1E+01			
Closure					
total	4.51E+02	4.12E+02			
tank Stab	4.01E+01	4.01E+01			
Barrier	4.10E+02	3.71E+02			
unc. Equip	1.2E+00	1.2E+00			

Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
9. Diesel consumption (m³)					
total					
WR&T					
vitrifi					
closure					
Construction					
total	2.3E+04	2.11E+04			
WR&T	1.0E+03	1.0E+03			
vitrifi	2.20E+04	2.01E+04			
operation					
total	1.22E+04	8.16E+03			
WR&T	1.02E+03	1.02E+03			
vitrifi	1.12E+04	7.14E+03			
closure					
total	7.68E+04	7.02E+04			
tank & tab	6.4E+03	6.4E+03			
Barrier	6.96E+04	6.3E+04			
anc Equip	8.02E+02	8.02E+02			
10. Kerosene (m³					
operation					
total	9.90E+04	6.58E+04	3.94E+04		
vitrifi	9.90E+04	6.58E+04	3.943E+04		
11. Material-Concrete (m³)					
total	1.22E+06	1.04E+06	7.87E+05		
WR&T	5.9E+04	5.9E+04	5.9E+04		
vitrifi	1.14E+06	9.57E+05	7.09E+05		
closure	1.90E+04	1.90E+04	1.90E+04		
Construction					
total	5.43E+05	5.41E+05	5.39E+05		

Item	Exploitation Intermediate HLW 15% LLW 10%	Exploitation Intermediate HLW 20% LLW 15%	Exploitation Intermediate HLW 40% LLW 25%		
Construction					
WR&T					
Total m^3	5.9E+04	5.9E+04	5.9E+04		
Sand m^3	3.98E+04	3.98E+04	3.98E+04		
gravel m^3	2.34E+04	2.34E+04	2.34E+04		
Cement MT	1.48E+04	1.48E+04	1.48E+04		
Vitrifi					
total	4.842E+05	4.82E+05	4.80E+05		
m^3 Sand	3.264E+05	3.25E+05	3.24E+05		
m^3 gravel	1.917E+05	1.91E+05	1.90E+05		
MT Cement	1.211E+05	1.21E+05	1.20E+05		
operation					
Total	6.51E+05	4.75E+05	2.29E+05		
WR&T					
total	NA	NA	NA		
Vitrifi					
total	6.51E+05	4.75E+05	2.29E+05		
LLW Vaults					
total	3.83E+05	3.0E+05	1.29E+05		
Sand	2.58E+05	2.02E+05	8.70E+04		
gravel	1.52E+05	1.19E+05	5.12E+04		
Cement	9.57E+04	7.5E+04	3.23E+04		
HLW Shield Casks					
total	2.68E+05	1.75E+05	1.0034E+05		
Sand	1.91E+05	1.18E+05	6.76E+04		
gravel	1.06E+05	6.93E+04	3.97E+04		
Cement	6.7E+04	4.4E+04	2.51E+04		
Closure					
Total	1.90E+04	1.90E+04	1.9E+04		
Tank Stat					
total	5.3E+03	5.3E+03	5.3E+03		
Sand	3.6E+03	3.6E+03	3.6E+03		
gravel	2.1E+03	2.1E+03	2.1E+03		
Cement	1.33E+03	1.33E+03	1.33E+03		

Item	Ex Situ Intermediate HLW LLW	Ex Situ Intermediate HLW LLW	Ex Situ Intermediate HLW LLW
Barrier	NA	NA	NA
Onc Equip			
total	1.37E+04	1.37E+04	1.37E+04
Sand	9.2E+03	9.2E+03	9.2E+03
gravel	5.4E+03	5.4E+03	5.4E+03
(MT) Cement	3.4E+03	3.4E+03	3.4E+03
12. Materials - Carbon Steel (MT)			
total	1.83E+06	1.73E+06	7.94E+05
WR&T			
Vitrifi			
Closure			
Construction			
total	1.07E+05	1.07E+05	1.07E+05
WR&T	1.0E+04	1.0E+04	1.0E+04
Vitrifi	9.72E+04	9.71E+04	9.70E+04
Operation			
total	1.72E+06	1.62E+06	4.97E+05
LLW Vaults	4.45E+04	3.3E+04	1.56E+04
HLW HMPCs	3.07E+04	1.97E+04	1.1505E+04
LLW Boxes	1.64E+06	1.09E+06	6.61E+05
closure			
13. Stainless Steel (MT)			
total	4.03E+04	3.26E+04	2.7E+04
WR&T	4.0E+03	4.0E+03	4.0E+03
Vitrifi	3.63E+04	2.86E+04	2.3E+04
Closure	NR	NR	NR
Construction			
total	1.9E+04	1.9E+04	1.9E+04
WR&T	4.0E+03	4.0E+03	4.0E+03
Vitrifi	1.5E+04	1.5E+04	1.5E+04

	Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
	operation					
	total	2.13E+04	1.36E+04	8.0E+03		
	55 Gallons	2.13E+04	1.36E+04	8.0E+03		
	closure	NA	NA	NA		
14	Hastelloy/Inconel (MT)					
	total	2.3E+03	2.3E+03	2.3E+03		
	Construction					
	total	2.3E+03	2.3E+03	2.3E+03		
	Vitrifi	2.3E+03	2.3E+03	2.3E+03		
15	Glass former [flux] MT					
	Total	9.08E+05	5.65E+05	2.91E+05		
	operation					
	alumina	3.88E+04	2.53E+04	1.26E+04		
	Borax	6.01E+03	3.32E+03	1.33E+03		
	Bulk frit					
	Calcium oxide	1.19E+05	7.44E+04	3.88E+04		
	Ferric oxide					
	Limestone					
	Lithium oxide	1.72E+03	9.5E+02	3.81E+02		
	Mag oxide					
	Silica	7.42E+03	4.6E+05	2.38E+05		
	Na_2O					
16	process chemicals (MT)					
	total					
	aluminum Nitrate					
	ammonia					
	anti-foam					
	APM					
	CMPO					
	Crown Ether					
	Decon Chemicals					
	Floc					
	Formic acid					

	Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
16	Process Chemicals (MT)					
	FeSA					
	Glycolic acid					
	HF					
	HNO_3, 50%					
	Hydroxylamine					
	NaOH, 50%					
	Na_3 DTPA					
	NPH					
	Oxalic acid					
	Oxygen					
	Peroxide					
	$KMnO_4$					
	Sodium bicarbonate					
	Sodium Carbonate					
	Sodium Nitrate					
	Sodium oxalate					
	TBP					
	TSP					
	Zinc Nitrate					
	Sugar					
17	Sulfur Cement (MT)					
	operation					
	Sulfur					
	Dicyclopentadiene					
	Oligomer					
18	Ion Exchange Media (m^3)					
	operation					
19.	Borrow site Silt (m^3) McGee Ranch					
	total	5.55 E+05	5.19 E+05	4.57 E+05		
	Closure					
	total	5.55 E+05	5.19 E+05	4.57 E+05		
	Barrier	5.55 E+05	5.19 E+05	4.57 E+05		

Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 20% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%		
20 Borrow site Sand and Gravel (m^3)					
Total	7.86E+06	2.45E+06	2.14E+06		
Construction					
total	5.81E+05	5.8E+05	5.79E+05		
sand	3.66E+05	3.65E+05	3.6E+05		
gravel	2.15E+05	2.15E+05	2.13E+05		
operation					
total	6.97E+05	5.08E+05	2.46E+05		
sand	4.39E+05	3.2E+05	1.55E+05		
gravel	1.06E+05	1.88E+05	9.09E+04		
closure					
total	6.58E+06	1.38E+06	1.31E+06		
tank slab					
sand	3.6E+03	3.6E+03	3.6E+03		
gravel	2.1E+03	2.1E+03	2.1E+03		
total	5.7E+03	5.7E+03	5.7E+03		
area cap					
total	1.46E+04	1.46E+04	1.46E+04		
sand	9.2E+03	9.2E+03	9.2E+03		
gravel	5.4E+03	5.4E+03	5.4E+03		
Barrier					
total	6.56E+06	5.8E+05	5.34E+05		
sand	4.15E+05				
gravel	2.117E+05	5.8E+05	5.10E+05		
pea gravel	2.884E+04	1.58E+04	2.35E+04		
Tank fill					
total					
gravel	7.58E+05	7.58E+05	7.58E+05		

Item	Ex Situ Intermediate HLW 15% LLW 10%	Ex Situ Intermediate HLW 25% LLW 15%	Ex Situ Intermediate HLW 40% LLW 25%
21. Borrow Site Basalt (Rip Rap) m^3 Vernita Quarry			
total	9.63E+05	8.78E+05	7.84E+05
Closure			
total	9.63E+05	8.78E+05	7.84E+05
Barrier	9.63E+05	8.78E+05	7.84E+05
22. Asphalt (m^3)			
total		8.6E+04	
Closure			
total		8.6E+04	
Barrier		8.6E+04	
23. Excavation (m^3			
Construction			
operation			
Closure			
24. Backfill (m^3)			
Construction			
operation			
Closure			
25. Grub and clear (m^3)			
Construction			
total			
26. Construction Consumables (m^3)			
total			
WR&T			
vitrifi			
Closure			

11	Item	Ex Situ Intermediate HLW 15% LCW 10%	Ex Situ Intermediate HLW 20% LCW 15%	Ex Situ Intermediate HLW 40% LCW 25%		
27.	Closure Barrier Geotextile Filter fabric	Rolls				
28.	Solid Waste (m^3) total Contained ops. Construction plant operation					

8. Develop new data for Table D. 4.8.1 for the Ex Situ / In Situ Combination 1 alternative. also Develop data for this Table for the Ex Situ / In Situ Combination 2 alternative.

A. Separation and Vitrification Emissions

1. 241 am in Table = 3.08E-03 Ci/yr for 20 years for Combo 1. New period for Combo 1 is 18 years; the new value is now (3.08E-03) (20/18) = 3.42E-03 Ci/yr.

2. 241 am for Combo 2

(3.08E-03)(20) (÷ 0.95) = 68.444
× 0.73 = 49.96
÷ 18 = 2.78E-03 Ci/yr.

3. 14C for Combo 1

= (2.21E+02) (20/18) = 2.46E+02 Ci/yr

4. 14C for Combo 2

(2.21E+02)(20) (÷ 0.95) = 46.526315
× 0.80 = 37.22
÷ 18 = 2.07 E+02 Ci/yr.

5. 137 Cs for Combo 1

= (1.49E+00) (20/18) = 1.66 Ci/yr.

6. 137 Cs for Combo 2

= (1.49E+00) (20) (÷ 0.89) = 33.483146
× 0.83 = 27.791011
÷ 18 = 1.54 E+00 Ci/yr

7. I 129 for Combo I

= (38 E+00) (0.9165) ÷ 18
= 34.827 ÷ 18
= 1.94 E+00 Ci/yr

8. 129 I for Combo II

= (38 E+00) (0.81) (÷ 18) = (30.78) ÷ (18)
= 1.71E+00 Ci/yr.

28. A. 9. 239 Pu for Combo 1

$= (6.71E-04)(20/18) = 7.46E-04$ Ci/yr.

10. 239 Pu for Combo 2

$= (6.71E+04)(20)(\div 0.78) = 172.05$

$= (172.05)(0.29) = 49.8948$

$\div 18 = 2.77E-04$ Ci/yr.

11. 106 Ru for Combo 1

$= (4.83E+07)(20/18) = 5.37E-07$ Ci/yr.

12. 106 Ru for Combo 2

$(4.83E-07)(20)(\div .3650) = 264.65753$

$(0.09)(264.65753) = 23.82 \div 18$

$= 1.32E-07$ Ci/yr.

13. 151 Sm for Combo 1

$= (1.43E-02)(20/18) = 1.59$ Ci/yr

14. 151 Sm for Combo 2.

$= (1.43E-02)(20)(\div 0.72) = 39.72$

$= (0.21)(39.72)(\div 18) = 0.4634E-02$

$= 4.63E-03$ Ci/yr.

15. 90 Sr for Combo 1.

$= (1.47)(20/18 = 1.63E+00$ Ci/yr.

16. 90 Sr. for Combo 2

$= (1.47E+00)(20)(\div 0.6538) = 44.96788$

$= (0.36)(44.96788) = 16.188436 \div 18$

$= 0.8993575 = 9.0E-01$ Ci/yr.

17. 99 Tc for Combo 1

$= (8.46E-04)(20/18) = 9.4E-04$ Ci/yr.

28. A. 18. 99 TC for Combo 2
(8.46E-04)(20)(÷91.62) = 18467583
(18467583)(0.85)(÷18) = 8.72 E-04 Ci/yr

19. 93 Zr for Combo 1
= (8.29E-03)(20/18) = 9.21E-03 Ci/yr.

20. 93 Zr for Combo 2.
= (8.29E-03)(20)(÷0.664) = 249.69879
= (249.69879)(0.11)(÷18) = 1.53 E-03 Ci/yr.

B. Retrieval Emissions

1. 90 Sr for Combo 1
= (5.00 E-04)(23/20) = 5.75 E-04 Ci/yr.

2. 137 CS for Combo 1
= (2.00 E-03)(23/20) = 2.30 E-03 Ci/yr

3. 129 I for Combo 1
= (4.00 E-03)(23/20) = 4.6 E-03 Ci/yr

4. 90 Sr for Combo 2
= (5.00E+04)(23)(÷0.76) = 151.32 E-04
= (151.32E-04)(0.36)(÷20) = 54.474 ÷ 20
= 2.72E-04 Ci/yr.

5. 137 Cs for Combo 2
= (2.00E-03)(23)(÷0.888) = 51.8018
= (51.80 E-03)(0.83)(÷20) = 2.15E-03 Ci/yr.

6. 129 I for Combo 2
= (4.00 E-03)(23)(÷0.9165) = 100.382
= (100.382)(0.81) ÷ (20) = 81.31 ÷ 20
= 4.07 E-03 Ci/yr

B.c. Continuous operations for Combination 1 and 2 alternatives.

1. Tank Farm emmissions

a. Total alpha for Combo 1

$= 2.88E+08 \ (29/26) = 3.21E+08$ Ci/yr.

b. Total alpha for Combo 2

$= (2.88E-08)(29) \div (1-0.78) = 379.64E-08$

$= (379.64E-08)(1-0.29) \div (25) = 9.263$

$= 9.26E-08$ Ci/yr.

In consideration that the number of double shell tanks taken in either Combo 1 or Combo 2 choice are nearly the same the Evaporator 2 emissions and the gravel and fill emissions will be the same for either combination. adjustment must be applied for any difference in the time frame applied.

The continual operations for tank farm emissions and evaporator emissions will not change. It is assumed that they will remain the same for the period now until there is activity for remediation of the liquid in the area.

2. Treatment (gravel fill) area

1. Gravel and fill Emissions adjusted for new duration and to Generate Combo 2 table.

a. total alpha for combo 1 and 2.

$= (4.92E-11)(20/18) = 5.47E-11$ Ci/yr.

b. Total Beta for Combo 1 and 2

$= (1.34E-09)(20/18) = 1.49E-09$ Ci/yr.

c. 90 Sr for Combo 1 and 2

$= (1.45E-08)(20/18) = 1.61E-08$ Ci/yr.

18. D. 1. d. 137 Cs for Combo 1 and 2
= (9.01 E-08) (20/18 = 1.00 E-07 Ci/yr.

e. 129 I for Combo 1 and 2

= (7.85 E-08) (20/18) = 8.72 E-08 Ci/yr.

2. Evaporator 2 emissions

a. total alpha for combo 1 and Combo 2.
= (1.04 E-04) (20/18) = 1.16 E-04 Ci/yr.

b. Total Beta for Combo 1 and Combo 2

= (8.04 E-05) (20/18) = 8.93 E-05 Ci/yr

29. Develop data changes for tables D. 4. n. 1, .2, .3, and .4 where needed for each of the alternatives. For n = 1 through 13.
A. The no action alternative
1. Table D.4.1.1, There is no change.

2. Table D.4.1.2, There is no change

3. Table D.4.1.3, there is no change. The duration of activity remained the same.

4. Table D.4.1.4, There is no change.

B. Long-term management alternative

1. Table D.4.2-1, There is no change because the duration of activity did not change.

2. Table D.4.2.2, There was no change.

3. Table D.4.2.3, There was a change in the duration of one activity which did not affect the other tables.

29. B. 4. Table D-4-2-4, there was no change

c. In Situ Fill and Cap alternative

1. Table D.4.3.1 there are some change because the time duration changed from 8 years to 9 years. for the treatment operations

a. Evaporator total alpha

$= (1.04E-04)(8/9) = 9.24E-05$ Ci/yr

b. Evaporator total Beta

$= (8.04E-05)(8/9) = 7.15E-05$ Ci/yr

c. Gravel Fill Emissions

1. total alpha

$= (9.83E-11)(8/9) = 8.74E-11$ Ci/yr.

2. total Beta

$= (2.69)(E-09)(8/9) = 2.39E-09$ Ci/yr

3. 90 Sr

$= (2.91E-08)(8/9) = 2.59E-08$ Ci/yr

4. 137 Cs

$= (1.81E-07)(8/9) = 1.61E-07$ Ci/yr

5. 129 I

$= (1.57E-07)(8/9 = 1.40E-07$ Ci/yr

2. Table D-4-3-2, There is no change

3. Table D-4.3.3, There was change because the duration period for some activities changed.

4. Table D-4-3-4, There was no change.

D. In Situ Vitrification alternative

29.D.1. Table D.4.4-1, Some data changed because the time duration for some activities changed. The treatment operations period changed from 9 years to 13 years.

a. DST Evaporator Emissions

1. total alpha
$= (1.04\ E-04)(9/13) = 7.2\ E-05$ Ci/yr.

2. Total Beta ⇒
$= (8.04\ E-05)(9/13) = 5.57\ E-05$ Ci/yr.

b. In Situ Vitrification Emissions

1. 241 Am
$= (1.90\ E-06)(9/13) = 1.32\ E-06$ Ci/yr.

2. 14 C $= (1.10\ E+03)(9/13) = 7.62\ E+02$ Ci/yr.
$= 7.62\ E+02$ Ci/yr.

3. 137 Cs
$= (6.20\ E-04)(9/13) = 4.29\ E-04$ Ci/yr.

4. I-129
$= (38\ E+00)(1/13) = 2.92\ E+00$ Ci/yr.

5. Pu-239
$= (6.00\ E-07)(9/13) = 4.15\ E-07$ Ci/yr.

6. Ru-106
$= (6.80\ E-13)(9/13) = 4.71\ E-13$ Ci/yr

7. Sm-151
$= (1.14\ E-05)(9/13) = 7.89\ E-06$ Ci/yr.

8 Sr-90
$= (9.40\ E-04)(9/13) = 7.05\ E-04$ Ci/yr.

29. D.1.b.9. Tc-99
$= (5.8E-07)(9/13) = 4.02E-07$ Ci/yr

10. Zr-93
$= (7.00E-08)(9/13 = 4.85E-08$ Ci/yr

2. Table D.4.4.2, There was no change

3. Table D.4.4.3, There was some change because the time duration for some activities changed.

4. Table D.4.4.4, There was no change.

E. Ex Situ Intermediate Separations alternative
1. In Table D.4.5-1 Some changes have occurred because of a time duration change for some of the activities (18 yrs now versus 20 years previously.

a. Retrieval emissions
1. Sr-90
$= (5.00E-04)(23/21) = 5.48E-04$ Ci/yr.

2. Cs-137
$= (2.00E-03)(23/21) = 2.19E-03$ Ci/yr.

3. I-129
$= (4.00E-03)(23/21) = 4.38E-03$ Ci/yr

b. Separation and vitrification Emissions
1. Am-241
$= (3.08E-03)(20/18) = 3.42E-03$ Ci/yr

2. C-14
$= (2.21E+02)(20/18) = 2.46E+02$ Ci/yr

3. Cs-137
$= (1.49E+00)(20/18) = 1.66E+00$ Ci/yr

19. E. 1. b. 4. I-129
= (38.0) (1/18) = 2.11E+00 Ci/yr

5. Pu-239
= (6.7E-04) (20/18) = 7.44E-04 Ci/yr

6. Ru-106
= (4.8E-07) (20/18) = 5.33E-07 Ci/yr.

7. Sm-151
= (1.43E-02) (20/18) = 1.59E-02 Ci/yr

8. Sr-90
= (1.4E+00) (20/18) = 1.56E+00 Ci/yr.

9. Tc-99
= (8.46E-04) (20/18) = 9.40E-04 Ci/yr

10. ZR-93
= (8.29E-03) (20/18) = 9.21E-03 Ci/yr

2. Table D.4.5.2, There was no change in the parameter.

3. Table D.4.5.3, There were change due to time duration changes for activities and a footnote added for potential interim storage up to 50 years extending beyond the year 2040.

4. Table D.4.5.4, There was no change in this Table.

J. C4 Site no Separations alternative.

1. Table D.4.6.1, There are changes due to duration time changes for several activities. the duration time periods varied from 18 to 17 for retrieval and 15 to 14 for treatment.

a. Retrieval Emissions (18/17)

1. Sr-90
= (5E-04) (18/17) = 5.29E-04 Ci/yr.

29.F.1.a.2. Cs-137
$= (2.00E-03)(18/17) = 2.12E-03$ ci/yr.

3. I-129
$= (4.00E-03)(18/17) = 4.24E-03$ ci/yr.

b. Vitrification/Calcination Emissions (15/14)

1. am-241
$= (5.3E-03)(15/14) = 5.68E-03$ Ci/yr.

2. C-14
$= (5.8E+01)(15/14) = 6.21E+01$ Ci/yr.

3. Cs-137
$= (1.80E+00)(15/14) = 1.93E+00$ Ci/yr.

4. I-129
$= (38.0E+00)(1/14) = 2.71E+00$ Ci/yr

5. Pu-239
$= (1.20E-03)(15/14) = 1.29E-03$ Ci/yr.

6. Ru-106
$= (8.30E-07)(15/14) = 8.60E-07$ Ci/yr

7. Sm-151
$= (2.50E-02)(15/14) = 2.68E-02$ Ci/yr

8. SR-90
$= (2.50E+00)(15/14) = 2.68E+00$ Ci/yr

9. Tc-99
$= (1.50E-03)(15/14) = 1.61E-03$ Ci/yr.

10. Zr-93
$= (1.40E-02)(15/14) = 1.50E-02$ Ci/yr.

29. F. 2. Table D.4.6.2, There was no change in the parameters.

3. Table D.4.6.3, There were changes due to time duration changes for some activities in vitrification.

4. Table D.4.6.4, There were no changes to this table.

5. Table D.4.6.16, There were changes due to time duration changes for some activities in calcination.

6. Table D.4.6.17, There were no changes required.

G. Ex Situ Extensive Separations alternative

1. Table D.4.7.1, There were changes caused by changes in the duration times of several activities - Retrieval 23 yrs to 20 yrs and separations and treatment 20 to 19 years.

a. Retrieval Emissions (23/20)

1. Sr-90

$= (5.00E-04)(23/20) = 5.75E-04$ Ci/yr.

2. Cs-137

$= (2.00E-03)(23/20) = 2.30E-03$ Ci/yr

3. I-129

$= (4.00E-03)(23/20) = 4.6E-03$ Ci/yr.

b. Separation and Vitrification emissions (20/19)

1. Am-241

$= (2.40E-03)(20/19) = 2.53E-03$ Ci/yr.

2. C-14

$= (2.50E+02)(20/19) = 2.63E+02$ Ci/yr.

3. Cs-137

$= (5.70E+01)(20/19) = 6.00E+01$ Ci/yr

29. D.1.b.4. I-129
$= (38.0)(1/19) = 2.0E+00$ ci/yr.

5. Pu-239
$= (8.90E-04)(20/19) = 9.37E-04$ ci/yr

6. Ru-106
$= (1.70E-07)(20/19) = 1.79E-07$ ci/yr

7. SR-90
$= (1.1E-02)(20/19) = 1.16E-02$ ci/yr

8. Tc-99
$= (2.3E-01)(20/19) = 2.42E-01$ ci/yr.

9. Zr-93
$= (5.50E-04)(20/19 = 5.79E-04$ ci/yr.

2. Table D.4.7.2, There were no parameter changes

3. Table D.4.7.3, There were changes due to changes in the time duration for the various activities.

4. Table D.4.7.4, There were no changes in these values.

H. Ex Situ / In Situ Combination 1 alternative
1. There were changes to Table D.4.8.1 due to changes in the duration times of several of the activities. Retrieval changed from 23 to 20 years and operation changed from 20 to 18 years.

a. Evaporator & Emissions under treatment (gravel fill)

The numbers for this changed table are calculated in item 28 above in this calculation.

2- Table D.4.8.2, changed the table title to reflect Combination 1.

19. H. 3. table D.4.8.3, Table changed due to duration time changes for several activities.

4. Table D.4.8.4, was changed in title to reflect the Combination 1 alternative.

I Ex-Situ/In-Situ Combination 2 alternative.

1. Table D.4.8.1 (b) was created for this new alternative and is based on the table in H.1 above.

2. Table D.4.8.2(b) was created for this new alternative and is carried forward as the same as for the table in H.2. above. The data matches data in the same table for other alternatives with the same activities.

3. Table D.4.8.3 (b) was created for this new alternative and is carried forward as the same as the Table in H-3. above. Some of the duration times however are different.

4. Table D.4.8.4(b) is carried as applicable and is the same as Table D.4.8.4(a) in H-4 above.

J. Phased Implementation alternative - phase 1.

1. Table D.4.9.1 has some changes. a value for I-129 was added.

I-129 = 38 — fraction of material processed in phase I.

(38)(0.0145) = 0.55 — Metric tons in phase 1

$\frac{10074}{692674} = 0.0145$

(0.55 ÷ 2) = .2755

÷ 10 = 0.02755

= 2.76E-02

Phase 1
HLW = 1314 MT
LLW = 8760 MT

Phase 2
HLW = 37600 MT
LLW = 645000 MT

2. Table D.4.9.2, There were no parameter changes.

29. J. 3. Table D.4.9.3, There were some changes due to time duration changes.

4. Table D.4.9.4, There were no changes here.

5. Table D.4.9.16, There were changes to this Table because several time duration changes occurred.

a. Continued operations emissions remain the same.

b. Retrieval operations emissions change - Duration change (22/20)

1. Sr-90
$= (5.00E-4)(22/20) = 5.5E-04$ Ci/yr

2. Cs-137
$= (2.00E-03)(22/20) = 2.2E-03$ Ci/yr

3 I-129
$= (4.00E-03)(22/20) = 4.4E-03$ Ci/yr.

c. Separations and treatment Emissions
(1.) Phase 1 column is deleted There will be two 100-Ton/day LAW units and a 10-Ton/day HLW unit.

(2.) Phase 2. duration period has changed (26/17).

(a) am-241
$= (3.08E-03)(26/17) = 4.71E-03$ Ci/yr.

(b) C-14
$= (2.21E+02)(26/17) = 3.38E+02$ Ci/yr

(c) Cs-137
$= (1.49E+00)(26/17) = 2.28E+00$ Ci/yr.

(d) I-129 $= (37.43)(1/17) = 2.20E+00$ Ci/yr.

29. J.5.C.2.(e). Pu-239
$= (6.70E-04)(26/17) = 1.03\ E-03\ ci/yr$

(f) Ru-106
$= (4.8E-07)(26/17) = 7.34\ E-07\ Ci/yr$

(g) Sm-151
$= (1.43E-02)(26/17) = 2.19\ E-02\ ci/yr.$

(h) Sr-90
$= (1.40E+00)(26/17) = 2.14\ E+00\ Ci/yr.$

(i) Tc-99
$= (8.46E-04)(26/17) = 1.29\ E-03\ ci/yr$

(j) Zr-93
$= (8.29E-03)(26/17) = 1.27\ E-02\ Ci/yr$

6. Table D.4.9.17, There were no parameter changes for this Table.

7. Table D.4.9.18, There were changes due to to changed period duration for the activities.

8. Table D.4.9.19, There were no changes recorded for this table.

H. Capsule No action alternative
1. Table D.4.10.1, there was no change in value

2. Table D.4.10.2, There were no parameter changes

3. Table D.4.10.3, There were no changes in values

I. Capsule onsite Disposal.
1. Table D.4.11.1, Correct the title from "No action" to "onsite Disposal" alternative

2. Table D.4.11.2, There were no parameter changes

19. L. 3. Table D. 4.11.3, There were no changes to be inserted now.

4. Table D. 4-11.4, There were no changes to be inserted now.

M. Capsule overpack and ship alternative.

1. Table D. 4.12.1, There were no changes.

2. Table D. 4.12.2, There were no parameter changes

3. Table D. 4.12.3, there were changed period durations inserted, The other values may change accordingly.

4 Table D. 4-12-4, No changes to be made at this time.

N. Capsule vitrify with tank waste alternative.

1. Table D. 4.13.1, no changes were initiated.

2. Table D. 4-13.2, No parameter changes.

3. Table D. 4.13.3, Inserted new period duration values — (28 years 19) and (18 yrs)

4. Table D. 4.13.4, No changes now but later.

30. The Ex Situ / In Situ Combination 1 alternative has been re-evaluated and new numbers generated that are essential in calculating the Resource and transportation quantities for the TWRS FEIS.
A. The permanently committed land will be determined later.
B. The Temporary committal of land will be determined later.
C. The Borrow pit disturbed area will be determined later.
D. Calculate the raw water usage (m^3)

Determine the new HLW and overall ratio. The SSU Ratio did not change See page 65, 4.D of this Calculation.

30. D.

HLW mass of glass = 26300 MT
Canisters = 8547
Hampers = 2137

HLW ratio = 26300/27200 = 0.9007

Overall ratio = (26300)+(395000)/(484000)+(27200)
= 421300/511200
= 0.8241392
= 0.824

Raw water = (0.824)(9.35E+06) = 7.71E+06 m^3

E. Determine the Sanitary water usage.

Original Concrete = 2.75 E+05 m^3

additional area + Volume of Concrete
= (2137 - 853) (6.6) (0.2) = 1694.88 = 1695 m^3
(1248) (8474.4)

New Concrete = 276695 m^3

Ratio = 276695/275000 = 1.0061636

1. Construction use of Sanitary water
= WR&T = 9.4E+03 m^3
= vitrifi = (409600) (1.006164)
= 412124.77
= 4.12E+05 m^3
total = (4.12)+(9.4) = 4.22E+05 m^3

2. operation use of Sanitary water
New vaults = 1.01 E+05 m^3

WR&T = 1.0 E+06 m^3
vitrifi = (5.24E+06) (0.8241392) - 1.0E+06 m^3
= (4.32 E+06)+(1.01E+05) - (1.0E6)
= 3.42 E+06 m^3
ops total = 4.42 E+06 m^3

3. Closure does not change.

30. F. Calculate the Electrical usage

1. Construction Kwh

WR+T = 1.46 E+00

vitrifi = (3.7 E+03) (1.006164)

= 3.72E+03 Kwh

2. operations Kwh.

WR+T = 3.0E-01

vitrifi = (7.69E+03)(0.824)

= 6.39 E+03

3. Closure = Not Reported

G. Calculate the Gasoline Requirements.

1. Construction

WR+T = 2.0E+02 m^3

vitrifi = (4.45 E+03) (1.006164)

= 4.48E+03 m^3

total = 4.68 E+03 m^3

2. operations

new vaults = 2.73 E+01 m^3

3. Closure = 3.5E+02 m^3 total.

H. Calculate the Diesel Requirements in (m^3)

1. Construction

WR+T = 600 m^3

vitrifi = (2.04 E+04) + Δ for pad mixer

= (1.224)(E+04) (2137/853) = 3.07E+04

total = 3.13 E+04 m^3

2. operations

vaults = 2.9 E+03 m^3

WR+T = 4.27 E+03 m^3

3. Closure - no change - total = 6.0E+04 m^3

30. J. Calculate new Kerosene value

1. operations Ratio = 421300 / 302400

Kerosene = (2.9E+04)(1.4)
= 4.04E+04 m^3

J. determine the Concrete, cement, sand and gravel requirements. (m^3 or MT)

Concrete requirements change for (1) HLW storage Pad area
(2) Shield Casks for HLW

1. Construction

WR&T = no change. = 2.95E+04 m^3

Vitrifi = ~~additional~~ new Concrete = 276695 m^3
= 2.77E+05 m^3

Sand = 1.87E+05 m^2
gravel = 1.10E+05 m^3
Cement (MT) = 6.93E+04 M Tons.

2. operations

a. Concrete for vaults = no change = 1.29E+05 m^3

b. Concrete for HLW shield Casks
= (2137)(90.7)(1/1.6) = 121141.2
= 1.21E+05 m^3

Sand = 8.17E+04 m^3
gravel = 4.80E+04 m^3
Cement MT = 3.03E+04 MT

K. determine the steel requirements (MT)

There change for rebar for storage pad and for the HMPCs required.

1. Construction

Pad area = Increase to Present numbers =

30. K. 1. (2137 - 1500) (6.6) = (637)(6.6) = 4204.2 m^2
= a 65 m x 65 m pad.
≃ to 3.923E+1 mT
= 48600 + 39 = 48639

Change is lost in Rounding.

2. operation
vaults = no change
boxes = no change

HMPCa = (637)(6.5) = 4140.5
= 4.14E+03 mT

9.75E+03 + 4.14E+03 = 1.39E+04

L. Determine the stainless steel due to an increase in the HLW mass for this alternative.

1. Stainless steel operation canisters.
= (0.75) (4.5/3) (8547)
= 9.62E+03 mTons.

M. Hastelloy / Inconel - no change

N. Calculate the glass formers needed.

HLW 18660 mT

		Fraction	amount
B_2O_3	1.51E+03	= 0.1295	= 2.42E+03
Li_2O	4.31E+02	= 0.037	= 6.91E+02
SiO_2	9.72E+03	= 0.83355	= ~~9.72E+03~~ 1.56E+04

Σ = 1.1661E+04

SiO_2 Σ = (2.67 E+05) + ~~9.72E+03~~ 1.56E+04

Σ = ~~2.77E+05 mT~~ 2.67 + 0.156
= 2.83

30. O. Determine process chemical change

only the oxygen increases, other stay same.

$O_2 = (1.31\ E+05\ mT)\ (4.04/3.97)$
$= 1.33\ E+05\ mT$

P. Obtain totals now for sand, gravel and concrete.

1. Construction vitrif.

		WRT
Concrete	= 2.77 E+05	2.95 E+04
sand	= 1.87 E+05	1.99 E+04
gravel	= 1.10 E+05	1.17 E+04

2. operation

	Concrete	Sand	gravel
LHW Vaults	1.29 E+05	8.7 E+04	5.11 E+04
HLW Shields	1.21 E+05	8.17 E+04	4.80 E+04
		1.69 E+05	9.91 E+04

Q. Barrow pit disturbance - pit 30

$1.89\ E+06\ m^3 = 0.63\ E+06\ m^2$
$= 6.3\ E+05\ m^2$
$= 630000 \quad \div 10000$
$= 63\ ha.$

R. Develop new transportation numbers for the increased values.

1. Gasoline

Construction vitrifi

$= 4.68\ E+03\ m^3$
$= (4680)(264)$ gallons $= 1235520$
$\div 5000 = 247.1$

2. Diesel

Construction - Veh

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30. R 2. Diesel

Construction vitrifi

= 3.07E+04 = 30700

x264 = 8104800

÷5000 = 1620.96 = 1621

3 Kerosene

operation vitrifi

= 4.04E+04 = 40400

x264 = 10665600

÷5000 = 2133.12

4. Concrete

a. Construction - vitrifi

(1) Concrete

= 2.77E+05 m^3 = 277000 m^3

x 1.31 = 363870 yds^3

@ 8 yds^3 ÷ = 45,359

(2) Sand

= 1.87E+05 m^3 = 187000 m^3

x 1.31 = 244970 yds^3

@ 16 yd^3 = 15310.625

(3) gravel

= 1.1 E+05 = 110000 m^3

x 1.31 = 144100

@ 16 yd^3 = 9006.25

(4) Cement

= 6.93 E+04 = 69300

x 1.1 = 76230

@ 100 Ton Hopper = 762.3

b. operation vitrifi - HLW shield casks

(1) Concrete

= 1.21 E+05 = 121000 m^3 = 158510 yds^3

@ 8 yds^3 = 19814 (19813.75)

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30. R. 4. b. (2) Sand

= 8.17 E+04 = 81700 m^3

= 107027

@ 16 yds^3 = 6689.1875 = 6690 trips.

(3) Gravel

= 4.80 E+04 = 48000

= 62880

@ 16 yds^3 = 3930

(4) Cement

= 3.03 E+04 = 30300

= 33330

@ 100 Ton Hopper = 333.3 = 334

5. Carbon Steel

a. operations HMPCs

= 1.39 E+04 = 13900

= 15290

@ 65 Ton Railcar = 235.231 = 236

6. Stainless Steel

(a) operations - Canisters

= 9.62 E+03 = 9620

= 10582

@ 65 Tons = 162.8 = 163

7. Glass formers

(a) Silica

= 2.83 E+05 mT = 283000/2 m^3

= 141500 = 185365 yds^3

@ 16 yds^3 = 11585.312 = 11585

(b.) Borax

= 2.42 E+03 = 2420 mT = 2662 tons

@ 100 Hopper = 2.663 = 27 hoppers of Borax

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30. R. 7.(c) Lithium oxide Li_2O

= 6.91 E +02 = 691 = 760.1

at 100+ Hoppers = 7.601 = 8 hoppers

$\Sigma = 8 + 27 = 35$

SiO_2 CaO B_2O_3 Al_2O_3

total for others Σ = 7 + 499 + 27 + 170

Page 138, 8.J.43; Σ = 703

8. Excavation

additional storage pad = 1695 m^3 + footings

= ~~and~~ 1700 m^3

= 2227 yds^3

@ 8 yd^3 = 278.375 = 279

Σ = 279 + 206325

= 206604

1260000 + 1695 = 1261695 = 1.26 E+06 m^3

[See Columns "Revised 77/170 in Table II and Table III. See Table IV for transportation revised numbers.]

31. The Ex Situ / In Situ Combination 2 alternative was re-evaluated and a new number derived for the number of canisters of HLW generated that results in increasing to trips to Yucca mountain from 89 to 123. Consequently the Resources and transportation numbers must be re evaluated for this change.

A. The permanently committed land will be determined later.
B. The temporarily committed land will be determined later.
C. The Borrow pit disturbed area will be determined later.
D. Calculate the raw water usage (m^3)

Determine the HLW and overall ratios for the new conditions the LLAW ratio remains unchanged see page 74, 5.D for Previous calculations in this Calculation collection.

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31. D. new mass of HLW generated = 15200 mTons

= 5780 m^3

= 4940 1.17 m^3 Canisters

= 1235 HMPCs

= 124 trains to yucca

	25/177	70/177
mt mass HLW	15200	26300
mt mass LLW	229000	395000
Σ	244200	421300

overall ratio = 244200/421300 = 0.5796344

ratio LLW = 229000/395000 = 0.57975

ratio HLW = 15200/26300 = 0.5779467

The mass of liquid waste treated – ratio assumed to be the same as the overall ratio of the mass of glass produced: = 0.5796344

Raw water use = (7.71 E+06 m^3)(0.5796344)

= 4468981.2

= 4.47 E+06 m^3

E. Determine sanitary water usage

1. Construction

WR&T = 5.45 E+03 m^3 no change

Vitrifi = ~~2.88 E+05~~ (4.12 E+05) use 0.7 factor

= (~~3.42 E+05~~) as was used in

= (4.12 E+05)(0.7) building siting

= 2.884 E+05 then by pad increase ratio.

= (2.884 E+05)(192958 / 192500) pad increase ratio

(275,000)(0.7)

= (2.884 E+05)(1.0024) ≅ 192500

= 2.891 E+05 m^3 192500 + (347)(6.6)(6.2)

= 192958

31 E. 2. operation

WR&T = 5.8 E+05 m^3

Vitrifi = (3.42 E+06)(~~0.5796~~ 0.5796344)
= 1.982 E+06 m^3

F. total water usage

= RW + SW
= (4.47 E+06) + (4.95 E+04) + (1.98 E+06) + (5.8 E+05) + (2.89 E+05)
+ (5.45 E+03)
= 7.3741 = 7.38 E+06 m^3

G. Determine Electrical energy requirements.

(1) Construction - vitrifi
= (2.59 E+03)(1.0024)
= 2.59622 = 2.60 E+03 Gwh.

(2.) operation - vitrifi
= (3.57 E+03)(4940/3550) = 4.97 E+03 Gwh.
(1.3915492)

H. Determine Gasoline Consumption

(1) Construction vitrifi
= 3.12 E+03 m^3
= (3120)(1.0024)
= 3128 m^3

I. Determine Diesel Consumption.

(1) Construction - vitri.
= (1.56 E+04)(1.0024)
= (1.564 E+04) m^3

J. Determine Kerosene increase

= 2.3 E+04 m^3
= (2.3 E+04)(244200/239900) = 2.3412254
(1.0179241) = 2.34 E+04 m^3

31. K. Determine concrete increases along with gravel, sand, and cement requirements.

1. Construction

vitrifi - Increase in storage pad

= 458 m^3 = 1.70E+05 m^3

Sand = 309 m^3 = 1.15E+05 m^3
gravel = 181 m^3 = 6.72E+04 m^3
Cement = 115 mT = 4.24E+04 m^3

2 operations - vitrifi

HLW shield Casks. New quantity = 1235

Concrete = (1235)(90.7)/(1.6) = 70009 m^3

Sand = 4.72E+04 m^3
gravel = 2.77E+04 m^3
Cement = 1.75E+04 mT

L. determine the Carbon Steel requirements.

1. Construction

2290 m^2 a 48m x 48m pad.

(3.9E+01 mT)(2290/4204.2) = 2.12 mT.

vitrifi Σ TOTAL = (3.4E+04) + (2.12E+01)
= 34000 + 21.2
= 3.4E+04 mT.

2. operation vitrifi

HLW 9Hmpcs = (1235)(6.5) = 8027.5
= 8.03E+03 mT.

M. determine the Stainless Steel needs.

1. operations - vitrifi

Canisters = (0.75)(4.5/3)(4940)
= 5.56E+03 mT

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31. n. Determine the Glass formers required.

HLW = 10700 mT

B_2O_3 = 0.12901 = 1.38 E+03

Li_2O = 0.03688 = 3.95 E+02

SiO_2 = 0.83382 = 8.92 E+03

SiO_2 total = Σ 8.92 E+03 + 1.56 E+05

= 1.65 E+05 mT

O. Determine the process chemical charge - Oxygen only charges.

O_2 = (7.6 E+04)(2.34/2.3) = 7.73 E+04 mT

P. Borrow site Sand and gravel (m^3) pit 30.

(1) Construction

	sand	gravel
WRAT	1.4E+04	8.2E+03
vitrifi	1.15E+05	6.72E+04
Σ	1.29E+05	7.54E+04

2. operation

	sand	gravel
WRAT	—	—
vitrifi		
LLW Σ	6.94E+04	4.08E+04
HLW	4.72E+04	2.77E+04
Σ	1.17E+05	6.85E+04

Q. Determine the disturbed area of Borrow pit 30

Area = (1.65 E+06)/3 = 5.5 E+05

= 550000

= 55 hectares

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BY RDW CHKD. JOB NO. 01K 47101

11. R. Develop new transportation numbers for the increased values

1. Gasoline

= 3128 m^3 = 825792 gals.

@5000 gal = 165.16 trips

2. Diesel

= (15640) m^3 = 4128960

@ 5000 gal = 825.792 = 826 trips.

3. Kerosene

= 2.34E+04 = (23400) m^3 = 6177600

@ 5000 = 1235.52 = 1236 trips.

4. Concrete, sand, gravel, cement

a. Construction

1. Sand

= 1.15E+05 m^3 = 1.5065E+05 yds^3

@ 16 yds^3 = 9415.625 = 9416 trips

2. Gravel

= 6.72E+04 = (67200)(1.31) = 88032

@ 16 yds^3 = 5502 trips

3. Cement

= 4.24E+04 = 42400 mT = 46640 tons

@ 100 ton/hopper = 466.4 trips

4. Concrete

= 1.7E+05 = (170000) m^3 = 222700 yds^3

@ 8 yds^3 = 27837.5 = 27838 trips

5. Pad Excavation

= 458 m^3 = 600 yds^3

@ 8 yds^3 = 75 trips

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JE JACOBS ENGINEERING GROUP INC.
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31. R. 4. b. operation

(1) Concrete

= 7.0E+04 = (70000) m^3 = 91700

@ 8 yds^3 = 11462.5 = 11463 trips

~~(2)~~

(2) Sand

= 4.72E+04 = (47200) m^3 = 61832

@ 16 yds^3 = 3864.5 = 3865 trips

(3) Gravel

= 2.77E+04 = 27700 m^3 = 36287

@ 16 yds^3 = 2268 trips

4. Cement

= 1.75E+04 = 17500 MT = 19250

@ 100 Ton Hopper = 192.5 = 193 trips (Cars)

5. Carbon Steel

operations HMPCS

= 8.03E+03 MT = 8030 MT = 8833 Tons

@ 65 Ton Car = 135.89 = 136 trips

6. Stainless Steel Canisters

= 5.62E+03 = (5620) MT = 6182 tons

@ 65 Ton Car = 95.11 = 95 trips (or Cars)

7. Glass Formers.

a. Silica

= 1.65E+05 = (165000)(1.31)/2 = 108075 yds^3 (216150)

@ 16 yds^3 = 6754.6875

= 6755 trips

b. Borax

= 1.38E+03 MT = 1518 tons.

@ 100 t Hopper = 15.2 trips

31. R. 7. c. Lithium oxide

= 3.95 E+02 = 395 mT = 434.5

@100 Hopper = 4.345 = 5 Cars

Σ = 16 + 5 + 99 + 290 = 410 Cars (Trips)

5. Calculate changes for Table 3.6-1 based on changes to Combination 1 and Combination 2.

1. Total Sand and gravel for Combination 1 from pit 30

		Sand C-1	gravel	Sand C-2	gravel
Construction	WR&T	1.99E+04	1.77E+04	1.4E+04	8.2E+03
	Vitrif	1.87E+05	1.10E+05	1.15E+05	6.72E+04
Operations	WR&T				
	vitrif				
	HLW vaults	8.7E+04	6.11E+04	6.94E+04	4.08E+04
	HLW Shields	8.17E+04	4.8E+04	4.72E+04	2.77E+04
		Σ 3.756E+05	2.168E+05	Σ 2.456E+05	1.439E+05
Closure					
	Tank Slab.	3.6E+03	2.1E+03	3.6E+03	2.1E+03
	asc. Equip	9.2E+03	5.4E+03	9.2E+03	5.4E+03
Tank fill					
	gravel	~~7.58E+05~~	7.58E+05		7.58E+05
Barrier			5.16E+05		4.82E+05
	gravel + Sand				
		Σ = 3.884 E+05	1.3806 E+06		

Σ = ~~3897~~ 17.69

= 1.77E+06 m^3

= 6.26 E+07 ft^3

operation = 91 tank fill $(91/161)(7.58E+05) = 4284E+05$

Combination 1 ops = 10.304 ~~E+05~~ .5652 m^3 pit 30 material

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31. S. 2. Sand and gravel for Comentaria 2.

$$\Sigma = (2.456E+05) + (1.439E+05) + \left[\left(\frac{136}{161}\right)(7.58E+05)\right]$$

0.844204

$$= (6.41E+05) + (2.456E+05) + (1.439E+05)$$
$$= 1.031E+06\ m^3$$
$$= 3.65E+07\ ft^3$$

32. Generate new Revised tables for appendix G.

A. Table G. 3-1-19

Using Table 5.3-1 Source types and locations for cross reference of TF "n" E or W nomenclature to the more routine nomenclature of alphabetic letters ~~Correlation~~ check the input values from the Routine tank emissions data sheets (and summary) to create these new tables.

Note: the Az Ay emissions divide (50%) to each TF6E and TF7E.

B. Table G. 3.1.20

Note: To account for increased emissions during retrieval TF6W is equal to 3 times the emissions from the highest TF during Routine operations.
[See page G-7 - noted text.]

C. Table G. 3.1.22

NOTE: to account for increased emissions during gravel fill, TF6W = 10 times the highest emission from the TFs during routine operations times 0.16

The 0.16 = 16 tanks in TF6W × (3 days to fill a tank) × (1/300 ops days/year)

D. Table G. 3-1.23

No peak values applied to TF6W

12. E. Table G. 3.1.24

Here TFGW = 3X maximum TF value for each isotope.

F. Table G. 3.1.25

Same as for G. 3-1-24

G. Table G. 3-1-26

Same as for G-3-1-24

H. Table G. 3-1-27

Here Tank TFGW ≅ 3X maximum TF value for each isotope divided by 2., or 10 times the maximum value times 0.16
= (1.5 + 1.6) ÷ 2 = 1.55

Here tank TFSW = the value for TFGW.
Since both tank farms are next to each other retrieval from one and gravel fill at the other equals the bounding conditions.

I. Table G. 3.1.28

Same as for Table G. 3-1.19

J. Table G. 3-1.29

Same as for Table G. 3-1.24

K. Create Table for Combination 2 alternative.

Same as for G. 3.1.27 using same peaking values as the bounding case. understandably the factor would be lower for TFGW; but this case would still be the Conservative bounding case.

33. Tabulation of alternative, canister size and number of canisters of HLW waste.

alternative	Canister Size	Number HLW Canisters
A. Ex Situ Intermediate Sep.	1.17 m^3	12,123
B. Ex Situ No Separations, vitr.	10 m^3	29,115
C. Ex Situ No Separations, Calci	10 m^3	10,300
D. Ex Situ Extension Sep.	1.17 m^3	667
E. Ex Situ/In Situ Combination 1	1.17 m^3	8,547
F. Ex Situ/In Situ Combination 2	1.17 m^3	4,940
G. Phased Implementation	1.17 m^3	12,220

Phase 1 LAW on site transfers
= 87600 MT (2.63)(0.7)
= 47582.834 m^3 (2.6)
= 18301.09.
@ 3/trip = 6100 trips to the B vault vaults and then to the phase 2 vault burial area.
@ 3 boxes/trip ≃ 27 trips per day. (1 for each plant)

34. Description of changes in Mileage numbers occurring in appendix E and in Table B.11.0.8.

a consistent basis for loading was applied to all of the alternatives. Bulk materials such as cement and the flux materials were estimated on 100 ton rail hopper cars and not trucks. Points of origin were set at Seattle

or Portland for all rail car (train) make up. Some trucks were used as a Seattle/Portland point of origin. Many trucks were given a point of origin from the tri-cities. This depended on the normal availability of material source.

Previously 6 or 8 cubic yard concrete trucks original from the tri-cities. Now this is a site function of the batch plant. The difference between concrete and its components were identified as to source for hauling. as noted above all cement comes by 100-ton rail hopper car. Concrete is Batch hauled by 8 Cubic yard trucks on site. The sand and gravel required is hauled from the borrow pit in 20 cubic yard (eff 16 Cu yd) dump trucks (these replaced the previous 10 cu yd (8 cu yd eff) trucks. The 8 cu yd trucks are now used only in Excavation, backfill and trash hauling.

Previously it showed some concrete being shipped from Seattle/Portland. now only Cement Comes from Seattle/Portland and is estimated as 100-ton hopper car.

Previously it was not identified as to which glass formers ~~and~~ which chemicals came by truck or by rail and whether Oxygen was brought in or supplied from an air separation plant. All oxygen was assumed to be generated on site as a part of the plant ~~operating cost~~ operations.

all Steel products were shipped by Rail on 65 Tons per rail Car, again Portland/Seattle as a point of origin.

Most trains were considered 20 car trains. In two instances, however, the trains became single car trains.

35. Generate values to fill Table 3.11.0.3 for Radiological Emissions. Values generated for the phased implementation phase 1 sections and Transcribed values from Dave Stein for the Combination & column.

waste from phase 1 in Metric Tons = (87600) + (1314)
= 88914 mt

total waste phase 1 and 2 in Metric Tons = (88914) + (645000) + (37600)
= 771514 mt

Phase 1 percent of total = [(88914) ÷ (771514)] (100)
= 11.525 %

A. americium - Am - 241

	Phase 1	Phase 2
1. Retrieval		
a. air	0	0
b. water	0	3.5 E+03
2. operations		
a air	1.4 E-03	5.1 E-02
b. water	6.4 E-05	3.7 E-04

B. Carbon, C-14

1. Retrieval		
a air	0	0
b water	0	1.0 E+02
2. operations		
a air	8.2 E+02	4.5 E+03
b. water	NA	NA

C. Cs - 137

1. Retrieval		
a. air	2.3 E+03	1.8 E+02
b. water	0	1.0 E+05
2. operations		
a air	1.1 E+00	2.3 E+01
b water	1.0 E-02	7.2 E-02

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	Phase 1	Phase 2
35. D. I-129		
1. Retrieval		
a air	3.5E-03	2.7E-02
b. water	0	1.0E-02
2. operations		
a air	4.4 E+00	3.4E+01
b water	3.6 E-05	2.7E-04
E. Ru-106		
1. Retrieval		
a. air	0	0
b water	0	3.83E-02
2. operations		
a. air	7.8E-10	6.0E-09
b. water	0	3.6E-03
F. Sm-151		
1. Retrieval		
a air	0	0
b. water	0	4.0E+04
2. operations		
a air	2.5E-02	2.0E-01
b water	NA	NA
G. Tc-99		
1. Retrieval		
a air	0	0
b. water	0	2.3E+02
2. operations		
a. air	1.1E-04	1.4E-02
b. water	NA	NA
3 Pu-239, -240		
Retrieval air/water	0/0	0/2.2E+03
operations air/water	3.4E-03/8.4E-05	1.4E-02/3.4E-04

FORM 91-005-1 (4/81)

35. H. Zr-93

	phase 1	phase 2
1. Retrieval		
a. air	0	0
b. water	0	2.2E+02
2. operations		
a. air	1.4E-02	1.1E-01
b. water	0	1.2E-01

I. Total alpha

1. Retrieval		
a. air	N/R	N/R
b. water	N/R	N/R
2. operations		
a. air	N/R	N/R
b. water	N/R	N/R

J. Total Beta

1. Retrieval		
a. air	N/R	N/R
b. water	N/R	N/R
2. operations		
a. air	N/R	N/R
b. water	N/R	N/R

36. Rewrite description of W-314 project for Appendix B and Section 3.

WHC-SD-W314-CDR-001, Rev. 0.

also included are new jumper and cover installations for selected valve pits and diversion boxes. The various flow paths combinations would be marked (indicated) on the new cover blocks. The replaced buried lines would be abandoned in place; whereas, the replaced items such as valve pit and diversion box jumpers and covers would be removed and disposed of accordingly (WHC ___).

37. Create column in Table B.11.0.7 Non Radiological Emissions, Tank Waste alternatives for the Ex Situ/In Situ Combination 2 alternative. a 0.6 factor was used for some of the calculations.

A. Particulates (Kg) Construction - 3.5E+04
operation - 4.9E+03 / Closure 1.81E+05

B. VOC (Kg) Construction - NR
operation - 2.3E+02 / Closure - NR

C. Fugitive Dust (metric Tons) Construction - 2.49E+02
operation - NR / closure - 3.6E+03

D. NO_x (Kg) Construction - 4.8E+05
operation - 3.3E+03 / closure 2.95E+06

E. SO_x (Kg) Construction - 6.5E+03
operation - 4.5E+03 / Closure - 3.25E+05

F. Toxic air pollutant (Kg)

1. Construction NR

2. operation

a. HCl 7.8E+02
b. HF 1.86E+03
c. NH_3 7.2E+03
d. HNO_3 4.2E+02

3 Closure NR

G. Hazardous air pollutant (Kg)

1. Construction NR

2. operation < 30 Kg/yr

3. closure NR

37. A. CO (Kg)

1. Construction 5.0 E+06
2. operation < 3.0 E+03
3. Closure 1.28 E+06

I. Hydrocarbons (Kg)

1. Construction 2.7 E+05
2. operation < 4.2
3. Closure 1.38 E+05

J. aldehydes (Kg)

1. Construction 2.55E+02
2. operation NR
3. closure 7.19E+02

K. Organic acids (Kg)

1. Construction 1.6E+02
2. operation NR
3. Closure NR

38. Table B.11.0.8 was changed due to revision of the input for transportation analysis in appendix E. A uniform basis was presented for all commodities considered. Data can be found in table IV of this calculation and from summation by author of appendix E transportation analysis.

39. Determine sand and gravel for operations and Construction and total sand and gravel usage for each alternative. and total borrow site material quantity.

A. No action

No sand and gravel usage.

B. Long term management.

1. operations and Construction
   a. Sand and gravel = 3.8 E+05 m^3 = 5.0E+05 yd^3 = 1.34E+07 ft^3

2. total Sand and gravel
   a. Sand and gravel, Const. = 3.8E+05 m^3 = 5.0E+05 yd^3 = 1.34E+07 ft^3

C. In Situ fill and Cap

1. operations and Construction Sand and gravel.
   a. fill tanks, (161) = 7.54E+05 m^3 = 9.88E+05 yd^3 = 2.67E+07 ft^3

2. total Sand and gravel
   a. fill tanks (161) = 7.54 E+05 m^3
   b. Tank Stab (Mustg) = 2.03 E+04 m^3
   c. Barrier = 4.24E+05 m^3
   Total = 11.98 E+05 m^3 = 1.57E+06 yd^3 = 4.24E+07 ft^3

3 Total Borrow material
   a. total Sand and gravel = 1.198E+06 m^3
   b. Silt = 3.72E+05 m^3
   c. RipRap (Basalt) = 6.38 E+05 m^3
   total = 2.213 E+06 m^3 = 2.90E+06 yd^3 = 7.83 E+07 ft^3

D. In Situ Vitrification

1. operations and Construction Sand and gravel
   a. Construction Sand and gravel = 1.39E+05 m^3
   b. Sand fill tanks = 5.4E+05 m^3
   total = 6.79E+05 m^3 = 8.90E+05 yd^3 = 2.40 E+07 ft^3

39.D.2. total Sand and gravel
a. Construction = 1.39 E+05 m^3
b. Sand fill tanks = 5.4 E+05 m^3
c. Barrier = 4.24 E+05 m^3
total = 1.103E+06 m^3 = 1.445 E+06 yd^3 = 3.90 E+07 ft^3

3. total Borrow material
a. total Sand and gravel = 1.103 E+06 m^3
b. Silt = 3.77 E+05 m^3
c. RipRap (Basalt) = 6.38 E+05 m^3
total = 2.118E+06 m^3 = 2.78E+06 yd^3 = 7.49E+07 ft^3

E Ex situ Intermediate Separations
1. operations and Construction Sand and Gravel
a. Construction = 1.148 E+06 m^3
b. operations = 5.1 E+05 m^3
Total = 1.658 E+06 m^3 = 2.172E+06 yd^3 = 5.86 E+07 ft^3

2. total Sand and gravel
a. operations and Construction = 1.658 E+06 m^3
b. Tank Slab. (Mastic) = 2.03 E+04 m^3
c. Tank fill (161) = 7.58 E+05 m^3
d. Barrier = 5.8 E+05 m^3
total = 3.02 E+06 m^3 = 3.95E+06 yd^3 = 1.07 E+07 ft^3

3. Total Borrow material
a. total Sand and gravel = 3.02E+06 m^3
b. Silt = 5.19 E+05 m^3
c. Basalt (RipRap) = 8.78E+05 m^3
total = 4.42E+06 m^3 = 5.79E+06 yd^3 = 1.56E+08 ft^3

F. Ex situ No Separations Vitrification
1. operations and Construction Sand and gravel
a. Construction = 2.97 E+05 m^3
b operations = 2.65 E+06 m^3
total = 2.95E+06 m^3 = 3.86 E+06 yd^3 = 1.04E+08 ft^3

39. F. 2. Total Sand and Gravel
a. Construction = 2.97E+05 m^3
b operation = 2.65E+06 m^3
c tank slab (mats) = 2.03E+04 m^3
d Barrier S+g = 4.24E+05 m^3
e. Tank fill = 7.58E+05 m^3
total = 4.16E+06 m^3 = 5.44E+06 yd^3 = 1.47E+08 ft^3

3. Total Borrow material
a. total Sand and gravel = 4.16E+06 m^3
b. Silt = 3.77E+05 m^3
c. Rip Rap (Basalt) = 6.38E+05 m^3
Total = 5.165E+06 m^3 = 6.77E+06 yd^3 = 1.83E+08 ft^3

G. C+ Site no separations calculation
1. operations and Construction Sand and gravel
a. Construction = 2.85E+05 m^3
b. operations = 1.05E+06 m^3
total = 1.335E+06 m^3 = 1.75E+06 yd^3 = 4.72E+07 ft^3

2. total Sand and gravel.
a. Construction = 2.85E+05 m^3
b. operations = 2.05E+06 m^3
c. Tank Slab (mats) = 2.03E+04 m^3
d Barrier = 4.24E+05 m^3
e. Tank Fill = 7.58E+05 m^3
total = 2.54E+06 m^3 = 3.324E+06 yd^3 = 8.97E+07 ft^3

3. total Borrow material
a. total Sand and gravel = 2.54E+06 m^3
b Silt = 3.77E+05 m^3
c. Rip Rap (basalt) = 6.38E+05 m^3

total = 3.555E+06 m^3 = 4.66E+06 yd^3 = 1.26E+08 ft^3

39. H. Ex Situ Extensive separations

1. operation and Construction sand and gravel
   a. Construction = 5.344 E+05 m^3
   b. operation = 4.17 E+05 m^3
   total = 9.514 E+05 m^3 = 1.246 E+06 yd^3 = 3.365 E+07 ft^3

2. total sand and gravel.
   a. Construction = 5.344 E+05 m^3
   b. operation = 4.17 E+05 m^3
   c. Tank Slab Caments = 2.03 E+04 m^3
   d. Barrier = 5.81 E+05 m^3
   e. Tank fill = 7.58 E+05 m^3
   total = 2.311 E+06 m^3 = 3.03 E+06 yd^3 = 8.173 E+07 ft^3

3. Total Borrow material
   a. Total sand and gravel = 2.311 E+06 m^3
   b. Silt = 5.66 E+05 m^3
   c. Rip Rap (Basalt) = 9.58 E+05 m^3
   total = 3.835 E+06 m^3 = 5.024 E+06 yd^3 = 1.36 E+08 ft^3

I. Ex Situ / In Situ Combination 1.

1. operation and Construction
   a. Construction = 2.9 E+05 m^3
   b. operation = 2.29 E+05 m^3
   c. gravel fill (91) = 4.28 E+05 m^3
   total = 9.47 E+05 m^3 = 1.241 E+06 yd^3 = 3.35 E+07 ft^3

2. Total Sand and Gravel
   a. Construction = 2.9 E+05 m^3
   b. operation = 2.29 E+05 m^3
   c. Gravel fill (91) = 4.28 E+05 m^3
   d. Tank Slab Caments = 2.03 E+04 m^3
   e. gravel fill (70) = 3.30 E+05 m^3
   f. Barrier = 5.16 E+05 m^3
   total = 1.8133 E+06 m^3 = 2.38 E+06 yd^3 = 6.43 E+07 ft^3

39.A.3. Total Borrow material

a. total Sand and gravel = 1.8133 E+06 m^3
b. Silt = 4.72 E+05 m^3
c. Rip Rap (Basalt) = 7.85 E+05 m^3
total = 3.07 E+06 m^3 = 4.02 E+06 yd^3 = 1.09 E+08 ft^3

J. Cut Site / In Site Combination 2

1. operation and Construction
a. Construction = 2.032 E+05 m^3
b operation = 1.64 E+05 m^3
c. gravel fill (136) = 6.4 E+05 m^3
total = 1.01 E+06 m^3 = 1.323 E+06 yd^3 = 3.57 E+06 ft^3

2. total Sand and gravel
a. operation = 1.64 E+05 m^3
b Construction = 2.032 E+05 m^3
c. gravel fill (136) = 6.4 E+05 m^3
d Tank Slab (Mats) = 2.03 E+04 m^3
e. gravel fill (25) = 1.18 E+05 m^3
f. Basin = 4.82 E+05 m^3.
total = 1.63 E+06 m^3 = 2.14 E+06 yd^3 = 5.77 E+07 ft^3

3. Total Borrow material
a total Sand and gravel = 1.63 E+06 m^3
b. Silt = 4.25 E+05 m^3
c. Rip Rap (Basalt = 7.18 E+05 m^3
total = 2.773 E+06 m^3 = 3.633 E+06 yd^3 = 9.81 E+07 ft^3

K. Phased Implementation, phase 1

1. operation and Construction
a. Construction = 2.55 E+04
b. operation = 6.49 E+03
total = 3.2 E+04 m^3 = 4.192 E+04 yd^3 = 1.13 E+06 ft^3

2. total Sand and gravel
a. total = 3.2 E+04 m^3 = 4.192 E+04 yd^3 = 1.13 E+06 ft^3

39. K. 3. Total Borrow material

a total Sand and gravel = 3.2E+04 m^3

total = 3.2E+04 m^3 = 4.192E+04 yd^3 = 1.13E+06 ft^3

L. Phased Implementation, phase 2.

1. Construction and operations

a. Construction = 7.65E+05

b. operations = 4.36E+05

Total = 1.201E+06 m^3 = 1.5733E+06 yd^3 = 4.25E+07 ft^3

2. Total Sand and gravel

a. Construction = 7.65E+05

b. operations = 4.36E+05

c. Tank Slab (Mats) = 2.03E+04

d. Barrier = 6.81E+05

e. Tank fill = 9.58E+05

total = 2.56E+06 m^3 = 3.354E+06 yd^3 = 9.06E+07 ft^3

3. total Borrow Material

a. Total Sand and gravel = 2.56E+06 m^3

b. Silt = 5.66E+05 m^3

c. Rip Rap (Basalt) = 9.58E+05 m^3

total = 4.084E+06 m^3 = 5.35E+06 yd^3 = 1.445E+08 ft^3

40. Verification check for quantity of Rip Rap (Basalt) for barrier use.

34300	77300	834613 cu yds = 637109 m^3
27000	60113	
61200	46200	6.38E+05 / 6.371E+05 = 1.0014126
63600	44100	
53000	35800	tank farm = 17.4495 ha
62300	19300	= 174495 m^2
54000	19300	@ 1.5m deep = 261742.5 m^3 = 2.62E+05 m^3
61200	27600	
63700		6.38E+05 / 2.62E+05 = 2.435
34600		
834613 cu yds.		

10. a. 99 vaults = 88944 m^2 @ 1.5 m deep = 1.334 E+05 m^3
b. 66 vaults = 64200 m^2 @ 1.5 m deep = 9.6300 E+04 m^3
c. 40 vaults = 37932 m^2 @ 1.5 m deep = 5.6898 E+04 m^3

a. @ 2.435 1.334 E+05 m^3 = 3.25 E+05 m^3
b. @ 2.435 9.6300 E+04 m^3 = 2.345 E+05 m^3

+ TF = (2.345 + 6.37)
= 8.72 E+05 m^3

a = (3.25) (6.37) = 9.62 E+05 m^3

(5.69 E+04)(2.435) =
1.3855 E+05 m^3

c = 7.85 E+05 m^3

(6.37 E+05) + (1.39 E+05) = 7.76 E+05 m^3

11. Dump truck sizing 20 cu yd. dump trucks.

20 cu yd = 540 ft^3

assume Trailer 1. 8' wide and 5' deep; Length = 14 ft
2. 8' wide add 4' deep; Length = 17 ft
3. 8' wide and 3' deep; Length = 23 ft
4. 7' wide and 3' deep; Length = 26 ft

for example, trailer could be 50' long with a 5' depth and 7' width = 1750 ft^3 = 64.8 cu yd; effective load of 52 cubic yards.

Concrete assumed as:
63% sand (Included 7% wastage)
37% gravel (" 7% ")
5 sacks mix = 5 sacks / cu yd. ≈ 500 LBS / cu yd.

12. Vault size

(35 meters) (15 meters) = 525 meters^2

for 5300 m^3 ≅ 10.09524 meters
= 10.1 meters ~~2.6~~

Boxes for LAW = 1.2 x 1.2 x 1.8 meters. = 2.6 m^3
= 6.84 mT/box
= 7.5 tons/box

10/1.2 = 8.4 = 8 = 96 per ~~column~~ Row
15/(1.2) = 12.5 = 12

35/1.8 = 19.4 = 19 = 1824 boxes

(1.8)(1.2)(4) + (1.2 x 1.2)(2) = (8.64 m^2) + (2.88 m^2) = 11.52 m^2
@ 0.0125 m thick = 0.144 m^3 @ 7 mgr/m^3
= 1.008 mgr/box

for vault = (1824)(1.008) = 1838.592
= 1.84E+03 mT CS/Vault for LLW Container.

For example. 40 full Vaults = 7.36 E+04 mT CS. for LLW Containers.

For Interim storage of Phase I LAW

4 Grout vaults per (W) Report will hold 22,080 boxes of LAW at 1.2m x 1.2m x 1.8 m = 2.6 m^3 of waste.

for phase I 87600 MT LLW to be produced
= (87600)/(2.63)(0.7) = 33308/0.7 = 47583 m^3

= 47583/2.6 = 18,301 boxes
915 boxes/plant/year (365)(0.6) = 219
at 0.60 eff = 915/219 = 4.2 boxes/day/plant

4 Grout vaults will hold the LAW until Phase I is ready.

43. Estimate HLW interim storage pad area needed.

A. Ex situ Intermediate Separations layout
See figure 3.4.6 and B.3.5.3

Pad shown ≈ 270 m wide by 400 m long.
= 108000 m²

HMPCs and Shielding Casks require
(3030)(6.6) ≈ 19998 m²
add 40% for spacing = (19998)(1.4) = 279972 m²
≈ = 168 m x 168 m

Pad as shown is sufficient.

B. Ex situ No Separations Facility Layout
See figure B.3.6.1
Pads shown ≅ (140 m) x (540 m) (3) = 226,800 m²
(140 m) x (300 m) (1) = 42,000 m²
Σ = 268,800 m²

HMPCs and shield casks required
(29100)(6.6)(1.4) = 268 884 m²

4 pads are sufficient for the estimated HLW interim storage

C. Ex situ Extensive Separations Facility Layout
See figure B.3.7.1

Pad shown ≅ 60 m x 130 m = 7800 m²

HMPCs and Shield Casks required
(143)(6.6)(1.4) = 1321 m² ≈ 37 m x 37 m

pad as shown sufficient for HLW interim storage

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 393 of 393

BY RDW CHKD. JOB NO. 01K47101

43. D. phased implementation
see figures 3.14.16 and B.3.9.3

same as A above, 1 cask pad sufficient for HLW interim storage.

E. Ex Situ/In situ combination 1

pad required for HMPCs and shield casks for HLW
$= (2137)(6.6)(1.4) = (14104\ m^2)(1.4)$
$= 19746\ m^2$
$S \cong 141\ m \times 141\ m$

pad shown, estimated as 270 m wide x 280 m long

F. Ex Situ / In Situ Combination 2.

pad required $= (1235)(6.6) = 8151$
$(8151)(1.4) = 11411\ m^2$ $S \approx 107\ m \times 107\ m$

pad shown, estimated at 270 m wide by 280 m long

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Appendices to FWRS FEIS Calculation.

Input source information documents for information and data used in generating the data used in the FEIS draft of July 31, 1996.

FORM 91-005-1 (4/81)

Sheet A-1

RDW 7-30-96

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGINEERING - Calculation of Data Revisions for Draft TWR-EIS

ORIGINATOR Ronald D. Weed DATE 2-15-96

REVISION NO. 0

OBJECTIVE Calculate DATA FOR TRANSPORTATION Evaluations BASED ON REVISED FROM table B.10.0.3.

METHODOLOGY applied INPUT data to obtain the new values FOR inclusion IN THE TRANSPORTATION tables and Accident ANALYSIS WORK WITHIN OTHERS SECTIONS OF THE TWRS-EIS.

ASSUMPTIONS See Calculation. sheet 1 of contains a listing of the tables and calculations covered within this Calculation.

(Continue on another sheet if necessary)

Ronald D. Weed
SIGNATURE

CHECKED CH 1/22/96.

CALCULATION & RESULTS ATTACHED

Cover sheet - 1
Pages - 37
appended material pages - B-1 7

JACOBS\FORMS\CALCVR.SHT

Sheet A-2
RDW-7-30-96

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGINEERING – Calculation of Data Revisions for Draft TWRS-EIS

ORIGINATOR Ronald D. WEED DATE 2-15-96

REVISION NO. 0

OBJECTIVE Revise Tabulated Data in Tables Contained within APPENDIX B and OTHER CHAPTERS OF THE EIS.

METHODOLOGY applied Input data to obtain the new values for inclusion in the REVISED DRAFT and as input for other tabulated calculations

ASSUMPTIONS SEE calculation. SHEET 1 of 48 contains a listing of the tables covered with in This Calculation.

(Continue on another sheet if necessary)

Ronald D. Weed
SIGNATURE CHK: CAH. 3/21/96.

CALCULATION & RESULTS ATTACHED

Cover Sheet – 1
pages – 48
appended material pages – A-1 through A-50

JACOBS\FORMS\CALCVR.SHT

Table B.11.0.3 Resource Summary, Tank Waste Alternatives

Resource	Phase	No Action Alternative	Long-Term Management	In Situ Fill and Cap Alternative	In Situ Vitrification Alternative	Ex Situ Intermediate Separations Alternative
Land, permanently committed (hectares) (Long-term commitment of radiologically contaminated area)	Total	17	25	25	25	49
	Construction/ Operation	0	8	17	17	37
	Closure	17	17	8	8	12
Land, incremental temporarily committed (hectares) (area disturbed during construction and operations)	Total	0	50	21	111	115
	Construction/ Operation	0	50	1	91	91
	Closure	0	N/A	20	20	24
Borrow Pit Disturbed Area (hectares) based on an excavation depth of 3 meters	McGee Ranch	N/A	N/A	16	16	25
	Pit 30	N/A	N/R	39	34	75
	Vernita Quarry	N/A	N/A	21	21	31
Water, Total (cubic meters)	Sanitary plus Raw Water	1.52E+06	1.52E+06	2.43E+06	1.71E+08	2.40E+07
Water, Sanitary (cubic meters)	Total	N/R	N/R	2.43E+06	1.71E+08	5.83E+06
	Construction	N/R	N/R	5.9E+05	1.7E+08	5.0E+05
	Operation	N/R	N/R	1.8E+06	1.2E+06	5.27E+06
	Closure	N/R	N/A	4.13E+04	3.8E+04	6.0E+04
Water, Raw (cubic meters)	Total	1.5E+06	1.52E+06	N/R	N/R	1.82E+07
	Construction	N/A	1.7E+04	N/R	N/R	N/R
	Operation	1.5E+06	1.5E+06	N/R	N/R	1.82E+07
	Closure	N/A	N/A	N/R	N/R	N/R
Energy Electricity (Gwh)	Total	1.1E+03	1.1E+03	1.8E+00	4.46E+03	1.56E+04
	Construction	N/A	4.4E-01	1.8E+00	5.6E+01	7.4E+01
	Operation	1.1E+03	1.1E+03	9.5E+02	4.4E+03	1.55E+04
	Closure	N/A	N/A	N/R	N/R	N/R
Gasoline (cubic meters)	Total	N/A	8.6E+04	4.0E+02	1.5E+04	8.0E+03
	Construction	N/A	8.6E+04	9.7E+01	1.5E+04	7.6E+03
	Operation	N/R	N/R	N/R	N/R	5.46E+01
	Closure	N/A	N/A	3.0E+02	3.0E+02	3.9E+02

Sheet A-4
Rev. 7-30-96

Table B.11.0.3 Resource Summary, Tank Waste Alternatives (cont'd)

Resource	Phase	No Action Alternative	Long-Term Management	In Situ Fill and Cap Alternative	In Situ Vitrification Alternative	Ex Situ Intermediate Separations Alternative
Diesel (cubic meters)	Total	2.2E+04	8.5E+04	5.96E+04	7.1E+04	9.47E+04
	Construction	N/A	6.3E+04	1.3E+03	1.5E+04	2.1E+04
	Operation	2.2E+04	2.2E+04	6.1E+03	6.1E+03	7.53E+03
	Closure	N/A	N/A	5.22E+04	4.5E+04	6.62E+04
Kerosene (cubic meters)	Operation	N/A	N/A	N/A	N/A	9.86E+04
Materials: Concrete (cubic meters)	Total	N/A	3.5E+05	1.9E+04	1.3E+05	1.67E+06
	Construction	N/A	3.5E+05	N/R	1.3E+05	5.49E+05
	Operation	N/A	N/A	N/R	N/R	1.11E+06
	Closure	N/A	N/A	1.9E+04	N/R	1.9E+04
Carbon Steel (metric tons)	Total	1E+03	1.33E+04	N/R	2.6E+05	1.78E+05
	Construction	N/A	1.23E+04	N/R	2.6E+05	1.07E+05
	Operation	1E+03	1.0E+03	N/R	2.6E+05	5.16E+04
	Closure	N/R	N/A	N/R	N/R	1.9E+04
Stainless Steel (mt)	Total	N/A	2.2E+01	N/R	N/R	4.41E+04
	Construction	N/A	2.2E+01	N/R	N/R	1.9E+04
	Operation	N/A	N/R	N/R	N/R	2.51E+04
Hastelloy/Inconel (mt)	Construction	N/R	N/R	N/R	N/R	2.3E+03
Glass Formers (mt)	Operation	N/A	N/A	N/A	1.1E+04	5.0E+05
Process Chemicals (mt)	Operation	N/A	N/A	N/R	6.8E+03	5.15E+05
Bulk sulfur cement sulfur (mt) dicyclopentadine (mt) oligomer (mt)	Operation	N/A	N/A	N/A	N/A	 2.21E+05 5.78E+03 5.78E+03
Ion exchange media (cubic meters)	Operation	N/A	N/A	N/A	N/R	2.2E+02
Borrow Site Silt (cubic meters) Water Ranch	Closure	N/A	N/A	3.77E+05	3.77E+05	6.45E+05
Borrow Site Sand and Gravel (cubic meters)	Total	N/A	N/A	1.1E+06	9.55E+05	3.11E+06
	Construction	N/A	N/A	6.9E+05	N/R	3.17E+05
pit 30	Operation	N/A	N/A	(see construction)	5.4E+05	1.29E+06
	Closure	N/A	N/A	4.15E+05	4.15E+05	1.5E+06
Borrow Site Basalt (cubic meters) Vernita Quarry	Closure	N/A	N/A	6.38E+05	6.38E+05	9.31E+05
Asphalt (cubic meters)	Closure	N/A	N/A	6.25E+04	6.25E+05	8.07E+04

add New Columns

EX SITU/IN SITU Combin. LOW ALTERNATIVE

Table B.11.0.3 Resource Summary, Tank Waste Alternatives (cont'd)

Resource	Phase	Ex Situ No Separations Alternative (Vitrification)	Ex Situ No Separations Alternative (Calcination)	Ex Situ Extensive Separations Alternative	Ex Situ/ In Situ Combination Alternative	Phased Implementation Alternative (Phase 1)	Phased Implementation Alternative (Phase 2)
Land, permanently committed (hectares) (Long-term commitment of radiologically contaminated area)	Total	27	27	46	41	0	52
	Construction/ Operation	19	19	34	31	0	40
	Closure	8	8	12	10	0	12
Land, incremental temporarily committed (hectares) (area disturbed during construction and operations)	Total	166	101	112	109	32	147
	Construction/ Operation	146	81	88	87	32	123
	Closure	20	20	24	22	0	24
Borrow Pit Disturbed Area (hectares) based on an excavation depth of 3 meters	McGee Ranch	16	16	25	21	1	25
	Pit 30	47	44	68	48	1	74
	Vernita Quarry	21	21	31	26	0	31
Water, Total (cubic meters)	Sanitary plus Raw Water	4.99E+06	2.4E+06	8.38E+07	2.06E+07	2.8E+06	1.81E+07
Water, Sanitary (cubic meters)	Total	4.13E+06	3.6E+05	8.76E+06	5.71E+06	6.3E+05	5.02E+06
	Construction	2.39E+05	2.39E+05	5.29E+05	4.19E+05	3.9E+05	2.54E+05
	Operation	3.85E+06	2.08E+06	8.03E+06	5.24E+06	2.2E+05	4.71E+06
	Closure	4.13E+04	4.13E+04	2.05E+05	4.9E+04	1.6E+04	6.03E+04

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Table B.11.0.3 Resource Summary, Tank Waste Alternatives (cont'd)

Resource	Phase	Ex Situ No Separations Alternative (Vitrification)	Ex Situ No Separations Alternative (Calcination)	Ex Situ Extensive Separations Alternative	Ex Situ/ In Situ Combination Alternative	Phased Implementation Alternative (Phase 1)	Phased Implementation Alternative (Phase 2)
Water, Raw (cubic meters)	Total	8.64E+05	8.58E+04	7.5E+07	1.49E+07	2.2E+06	1.31E+07
	Construction	N/R	N/R	N/R	5.5E+06	N/R	N/R
	Operation	8.64E+05	8.58E+04	7.5E+05	9.35E+06	2.2E+06	1.31E+07
	Closure	N/R	N/R	N/R	N/R	N/R	N/R
Energy Electricity (Gwh)	Total	8.8E+03	4.72E+03	4.16E+04	7.69E+03	1.7E+03	1.04Tbale B.8.3.1 E+04
	Construction	3.0E+01	3.0E+01	8.9E+01	3.8E+01	5.0E+01	3.73E+01
	Operation	8.77E+03	4.69E+03	4.15E+04	7.65E+03	1.6E+03	1.04E+04
	Closure	N/R	N/R	N/R	N/R	N/R	N/R
Gasoline (cubic meters)	Total	5.4E+03	5.4E+03	1.02E+04	3.0E+05	6.8E+03	5.18E+03
	Construction	5.1E+03	5.1E+03	9.7E+03	3.0E+05	6.5E+03	4.71E+03
	Operation	N/R	N/R	5.46E+01	2.0E+01	N/R	7.55+01
	Closure	3.01E+02	3.01E+02	3.91E+02	3.36E+02	3.3E+02	3.91E+02
Diesel (cubic meters)	Total	7.81E+04	6.44E+04	1.2E+05	5.21E+05	3.6E+04	3.7E+04
	Construction	1.19E+04	1.19E+04	2.9E+04	~~2.69E+04~~ 9.54E+05 2.69E+04	1.8E+04	1.3E+04
	Operation	1.4E+04	2.68E+02	2.4E+04	9.22E+03	2.0E+02	6.0E+03
	Closure	5.22E+04	5.22E+04	6.72E+04	5.8E+04	1.8E+04	1.8E+04
Kerosene (cubic meters)	Operation	1.06E+05	1.05E+04	2.34E+05	4.93E+04	9.8E+02	5.1E+04

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Table B.11.0.3 Resource Summary, Tank Waste Alternatives (cont'd)

Resource	Phase	Ex Situ No Separations Alternative (Vitrification)	Ex Situ No Separations Alternative (Calcination)	Ex Situ Extensive Separations Alternative	Ex Situ/ In Situ Combination Alternative	Phased Implementation Alternative (Phase 1)	Phased Implementation Alternative (Phase 2)
Materials: Concrete (cubic meters)	Total	9.62E+06	2.24E+06	8.66E+05	6.61E+05	2.4E+04	6.4E+05
	Construction	4.32E+05	2.88E+05	5.0E+05	2.74E+05	2.4E+04	3.78E+04
	Operation	9.17E+06	1.93E+06	3.47E+05	3.68E+05	4.4E+02	5.83E+05
	Closure	1.9E+04	1.9E+04	1.9E+04	1.9E+04	0	1.9E+04
Carbon Steel (metric tons)	Total	2.06E+05	1.33E+05	2.84E+05	1.28E+05	8.3E+04	2.07E+05
	Construction	6.72E+04	6.22E+04	1.4E+05	5.36E+04	8.3E+04	5.89E+04
	Operation	1.46E+05	7.04E+04	1.44E+05	7.41E+04	2.9E+02	1.48E+05
	Closure	N/A	N/A	N/A	N/A	N/A	N/A
Stainless Steel (mt)	Total	4.53E+05	9.39E+04	2.22E+04	2.2E+04	1.5E+04	3.66E+04
	Construction	1.26E+04	1.26E+04	2.1E+04	9.5E+03	1.5E+04	1.15E+04
	Operation	4.4E+05	8.13E+04	1.2E+03	1.25E+04	N/R	2.57E+04
Hastelloy/Inconel (mt)	Construction	1.51E+03	1.51E+03	1.80E+03	1.15E+03	2.6E+03	1.15E+04
Glass Formers (mt)	Operation	4.68E+05	N/A	8.88E+05	2.50E+05	1.3E+05	4.76E+05
Process Chemicals (mt)	Operation	3.56E+05	3.06E+05	1.32E+06	2.59E+05	5.8E+04	4.75E+05
Bulk sulfur cement sulfur (mt) dicyclopentadine (mt) oligomer (mt)	Operation	N/A N/A N/A	N/A N/A N/A	4.25E+05 1.12E+04 1.12E+04	1.11E+05 2.89E+03 2.89E+03	1.45E+04 3.74E+02 3.74E+02	2.04E+05 5.78E+03 5.78E+03
Ion exchange media (cubic meters)	Operation	N/A	N/A	4.9E+03	1.1E+02	1.4E+01	1.4E+02
Borrow Site Silt (cubic meters)	Closure	3.77E+05	3.77E+05	6.45E+05	5.11E+05	0	6.45E+05

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Sheet A-8
Rev-7-30-96

Table B.11.0.3 Resource Summary, Tank Waste Alternatives (cont'd)

Resource	Phase	Ex Situ No Separations Alternative (Vitrification)	Ex Situ No Separations Alternative (Calcination)	Ex Situ Extensive Separations Alternative	Ex Situ/ In Situ Combination Alternative	Phased Implementation Alternative (Phase 1)	Phased Implementation Alternative (Phase 2)
Borrow Site Sand and Gravel (cubic meters)	Total	1.59E+07	3.24E+06	2.4E+06	1.92E+06	1.2E+04	2.7E+06
	Construction	4.55E+05	1.68E+05	8.88E+05	6.05E+05	1.2E+04	5.67E+05
	Operation	1.43E+07	1.9E+06	1.62E+04	3.76E+05 (see construction)	N/A	7.54E+05
	Closure	1.17E+06	1.17E+06	1.5E+06	9.4E+05	N/A	1.5E+06
Borrow Site Basalt (cubic meters) [1]	Closure	6.38E+05	6.38E+05	9.31E+05	7.85E+05	N/A	9.31E+05
Asphalt (cubic meters)	Closure	6.25E+04 3.19	6.25E+04	8.16E+04	6.98E+04	N/A	8.07E+04

Notes:
[1] Silt and Basalt Borrow materials are used only for barrier construction during closure.
N/A = Not Applicable
N/R = Not Reported

Sheet A-9
RJW - 7-30-96

Assumptions:							
'ILW glass waste oxide loading basis to be 20 wt% sodium oxides							
,sing the WHC engineering data package material balance calculate the waste oxide loading							
and adjust mass of the glass produced to achieve a 20 wt % sodium oxide loading							
	Input		Frit	Output			
	Stream1		stream407	stream437			
	liquids	solids					
Volume kilo-liters	5.85E+05						
Specific Gravity	1.21E+00						
Cs and Ba, (MCi)	6.28E+01	5.28E+00		6.79E+01			
Sr and Y, (MCi)	2.10E+00	1.05E+02		1.07E+02			
Tc, (MCi)	2.61E-02	5.89E-03		3.18E-02			
Am, (MCi)	8.61E-03	9.51E-02		1.04E-01			
Np, (MCi)	1.03E-05	9.29E-05		1.03E-04			
Pu-239, (MCi)	1.67E-03	2.47E-02		2.64E-02			
Pu-240, (MCi)	4.14E-04	6.28E-03		6.70E-03			
Pu-241,(MCi)	1.49E-03	7.34E-02		7.48E-02			
Total TRU, (MCi)	1.22E-02	2.00E-01		2.12E-01			
Total MCi	6.49E+01	1.11E+02		1.76E+02			
Total Mass Flow (MT)	7.10E+05	1.94E+04	2.50E+05	3.57E+05			
Total Cr, (MT)	5.15E+01	1.32E+02		1.84E+02			
'l Na, (MT)	6.51E+04	1.24E+03		6.63E+04			
l Si, (MT)	5.65E+00	5.24E+02	9.56E+04	9.61E+04			
Total P, (MT)	8.42E+02	7.80E+02		1.62E+03			
Total NO2-, (MT)	9.54E+03	7.38E+01					
Total NO3-, (MT)	1.06E+05	1.03E+03					
AG+	3.28E-01	1.38E+00					
AG2O				1.83E+00			
AL+3		2.37E+03					
AL2O3			1.00E+04	1.79E+04	✓		
AL(OH)4-	4.83E+03						
AM+3	2.51E-03	2.77E-02					
AM2O3				3.32E-02			
AS+5	7.70E-01	4.98E-01					
AS2O5				1.95E+00			
B+3	5.19E-01	9.94E-01					
B2O3				4.87E+00			
BA+2	7.91E-01	3.09E+00					
BAO				4.33E+00			
BE+2	8.19E-02	7.61E-03					
BEO				2.48E-01			
BI+3	6.76E+01	1.96E+02					
BI2O3				2.94E+02			
C14	7.43E-04	4.53E-04					
CA+2	1.67E+01	1.33E+02					
'CRINITE		2.70E+03					
)			3.55E+04	3.58E+04	✓		

Sheet A-10
7-30-96 RDV

CD+2	2.09E+00	7.93E+00					
[illegible]				1.14E+01			
[illegible]+3	2.37E+00	2.35E+02					
CE2O3				2.78E+02			
CL-	3.11E+02	3.49E+00					
CL2							
CO							
CO2							
CO3-2	3.37E+03	2.25E+02					
CR+3		1.32E+02					
CR2O3				2.68E+02			
CR(OH)4-	1.19E+02						
CS+	8.19E-01	9.25E-02					
CS2O				9.65E-01			
CU+2	1.77E-01	7.46E-01					
CUO				1.16E+00			
CUSO4							
F-	1.12E+03	5.97E+01					
F2							
FE+3	1.44E+01	7.63E+02					
FE2O3				1.23E+03			
H2							
H2O	5.07E+05						
H2S							
HG							
[illegible]+2	9.49E-01	9.00E-03					
[illegible]	5.46E+02	2.02E+01					
I2							
K+	2.19E-01	2.10E+01					
K2O				2.56E+01			
KEROSENE							
LA+3	2.19E-01	2.10E+01					
LA2O3				2.49E+01			
LI+	5.77E-03	2.46E-02					
LI2O				6.53E-02			
MG+2	9.65E-01	1.10E+01					
MGO				1.98E+01			
MNO2	2.17E+01	2.09E+02		2.31E+02			
MO+6	4.87E+00	8.01E-01					
MOO3				8.51E+00			
N2							
NA+	6.51E+04	7.77E+02					
NA2O				8.94E+04			
NH3							
NI+3	4.07E+00	6.57E+00					
NI2FECN6		5.00E+02					
NI2O3				1.50E+01			
NIO				2.27E+02			
NO							
[illegible]							
[illegible]-	9.54E+03	7.38E+01					

Sheet A-11
RJW 7-30-96

NO3-	1.06E+05	1.03E+03					
+4	1.46E-02	1.32E-01					
)2				1.66E-01			
O2							
OH-	6.44E+03	5.00E+03					
PB+4	1.96E+00	3.28E+00					
PBO2				6.05E+00			
PO4-3	2.58E+03	2.39E+03					
P2O5				3.71E+03			
P2O5:24W		5.21E-01					
PU+4	2.88E-02	4.27E-01					
PUO2				5.16E-01			
S							
SI+4	5.65E+00	7.90E+01					
SIO2			2.04E+05	2.06E+05	✓		
SO2							
SO4-2	2.01E+03	3.97E+01					
SR+2	3.75E-01	3.64E+01					
SRO				4.33E+01			
TCO2							
TCO4-	2.52E+00	5.68E-01					
TC2O7				2.94E+00			
TOC	1.42E+03	1.16E+02					
UO2+2	8.52E+01	1.58E+03					
UO3				1.76E+03			
5	6.20E-02	1.88E-01					
5				4.46E-01			
W+6	7.47E-01						
WO2				4.41E-01			
WO3				9.42E-01			
ZN+2	3.59E+00	9.45E-01					
ZNO				5.65E+00			
ZR+4	4.48E-01	2.77E+02					
ZRO2				7.07E+02			
ZRO2:2H2	2.15E+01	4.09E+02					
WHC data package basis:							
mass waste oxides				1.08E+05	✓		
waste loading (wt%)				30%			
sodium oxide loading				25%			
20 wt. % sodium oxide loading							
Blending factor			1	1.2	1.5	2	3.5
Mass of glass required to achieve 20% sodium loading, M			✓4.47E+05	✓**5.36E+05**	6.71E+05	8.94E+05	1564500
additional frit required (equals increased glass) MT			9.00E+04	**1.79E+05**	3.14E+05	5.37E+05	1.21E+06
total frit required, MT			✓3.40E+05	✓**4.29E+05**	5.64E+05	7.87E+05	1.46E+06
Waste Loading (Na20 wt. %)			20%	**17%**	13%	10%	6%
Waste Loading (waste oxides)			24%	**20%**	16%	12%	7%

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glass density (MT/m^3)	2.63						
:t packing fraction	0.7						
Waste volume (m^3)			2.43E+05	✓ 2.91E+05	3.64E+05	4.86E+05	8.50E+05
Canister Volume (m^3)	10						
Number of Canisters (1x)			2.43E+04	✓2.91E+04	3.64E+04	4.86E+04	8.50E+04
Number of Canisters per HMPC		1		2.91E+04			
Number of HMPCs			6.07E+03	~~7.28E+03~~	9.11E+03	1.21E+04	2.12E+04
Number of trips @ 10 HMPCs /trip			6.07E+02	~~7.28E+02~~	9.11E+02	1.21E+03	2.12E+03
				2.91E+03			
Glass formulation:							
(ref Ext. Sep Data Pkg.)	acceptable range	Calculated value					
SiO2	42 to 57 wt %		62.51%	✓65.70%	68.88%	72.06%	76.15%
B2O3	5 to 20 wt %		0.00%	0.00%	0.00%	0.00%	0.00%
Na20	5 to 20 wt %		20.00%	16.67%	13.33%	10.00%	5.71%
Li2O	1 to 7 wt %		0.00%	0.00%	0.00%	0.00%	0.00%
Fe2O3	2 to 15 wt %		0.28%	0.23%	0.18%	0.14%	0.08%
CaO	< or= 10 wt %		10.87%	✓11.42%	11.98%	12.53%	13.25%
MgO	< or = 8 wt %		0.00%	0.00%	0.00%	0.00%	0.00%
Al2O3	< or = 15 wt %		4.81%	✓ 4.67%	4.54%	4.40%	4.23%
ZrO2	< or = 13 wt %		0.16%	0.13%	0.11%	0.08%	0.05%
Cr2O3	< or = 0.5 wt %		0.06%	0.05%	0.04%	0.03%	0.02%
)5	< or = 3 wt %		0.83%	0.69%	0.55%	0.41%	0.24%
3	< or = 0.5 wt %						
Facility Sizing							
Schedule	14 yrs						
Capacity MT/day	200						
Overall efficiency, %			44%	52%	66%	87%	153%
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				✓175	219	292	510
Required operating duration yrs (assuming 200 MT/day, 60% OE)				✓ 12	15.31	20	36
15 wt % sodium oxide loading							
Mass of glass required to achieve 15% wo loading MT			5.96E+05			Na2O loadin	15%
Volume (m^3) as cullet			3.24E+05				
Number of Canisters (1x)			3.24E+04				
40 wt % sodium oxide loading							
Mass of glass required to achieve 40% wo loading MT			2.24E+05			Na2O loadin	40%
Volume (m^3) as cullet			1.21E+05				
Number of Canisters (1x)			1.21E+04				

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Assumptions:
1. HLW glass waste oxide loading basis to be ~20 wt% waste oxides (excluding Na2O and SiO2) following a 1.2 blending factor
2. Using the WHC engineering data package material balance calculate the waste oxide loading
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading
3. LAW glass sodium oxide loading basis is to be 15 wt%

	Input Stream			LAW			HLW			HLW fraction
	STREAM 1			407	437		314	344		from Intermediate
	solids	liquids		FRIT	GLASS		FRIT	GLASS		Separations
Volume kilo-liters										
Specific Gravity										
Cs and Ba, (MCi)	5.28E+00	6.28E+01			1.00E+01			5.81E+01		0.853113984
Sr and Y, (MCi)	1.05E+02	2.10E+00			6.80E+00			1.00E+02		0.936507937
Tc, (MCi)	5.89E-03	2.61E-02			2.59E-02			5.91E-03		0.185790632
Am, (MCi)	9.51E-02	8.61E-03			8.60E-03			9.52E-02		0.917148362
Np, (MCi)	9.29E-05	1.03E-05			1.03E-05			9.29E-05		0.900193798
Pu-239, (MCi)	2.47E-02	1.67E-03			1.67E-03			2.47E-02		0.936670459
Pu-240, (MCi)	6.28E-03	4.14E-04			4.14E-04			6.28E-03		0.93815357
Pu-241,(MCi)	7.34E-02	1.49E-03			1.48E-03			7.34E-02		0.980235043
Total TRU, (MCi)	2.00E-01	1.22E-02			1.22E-02			2.00E-01		0.942507069
Total MCi	1.11E+02	6.49E+01			2.43E+00			1.73E+02		0.986148321
Total Mass Flow (MT)	1.94E+04	7.10E+05		2.81E+05	3.87E+05		1.36E+04	2.51E+04		
Total Cr, (MT)	1.32E+02	5.15E+01			1.44E+02			3.96E+01		0.215686275
Total Na, (MT)	1.24E+03	6.51E+04			7.18E+04			2.33E+03		0.031431269
Total Si, (MT)	5.24E+02	5.65E+00		1.07E+05	1.07E+05		5.29E+03	5.83E+03		
Total P, (MT)	7.80E+02	8.42E+02			1.35E+03			2.72E+02		0.167694205
Total NO2-, (MT)	7.38E+01	9.54E+03								
Total NO3-, (MT)	1.03E+03	1.06E+05								
AG+	1.38E+00	3.28E-01								
AG2O					3.52E-01			1.48E+00		0.807860262
AL+3	2.37E+03									
AL2O3				1.32E+04	1.94E+04			1.73E+03		0.21815889
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					2.76E-03			3.05E-02		0.917017438
AS+5	4.98E-01	7.70E-01								
AS2O5					1.18E+00			7.66E-01		0.393627955
B+3	9.94E-01	5.19E-01								
B2O3					1.67E+00		1.75E+03	1.76E+03		0.856898029
BA+2	3.09E+00	7.91E-01								
BAO					8.81E-01			3.45E+00		0.796582775
BE+2	7.61E-03	8.19E-02								
BEO					2.27E-01			2.16E-02		0.086886565
BI+3	1.96E+02	6.76E+01								
BI2O3					7.52E+01			2.19E+02		0.74439157
CI4	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.87E+04	3.87E+04			1.89E+02		
CD+2	7.93E+00	2.09E+00								
CDO					2.38E+00			9.06E+00		0.791958042
CE+3	2.35E+02	2.37E+00								
CE2O3					2.79E+00			2.76E+02		0.989992467
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
CR2O3					2.11E+02			5.79E+01		0.215321681
CR(OH)4-		1.19E+02								
CS+	9.25E-02	8.19E-01								
CS2O					6.83E-03			9.58E-01		0.992921033
CU+2	7.46E-01	1.77E-01								
CUO					2.21E-01			9.34E-01		0.808658009
CUSO4										
F-	5.97E+01	1.12E+03								
F2										

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FE+3	7.63E+02	1.44E+01								
FE2O3					2.06E+01			1.21E+03		0.983260198
H2										
H20		5.07E+05								
H2S										
HG										
HG+2	9.00E-03	9.49E-01								
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.65E-01			2.53E+01		0.989634266
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.58E-01			2.46E+01		0.989621048
LI+	2.46E-02	5.77E-03								
LI2O					1.24E-02		5.00E+02	5.03E+02		0.995883681
MG+2	1.10E+01	9.65E-01								
MGO					1.60E+00			1.88E+01		0.921568627
MNO2	2.09E+02	2.17E+01			2.16E+01			2.09E+02		0.90633131
MO+6	8.01E-01	4.87E+00								
MOO3					7.29E+00			1.22E+00		0.143360752
N2										
NA+	7.77E+02	6.51E+04								
NA2O					9.68E+04			3.14E+03		0.031418851
NH3										
NI+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					5.72E+00			9.27E+00		0.618412275
NIO					1.50E-02			2.27E+02		0.999933925
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					1.66E-02			1.50E-01		0.900360144
O2										
OH-	5.00E+03	6.44E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					2.26E+00			3.79E+00		0.626446281
PO4-3	2.39E+03	2.58E+03								
P2O5					3.09E+03			6.22E+02		0.167564655
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					3.26E-02			4.84E-01		0.936895083
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.29E+05	2.29E+05		1.13E+04	1.25E+04		1
SO2										
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.00E-01			4.29E+01		0.990762125
TCO2										
TCO4-	5.68E-01	2.52E+00								
TC2O7					2.39E+00			5.45E-01		0.185689949
TOC	1.16E+02	1.42E+03								
UO2+2	1.58E+03	8.52E+01								
UO3					9.02E+01			1.67E+03		0.948755823
V+5	1.88E-01	6.20E-02								
V2O5					1.11E-01			3.35E-01		0.751121076
W+6		7.47E-01								
WO2					2.91E-05			4.41E-01		0.999934018
WO3					9.40E-01			2.06E-03		0.002186697
ZN+2	9.45E-01	3.59E+00								
ZNO					4.46E+00			1.19E+00		0.210619469
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.49E-01			6.90E+02		0.999060304
ZRO2:2H2	4.09E+02	2.15E+01								
WHC Data Package Basis:										
Mass LAW waste oxides					106544.7302					

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LAW waste loading (waste oxide)					28%				
LAW waste loading (sodium oxide)					25%				
Mass HLW waste oxides								7.26E+03	
HLW waste loading (waste oxides)									
HLW WOL (- Na2O, - SiO2)								29%	
HLW WOL (all tank waste)								46%	
HLW									
20 wt. % waste oxide loading									
Blending factor				1	1.2	1.5	2	3.5	
Mass of glass required for 23,000 can @ 1.2 Blend , MT				31086.19769	37303.437	46629.2965	62172.3954	108801.6919	
additional frit required (equals increased glass) MT				5.99E+03	1.22E+04	2.15E+04	3.71E+04	8.37E+04	
total frit required, MT				1.96E+04	2.58E+04	3.51E+04	5.07E+04	9.73E+04	
WOL (- Na2O, - SiO2)				23%	19%	16%	12%	7%	
WOL (with all tank wastes)				37%	31%	25%	18%	11%	
glass density (MT/m^3)	2.63								
cullet packing fraction	0.7	(LAW only)							
Waste volume (m^3)				1.18E+04	1.42E+04	1.77E+04	2.36E+04	4.14E+04	
Canister Volume (m^3)	1.17								
Number of Canisters (2x)				1.01E+04	1.21E+04	1.52E+04	2.02E+04	3.54E+04	
Nu. of Canisters /HMPC	4								
Number of HMPCs				2.53E+03	3.03E+03	3.79E+03	5.05E+03	8.84E+03	
Number of trips @ 10 HMPCs /trip				253	303	379	505	884	
Glass formulation:									
(ref Ext. Sep Data Pkg.)	acceptable range			1	1.2	1.5	2	3.5	
SiO2	42 to 57 wt %			56.21%	60.69%	65.18%	69.66%	75.42%	
B2O3	5 to 20 wt %			8.14%	8.93%	9.72%	10.51%	11.52%	
Na2O	5 to 20 wt %			10.10%	8.42%	6.73%	5.05%	2.89%	
Li2O	1 to 7 wt %			2.33%	2.55%	2.78%	3.00%	3.29%	
Fe2O3	2 to 15 wt %			3.89%	0.00%	0.00%	0.00%	0.00%	
CaO	< or = 10 wt %			0.61%	0.51%	0.41%	0.30%	0.17%	
MgO	< or = 8 wt %			0.06%	0.05%	0.04%	0.03%	0.02%	
Al2O3	< or = 15 wt %			5.57%	4.64%	3.71%	2.78%	1.59%	
ZrO2	< or = 13 wt %			2.22%	1.85%	1.48%	1.11%	0.63%	
Cr2O3	< or = 0.5 wt %			0.19%	0.16%	0.12%	0.09%	0.05%	
P2O5	< or = 3 wt %			2.00%	1.67%	1.33%	1.00%	0.57%	
SO3	< or = 0.5 wt %								
HLW Facility Sizing									
Schedule	14 yrs								
Capacity MT/day	20								
Overall efficiency, %				30%	37%	46%	61%	106%	
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				10.14	12.17	15.21	20.28	35.49	
Required operating duration yrs (assuming 20 MT/day, 60% OE)					8.52	10.65	14.19	24.84	
15 wt % waste oxide loading									
Mass of glass required to achieve 15% wo loading MT				4.84E+04	6.05E+04	7.26E+04	9.68E+04	1.69E+05	
Volume (m^3)				1.84E+04	2.30E+04	2.76E+04	3.68E+04	6.44E+04	
Number of Canisters (1x)				1.57E+04	1.97E+04	2.36E+04	3.15E+04	5.50E+04	
40 wt % waste oxide loading									
Mass of glass required to achieve 40% wo loading MT				1.81E+04	2.27E+04	2.72E+04	3.63E+04	6.35E+04	
Volume (m^3)				6.90E+03	8.62E+03	1.03E+04	1.38E+04	2.41E+04	
Number of Canisters (1x)				5.90E+03	7.37E+03	8.85E+03	1.18E+04	2.06E+04	
LAW									

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15 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading, MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
additional frit required (equals increased glass) MT				3.64E+05	5.26E+05	6.87E+05	1.01E+06	1.98E+06		
total frit required, MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7									
Waste volume (m^3)				3.51E+05	4.38E+05	5.26E+05	7.01E+05	1.23E+06		
Number of 5300 m^3 vaults				66	83	99	132	231		
LAW facility sizing										
Schedule, years	14									
Capacity MT/day	200									
Overall efficiency, %				63%	79%	95%	126%	221%		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				210.48	263.10	315.72	420.96	736.68		
Required operating duration yrs (assuming 200 MT/day, 60% OE)				14.73	18.42	22.10	29.47	51.57		
10 wt. % sodium oxide loading										
Blending factor				1	1.25		2	3.5		
Mass of glass required to achieve 10				968000	1210000		1936000	3388000		
Waste volume, m^3				525801.195	657251.4938		1051602.39	1840304.183		
Number of 5,300 m^3 vaults				99	124		198	347		
25 wt. % sodium oxide loading										
Blending factor				1	1.25		2	3.5		
Mass of glass required to achive 25 wt % Na2O				387200	484000		774400	1355200		
Waste Volume				210320.478	262900.5975		420640.956	736121.673		
Number of 5,300 m^3 vaults				40	50		79	139		

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Assumptions:

HLW glass waste oxide loading basis to be ~20 wt% waste oxides (excluding Na2O and SiO2) following a 1.2 blending factor

sing the WHC engineering data package material balance calculate the waste oxide loading

.. adjust mass of the glass produced to achieve a 20 wt % waste oxide loading

not counting the SiO2 or the Na2O

	Input Stream			LAW			HLW			HLW fraction
	STREAM 1			407	437		1314	1344		
	solids	liquids		FRIT	GLASS		FRIT	GLASS		
Volume kilo-liters		5.84E+05								
Specific Gravity		1.21E+00								
Cs and Ba, (MCi)	7.60E+00	6.72E+01			6.86E-02			7.46E+01		0.997326203
Sr and Y, (MCi)	1.37E+02	1.41E+00			1.40E-02			1.37E+02		0.989812875
Tc, (MCi)	5.89E-03	2.61E-02			1.53E-04			3.17E-02		0.990934667
Am, (MCi)										
Np, (MCi)										
Pu-239, (MCi)										
Pu-240, (MCi)										
Pu-241,(MCi)										
Total TRU, (MCi)	1.92E-01	1.52E-02			1.20E-03			2.06E-01		0.994208494
Total MCi	1.45E+02	6.87E+01			8.39E-02			2.12E+02		0.992044923
Total Mass Flow (MT)	2.37E+04	7.06E+05		2.65E+05	3.86E+05		8.73E+02	1.32E+03		
Total Cr, (MT)										
Total Na, (MT)										
Total Si, (MT)										
Total P, (MT)										
Total NO2-, (MT)										
Total NO3-, (MT)										
AG+	1.38E+00	3.28E-01								
AG2O					4.07E-01			1.43E+00		
+3	2.37E+03									
.O3				1.16E+04	1.93E+04			1.94E+02		
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					3.41E-05			3.32E-02		
APM-								3.44E-03		
AS+5	4.98E-01	7.70E-01								
AS2O5					4.33E-01			1.51E+00		
B+3	9.94E-01	5.19E-01								
B2O3					4.82E+00		1.22E+02	1.22E+02		
BA+2	3.09E+00	7.91E-01								
BAO					8.76E-01			3.46E+00		
BE+2	7.61E-03	8.19E-02								
BEO					5.53E-02			1.93E-01		
BI+3	1.96E+02	6.76E+01								
BI2O3					2.90E+02			3.45E+00		
C14	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.84E+04	3.86E+04			2.34E+00		
CD+2	7.93E+00	2.09E+00								
CDO					1.13E+01			1.26E-01		
CE+3	2.35E+02	2.37E+00								
CE2O3					2.75E+02			3.40E+00		
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
03					2.67E+02			1.38E+00		
OH)4-		1.19E+02								

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CS+	9.25E-02	8.19E-01								
2O					8.85E-04			9.64E-01		
+2	7.46E-01	1.77E-01								
UO					2.57E-01			8.99E-01		
CUSO4										
F-	5.97E+01	1.12E+03								
F2										
FE+3	7.63E+02	1.44E+01								
FE2O3					3.74E+03			4.24E+01		
H2										
H20		5.07E+05			2.11E-04			1.10E+00		
H2S										
HG										
HG+2	9.00E-03	9.49E-01								
HGO					2.07E+00					
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.55E+01			2.34E-02		
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.46E+01			3.04E-01		
LI+	2.46E-02	5.77E-03								
LI2O					6.53E-02		1.32E+01	1.32E+01		
MG+2	1.10E+01	9.65E-01								
MGO					1.96E+01			2.20E-01		
MNO2	2.09E+02	2.17E+01			2.31E+02			1.08E-01		
MO+6	8.01E-01	4.87E+00								
MOO3					1.03E+01			9.24E-02		
N2										
NA+	3.21E+03	6.26E+04								
NA2O					9.65E+04		2.40E+01	6.59E+01		
3										
+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					2.62E+02			2.82E+00		
NIO					1.06E-03			1.20E+00		
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					6.52E-03			1.66E-01		
O2										
OH-	6.80E+03	4.64E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					1.35E+00			4.71E+00		
PO4-3	2.39E+03	2.58E+03								
P2O5					3.68E+03			3.96E+01		
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					5.42E-03			5.11E-01		
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.15E+05	2.16E+05		7.13E+02	7.52E+02		
SO2										
SO3					6.22E+03			1.92E-03		
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.41E-03			4.33E+01		
TCO2										
TCO4-	5.68E-01	2.52E+00								
2O7					1.41E-02			2.92E+00		
2					3.16E-02			3.51E-04		

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TOC	1.16E+02	1.42E+03								
''O2+2	1.58E+03	8.52E+01								
3								2.77E+00		
.5O8					1.08E+00			1.15E-02		
V+5	1.88E-01	6.20E-02								
V2O5					9.92E-02			3.47E-01		
W+6		7.47E-01								
WO2					1.09E-06			2.26E-04		
WO3					2.10E-01			7.33E-01		
ZN+2	9.45E-01	3.59E+00								
ZNO					3.17E+01			4.31E-01		
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.99E+02			8.55E+00		
ZRO2:2H2	4.09E+02	2.15E+01								
Mass LAW waste oxides					121198.787					
LAW waste loading (waste oxides)					31%					
LAW waste loading (sodium oxide)					25%					
Mass HLW waste oxides								3.42E+02		
HLW waste loading(-Na,-Si)								26%		
HLW WOL (all tank waste)								34%		
HLW										
20 wt. % waste oxide loading										
Blending factor				1	**1.2**	1.5	2	3.5		
Mass of glass required to achieve 20% wo loading, MT				1462.562899	**1755.075479**	2193.844349	2925.1258	5118.970148		
additional frit required (equals increased glass) MT				1.43E+02	**4.35E+02**	8.74E+02	1.61E+03	3.80E+03		
total frit required, MT				1.02E+03	**1.31E+03**	1.75E+03	2.48E+03	4.67E+03		
WOL (-Na,- Si)				23%	**19%**	16%	12%	7%		
WOL (all tank waste)				31%	**25%**	20%	15%	9%		
ass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				5.56E+02	**6.67E+02**	8.34E+02	1.11E+03	1.95E+03		
Canister Volume (m^3)	1.17									
Number of Canisters (2x)				4.75E+02	**5.70E+02**	7.13E+02	9.51E+02	1.66E+03		
Nu. of Canisters /HMPC	4									
Number of HMPCs				1.19E+02	**1.43E+02**	1.78E+02	2.38E+02	4.16E+02		
Number of trips @ 10 HMPCs /trip				12	**14**	18	24	42		
Glass formulation:										
(ref Ext. Sep Data Pkg.)	acceptable range			1	1.25	1.5	2	3.5		
SiO2	42 to 57 wt %			59.38%	63.09%	66.81%	70.52%	75.30%		
B2O3	5 to 20 wt %			9.71%	10.42%	11.14%	11.85%	12.77%		
Na20	5 to 20 wt %			4.77%	4.44%	4.10%	3.76%	3.33%		
Li2O	1 to 7 wt %			1.05%	1.12%	1.20%	1.27%	1.37%		
Fe2O3	2 to 15 wt %			2.90%	0.00%	0.00%	0.00%	0.00%		
CaO	< or= 10 wt %			0.16%	0.13%	0.11%	0.08%	0.05%		
MgO	< or = 8 wt %			0.02%	0.01%	0.01%	0.01%	0.00%		
Al2O3	< or = 15 wt %			13.26%	11.05%	8.84%	6.63%	3.79%		
ZrO2	< or = 13 wt %			0.58%	0.49%	0.39%	0.29%	0.17%		
Cr2O3	< or = 0.5 wt %			0.09%	0.08%	0.06%	0.05%	0.03%		
P2O5	< or = 3 wt %			2.71%	2.26%	1.81%	1.35%	0.77%		
SO3	< or = 0.5 wt %			0.00%	0.00%	0.00%	0.00%	0.00%		
HLW Facility Sizing										
edule	14 yrs									
pacity MT/day	1									

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erall efficiency, %				29%	34%	43%	57%	100%		
uired capacity MT/day (assuming 14 yrs ops, 60% OE)				0.48	0.57	0.72	0.95	1.67		
quired operating duration yrs (assuming 1 MT/day, 60% OE)					8.01	10.02	13.36	23.37		
15 wt % waste oxide loading										
Mass of glass required to achieve 15% wo loading MT				2.28E+03	2.85E+03	3.42E+03	4.55E+03	7.97E+03		
Volume (m^3)				8.66E+02	1.08E+03	1.30E+03	1.73E+03	3.03E+03		
Number of Canisters (1x)				7.40E+02	9.25E+02	1.11E+03	1.48E+03	2.59E+03		
40 wt % waste oxide loading										
Mass of glass required to achieve 40% wo loading MT				8.54E+02	1.07E+03	1.28E+03	1.71E+03	2.99E+03		
Volume (m^3)				3.25E+02	4.06E+02	4.87E+02	6.49E+02	1.14E+03		
Number of Canisters (1x)				2.77E+02	3.47E+02	4.16E+02	5.55E+02	9.71E+02		
LAW										
15 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading, MT				6.43E+05	8.04E+05	9.65E+05	1.29E+06	2.25E+06		
additional frit required (equals increased glass) MT				2.57E+05	4.18E+05	5.79E+05	9.01E+05	1.87E+06		
total frit required, MT				5.22E+05	6.83E+05	8.44E+05	1.17E+06	2.13E+06		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7									
Waste volume (m^3)				3.49E+05	4.37E+05	5.24E+05	6.99E+05	1.22E+06		
mber of 5300 m^3 vaults				66	83	99	132	231		
LAW facility sizing										
Schedule, years	19									
Capacity MT/day	200									
Overall efficiency, %				46%	58%	70%	93%	162%		
Required capacity MT/day (assuming 19 yrs ops, 60% OE)				154.61	193.26	231.92	309.22	541.14		
Required operating duration yrs (assuming 200 MT/day, 60% OE)				14.69	18.36	22.03	29.38	51.41		
10 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achieve 10				9.65E+05	1.21E+06	1.45E+06	1.93E+06	3.38E+06		
Waste volume, m^3				5.24E+05	6.55E+05	7.86E+05	1.05E+06	1.83E+06		
Number of 5,300 m^3 vaults				99	124	148	198	346		
25 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achive 25 wt % Na2O				3.86E+05	4.83E+05	5.79E+05	7.72E+05	1.35E+06		
Waste Volume				2.10E+05	2.62E+05	3.15E+05	4.19E+05	7.34E+05		
Number of 5,300 m^3 vaults				40	49	59	79	138		

Sheet A-21
BGW - 7-30-96

Assumptions:										
1. HLW glass waste oxide loading basis to be – 20 wt% waste oxides with a 1.2 blending factor (excluding Na2O and SiO2)										
2. Using the WHC engineering data package material balance calculate the waste oxide loading										
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading										
3. LAW glass sodium oxide loading basis is to be 15 wt%										
	Input Stream			LAW			HLW		HLW fraction	
	STREAM 1	converted to		407	437		314	344		
		oxides		FRIT	GLASS		FRIT	GLASS		
Volume kilo-liters										
Specific Gravity										
Cs and Ba, (MCi)	6.66E+01				9.78E+00			5.68E+01	0.85311	
Sr and Y, (MCi)	8.29E+01				5.26E+00			7.76E+01	0.9365	
Tc, (MCi)	2.94E-02				2.39E-02			5.46E-03	0.18579063	
Am, (MCi)	7.98E-02				6.61E-03			7.32E-02	0.91714836	
Np, (MCi)	1.38E-04				1.38E-05			1.24E-04	0.9001938	
Pu-239, (MCi)	1.66E-04				1.05E-05			1.55E-04	0.93667046	
Pu-240, (MCi)	4.08E-03				2.52E-04			3.83E-03	0.93815357	
Pu-241,(MCi)	4.67E-02				9.23E-04			4.58E-02	0.98023504	
Total TRU, (MCi)	1.48E-01				8.51E-03			1.39E-01	0.94250707	
Total MCi	1.50E+08				2.08E+06			1.48E+08	0.98614832	
Total Mass Flow (MT)				3.28E+05			1.17E+04			
Total Cr, (MT)									0.21568627	
Total Na, (MT)									0.03143127	
Total Si, (MT)										
Total P, (MT)									0.1676942	
Total NO2-, (MT)										
Total NO3-, (MT)										
AG+	0.50337									
AG2O		5.41E-01			1.04E-01			4.37E-01	0.80786026	
AL+3	1681.456									
AL2O3		4.38E+03		1.54E+04	2.04E+04			1.39E+03	0.21815889	
AL(OH)4-	5968.793									
AM+3										
AM2O3									0.91701744	
AS+5	1.0285									
AS2O5		1.54E+00			9.56E-01			6.21E-01	0.39362795	
B+3	0.6485									
B2O3		2.09E+00			2.99E-01		1.51E+03	1.51E+03	0.85689803	
BA+2	1.1804									
BAO		1.32E+00			2.68E-01			1.05E+00	0.79658278	
BE+2	131.5917									
BEO		3.66E+02			3.35E+02			3.18E+01	0.08688656	
BI+3	2.21859									
BI2O3		2.47E+00			6.32E-01			1.84E+00	0.74439157	
C14										
CA+2	62.2066									
CANCRINITE										
CAO		8.71E+01		4.52E+04	4.52E+04			7.85E+01	0.9018	
CD+2	5.6576									
CDO		4.46E+00			1.34E+00			5.12E+00	0.79195804	
CE+3	153.1929									
CE2O3		1.79E+02			1.80E+00			1.78E+02	0.98999247	
CL-	260.9235									
CL2										
CO										
CO2										
CO3-2	2240.289									
CR+3	64.3875									
CR2O3		9.63E+01			7.56E+01			2.07E+01	0.21532168	
CR(OH)4-	102.4395									
CS+										

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CS2O								0.00E+00		0.99292103	
CU+2	0.4759										
CUO		5.96E-01			1.14E-01			4.82E-01		0.80865801	
CUSO4											
F-	739.1503										
F2											
FE+3	509.9566										
FE2O3		7.29E+02			1.22E+01			7.17E+02		0.9832602	
H2											
H2O											
H2S											
HG											
HG+2	0.7113										
I-											
I2											
K+	353.4002										
K2O		4.21E+02			4.37E+00			4.17E+02		0.98963427	
KEROSENE											
LA+3	3.1199										
LA2O3		3.66E+00			3.80E-02			3.62E+00		0.98962105	
LI+	0.0243										
LI2O		5.21E-02			2.14E-04		4.31E+02	4.31E+02		0.99588368	
MG+2	1.173										
MGO		8.92E-01			7.00E-02			8.22E-01		0.92156863	
MNO2	105.73	1.67E+02			1.57E+01			1.52E+02		0.90633131	
MO+6	5.0199										
MOO3		7.53E+00			6.45E+00			1.08E+00		0.14336075	
N2											
NA+	45382.16										
NA2O		6.12E+04			5.92E+04			1.92E+03		0.03141885	
NH3											
NI+3	137.5048										
NI2FECN6	223.597										
NI2O3		2.50E+02			9.54E+01			1.55E+02		0.61841227	
NIO										0.99993393	
NO											
NO2											
NO2-	6495.108										
NO3-	71426.9										
NP+4											
NPO2										0.90036014	
O2											
OH-	5131.203										
PB+4	3.0014										
PBO2		3.47E+00			1.29E+00			2.17E+00		0.62644628	
PO4-3	2824.588										
P2O5		2.11E+03			1.76E+03			3.54E+02		0.16756466	
P2O5:24W											
PU+4											
PUO2										0.93689508	
S											
SI+4											
SIO2	890.9147	7.03E+02		2.67E+05	2.67E+05		9.72E+03	1.04E+04		1	
SO2											
SO4-2	1597.07										
SR+2	31.928										
SRO		3.77E+01			3.49E-01			3.74E+01		0.99076212	
TCO2											
TCO4-											
TC2O7										0.18568995	
TOC	931.291										
UO2+2	1.5866										
UO3		1.50E+00			7.70E-02			1.43E+00		0.94875582	
V+5	0.0694										

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V2O5		1.24E-01								0.75112108	
W+6	11.328										
WO2										0.99993402	
WO3		1.43E+01			1.43E+01			3.12E-02		0.0021867	
ZN+2	2.9658										
ZNO		3.69E+00			2.91E+00			7.77E-01		0.21061947	
ZR+4	16.2216										
ZRO2		2.19E+01			2.06E-02			2.19E+01		0.9990603	
ZRO2:2H2											
Waste Oxides Total (MT)					6.66E+04			6.20E+03			
Waste Oxides Less Na & Si								3.57E+03			
HLW											
20 wt. % waste oxide loading											
Blending factor				1	1.2	1.5	2	3.5			
Mass of glass required				15408.95686	18490.7482	23113.4353	30817.9137	53931.349			
glass formers required MT				9.21E+03	1.23E+04	1.69E+04	2.46E+04	4.77E+04			
WOL (- Na2O, - SiO2)				23%	19%	15%	12%	7%			
WOL (with all tank wastes)				40%	34%	27%	20%	11%			
Glass Formers Required											
B2O3 (MT)				1.19E+03	1.58E+03	2.18E+03	3.17E+03	6.14E+03			
Li2O (MT)				3.39E+02	4.52E+02	6.22E+02	9.06E+02	1.76E+03			
SiO2 (MT)				7.65E+03	1.02E+04	1.41E+04	2.05E+04	3.97E+04			
glass density (MT/m^3)	2.63										
cullet packing fraction	0.7	(LAW only)									
Waste volume (m^3)				5.86E+03	7.03E+03	8.79E+03	1.17E+04	2.05E+04			
Canister Volume (m^3)	1.17										
Number of Canisters (2x)				5.01E+03	6.01E+03	7.51E+03	1.00E+04	1.75E+04			
Nu. of Canisters /HMPC	4										
Number of HMPCs				1.25E+03	1.50E+03	1.88E+03	2.50E+03	4.38E+03			
Number of trips @ 10 HMPCs /trip				125	150	188	250	438			
HLW Facility Sizing											
Schedule	14 yrs										
Capacity MT/day	7										
Overall efficiency, %				26%	34%	47%	69%	133%			

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Required capacity MT/day (assuming 14 yrs ops, 60% OE)				3.00	4.01	5.52	8.03	15.57			
Required operating duration yrs (assuming 8 MT/day, 60% OE)				5.26	7.02	9.65	14.05	27.24			
LAW											
15 wt. % sodium oxide loading											
Blending factor				1	1.25	1.5	2	3.5			
Mass of glass required to achieve 15% wo loading, MT				3.95E+05	4.94E+05	5.92E+05	7.90E+05	1.38E+06			
total frit required, MT				3.28E+05	4.27E+05	5.26E+05	7.23E+05	1.32E+06			
Glass formers											
Al2O3				1.54E+04	2.01E+04	2.47E+04	3.40E+04	6.18E+04			
CaO				4.52E+04	5.88E+04	7.24E+04	9.96E+04	1.81E+05			
SiO2				2.68E+05	3.48E+05	4.29E+05	5.89E+05	1.07E+06			
glass density (MT/m^3)	2.63										
cullet packing fraction	0.7										
Waste volume (m^3)				2.15E+05	2.68E+05	3.22E+05	4.29E+05	7.51E+05	0.00E+00		
Number of 5300 m^3 vaults				40	51	61	81	142			
LAW facility sizing											
Schedule, years	14										
Capacity MT/day	200										
Overall efficiency, %				39%	48%	58%	77%	135%			
Required capacity MT/day (assuming 14 yrs ops 60% OE)				128.82	161.03	193.23	257.64	450.88			
Required operating duration yrs (assuming 120 MT day, 60% OE)				15.03	18.79	22.54	30.06	52.60			
10 wt. % sodium oxide loading											
Blending factor				1	1.25		2	3.5			
Mass of glass required to achieve 10				592454.5411	740568.1764		1184909.08	2073590.89			
Waste volume, m^3				321811.2662	402264.0828		643622.532	1126339.43			
Number of 5,300 m^3 vaults				61	76		121	213			
25 wt. % sodium oxide loading											
Blending factor				1	1.25		2	3.5			
Mass of glass required to achive 25 wt % Na2O				236981.8164	296227.2706		473963.633	829436.358			
Waste Volume				128724.5065	160905.6331		257449.013	450535.773			
Number of 5,300 m^3 vaults				24	30		49	85			

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Assumptions:										
1. Phased Implementation Separations and Treatment is similar to Intermediate Separations										
except the separations for Sr, Tc, and TRU elements are taken from Extensive Separations										
2. HLW glass waste oxide loading basis to be ~20 wt% waste oxides										
not counting the Na2O or SiO2 in the waste feed stream following a 1.2 blend factor										
3. Using the WHC engineering data package material balance calculate the waste oxide loading										
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading										
4. LAW glass sodium oxide loading basis is to be 15 wt%										
	Input Stream			LAW			HLW			
	STREAM 1			407	437		314	344		
	solids	liquids		FRIT	GLASS		FRIT	GLASS		HLW
Volume kilo-liters										fraction
Specific Gravity										
Cs and Ba, (MCi)	5.28E+00	6.28E+01			1.00E+01			5.81E+01		0.85311
Sr and Y, (MCi)	1.05E+02	2.10E+00			6.80E+00			1.00E+02		0.9365
Tc, (MCi)	5.89E-03	2.61E-02			3.20E-04			3.17E-02		0.99
Am, (MCi)	9.51E-02	8.61E-03			1.04E-03			1.03E-01		0.99
Np, (MCi)	9.29E-05	1.03E-05			1.03E-06			1.02E-04		0.99
Pu-239, (MCi)	2.47E-02	1.67E-03			2.64E-04			2.61E-02		0.99
Pu-240, (MCi)	6.28E-03	4.14E-04			6.69E-05			6.63E-03		0.99
Pu-241,(MCi)	7.34E-02	1.49E-03			7.49E-04			7.41E-02		0.99
Total TRU, (MCi)	2.00E-01	1.22E-02			2.12E-03			2.10E-01		0.99
Total MCi	1.11E+02	6.49E+01			1.76E+00			1.74E+02		0.99
Total Mass Flow (MT)	1.94E+04	7.10E+05		2.81E+05	3.87E+05		1.36E+04	2.51E+04		
Total Cr, (MT)	1.32E+02	5.15E+01			1.44E+02			3.96E+01		
Total Na, (MT)	1.24E+03	6.51E+04			7.18E+04			2.33E+03		
Total Si, (MT)	5.24E+02	5.65E+00		1.07E+05	1.07E+05		5.29E+03	5.83E+03		
Total P, (MT)	7.80E+02	8.42E+02			1.35E+03			2.72E+02		
Total NO2-, (MT)	7.38E+01	9.54E+03								
Total NO3-, (MT)	1.03E+03	1.06E+05								
AG+	1.38E+00	3.28E-01								
AG2O					3.52E-01			1.48E+00		
AL+3	2.37E+03									
AL2O3				1.32E+04	1.94E+04			1.73E+03		
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					2.76E-03			3.05E-02		
AS+5	4.98E-01	7.70E-01								
AS2O5					1.18E+00			7.66E-01		
B+3	9.94E-01	5.19E-01								
B2O3					1.67E+00		1.75E+03	1.76E+03		
BA+2	3.09E+00	7.91E-01								
BAO					8.81E-01			3.45E+00		
BE+2	7.61E-03	8.19E-02								
BEO					2.27E-01			2.16E-02		
BI+3	1.96E+02	6.76E+01								
BI2O3					7.52E+01			2.19E+02		
C14	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.87E+04	3.87E+04			1.89E+02		
CD+2	7.93E+00	2.09E+00								
CDO					2.38E+00			9.06E+00		
CE+3	2.35E+02	2.37E+00								
CE2O3					2.79E+00			2.76E+02		
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
CR2O3					2.11E+02			5.79E+01		
CR(OH)4-		1.19E+02								
CS+	9.25E-02	8.19E-01								
CS2O					6.83E-03			9.58E-01		
CU+2	7.46E-01	1.77E-01								
CUO					2.21E-01			9.34E-01		
CUSO4										
F-	5.97E+01	1.12E+03								
F2										

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FE+3	7.63E+02	1.44E+01								
FE2O3					2.06E+01			1.21E+03		
H2										
H2O		5.07E+05								
H2S										
HG										
HG+2	9.00E-03	9.49E-01								
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.65E-01			2.53E+01		
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.58E-01			2.46E+01		
LI+	2.46E-02	5.77E-03								
LI2O					1.24E-02		5.00E+02	5.03E+02		
MG+2	1.10E+01	9.65E-01								
MGO					1.60E+00			1.88E+01		
MNO2	2.09E+02	2.17E+01			2.16E+01			2.09E+02		
MO+6	8.01E-01	4.87E+00								
MOO3					7.29E+00			1.22E+00		
N2										
NA+	7.77E+02	6.51E+04								
NA2O					9.68E+04			3.14E+03		
NH3										
NI+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					5.72E+00			9.27E+00		
NIO					1.50E-02			2.27E+02		
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					1.66E-02			1.50E-01		
O2										
OH-	5.00E+03	6.44E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					2.26E+00			3.79E+00		
PO4-3	2.39E+03	2.58E+03								
P2O5					3.09E+03			6.22E+02		
P2O5-24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					3.26E-02			4.84E-01		
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.29E+05	2.29E+05		1.13E+04	1.25E+04		
SO2										
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.00E-01			4.29E+01		
TCO2										
TCO4-	5.68E-01	2.52E+00								
TC2O7					2.94E-02			2.91E+00		
TOC	1.16E+02	1.42E+03								
UO2+2	1.58E+03	8.52E+01								
UO3					9.02E+01			1.67E+03		
V+5	1.88E-01	6.20E-02								
V2O5					1.11E-01			3.35E-01		
W+6		7.47E-01								
WO2					2.91E-05			4.41E-01		
WO3					9.40E-01			2.06E-03		
ZN+2	9.45E-01	3.59E+00								
ZNO					4.46E+00			1.19E+00		
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.49E-01			6.90E+02		
ZRO2 2H2	4.09E+02	2.15E+01								
WHC Data Package Basis:										
Mass LAW waste oxides					106542.3696					
LAW waste loading (waste oxide)					28%					
LAW waste loading (sodium oxide)					25%					
Mass HLW waste oxides								7.26E+03		

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HLW waste loading (waste oxides)								29%		
HLW										
20 wt. % waste oxide loading										
Blending factor				1	1.2	1.5	2	3.5		
Mass of glass required to achieve12,200 (2X) can @1.2 blend, MT				3.13E+04	3.76E+04	4.69E+04	6.26E+04	1.10E+05		
additional frit required (equals increased glass) MT				6.20E+03	1.25E+04	2.18E+04	3.75E+04	8.44E+04		
total frit required, MT				1.98E+04	2.61E+04	3.54E+04	5.11E+04	9.80E+04		
WOL (- Na2O, - SiO2)				23%	19%	15%	12%	7%		
WOL (with all tank wastes)				37%	31%	24%	18%	10%		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				1.19E+04	1.43E+04	1.79E+04	2.38E+04	4.17E+04		
Canister Volume (m^3)	1.17									
Number of Canisters (1x)				1.02E+04	1.22E+04	1.53E+04	2.03E+04	3.56E+04		
Nu. of Canisters /HMPC	4									
Number of HMPCs				2.54E+03	3.05E+03	3.81E+03	5.09E+03	8.90E+03		
Number of trips @ 10 HMPCs /trip				254	305	381	509	890		
Glass formulation:										
(ref Ext. Sep Data Pkg.)	acceptable range			1	1.2	1.5	2	3.5		
SiO2	42 to 57 wt %			56.39%	60.85%	65.30%	69.75%	75.47%		
B2O3	5 to 20 wt %			8.17%	8.95%	9.74%	10.52%	11.53%		
Na2O	5 to 20 wt %			10.03%	8.36%	6.69%	5.02%	2.87%		
Li2O	1 to 7 wt %			2.34%	2.56%	2.78%	3.01%	3.30%		
Fe2O3	2 to 15 wt %			3.87%	0.00%	0.00%	0.00%	0.00%		
CaO	< or = 10 wt %			0.60%	0.50%	0.40%	0.30%	0.17%		
MgO	< or = 8 wt %			0.06%	0.05%	0.04%	0.03%	0.02%		
Al2O3	< or = 15 wt %			5.53%	4.61%	3.69%	2.76%	1.58%		
ZrO2	< or = 13 wt %			2.20%	1.84%	1.47%	1.10%	0.63%		
Cr2O3	< or = 0.5 wt %			0.18%	0.15%	0.12%	0.09%	0.05%		
P2O5	< or = 3 wt %			1.99%	1.66%	1.32%	0.99%	0.57%		
SO3	< or = 0.5 wt %									
HLW Facility Sizing										
Phase 1 HLW= 1plant @ 1 mt/day, 6 yrs, 60% OE			Phase 1 HLW produced (MT)		1314					
Schedule (years) =	1*									
Phase 2 Requirements										
Required capacity MT/day (assuming 17 yrs ops, 70% OE)				6.90	8.34	10.51	14.11	24.92		
Required operating duration yrs (assuming 10 MT/day, 70% OE)				11.74	14.19	17.86	23.98	42.36		
15 wt % waste oxide loading										
Mass of glass required to achieve 15% wo loading MT				4.84E+04	6.05E+04	7.26E+04	9.68E+04	1.69E+05		
Volume (m^3)				1.84E+04	2.30E+04	2.76E+04	3.68E+04	6.44E+04		
Number of Canisters (1x)				1.57E+04	1.97E+04	2.36E+04	3.15E+04	5.51E+04		
40 wt % waste oxide loading										
Mass of glass required to achieve 40% wo loading MT				1.82E+04	2.27E+04	2.72E+04	3.63E+04	6.35E+04		
Volume (m^3) as cullet				6.90E+03	8.63E+03	1.04E+04	1.38E+04	2.42E+04		
Number of Canisters (1x)				5.90E+03	7.37E+03	8.85E+03	1.18E+04	2.06E+04		
LAW										
15 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
additional frit required (equals increased glass) MT				3.64E+05	5.26E+05	6.87E+05	1.01E+06	1.98E+06		
total frit required, MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
glass density (MT/m^3)	2.63			5.38E06						
cullet packing fraction	0.7									

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Waste volume (m^3)				3.51E+05	4.38E+05	5.26E+05	7.01E+05	1.23E+06		
Number of 5300 m^3 vaults				66	83	99	132	231		
LAW facility sizing										
Phase 1 LAW=2 plants @ 20 mt/day, 10 yrs op, 60 % OE			Phase 1 LAW produced (MT)		8760					
Schedule, years	13									
Capacity MT/day	200									
Phase 2 LAW total capacity (Each LAW Plant would have 1/2 of total capacity)										
Overall efficiency, %				67%	84%	101%	135%	237%		
Required capacity MT/day (assuming 13 yrs ops, 70% OE)				191.65	240.22	288.80	385.94	677.38		
Required operating duration yrs (assuming 200 MT/day, 70% OE)				12.46	15.61	18.77	25.09	44.03		
10 wt. % sodium oxide loading										
Blending factor				1			2	3.5		
Mass of glass required to achieve 10				968000			1936000	3388000		
Waste volume, m^3				525801.195			1051602.39	1840304.183		
Number of 5,300 m^3 vaults				99			198	347		
25 wt. % sodium oxide loading										
Blending factor				1			2	3.5		
Mass of glass required to achive 25 wt % Na2O				387200			774400	1355200		
Waste Volume				210320.478			420640.956	736121.673		
Number of 5,300 m^3 vaults				40			79	139		

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Assumptions:									
1. HLW glass waste oxide loading basis to be 20 wt% waste oxides (excluding Na2O and SiO2)									
2. Using the WHC engineering data package material balance calculate the waste oxide loading									
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading									
3. LAW glass sodium oxide loading basis is to be 15 wt%									
	Input Stream	Input		LAW			HLW		HLW fraction
	STREAM 1	converted to		407	437		314	344	
		oxides		FRIT	GLASS		FRIT	GLASS	
Volume kilo-liters									
Specific Gravity									
Cs and Ba, (MCi)	63.774				9.37E+00			5.44E+01	0.85311
Sr and Y, (MCi)	43.032				2.73E+00			4.03E+01	0.9365
Tc, (MCi)	0.0274				2.23E-02			5.09E-03	0.185790632
Am, (MCi)	0.0763				6.32E-03			7.00E-02	0.917148362
Np, (MCi)	0.0001				9.98E-06			9.00E-05	0.900193798
Pu-239, (MCi)	0.0076				4.81E-04			7.12E-03	0.936670459
Pu-240, (MCi)	0.0019				1.18E-04			1.78E-03	0.93815357
Pu-241,(MCi)	0.0189				3.74E-04			1.85E-02	0.980235043
Total TRU, (MCi)	0.1053				6.05E-03			9.92E-02	0.942507069
Total MCi	115.095				1.59E+00			1.14E+02	0.986148321
Total Mass Flow (MT)				1.91E+05			6.88E+03		
Total Cr, (MT)									0.215686275
Total Na, (MT)									0.031431269
Total Si, (MT)									
Total P, (MT)									0.167694205
Total NO2-, (MT)									
Total NO3-, (MT)									
AG+	5.05E-01								
AG2O		5.43E-01			1.04E-01			4.39E-01	0.807860262
AL+3	4.33E+02								
AL2O3		3.51E+03		8.98E+03	1.17E+04			7.66E+02	0.21815889
AL(OH)4-	5.02E+03								
AM+3									
AM2O3									0.917017438
AS+5	1.04E+00								
AS2O5		1.59E+00			9.66E-01			6.27E-01	0.393627955
B+3	9.68E-01								
B2O3		3.12E+00			4.47E-01		8.85E+02	8.88E+02	0.856898029
BA+2	2.89E+00								
BAO		3.23E+00			6.57E-01			2.57E+00	0.796582775
BE+2	6.61E-02								
BEO		1.84E-01			1.68E-01			1.60E-02	0.086886565
BI+3	2.05E+01								
BI2O3		2.29E+01			5.85E+00			1.70E+01	0.74439157
C14									
CA+2	3.21E+01								
CANCRINITE									
CAO		4.49E+01		2.63E+04	2.63E+04			4.05E+01	0.9018
CD+2	6.14E+00								
CDO		7.01E+00			1.46E+00			5.55E+00	0.791958042
CE+3	8.75E+01								
CE2O3		1.02E+02			1.03E+00			1.01E+02	0.989992467
CL-	2.62E+02								
CL2									
CO									
CO2									
CO3-2	1.88E+03								
CR+3	3.31E+01								
CR2O3		5.05E+01			3.97E+01			1.09E+01	0.215321681
CR(OH)4-	9.93E+01								
CS+									
CS2O								0.00E+00	0.992921033
CU+2	5.82E-01								
CUO		7.28E-01			1.39E-01			5.89E-01	0.808658009
CUSO4									
F-	1.22E+02								
F2									
FE+3	2.33E+02								

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FE2O3		3.33E+02		5.58E+00			3.28E+02	0.983260198
H2								
H20								
H2S								
HG								
HG+2	1.35E-01							
I-								
I2								
K+	3.63E+02							
K2O		4.33E+02		4.49E+00			4.29E+02	0.989634266
KEROSENE								
LA+3	1.93E+01							
LA2O3		2.27E+01		2.35E-01			2.24E+01	0.989621048
LI+	2.46E-02							
LI2O		5.27E-02		2.17E-04		2.53E+02	2.53E+02	0.995883681
MG+2	9.33E+00							
MGO		7.10E+00		5.57E-01			6.54E+00	0.921568627
MNO2	7.37E+01	1.17E+02		1.09E+01			1.06E+02	0.90633131
MO+6	5.10E+00							
MOO3		7.64E+00		6.55E+00			1.10E+00	0.143360752
N2								
NA+	2.63E+04							
NA2O		3.55E+04		3.44E+04			1.12E+03	0.031418851
NH3								
NI+3	5.91E+01							
NI2FECN6	8.62E+01							
NI2O3		1.05E+02		4.00E+01			6.49E+01	0.618412275
NIO								0.999933925
NO								
NO2								
NO2-	4.57E+03							
NO3-	3.99E+04							
NP+4								
NPO2								0.900360144
O2								
OH-	2.25E+03							
PB+4	4.79E+00							
PBO2		5.53E+00		2.07E+00			3.46E+00	0.626446281
PO4-3	1.32E+03							
P2O5		9.59E+02		8.23E+02			1.66E+02	0.167564655
P2O5:24W								
PU+4								
PUO2								0.936895083
S								
SI+4								
SIO2	4.59E+02	4.59E+02	1.56E+05	1.56E+05		5.72E+03	6.18E+03	1
SO2								
SO4-2	1.06E+03							
SR+2	3.73E-01							
SRO		4.41E-01		4.07E-03			4.37E-01	0.990762125
TCO2								
TCO4-								
TC2O7								0.185689949
TOC	1.10E+03							
UO2+2	1.69E+00							
UO3		1.60E+00		8.21E-02			1.52E+00	0.948755823
V+5								
V2O5								0.751121076
W+6	1.99E+00							
WO2								0.999934018
WO3		2.50E+00		2.50E+00			5.47E-03	0.002186697
ZN+2	3.26E+00							
ZNO		4.06E+00		3.20E+00			8.54E-01	0.210619469
ZR+4	2.72E+01							
ZRO2		3.67E+01		3.45E-02			3.67E+01	0.999060304
ZRO2:2H2								
Waste Oxides Total (MT)				3.81E+04			3.69E+03	
Waste Oxides Less Na & Si							2.11E+03	

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HLW									
20 wt. % waste oxide loading									
Blending factor				1	1.2	1.5	2	3.5	
Mass of glass required				9113.096148	1.09E+04	13669.6442	18226.1923	31895.83652	
frit required MT				5.42E+03	7.25E+03	9.98E+03	1.45E+04	2.82E+04	
WOL (- Na2O, - SiO2)				23%	19%	15%	12%	7%	
WOL (with all tank wastes)				40%	34%	27%	20%	12%	
Glass Formers Required									
B2O3 (MT)				6.98E+02	9.33E+02	1.28E+03	1.87E+03	3.63E+03	
Li2O (MT)				2.00E+02	2.67E+02	3.67E+02	5.35E+02	1.04E+03	
SiO2 (MT)				4.51E+03	6.02E+03	8.29E+03	1.21E+04	2.34E+04	
glass density (MT/m^3)	2.63								
cullet packing fraction	0.7	(LAW only)							
Waste volume (m^3)				3.47E+03	4.16E+03	5.20E+03	6.93E+03	1.21E+04	
Canister Volume (m^3)	1.17								
Number of Canisters (2x)				2.96E+03	3.55E+03	4.44E+03	5.92E+03	1.04E+04	
Nu. of Canisters /HMPC	4								
Number of HMPCs				7.40E+02	8.88E+02	1.11E+03	1.48E+03	2.59E+03	
Number of trips @ 10 HMPCs /trip				74	89	111	148	259	
HLW Facility Sizing									
Schedule	14 yrs								
Capacity MT/day	3								
Overall efficiency, %				35%	47%	65%	95%	184%	
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				1.77	2.36	3.26	4.74	9.20	
Required operating duration yrs (assuming 5 MT/day, 60% OE)				4.95	6.62	9.11	13.28	25.76	
LAW									
15 wt. % sodium oxide loading									
Blending factor				1	1.25	1.5	2	3.5	

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Mass of glass required to achieve 15% wo loading, MT			2.29E+05	2.87E+05	3.44E+05	4.59E+05	8.03E+05
total glass formers required, MT			1.91E+05	2.49E+05	3.06E+05	4.21E+05	7.64E+05
glass density (MT/m^3)	2.63						
cullet packing fraction	0.7						
Glass formers (MT)							
Al2O3			8.99E+03	1.17E+04	1.44E+04	1.98E+04	3.59E+04
CaO			2.63E+04	3.42E+04	4.21E+04	5.79E+04	1.05E+05
SiO2			1.56E+05	2.03E+05	2.49E+05	3.43E+05	6.23E+05
Waste volume (m^3)			1.25E+05	1.56E+05	1.87E+05	2.49E+05	4.36E+05
Number of 5300 m^3 vaults			24	29	35	47	82
LAW facility sizing							
Schedule, years	14						
Capacity MT/day	200						
Overall efficiency, %			22%	28%	34%	45%	79%
Required capacity MT/day (assuming 14 yrs ops, 60% OE)			75	93.49	112.19	149.58	261.77
Required operating duration yrs (assuming 75 MT/day, 60% OE)			13.96	17.45	20.94	27.92	48.86
10 wt. % sodium oxide loading							
Blending factor			1	1.25		2	3.5
Mass of glass required to achieve 10			343959.5014	429949.3768		687919.0028	1203858.255
Waste volume, m^3			186832.972	233541.215		373665.944	653915.4019
Number of 5,300 m^3 vaults			35	44		71	123
25 wt. % sodium oxide loading							
Blending factor			1	1.25		2	3.5
Mass of glass required to achive 25 wt % Na2O			137583.8006	171979.7507		275167.6011	481543.302
Waste Volume			74733.18879	93416.48599		149466.3776	261566.1608
Number of 5,300 m^3 vaults			14	18		28	49

Sheet A-33
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Mass of calcined waste,MT	1.68E+05
Volume of Calcined Waste, m^3	6.70E+04
Number of Canisters @ 10 m^3	10300
Number of Canisters @ .62 m^3	154700
Number of HMPCs @ 1 10m^3 can/HMPC	10300

Combo Low +

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Assumptions:									
1. HLW glass waste oxide loading basis to be 20 wt% waste oxides (excluding Na2O and SiO2)									
2. Using the WHC engineering data package material balance calculate the waste oxide loading									
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading									
3. LAW glass sodium oxide loading basis is to be 15 wt%									
	Input Stream	Input		LAW			HLW		HLW fraction
	STREAM 1	converted to		407	437		314	344	
		oxides		FRIT	GLASS		FRIT	GLASS	
Volume kilo-liters									
Specific Gravity									
Cs and Ba, (MCi)	63.774				9.37E+00			5.44E+01	0.85311
Sr and Y, (MCi)	43.032				2.73E+00			4.03E+01	0.9365
Tc, (MCi)	0.0274				2.23E-02			5.09E-03	0.185790632
Am, (MCi)	0.0763				6.32E-03			7.00E-02	0.917148362
Np, (MCi)	0.0001				9.98E-06			9.00E-05	0.900193798
Pu-239, (MCi)	0.0076				4.81E-04			7.12E-03	0.936670459
Pu-240, (MCi)	0.0019				1.18E-04			1.78E-03	0.93815357
Pu-241,(MCi)	0.0189				3.74E-04			1.85E-02	0.980235043
Total TRU, (MCi)	0.1053				6.05E-03			9.92E-02	0.942507069
Total MCi	115.095				1.59E+00			1.14E+02	0.986148321
Total Mass Flow (MT)				1.91E+05			6.88E+03		
Total Cr, (MT)									0.215686275
Total Na, (MT)									0.031431269
Total Si, (MT)									
Total P, (MT)									0.167694205
Total NO2-, (MT)									
Total NO3-, (MT)									
AG+	5.05E-01								
AG2O		5.43E-01			1.04E-01			4.39E-01	0.807860262
AL+3	4.33E+02								
AL2O3		3.51E+03		8.98E+03	1.17E+04			7.66E+02	0.21815889
AL(OH)4-	5.02E+03								
AM+3									
AM2O3									0.917017438
AS+5	1.04E+00								
AS2O5		1.59E+00			9.66E-01			6.27E-01	0.393627955
B+3	9.68E-01								
B2O3		3.12E+00			4.47E-01		8.85E+02	8.88E+02	0.856898029
BA+2	2.89E+00								
BAO		3.23E+00			6.57E-01			2.57E+00	0.796582775
BE+2	6.61E-02								
BEO		1.84E-01			1.68E-01			1.60E-02	0.086886565
BI+3	2.05E+01								
BI2O3		2.29E+01			5.85E+00			1.70E+01	0.74439157
C14									
CA+2	3.21E+01								
CANCRINITE									
CAO		4.49E+01		2.63E+04	2.63E+04			4.05E+01	0.9018
CD+2	6.14E+00								
CDO		7.01E+00			1.46E+00			5.55E+00	0.791958042
CE+3	8.75E+01								
CE2O3		1.02E+02			1.03E+00			1.01E+02	0.989992467
CL-	2.62E+02								
CL2									
CO									
CO2									
CO3-2	1.88E+03								
CR+3	3.31E+01								
CR2O3		5.05E+01			3.97E+01			1.09E+01	0.215321681
CR(OH)4-	9.93E+01								
CS+									
CS2O								0.00E+00	0.992921033
CU+2	5.82E-01								
CUO		7.28E-01			1.39E-01			5.89E-01	0.808658009
CUSO4									
F-	1.22E+02								
F2									
FE+3	2.33E+02								

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FE2O3		3.33E+02			5.58E+00			3.28E+02	0.983260198
H2									
H20									
H2S									
HG									
HG+2	1.35E-01								
I-									
I2									
K+	3.63E+02								
K2O		4.33E+02			4.49E+00			4.29E+02	0.989634266
KEROSENE									
LA+3	1.93E+01								
LA2O3		2.27E+01			2.35E-01			2.24E+01	0.989621048
LI+	2.46E-02								
LI2O		5.27E-02			2.17E-04		2.53E+02	2.53E+02	0.995883681
MG+2	9.33E+00								
MGO		7.10E+00			5.57E-01			6.54E+00	0.921568627
MNO2	7.37E+01	1.17E+02			1.09E+01			1.06E+02	0.90633131
MO+6	5.10E+00								
MOO3		7.64E+00			6.55E+00			1.10E+00	0.143360752
N2									
NA+	2.63E+04								
NA2O		3.55E+04			3.44E+04			1.12E+03	0.031418851
NH3									
NI+3	5.91E+01								
NI2FECN6	8.62E+01								
NI2O3		1.05E+02			4.00E+01			6.49E+01	0.618412275
NIO									0.999933925
NO									
NO2									
NO2-	4.57E+03								
NO3-	3.99E+04								
NP+4									
NPO2									0.900360144
O2									
OH-	2.25E+03								
PB+4	4.79E+00								
PBO2		5.53E+00			2.07E+00			3.46E+00	0.626446281
PO4-3	1.32E+03								
P2O5		9.89E+02			8.23E+02			1.66E+02	0.167564655
P2O5:24W									
PU+4									
PUO2									0.936895083
S									
SI+4									
SIO2	4.59E+02	4.59E+02		1.56E+05	1.56E+05		5.72E+03	6.18E+03	1
SO2									
SO4-2	1.06E+03								
SR+2	3.73E-01								
SRO		4.41E-01			4.07E-03			4.37E-01	0.990762125
TCO2									
TCO4-									
TC2O7									0.185689949
TOC	1.10E+03								
UO2+2	1.69E+00								
UO3		1.60E+00			8.21E-02			1.52E+00	0.948755823
V+5									
V2O5									0.751121076
W+6	1.99E+00								
WO2									0.999934018
WO3		2.50E+00			2.50E+00			5.47E-03	0.002186697
ZN+2	3.26E+00								
ZNO		4.06E+00			3.20E+00			8.54E-01	0.210619469
ZR+4	2.72E+01								
ZRO2		3.67E+01			3.45E-02			3.67E+01	0.999060304
ZRO2:2H2									
Waste Oxides Total (MT)					3.81E+04			3.69E+03	
Waste Oxides Less Na & Si								2.11E+03	

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HLW								
20 wt. % waste oxide loading								
Blending factor			1	1.2	1.5	2	3.5	
Mass of glass required			9.11E+03	1.09E+04	1.37E+04	1.82E+04	3.19E+04	
frit required MT			5.42E+03	7.25E+03	9.98E+03	1.45E+04	2.82E+04	
WOL (- Na2O, - SiO2)			23%	20%	15%	12%	7%	
WOL (with all tank wastes)			40%	34%	27%	20%	12%	
Glass Formers Required								
B2O3 (MT)			6.98E+02	9.33E+02	1.28E+03	1.87E+03	3.63E+03	
Li2O (MT)			2.00E+02	2.67E+02	3.67E+02	5.35E+02	1.04E+03	
SiO2 (MT)			4.51E+03	6.02E+03	8.29E+03	1.21E+04	2.34E+04	
glass density (MT/m^3)	2.63							
cullet packing fraction	0.7	(LAW only)						
Waste volume (m^3)			~~3.47E+03~~	4.16E+03	~~5.20E+03~~	~~6.93E+03~~	~~1.21E+04~~	
Canister Volume (m^3)	1.17							
Number of Canisters (2x)			~~2.96E+03~~	3.55E+03	~~4.44E+03~~	~~5.92E+03~~	~~1.04E+04~~	
Nu. of Canisters /HMPC	4							
Number of HMPCs			~~7.40E+02~~	8.88E+02	~~1.11E+03~~	~~1.48E+03~~	~~2.59E+03~~	
Number of trips @ 10 HMPCs /trip			~~74~~	89	~~111~~	~~148~~	~~259~~	
HLW Facility Sizing								
Schedule	14 yrs							
Capacity MT/day	3							
Overall efficiency, %			~~35%~~	~~47%~~	~~65%~~	~~95%~~	~~184%~~	
Required capacity MT/day (assuming 14 yrs ops, 60% OE)			~~1.77~~	~~2.36~~	~~3.26~~	~~4.74~~	~~9.20~~	
Required operating duration yrs (assuming 3 MT/day, 60% OE)			~~8.00~~	11	~~15.00~~	~~22.00~~	~~43.00~~	
Required Operating duration, yrs (including 2 yrs start up)				13				
LAW								
15 wt. % sodium oxide loading								
Blending factor			1	1.25	1.5	2	3.5	
Mass of glass required to achieve 15% wo loading, MT			2.29E+05	2.87E+05	3.44E+05	4.59E+05	8.03E+05	
total glass formers required, MT			1.91E+05	2.49E+05	3.06E+05	4.21E+05	7.64E+05	
glass density (MT/m^3)	2.63							
cullet packing fraction	0.7							
Glass formers (MT)								
Al2O3			8.99E+03	1.17E+04	1.44E+04	1.98E+04	3.59E+04	
CaO			2.63E+04	3.42E+04	4.21E+04	5.79E+04	1.05E+05	
SiO2			1.56E+05	2.03E+05	2.49E+05	3.43E+05	6.23E+05	
Waste volume (m^3)			1.25E+05	1.56E+05	1.87E+05	2.49E+05	4.36E+05	
Number of 5300 m^3 vaults			24	29	35	47	82	
LAW facility sizing								
Schedule, years	14							
Capacity MT/day	200							
Overall efficiency, %			~~22%~~	~~28%~~	~~34%~~	~~45%~~	~~79%~~	
Required capacity MT/day (assuming 15 yrs ops, 60% OE)			70	~~87~~	~~105~~	~~140~~	~~244~~	
Required operating duration yrs (assuming 70 MT/day, 60% OE)			15	~~18.70~~	~~22.44~~	~~29.92~~	~~52.35~~	
Operating duration (including 2 yrs start up)			17					

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Assumptions:										
1. Phased Implementation Separations and Treatment is similar to Intermediate Separations										
except the separations for Sr, Tc, and TRU elements are taken from Extensive Separations										
2. HLW glass waste oxide loading basis to be ~20 wt% waste oxides										
not counting the Na2O or SiO2 in the waste feed stream following a 1.2 blend factor										
3. Using the WHC engineering data package material balance calculate the waste oxide loading										
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading										
4. LAW glass sodium oxide loading basis is to be 15 wt%										
	Input Stream			LAW			HLW			
	STREAM 1			407	437		314	344		
	solids	liquids		FRIT	GLASS		FRIT	GLASS		HLW
Volume kilo-liters										fraction
Specific Gravity										
Cs and Ba, (MCi)	5.28E+00	6.28E+01			1.00E+01			5.81E+01		0.85311
Sr and Y, (MCi)	1.05E+02	2.10E+00			6.80E+00			1.00E+02		0.9365
Tc, (MCi)	5.89E-03	2.61E-02			3.20E-04			3.17E-02		0.99
Am, (MCi)	9.51E-02	8.61E-03			1.04E-03			1.03E-01		0.99
Np, (MCi)	9.29E-05	1.03E-05			1.03E-06			1.02E-04		0.99
Pu-239, (MCi)	2.47E-02	1.67E-03			2.64E-04			2.61E-02		0.99
Pu-240, (MCi)	6.28E-03	4.14E-04			6.69E-05			6.63E-03		0.99
Pu-241,(MCi)	7.34E-02	1.49E-03			7.49E-04			7.41E-02		0.99
Total TRU, (MCi)	2.00E-01	1.22E-02			2.12E-03			2.10E-01		0.99
Total MCi	1.11E+02	6.49E+01			1.76E+00			1.74E+02		0.99
Total Mass Flow (MT)	1.94E+04	7.10E+05		2.81E+05	3.87E+05		1.36E+04	2.51E+04		
Total Cr, (MT)	1.32E+02	5.15E+01			1.44E+02			3.96E+01		
Total Na, (MT)	1.24E+03	6.51E+04			7.18E+04			2.33E+03		
Total Si, (MT)	5.24E+02	5.65E+00		1.07E+05	1.07E+05		5.29E+03	5.83E+03		
Total P, (MT)	7.80E+02	8.42E+02			1.35E+03			2.72E+02		
Total NO2-, (MT)	7.38E+01	9.54E+03								
Total NO3-, (MT)	1.03E+03	1.06E+05								
AG+	1.38E+00	3.28E-01								
AG2O					3.52E-01			1.48E+00		
AL+3	2.37E+03									
AL2O3				1.32E+04	1.94E+04			1.73E+03		
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					2.76E-03			3.05E-02		
AS+5	4.98E-01	7.70E-01								
AS2O5					1.18E+00			7.66E-01		
B+3	9.94E-01	5.19E-01								
B2O3					1.67E+00		1.75E+03	1.76E+03		
BA+2	3.09E+00	7.91E-01								
BAO					8.81E-01			3.45E+00		
BE+2	7.61E-03	8.19E-02								
BEO					2.27E-01			2.16E-02		
BI+3	1.96E+02	6.76E+01								
BI2O3					7.52E+01			2.19E+02		
C14	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.87E+04	3.87E+04			1.89E+02		
CD+2	7.93E+00	2.09E+00								
CDO					2.38E+00			9.06E+00		
CE+3	2.35E+02	2.37E+00								
CE2O3					2.79E+00			2.76E+02		
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
CR2O3					2.11E+02			5.79E+01		
CR(OH)4-		1.19E+02								
CS+	9.25E-02	8.19E-01								
CS2O					6.83E-03			9.58E-01		
CU+2	7.46E-01	1.77E-01								
CUO					2.21E-01			9.34E-01		
CUSO4										
F-	5.97E+01	1.12E+03								
F2										

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FE+3	7.63E+02	1.44E+01								
FE2O3					2.06E+01			1.21E+03		
H2										
H2O		5.07E+05								
H2S										
HG										
HG+2	9.00E-03	9.49E-01								
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.65E-01			2.53E+01		
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.58E-01			2.46E+01		
LI+	2.46E-02	5.77E-03								
LI2O					1.24E-02		5.00E+02	5.03E+02		
MG+2	1.10E+01	9.65E-01								
MGO					1.60E+00			1.88E+01		
MNO2	2.09E+02	2.17E+01			2.16E+01			2.09E+02		
MO+6	8.01E-01	4.87E+00								
MOO3					7.29E+00			1.22E+00		
N2										
NA+	7.77E+02	6.51E+04								
NA2O					9.68E+04			3.14E+03		
NH3										
NI+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					5.72E+00			9.27E+00		
NIO					1.50E-02			2.27E+02		
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					1.66E-02			1.50E-01		
O2										
OH-	5.00E+03	6.44E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					2.26E+00			3.79E+00		
PO4-3	2.39E+03	2.58E+03								
P2O5					3.09E+03			6.22E+02		
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					3.26E-02			4.84E-01		
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.29E+05	2.29E+05		1.13E+04	1.25E+04		
SO2										
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.00E-01			4.29E+01		
TCO2										
TCO4-	5.68E-01	2.52E+00								
TC2O7					2.94E-02			2.91E+00		
TOC	1.16E+02	1.42E+03								
UO2+2	1.58E+03	8.52E+01								
UO3					9.02E+01			1.67E+03		
V+5	1.88E-01	6.20E-02								
V2O5					1.11E-01			3.35E-01		
W+6		7.47E-01								
WO2					2.91E-05			4.41E-01		
WO3					9.40E-01			2.06E-03		
ZN+2	9.45E-01	3.59E+00								
ZNO					4.46E+00			1.19E+00		
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.49E-01			6.90E+02		
ZRO2:2H2	4.09E+02	2.15E+01								
HLW										
20 wt. % waste oxide loading										
Blending factor				1	1.2	1.5	2	3.5		

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Mass of glass required to achieve12,200 (2X) can @1.2 blend, MT				3.13E+04	**3.76E+04**	4.69E+04	6.26E+04	1.10E+05		
additional frit required (equals increased glass) MT				6.20E+03	**1.25E+04**	2.18E+04	3.75E+04	8.44E+04		
total frit required, MT				1.98E+04	**2.61E+04**	3.54E+04	5.11E+04	9.80E+04		
WOL (- Na2O, - SiO2)				23%	**20%**	15%	12%	7%		
WOL (with all tank wastes)				37%	**31%**	24%	18%	10%		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				1.19E+04	**1.43E+04**	1.79E+04	2.38E+04	4.17E+04		
Canister Volume (m^3)	1.17									
Number of Canisters (1x)				1.02E+04	**1.22E+04**	1.53E+04	2.03E+04	3.56E+04		
Nu. of Canisters /HMPC	4									
Number of HMPCs				2.54E+03	**3.05E+03**	3.81E+03	5.09E+03	8.90E+03		
Number of trips @ 10 HMPCs /trip				254	**305**	381	509	890		
HLW Facility Sizing										
Phase 1 HLW= 1plant @ 1 mt/day, 6 yrs, 60% OE			Phase 1 HLW produced (MT)		1314					
Schedule (years) =	~~17~~									
Phase 2 Requirements										
Required capacity MT/day (assuming 17 yrs ops, 70% OE)				~~6.90~~	~~8.34~~	~~10.51~~	~~14.11~~	~~24.92~~		
Required operating duration yrs (assuming 10 MT/day, 70% OE)				~~11.74~~	**14**	~~17.86~~	~~23.98~~	~~42.36~~		
Required operating duration (including 2 yrs start up)					16					
LAW										
15 wt. % sodium oxide loading										
Blending factor				566,160 1	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading, MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
additional frit required (equals increased glass) MT				2.58E+05	4.20E+05	5.81E+05	9.04E+05	1.87E+06		
total frit required, MT				5.39E+05	7.01E+05	8.62E+05	1.18E+06	2.15E+06		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7									
Waste volume (m^3) (total Phase 1 + Phase 2)				3.51E+05	4.38E+05	5.26E+05	7.01E+05	1.23E+06		
Number of 5300 m^3 vaults				66	83	99	132	231		
LAW facility sizing										
Phase 1 LAW=2 plants @ 20 mt/day, 10 yrs op, 60 % OE			Phase 1 LAW produced (MT)		8760 87600					
Schedule, years	13									
Capacity MT/day	200									
Phase 2 LAW total capacity (Each LAW Plant would have 1/2 of total capacity)										
Overall efficiency, %				67%	~~84%~~	~~101%~~	~~135%~~	~~237%~~		
Required capacity MT/day (assuming 13 yrs ops, 70% OE)				191.65	~~240.22~~	~~288.80~~	~~385.94~~	~~677.38~~		
Required operating duration yrs (assuming 200 MT/day, 70% OE)				**12**	~~15.61~~	~~18.77~~	~~25.09~~	~~44.03~~		
Required operating duration, yrs, (including 2 yrs start up)				**14**						

4 grout vaults okay
22,050 vs 18,301 boxes

915 boxes/plant/year
@60% = 4.2 boxes/~~day~~/plant.
2.6 m³

47583. m³ = 3 boxes/trip

6100 trips.

18,301 boxes.

15 1/4 vaults

@1200/vaults !!

Attachment 2 (5 pp.)

TECHNICAL DATA TO SUPPORT DISPOSAL FEE CALCULATIONS FOR TWRS-EIS

	Outer Diam., m	Length, m	Wall thickness, cm	Nominal Glass Volume, m^3	Total Nominal Weight, kg	Annual Production Rate, # of canisters
DWPF standard canister	0.61	3.00	1.0	0.62	2,200	1,500[1]
TWRS standard canister	0.61	4.50	1.0	1.17	3,700	800[1] 75[2]
TWRS "very large" canister	1.68	5.03	2.5	10.0	29,700	2,200[3]

The total thermal output from all Hanford waste is 930 kW, indexed to December 2021 and assuming that the Cs and Sr capsule inventories are included in the glass. For purposes of evaluating the four (4) scenarios, it should be assumed that the thermal output is uniformly distributed among the number of canisters associated with each scenario, e.g. 1.8 kW per canister for Scenario 3.

The total equivalent Metric Tons Heavy Metal (eMTHM) for all Hanford tank waste is estimated to be 2,600, using the proposed methodology for calculating equivalency that is described in DOE-RL/87-04. For purposes of this exercise, it should be assumed that the eMTHM are uniformly distributed among the number of canisters associated with each scenario, e.g. 4.9 eMTHM per canister for Scenario 3.

[1] For Scenarios 1 and 2, the full-scale (Phase II) production rates are based on an instantaneous melter capacity of 12 MT/day at 60% total operating efficiency.

[2] For Scenario 3, the production rate is based on an instantaneous melter rate of 1 MT/day and a 60% TOE.

[3] For Scenario 4, the full-scale (Phase II) production rate is based on an instantaneous melter rate of 260 MT/day and a 60% TOE.

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Assumptions:							
W glass waste oxide loading basis to be 20 wt% sodium oxides							
...ing the WHC engineering data package material balance calculate the waste oxide loading							
and adjust mass of the glass produced to achieve a 20 wt % sodium oxide loading							
	Input		Frit	Output			
	Stream1		stream407	stream437			
	liquids	solids					
Volume kilo-liters	5.85E+05						
Specific Gravity	1.21E+00						
Cs and Ba, (MCi)	6.28E+01	5.28E+00		6.79E+01			
Sr and Y, (MCi)	2.10E+00	1.05E+02		1.07E+02			
Tc, (MCi)	2.61E-02	5.89E-03		3.18E-02			
Am, (MCi)	8.61E-03	9.51E-02		1.04E-01			
Np, (MCi)	1.03E-05	9.29E-05		1.03E-04			
Pu-239, (MCi)	1.67E-03	2.47E-02		2.64E-02			
Pu-240, (MCi)	4.14E-04	6.28E-03		6.70E-03			
Pu-241,(MCi)	1.49E-03	7.34E-02		7.48E-02			
Total TRU, (MCi)	1.22E-02	2.00E-01		2.12E-01			
Total MCi	6.49E+01	1.11E+02		1.76E+02			
Total Mass Flow (MT)	7.10E+05	1.94E+04	2.50E+05	3.57E+05			
Total Cr, (MT)	5.15E+01	1.32E+02		1.84E+02			
Total Na, (MT)	6.51E+04	1.24E+03		6.63E+04			
Total Si, (MT)	5.65E+00	5.24E+02	9.56E+04	9.61E+04			
P, (MT)	8.42E+02	7.80E+02		1.62E+03			
NO2-, (MT)	9.54E+03	7.38E+01					
Total NO3-, (MT)	1.06E+05	1.03E+03					
AG+	3.28E-01	1.38E+00					
AG2O				1.83E+00			
AL+3		2.37E+03					
AL2O3			1.00E+04	1.79E+04			
AL(OH)4-	4.83E+03						
AM+3	2.51E-03	2.77E-02					
AM2O3				3.32E-02			
AS+5	7.70E-01	4.98E-01					
AS2O5				1.95E+00			
B+3	5.19E-01	9.94E-01					
B2O3				4.87E+00			
BA+2	7.91E-01	3.09E+00					
BAO				4.33E+00			
BE+2	8.19E-02	7.61E-03					
BEO				2.48E-01			
BI+3	6.76E+01	1.96E+02					
BI2O3				2.94E+02			
C14	7.43E-04	4.53E-04					
CA+2	1.67E+01	1.33E+02					
CANCRINITE		2.70E+03					
			3.55E+04	3.58E+04			
2	2.09E+00	7.93E+00					

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CDO				1.14E+01			
[illegible]	2.37E+00	2.35E+02					
[illegible]3				2.78E+02			
CL-	3.11E+02	3.49E+00					
CL2							
CO							
CO2							
CO3-2	3.37E+03	2.25E+02					
CR+3		1.32E+02					
CR203				2.68E+02			
CR(OH)4-	1.19E+02						
CS+	8.19E-01	9.25E-02					
CS2O				9.65E-01			
CU+2	1.77E-01	7.46E-01					
CUO				1.16E+00			
CUSO4							
F-	1.12E+03	5.97E+01					
F2							
FE+3	1.44E+01	7.63E+02					
FE2O3				1.23E+03			
H2							
H20	5.07E+05						
H2S							
HG							
[illegible]2	9.49E-01	9.00E-03					
[illegible]	5.46E+02	2.02E+01					
I2							
K+	2.19E-01	2.10E+01					
K2O				2.56E+01			
KEROSENE							
LA+3	2.19E-01	2.10E+01					
LA2O3				2.49E+01			
LI+	5.77E-03	2.46E-02					
LI2O				6.53E-02			
MG+2	9.65E-01	1.10E+01					
MGO				1.98E+01			
MNO2	2.17E+01	2.09E+02		2.31E+02			
MO+6	4.87E+00	8.01E-01					
MOO3				8.51E+00			
N2							
NA+	6.51E+04	7.77E+02					
NA2O				8.94E+04			
NH3							
NI+3	4.07E+00	6.57E+00					
NI2FECN6		5.00E+02					
NI2O3				1.50E+01			
NIO				2.27E+02			
[illegible]							
[illegible]							

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NO2-	9.54E+03	7.38E+01					
	1.06E+05	1.03E+03					
[illegible]	1.46E-02	1.32E-01					
NPO2				1.66E-01			
O2							
OH-	6.44E+03	5.00E+03					
PB+4	1.96E+00	3.28E+00					
PBO2				6.05E+00			
PO4-3	2.58E+03	2.39E+03					
P2O5				3.71E+03			
P2O5:24W		5.21E-01					
PU+4	2.88E-02	4.27E-01					
PUO2				5.16E-01			
S							
SI+4	5.65E+00	7.90E+01					
SIO2			2.04E+05	2.06E+05			
SO2							
SO4-2	2.01E+03	3.97E+01					
SR+2	3.75E-01	3.64E+01					
SRO				4.33E+01			
TCO2							
TCO4-	2.52E+00	5.68E-01					
TC2O7				2.94E+00			
TOC	1.42E+03	1.16E+02					
[illegible]+2	8.52E+01	1.58E+03					
				1.76E+03			
V+5	6.20E-02	1.88E-01					
V2O5				4.46E-01			
W+6	7.47E-01						
WO2				4.41E-01			
WO3				9.42E-01			
ZN+2	3.59E+00	9.45E-01					
ZNO				5.65E+00			
ZR+4	4.48E-01	2.77E+02					
ZRO2				7.07E+02			
ZRO2:2H2	2.15E+01	4.09E+02					
WHC data package basis:							
mass waste oxides				1.08E+05			
waste loading (wt%)				30%			
sodium oxide loading				25%			

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% sodium oxide loading							
..ing factor			1	1.2	1.5	2	3.5
Mass of glass required to achieve 20% sodium loading, M			4.47E+05	**5.36E+05**	6.71E+05	8.94E+05	1564500
additional frit required (equals increased glass) MT			9.00E+04	**1.79E+05**	3.14E+05	5.37E+05	1.21E+06
total glass formers required, MT			3.40E+05	**4.29E+05**	5.64E+05	7.87E+05	1.46E+06
Waste Loading (Na20 wt. %)			20%	**17%**	13%	10%	6%
Waste Loading (waste oxides)			24%	**20%**	16%	12%	7%
glass density (MT/m^3)	2.63						
cullet packing fraction	0.7						
Waste volume (m^3)			2.43E+05	**2.91E+05**	3.64E+05	4.86E+05	8.50E+05
Canister Volume (m^3)	10						
Number of Canisters (1x)			2.43E+04	**2.91E+04**	3.64E+04	4.86E+04	8.50E+04
Number of Canisters per HMPC		1					
Number of HMPCs			2.43E+04	**2.91E+04**	3.64E+04	4.86E+04	8.50E+04
Number of trips @ 10 HMPCs /trip			2.43E+03	**2.91E+03**	3.64E+03	4.86E+03	8.50E+03
Facility Sizing							
..dule	14 yrs						
..ity MT/day	200						
Overall efficiency, %, based on 14 yrs @ 200 mt/day			~~44%~~	~~52%~~	~~66%~~	~~87%~~	~~153%~~
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~175~~	~~219~~	~~292~~	~~510~~
Required operating duration yrs (assuming 200 MT/day, 60% OE)				**12**	~~15.31~~	~~20~~	~~36~~
Required operating duration (including 2 yrs start up)				**14**			

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Assumptions:
1. HLW glass waste oxide loading basis to be ~20 wt% waste oxides (excluding Na2O and SiO2) following a 1.2 blending factor
2. Using the WHC engineering data package material balance calculate the waste oxide loading and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading
3. LAW glass sodium oxide loading basis is to be 15 wt%

	Input Stream			LAW			HLW			HLW fraction
	STREAM 1			407	437		314	344		from Intermediate
	solids	liquids		FRIT	GLASS		FRIT	GLASS		Separations
Volume kilo-liters										
Specific Gravity										
Cs and Ba, (MCi)	5.28E+00	6.28E+01			1.00E+01			5.81E+01		0.853113984
Sr and Y, (MCi)	1.05E+02	2.10E+00			6.80E+00			1.00E+02		0.936507937
Tc, (MCi)	5.89E-03	2.61E-02			2.59E-02			5.91E-03		0.185790632
Am, (MCi)	9.51E-02	8.61E-03			8.60E-03			9.52E-02		0.917148362
Np, (MCi)	9.29E-05	1.03E-05			1.03E-05			9.29E-05		0.900193798
Pu-239, (MCi)	2.47E-02	1.67E-03			1.67E-03			2.47E-02		0.936670459
Pu-240, (MCi)	6.28E-03	4.14E-04			4.14E-04			6.28E-03		0.93815357
Pu-241,(MCi)	7.34E-02	1.49E-03			1.48E-03			7.34E-02		0.980235043
Total TRU, (MCi)	2.00E-01	1.22E-02			1.22E-02			2.00E-01		0.942507069
Total MCi	1.11E+02	6.49E+01			2.43E+00			1.73E+02		0.986148321
Total Mass Flow (MT)	1.94E+04	7.10E+05		2.81E+05	3.87E+05		1.36E+04	2.51E+04		
Total Cr, (MT)	1.32E+02	5.15E+01			1.44E+02			3.96E+01		0.215686275
Total Na, (MT)	1.24E+03	6.51E+04			7.18E+04			2.33E+03		0.031431269
Total Si, (MT)	5.24E+02	5.65E+00		1.07E+05	1.07E+05		5.29E+03	5.83E+03		
Total P, (MT)	7.80E+02	8.42E+02			1.35E+03			2.72E+02		0.167694205
Total NO2-, (MT)	7.38E+01	9.54E+03								
Total NO3-, (MT)	1.03E+03	1.06E+05								
AG+	1.38E+00	3.28E-01								
AG2O					3.52E-01			1.48E+00		0.807860262
AL+3	2.37E+03									
AL2O3				1.32E+04	1.94E+04			1.73E+03		0.21815889
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					2.76E-03			3.05E-02		0.917017438
AS+5	4.98E-01	7.70E-01								
AS2O5					1.18E+00			7.66E-01		0.393627955
B+3	9.94E-01	5.19E-01								
B2O3					1.67E+00		1.75E+03	1.76E+03		0.856898029
BA+2	3.09E+00	7.91E-01								
BAO					8.81E-01			3.45E+00		0.796582775
BE+2	7.61E-03	8.19E-02								
BEO					2.27E-01			2.16E-02		0.086886565
BI+3	1.96E+02	6.76E+01								
BI2O3					7.52E+01			2.19E+02		0.74439157
C14	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.87E+04	3.87E+04			1.89E+02		
CD+2	7.93E+00	2.09E+00								
CDO					2.38E+00			9.06E+00		0.791958042
CE+3	2.35E+02	2.37E+00								
CE2O3					2.79E+00			2.76E+02		0.989992467
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
CR2O3					2.11E+02			5.79E+01		0.215321681
CR(OH)4-		1.19E+02								
CS+	9.25E-02	8.19E-01								
CS2O					6.83E-03			9.58E-01		0.992921033
CU+2	7.46E-01	1.77E-01								
CUO					2.21E-01			9.34E-01		0.808658009
CUSO4										
F-	5.97E+01	1.12E+03								
F2										
FE+3	7.63E+02	1.44E+01								
FE2O3					2.06E+01			1.21E+03		0.983260198
H2										
H2O		5.07E+05								

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H2S										
HG										
HG+2	9.00E-03	9.49E-01								
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.65E-01			2.53E+01		0.989634266
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.58E-01			2.46E+01		0.989621048
LI+	2.46E-02	5.77E-03								
LI2O					1.24E-02		5.00E+02	5.03E+02		0.995883681
MG+2	1.10E+01	9.65E-01								
MGO					1.60E+00			1.88E+01		0.921568627
MNO2	2.09E+02	2.17E+01			2.16E+01			2.09E+02		0.90633131
MO+6	8.01E-01	4.87E+00								
MOO3					7.29E+00			1.22E+00		0.143360752
N2										
NA+	7.77E+02	6.51E+04								
NA2O					9.68E+04			3.14E+03		0.031418851
NH3										
NI+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					5.72E+00			9.27E+00		0.618412275
NIO					1.50E-02			2.27E+02		0.999933925
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					1.66E-02			1.50E-01		0.900360144
O2										
OH-	5.00E+03	6.44E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					2.26E+00			3.79E+00		0.626446281
PO4-3	2.39E+03	2.58E+03								
P2O5					3.09E+03			6.22E+02		0.167564655
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					3.26E-02			4.84E-01		0.936895083
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.29E+05	2.29E+05		1.13E+04	1.25E+04		1
SO2										
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.00E-01			4.29E+01		0.990762125
TCO2										
TCO4-	5.68E-01	2.52E+00								
TC2O7					2.39E+00			5.45E-01		0.185689949
TOC	1.16E+02	1.42E+03								
UO2+2	1.58E+03	8.52E+01								
UO3					9.02E+01			1.67E+03		0.948755823
V+5	1.88E-01	6.20E-02								
V2O5					1.11E-01			3.35E-01		0.751121076
W+6		7.47E-01								
WO2					2.91E-05			4.41E-01		0.999934018
WO3					9.40E-01			2.06E-03		0.002186697
ZN+2	9.45E-01	3.59E+00								
ZNO					4.46E+00			1.19E+00		0.210619469
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.49E-01			6.90E+02		0.999060304
ZRO2:2H2	4.09E+02	2.15E+01								
WHC Data Package Basis:										
Mass LAW waste oxides					106544.7302					
LAW waste loading (waste oxide)					28%					
LAW waste loading (sodium oxide)					25%					
Mass HLW waste oxides								7.26E+03		
HLW waste loading (waste oxides)										
HLW WOL (- Na2O, - SiO2)								29%		
HLW WOL (all tank waste)								46%		

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HLW										
20 wt. % waste oxide loading										
Blending factor				1	**1.2**	1.5	2	3.5		
Mass of glass required for 12,200 "long" can @ 1.2 Blend , MT				31086.19769	**37303.437**	46629.29653	62172.39537	108801.6919		
additional frit required (equals increased glass) MT				5.99E+03	**1.22E+04**	2.15E+04	3.71E+04	8.37E+04		
total frit required, MT				1.96E+04	**2.58E+04**	3.51E+04	5.07E+04	9.73E+04		
WOL (- Na2O, - SiO2)				23%	**20%**	16%	12%	7%		
WOL (with all tank wastes)				37%	**31%**	25%	18%	11%		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				1.18E+04	**1.42E+04**	1.77E+04	2.36E+04	4.14E+04		
Canister Volume (m^3)	1.17									
Number of Canisters (2x)				1.01E+04	**1.21E+04**	1.52E+04	2.02E+04	3.54E+04		
Nu. of Canisters /HMPC	4									
Number of HMPCs				2.53E+03	**3.03E+03**	3.79E+03	5.05E+03	8.84E+03		
Number of trips @ 10 HMPCs /trip				253	**303**	379	505	884		
HLW Facility Sizing										
Schedule	14 yrs									
Capacity MT/day	**20**									
Overall efficiency, %				~~30%~~	37%	~~46%~~	~~61%~~	~~106%~~		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~10.14~~	12.17	~~15.21~~	~~20.28~~	~~35.49~~		
Required operating duration yrs (assuming 20 MT/day, 60% OE)					**9**	~~10.65~~	~~14.19~~	~~24.84~~		
Required operating duration, yrs, including 2 yrs. start up					**11**					
LAW										
15 wt. % sodium oxide loading										
Blending factor				**1**	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading, MT				**6.45E+05**	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
additional frit required (equals increased glass) MT				**2.58E+05**	4.20E+05	5.81E+05	9.04E+05	1.87E+06		
total frit required, MT				**5.39E+05**	7.01E+05	8.62E+05	1.18E+06	2.15E+06		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7									
Waste volume (m^3)				**3.51E+05**	3.81E+05	4.68E+05	6.43E+05	1.17E+06		
Number of 5300 m^3 vaults				**66**	72	88	121	221		
LAW facility sizing										
Schedule, years	14									
Capacity MT/day	**200**									
Overall efficiency, %				~~63%~~	~~79%~~	~~95%~~	~~126%~~	~~221%~~		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~210.48~~	~~263.10~~	~~315.72~~	~~420.96~~	~~736.68~~		
Required operating duration yrs (assuming 200 MT/day, 60% OE)				**15**	~~18.42~~	~~22.10~~	~~29.47~~	~~51.57~~		
Required operating duration, yrs (with 2 yrs start up)				**17**						

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Assumptions:										
LW glass waste oxide loading basis to be ~20 wt% waste oxides (excluding Na2O and SiO2) following a 1.2 blending factor										
ng the WHC engineering data package material balance calculate the waste oxide loading										
adjust mass of the glass produced to achieve a 20 wt % waste oxide loading										
not counting the SiO2 or the Na2O										
	Input Stream			LAW			HLW			HLW fraction
	STREAM 1			407	437		1314	1344		
	solids	liquids		FRIT	GLASS		FRIT	GLASS		
Volume kilo-liters		5.84E+05								
Specific Gravity		1.21E+00								
Cs and Ba, (MCi)	7.60E+00	6.72E+01			6.86E-02			7.46E+01		0.997326203
Sr and Y, (MCi)	1.37E+02	1.41E+00			1.40E-02			1.37E+02		0.989812875
Tc, (MCi)	5.89E-03	2.61E-02			1.53E-04			3.17E-02		0.990934667
Am, (MCi)										
Np, (MCi)										
Pu-239, (MCi)										
Pu-240, (MCi)										
Pu-241,(MCi)										
Total TRU, (MCi)	1.92E-01	1.52E-02			1.20E-03			2.06E-01		0.994208494
Total MCi	1.45E+02	6.87E+01			8.39E-02			2.12E+02		0.992044923
Total Mass Flow (MT)	2.37E+04	7.06E+05		2.65E+05	3.86E+05		8.73E+02	1.32E+03		
Total Cr, (MT)										
Total Na, (MT)										
Total Si, (MT)										
Total P, (MT)										
Total NO2-, (MT)										
Total NO3-, (MT)										
AG+	1.38E+00	3.28E-01								
AG2O					4.07E-01			1.43E+00		
3	2.37E+03									
O3				1.16E+04	1.93E+04			1.94E+02		
(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					3.41E-05			3.32E-02		
APM-								3.44E-03		
AS+5	4.98E-01	7.70E-01								
AS2O5					4.33E-01			1.51E+00		
B+3	9.94E-01	5.19E-01								
B2O3					4.82E+00		1.22E+02	1.22E+02		
BA+2	3.09E+00	7.91E-01								
BAO					8.76E-01			3.46E+00		
BE+2	7.61E-03	8.19E-02								
BEO					5.53E-02			1.93E-01		
BI+3	1.96E+02	6.76E+01								
BI2O3					2.90E+02			3.45E+00		
C14	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.84E+04	3.86E+04			2.34E+00		
CD+2	7.93E+00	2.09E+00								
CDO					1.13E+01			1.26E-01		
CE+3	2.35E+02	2.37E+00								
CE2O3					2.75E+02			3.40E+00		
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
+3	1.32E+02									
O3					2.67E+02			1.38E+00		
(OH)4-		1.19E+02								

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CS+	9.25E-02	8.19E-01								
[illegible]					8.85E-04			9.64E-01		
[illegible]2	7.46E-01	1.77E-01								
[illegible]					2.57E-01			8.99E-01		
CUSO4										
F-	5.97E+01	1.12E+03								
F2										
FE+3	7.63E+02	1.44E+01								
FE2O3					3.74E+03			4.24E+01		
H2										
H20		5.07E+05			2.11E-04			1.10E+00		
H2S										
HG										
HG+2	9.00E-03	9.49E-01								
HGO					2.07E+00					
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.55E+01			2.34E-02		
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.46E+01			3.04E-01		
LI+	2.46E-02	5.77E-03								
LI2O					6.53E-02		1.32E+01	1.32E+01		
MG+2	1.10E+01	9.65E-01								
MGO					1.96E+01			2.20E-01		
MNO2	2.09E+02	2.17E+01			2.31E+02			1.08E-01		
MO+6	8.01E-01	4.87E+00								
MOO3					1.03E+01			9.24E-02		
N2										
NA+	3.21E+03	6.26E+04								
[illegible]O					9.65E+04		2.40E+01	6.59E+01		
[illegible]										
[illegible]+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					2.62E+02			2.82E+00		
NIO					1.06E-03			1.20E+00		
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					6.52E-03			1.66E-01		
O2										
OH-	6.80E+03	4.64E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					1.35E+00			4.71E+00		
PO4-3	2.39E+03	2.58E+03								
P2O5					3.68E+03			3.96E+01		
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					5.42E-03			5.11E-01		
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.15E+05	2.16E+05		7.13E+02	7.52E+02		
SO2										
SO3					6.22E+03			1.92E-03		
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.41E-03			4.33E+01		
[illegible]O2										
[illegible]4-	5.68E-01	2.52E+00								
[illegible]O7					1.41E-02			2.92E+00		

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TIO2					3.16E-02			3.51E-04		
[illegible]	1.16E+02	1.42E+03								
[illegible]+2	1.58E+03	8.52E+01								
[illegible]3								2.77E+00		
U3O8					1.08E+00			1.15E-02		
V+5	1.88E-01	6.20E-02								
V2O5					9.92E-02			3.47E-01		
W+6		7.47E-01								
WO2					1.09E-06			2.26E-04		
WO3					2.10E-01			7.33E-01		
ZN+2	9.45E-01	3.59E+00								
ZNO					3.17E+01			4.31E-01		
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.99E+02			8.55E+00		
ZRO2:2H2	4.09E+02	2.15E+01								
Mass LAW waste oxides					121198.787					
LAW waste loading (waste oxides)					31%					
LAW waste loading (sodium oxide)					25%					
Mass HLW waste oxides								3.42E+02		
HLW waste loading(-Na,-Si)								26%		
HLW WOL (all tank waste)								34%		
HLW										
20 wt. % waste oxide loading										
Blending factor				1	**1.2**	1.5	2	3.5		
Mass of glass required to achieve 20% wo loading, MT				1462.562899	**1755.075479**	2193.844349	2925.1258	5118.970148		
additional frit required (equals increased glass) MT				1.43E+02	**4.35E+02**	8.74E+02	1.61E+03	3.80E+03		
total frit required, MT				1.02E+03	**1.31E+03**	1.75E+03	2.48E+03	4.67E+03		
[illegible]L (-Na,- Si)				23%	**20%**	16%	12%	7%		
[illegible] (all tank waste)				31%	**25%**	20%	15%	9%		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				5.56E+02	**6.67E+02**	8.34E+02	1.11E+03	1.95E+03		
Canister Volume (m^3)	1.17									
Number of Canisters (2x)				4.75E+02	**5.70E+02**	7.13E+02	9.51E+02	1.66E+03		
Nu. of Canisters /HMPC	4									
Number of HMPCs				1.19E+02	**1.43E+02**	1.78E+02	2.38E+02	4.16E+02		
Number of trips @ 10 HMPCs /trip				12	**14**	18	24	42		
HLW Facility Sizing										
Schedule	14 yrs									
Capacity MT/day	1									
Overall efficiency, %				~~29%~~	~~34%~~	~~43%~~	~~57%~~	~~100%~~		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~0.48~~	~~0.57~~	~~0.72~~	~~0.95~~	~~1.67~~		
Required operating duration yrs (assuming 1 MT/day, 60% OE)					**8**	~~10.02~~	~~13.36~~	~~23.37~~		
Required operating duration , yrs (includes 2 yrs start up)					**10**					
LAW										
15 wt. % sodium oxide loading										
Blending factor				**1**	1.25	1.5	2	3.5		
[illegible]ass of glass required to achieve 15% wo loading, MT				**6.43E+05**	8.04E+05	9.65E+05	1.29E+06	2.25E+06		
[illegible]ional frit required (equals increased glass) MT				**2.57E+05**	4.18E+05	5.79E+05	9.01E+05	1.87E+06		
[illegible]al frit required, MT				**5.22E+05**	6.83E+05	8.44E+05	1.17E+06	2.13E+06		

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density (MT/m^3)	2.63									
packing fraction	0.7									
Waste volume (m^3)				**3.49E+05**	4.37E+05	5.24E+05	6.99E+05	1.22E+06		
Number of 5300 m^3 vaults				**66**	83	99	132	231		
LAW facility sizing										
Schedule, years	19									
Capacity MT/day	**200**									
Overall efficiency, %				~~46%~~	~~58%~~	~~70%~~	~~93%~~	~~162%~~		
Required capacity MT/day (assuming 19 yrs ops, 60% OE)				~~154.61~~	~~193.26~~	~~231.92~~	~~309.22~~	~~541.14~~		
Required operating duration yrs (assuming 200 MT/day, 60% OE)				**15**	~~18.36~~	~~22.03~~	~~29.38~~	~~51.41~~		
Required operation duration, yrs (including 2 yrs start up)				**17**						

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Assumptions:

LW glass waste oxide loading basis to be ~ 20 wt% waste oxides with a 1.2 blending factor (excluding Na2O and SiO2)

ing the WHC engineering data package material balance calculate the waste oxide loading

. adjust mass of the glass produced to achieve a 20 wt % waste oxide loading

3. LAW glass sodium oxide loading basis is to be 15 wt%

	Input Stream			LAW			HLW			HLW fraction
	STREAM 1	converted to		407	437		314	344		
		oxides		FRIT	GLASS		FRIT	GLASS		
Volume kilo-liters										
Specific Gravity										
Cs and Ba, (MCi)	6.66E+01				9.78E+00			5.68E+01		0.85311
Sr and Y, (MCi)	8.29E+01				5.26E+00			7.76E+01		0.9365
Tc, (MCi)	2.94E-02				2.39E-02			5.46E-03		0.185791
Am, (MCi)	7.98E-02				6.61E-03			7.32E-02		0.917148
Np, (MCi)	1.38E-04				1.38E-05			1.24E-04		0.900194
Pu-239, (MCi)	1.66E-04				1.05E-05			1.55E-04		0.93667
Pu-240, (MCi)	4.08E-03				2.52E-04			3.83E-03		0.938154
Pu-241,(MCi)	4.67E-02				9.23E-04			4.58E-02		0.980235
Total TRU, (MCi)	1.48E-01				8.51E-03			1.39E-01		0.942507
Total MCi	1.50E+08				2.08E+06			1.48E+08		0.986148
Total Mass Flow (MT)				3.28E+05			1.17E+04			
Total Cr, (MT)										0.215686
Total Na, (MT)										0.031431
Total Si, (MT)										
Total P, (MT)										0.167694
Total NO2-, (MT)										
Total NO3-, (MT)										
AG+	0.50337									
AG2O		5.41E-01			1.04E-01			4.37E-01		0.80786
AL+3	1681.486									
AL2O3		6.38E+03		1.54E+04	2.04E+04			1.39E+03		0.218159
AL(OH)4-	5968.793									
+3										
.O3										0.917017
..5+5	1.0285									
AS2O5		1.58E+00			9.56E-01			6.21E-01		0.393628
B+3	0.6485									
B2O3		2.09E+00			2.99E-01		1.51E+03	1.51E+03		0.856898
BA+2	1.1804									
BAO		1.32E+00			2.68E-01			1.05E+00		0.796583
BE+2	131.8917									
BEO		3.66E+02			3.35E+02			3.18E+01		0.086887
BI+3	2.21859									
BI2O3		2.47E+00			6.32E-01			1.84E+00		0.744392
C14										
CA+2	62.2086									
CANCRINITE										
CAO		8.71E+01		4.52E+04	4.52E+04			7.85E+01		0.9018
CD+2	5.6576									
CDO		6.46E+00			1.34E+00			5.12E+00		0.791958
CE+3	153.1929									
CE2O3		1.79E+02			1.80E+00			1.78E+02		0.989992
CL-	260.9235									
CL2										
CO										
CO2										
CO3-2	2240.289									
CR+3	64.3875									
CR2O3		9.63E+01			7.56E+01			2.07E+01		0.215322
CR(OH)4-	102.4395									
CS+										
CS2O								0.00E+00		0.992921
CU+2	0.4759									
O		5.96E-01			1.14E-01			4.82E-01		0.808658
O4										
	739.1503									

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F2											
3	509.9566										
3		7.29E+02			1.22E+01			7.17E+02		0.98326	
H20											
H2S											
HG											
HG+2	0.7113										
I-											
I2											
K+	353.4002										
K2O		4.21E+02			4.37E+00			4.17E+02		0.989634	
KEROSENE											
LA+3	3.1199										
LA2O3		3.66E+00			3.80E-02			3.62E+00		0.989621	
LI+	0.0243										
LI2O		5.21E-02			2.14E-04		4.31E+02	4.31E+02		0.995884	
MG+2	1.173										
MGO		8.92E-01			7.00E-02			8.22E-01		0.921569	
MNO2	105.73	1.67E+02			1.57E+01			1.52E+02		0.906331	
MO+6	5.0199										
MOO3		7.53E+00			6.45E+00			1.08E+00		0.143361	
N2											
NA+	45382.16										
NA2O		6.12E+04			5.92E+04			1.92E+03		0.031419	
NH3											
NI+3	137.5048										
NI2FECN6	223.597										
NI2O3		2.50E+02			9.54E+01			1.55E+02		0.618412	
NIO										0.999934	
NO											
NO2											
NO2-	6495.108										
	71426.9										
4											
O2										0.90036	
O2											
OH-	5131.203										
PB+4	3.0014										
PBO2		3.47E+00			1.29E+00			2.17E+00		0.626446	
PO4-3	2824.588										
P2O5		2.11E+03			1.76E+03			3.54E+02		0.167565	
P2O5:24W											
PU+4											
PUO2										0.936895	
S											
SI+4											
SIO2	890.9147	7.03E+02		2.67E+05	2.67E+05		9.72E+03	1.04E+04		1	
SO2											
SO4-2	1597.07										
SR+2	31.928										
SRO		3.77E+01			3.49E-01			3.74E+01		0.990762	
TCO2											
TCO4-											
TC2O7										0.18569	
TOC	931.291										
UO2+2	1.5866										
UO3		1.50E+00			7.70E-02			1.43E+00		0.948756	
V+5	0.0694										
V2O5		1.24E-01								0.751121	
W+6	11.328										
WO2										0.999934	
WO3		1.43E+01			1.43E+01			3.12E-02		0.002187	
ZN+2	2.9658										
O		3.69E+00			2.91E+00			7.77E-01		0.210619	
4	16.2216										
O2		2.19E+01			2.06E-02			2.19E+01		0.99906	

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ZRO2:2H2											
..e Oxides Total (MT)					6.66E+04			6.20E+03			
Waste Oxides Less Na & Si								3.57E+03			
HLW											
20 wt. % waste oxide loading											
Blending factor				1	1.2	1.5	2	3.5			
Mass of glass required				1.54E+04	1.85E+04	2.31E+04	3.08E+04	5.39E+04			
glass formers required MT				9.21E+03	1.23E+04	1.69E+04	2.46E+04	4.77E+04			
WOL (- Na2O, - SiO2)				23%	20%	15%	12%	7%			
WOL (with all tank wastes)				40%	34%	27%	20%	11%			
Glass Formers Required											
B2O3 (MT)				1.19E+03	1.58E+03	2.18E+03	3.17E+03	6.14E+03			
Li2O (MT)				3.39E+02	4.52E+02	6.22E+02	9.06E+02	1.76E+03			
SiO2 (MT)				7.65E+03	1.02E+04	1.41E+04	2.05E+04	3.97E+04			
glass density (MT/m^3)	2.63										
cullet packing fraction	0.7	(LAW only)									
Waste volume (m^3)				5.86E+03	7.03E+03	8.79E+03	1.17E+04	2.05E+04			
Canister Volume (m^3)	1.17										
Number of Canisters (2x)				5.01E+03	6.01E+03	7.51E+03	1.00E+04	1.75E+04			
Nu. of Canisters /HMP	4										
Number of HMPCs				1.25E+03	1.50E+03	1.88E+03	2.50E+03	4.38E+03			
Number of trips @ 10 HMPCs /trip				125	150	188	250	438			
HLW Facility Sizing											
Schedule	14 yrs										
Capacity MT/day	5										
Overall efficiency, %				~~36%~~	~~48%~~	~~66%~~	~~96%~~	~~187%~~			
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~3.00~~	4	~~6~~	~~8~~	~~16~~			
Required operating duration yrs (assuming 5 MT/day, 60% OE)				~~8.41~~	11	~~15~~	~~22~~	44			
Required operating duration (2 yrs start up)					13						
LAW											
15 wt. % sodium oxide loading											
Blending factor				1	1.25	1.5	2	3.5			
Mass of glass required to achieve 15% wo loading, MT				3.95E+05	4.94E+05	5.92E+05	7.90E+05	1.38E+06			
total frit required, MT				3.28E+05	4.27E+05	5.26E+05	7.23E+05	1.32E+06			
Glass formers											
Al2O3				1.54E+04	2.01E+04	2.47E+04	3.40E+04	6.18E+04			
				4.52E+04	5.88E+04	7.24E+04	9.96E+04	1.81E+05			
				2.68E+05	3.48E+05	4.29E+05	5.89E+05	1.07E+06			

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glass density (MT/m^3)	2.63										
t packing fraction	0.7										
ce volume (m^3)				2.15E+05	2.68E+05	3.22E+05	4.29E+05	7.51E+05	########		
Number of 5300 m^3 vaults				40	51	61	81	142			
LAW facility sizing											
Schedule, years	14										
Capacity MT/day	120										
Overall efficiency, %				~~64%~~	~~81%~~	~~97%~~	~~129%~~	~~225%~~			
Required capacity MT/day (assuming 15 yrs ops, 60% OE)				~~120~~	~~150~~	~~180~~	~~240~~	~~421~~			
Required operating duration yrs (assuming 120 MT/day, 60% OE)				15	~~19~~	~~23~~	~~30~~	~~53~~			
Operating duration (with 2 yrs start up)				17							

Combo 2 Rev 1 Combo 2 Sheet A.56
RDW 7-30-96

Assumptions:									
1. HLW glass waste oxide loading basis to be 20 wt% waste oxides (excluding Na2O and SiO2)									
2. Using the WHC engineering data package material balance calculate the waste oxide loading									
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading									
3. LAW glass sodium oxide loading basis is to be 15 wt%									
	Input Stream	Input		LAW			HLW		HLW fraction
	STREAM 1	converted to		407	437		314	344	
		oxides		FRIT	GLASS		FRIT	GLASS	
Volume kilo-liters									
Specific Gravity									
Cs and Ba, (MCi)	63.774				9.37E+00			5.44E+01	0.85311
Sr and Y, (MCi)	43.032				2.73E+00			4.03E+01	0.9365
Tc, (MCi)	0.0274				2.23E-02			5.09E-03	0.185790632
Am, (MCi)	0.0763				6.32E-03			7.00E-02	0.917148362
Np, (MCi)	0.0001				9.98E-06			9.00E-05	0.900193798
Pu-239, (MCi)	0.0076				4.81E-04			7.12E-03	0.936670459
Pu-240, (MCi)	0.0019				1.18E-04			1.78E-03	0.93815357
Pu-241,(MCi)	0.0189				3.74E-04			1.85E-02	0.980235043
Total TRU, (MCi)	0.1053				6.05E-03			9.92E-02	0.942507069
Total MCi	115.095				1.59E+00			1.14E+02	0.986148321
Total Mass Flow (MT)				1.91E+05			6.88E+03		
Total Cr, (MT)									0.215686275
Total Na, (MT)									0.031431269
Total Si, (MT)									
Total P, (MT)									0.167694205
Total NO2-, (MT)									
Total NO3-, (MT)									
AG+	5.05E-01								
AG2O		5.43E-01			1.04E-01			4.39E-01	0.807860262
AL+3	4.33E+02								
AL2O3		3.51E+03		8.98E+03	1.17E+04			7.66E+02	0.21815889
AL(OH)4-	5.02E+03								
AM+3									
AM2O3	0.02452	2.45E-02			2.03E-03			2.25E-02	0.917017438
AS+5	1.04E+00								
AS2O5		1.59E+00			9.66E-01			6.27E-01	0.393627955
B+3	9.68E-01								
B2O3		3.12E+00			4.47E-01		8.85E+02	8.88E+02	0.856898029
BA+2	2.89E+00								
BAO		3.23E+00			6.57E-01			2.57E+00	0.796582775
BE+2	6.61E-02								
BEO		1.84E-01			1.68E-01			1.60E-02	0.086886565
BI+3	2.05E+01								
BI2O3		2.29E+01			5.85E+00			1.70E+01	0.74439157
C14									
CA+2	3.21E+01								
CANCRINITE									
CAO		4.49E+01		2.63E+04	2.63E+04			4.05E+01	0.9018
CD+2	6.14E+00								
CDO		7.01E+00			1.46E+00			5.55E+00	0.791958042
CE+3	8.75E+01								
CE2O3		1.02E+02			1.03E+00			1.01E+02	0.989992467
CL-	2.62E+02								
CL2									
CO									
CO2									
CO3-2	1.88E+03								
CR+3	3.31E+01								
CR2O3		5.05E+01			3.97E+01			1.09E+01	0.215321681
CR(OH)4-	9.93E+01								
CS+									
CS2O		4.88E-01			3.46E-03			4.85E-01	0.992921033
CU+2	5.82E-01								
CUO		7.28E-01			1.39E-01			5.89E-01	0.808658009
CUSO4									
F-	1.22E+02								
F2									
FE+3	2.33E+02								

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FE2O3		3.33E+02			5.58E+00			3.28E+02	0.983260198
H2									
H2O									
H2S									
HG									
HG+2	1.35E-01								
I-									
I2									
K+	3.63E+02								
K2O		4.33E+02			4.49E+00			4.29E+02	0.989634266
KEROSENE									
LA+3	1.93E+01								
LA2O3		2.27E+01			2.35E-01			2.24E+01	0.989621048
LI+	2.46E-02								
LI2O		5.27E-02			2.17E-04		2.53E+02	2.53E+02	0.995883681
MG+2	9.33E+00								
MGO		7.10E+00			5.57E-01			6.54E+00	0.921568627
MNO2	7.37E+01	1.17E+02			1.09E+01			1.06E+02	0.90633131
MO+6	5.10E+00								
MOO3		7.64E+00			6.55E+00			1.10E+00	0.143360752
N2									
NA+	2.63E+04								
NA2O		3.55E+04			3.44E+04			1.12E+03	0.031418851
NH3									
NI+3	5.91E+01								
NI2FECN6	8.62E+01								
NI2O3		1.05E+02			4.00E+01			6.49E+01	0.618412275
NIO									0.999933925
NO									
NO2									
NO2-	4.57E+03								
NO3-	3.99E+04								
NP+4									
NPO2		1.34E-01			1.34E-02			1.21E-01	0.900360144
O2									
OH-	2.25E+03								
PB+4	4.79E+00								
PBO2		5.53E+00			2.07E+00			3.46E+00	0.626446281
PO4-3	1.32E+03								
P2O5		9.89E+02			8.23E+02			1.66E+02	0.167564655
P2O5:24W									
PU+4									
PUO2		1.50E-01			9.44E-03			1.40E-01	0.936895083
S									
SI+4									
SIO2	4.59E+02	4.59E+02		1.56E+05	1.56E+05		5.72E+03	6.18E+03	1
SO2									
SO4-2	1.06E+03								
SR+2	3.73E-01								
SRO		4.41E-01			4.07E-03			4.37E-01	0.990762125
TCO2									
TCO4-									
TC2O7		2.54E+00			2.07E+00			4.71E-01	0.185689949
TOC	1.10E+03								
UO2+2	1.69E+00								
UO3		8.67E+02			4.44E+01			8.23E+02	0.948755823
V+5									
V2O5									0.751121076
W+6	1.99E+00								
WO2									0.999934018
WO3		2.50E+00			2.50E+00			5.47E-03	0.002186697
ZN+2	3.26E+00								
ZNO		4.06E+00			3.20E+00			8.54E-01	0.210619469
ZR+4	2.72E+01								
ZRO2		3.67E+01			3.45E-02			3.67E+01	0.999060304
ZRO2:2H2									
Waste Oxides Total (MT)					3.81E+04			4.51E+03	
Waste Oxides Less Na & Si								2.94E+03	

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RDW - 7-30-96

HLW								
20 wt. % waste oxide loading								
Blending factor			1	**1.2**	1.5	2	3.5	
Mass of glass required			1.27E+04	**1.52E+04**	1.90E+04	2.53E+04	4.43E+04	
frit required MT			8.15E+03	**1.07E+04**	1.45E+04	2.08E+04	3.98E+04	
WOL (- Na2O, - SiO2)			23%	**20%**	15%	12%	7%	
WOL (with all tank wastes)			36%	**30%**	24%	18%	10%	
Glass Formers Required								
B2O3 (MT)			1.05E+03	**1.37E+03**	1.86E+03	2.68E+03	5.12E+03	
Li2O (MT)			3.00E+02	**3.93E+02**	5.33E+02	7.66E+02	1.46E+03	
SiO2 (MT)			6.77E+03	**8.87E+03**	1.20E+04	1.73E+04	3.31E+04	
glass density (MT/m^3)	2.63							
cullet packing fraction	0.7	(LAW only)						
Waste volume (m^3)			~~4.81E+03~~	**5.78E+03**	~~7.22E+03~~	~~9.63E+03~~	~~1.68E+04~~	
Canister Volume (m^3)	1.17							
Number of Canisters (2x)			~~4.11E+03~~	**4.94E+03**	~~6.17E+03~~	~~8.23E+03~~	~~1.44E+04~~	
Nu. of Canisters /HMPC	4							
Number of HMPCs			~~1.03E+03~~	**1.23E+03**	~~1.54E+03~~	~~2.06E+03~~	~~3.60E+03~~	
Number of trips @ 10 HMPCs /trip			~~103~~	**123**	~~154~~	~~206~~	~~360~~	
HLW Facility Sizing								
Schedule	14 yrs							
Capacity MT/day	**4.5**							
Overall efficiency, %			~~35%~~	~~46%~~	~~63%~~	~~90%~~	~~173%~~	
Required capacity MT/day (assuming 14 yrs ops, 60% OE)			~~2.66~~	~~3.48~~	~~4.72~~	~~6.79~~	~~12.98~~	
Required operating duration yrs (assuming 4.5 MT/day, 60% OE)			~~12.00~~	**11**	~~22.00~~	~~32.00~~	~~61.00~~	
Required Operating duration, yrs (including 2 yrs start up)				**13**	-			
LAW								
15 wt. % sodium oxide loading								
Blending factor			**1**	1.25	1.5	2	3.5	
Mass of glass required to achieve 15% wo loading, MT			**2.29E+05**	2.87E+05	3.44E+05	4.59E+05	8.03E+05	
total glass formers required, MT			**1.91E+05**	2.48E+05	3.06E+05	4.20E+05	7.64E+05	
glass density (MT/m^3)	2.63							
cullet packing fraction	0.7							
Glass formers (MT)								
Al2O3			**8.98E+03**	1.17E+04	1.44E+04	1.98E+04	3.59E+04	
CaO			**2.63E+04**	3.42E+04	4.21E+04	5.79E+04	1.05E+05	
SiO2			**1.56E+05**	2.02E+05	2.49E+05	3.43E+05	6.23E+05	
Waste volume (m^3)			**1.25E+05**	1.56E+05	1.87E+05	2.49E+05	4.36E+05	
Number of 5300 m^3 vaults			**24**	29	35	47	82	
LAW facility sizing								
Schedule, years	14							
Capacity MT/day	200							
Overall efficiency, %			~~22%~~	~~28%~~	~~34%~~	~~45%~~	~~79%~~	
Required capacity MT/day (assuming 15 yrs ops, 60% OE)			**70**	~~87~~	~~105~~	~~140~~	~~244~~	
Required operating duration yrs (assuming 70 MT/day, 60% OE)			**15**	~~18.70~~	~~22.44~~	~~29.92~~	~~52.35~~	
Operating duration (including 2 yrs start up)			**17**					

Combo 1
Ex Situ-In Situ Comb

Rev 1 7/4/96. Sheet A-59
AW 9-30-96

Assumptions:											
LW glass waste oxide loading basis to be ~ 20 wt% waste oxides with a 1.2 blending factor (excluding Na2O and SiO2)											
ing the WHC engineering data package material balance calculate the waste oxide loading											
. adjust mass of the glass produced to achieve a 20 wt % waste oxide loading											
3. LAW glass sodium oxide loading basis is to be 15 wt%											
	Input Stream			LAW			HLW			HLW fraction	
	STREAM 1	converted to		407	437		314	344			
		oxides		FRIT	GLASS		FRIT	GLASS			
Volume kilo-liters											
Specific Gravity											
Cs and Ba, (MCi)	6.66E+01				9.78E+00			5.68E+01		0.85311	
Sr and Y, (MCi)	8.29E+01				5.26E+00			7.76E+01		0.9365	
Tc, (MCi)	2.94E-02				2.39E-02			5.46E-03		0.185791	
Am, (MCi)	7.98E-02				6.61E-03			7.32E-02		0.917148	
Np, (MCi)	1.38E-04				1.38E-05			1.24E-04		0.900194	
Pu-239, (MCi)	1.66E-04				1.05E-05			1.55E-04		0.93667	
Pu-240, (MCi)	4.08E-03				2.52E-04			3.83E-03		0.938154	
Pu-241,(MCi)	4.67E-02				9.23E-04			4.58E-02		0.980235	
Total TRU, (MCi)	1.48E-01				8.51E-03			1.39E-01		0.942507	
Total MCi	1.50E+08				2.08E+06			1.48E+08		0.986148	
Total Mass Flow (MT)				3.28E+05			1.17E+04				
Total Cr, (MT)										0.215686	
Total Na, (MT)										0.031431	
Total Si, (MT)											
Total P, (MT)										0.167694	
Total NO2-, (MT)											
Total NO3-, (MT)											
AG+	0.50337										
AG2O		5.41E-01			1.04E-01			4.37E-01		0.80786	
AL+3	1681.486										
AL2O3		6.38E+03		1.54E+04	2.04E+04			1.39E+03		0.218159	
AL(OH)4-	5968.793										
+3											
O3										0.917017	
+5	1.0285										
AS2O5		1.58E+00			9.56E-01			6.21E-01		0.393628	
B+3	0.6485										
B2O3		2.09E+00			2.99E-01		1.51E+03	1.51E+03		0.856898	
BA+2	1.1804										
BAO		1.32E+00			2.68E-01			1.05E+00		0.796583	
BE+2	131.8917										
BEO		3.66E+02			3.35E+02			3.18E+01		0.086887	
BI+3	2.21859										
BI2O3		2.47E+00			6.32E-01			1.84E+00		0.744392	
C14											
CA+2	62.2086										
CANCRINITE											
CAO		8.71E+01		4.52E+04	4.52E+04			7.85E+01		0.9018	
CD+2	5.6576										
CDO		6.46E+00			1.34E+00			5.12E+00		0.791958	
CE+3	153.1929										
CE2O3		1.79E+02			1.80E+00			1.78E+02		0.989992	
CL-	260.9235										
CL2											
CO											
CO2											
CO3-2	2240.289										
CR+3	64.3875										
CR2O3		9.63E+01			7.56E+01			2.07E+01		0.215322	
CR(OH)4-	102.4395										
CS+											
CS2O								0.00E+00		0.992921	
CU+2	0.4759										
O		5.96E-01			1.14E-01			4.82E-01		0.808658	
O4											
	739.1503										

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F2											
3	509.9566				-						
3		7.29E+02			1.22E+01			7.17E+02		0.98326	
H20											
H2S											
HG											
HG+2	0.7113										
I-											
I2											
K+	353.4002										
K2O		4.21E+02			4.37E+00			4.17E+02		0.989634	
KEROSENE											
LA+3	3.1199										
LA2O3		3.66E+00			3.80E-02			3.62E+00		0.989621	
LI+	0.0243										
LI2O		5.21E-02			2.14E-04		4.31E+02	4.31E+02		0.995884	
MG+2	1.173										
MGO		8.92E-01			7.00E-02			8.22E-01		0.921569	
MNO2	105.73	1.67E+02			1.57E+01			1.52E+02		0.906331	
MO+6	5.0199										
MOO3		7.53E+00			6.45E+00			1.08E+00		0.143361	
N2											
NA+	45382.16										
NA2O		6.12E+04			5.92E+04			1.92E+03		0.031419	
NH3											
NI+3	137.5048										
NI2FECN6	223.597										
NI2O3		2.50E+02			9.54E+01			1.55E+02		0.618412	
NIO										0.999934	
NO											
NO2											
NO2-	6495.108										
	71426.9										
4											
O2										0.90036	
O2											
OH-	5131.203										
PB+4	3.0014										
PBO2		3.47E+00			1.29E+00			2.17E+00		0.626446	
PO4-3	2824.588										
P2O5		2.11E+03			1.76E+03			3.54E+02		0.167565	
P2O5:24W											
PU+4											
PUO2										0.936895	
S											
SI+4											
SIO2	890.9147	7.03E+02		2.67E+05	2.67E+05		9.72E+03	1.04E+04		1	
SO2											
SO4-2	1597.07										
SR+2	31.928										
SRO		3.77E+01			3.49E-01			3.74E+01		0.990762	
TCO2											
TCO4-											
TC2O7										0.18569	
TOC	931.291										
UO2+2	1.5866										
UO3		1.59E+03			8.13E+01			1.50E+03		0.948756	
V+5	0.0694										
V2O5		1.24E-01								0.751121	
W+6	11.328										
WO2										0.999934	
WO3		1.43E+01			1.43E+01			3.12E-02		0.002187	
ZN+2	2.9658										
2		3.69E+00			2.91E+00			7.77E-01		0.210619	
4	16.2216										
2		2.19E+01			2.06E-02			2.19E+01		0.99906	

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ZRO2:2H2							
…ste Oxides Total (MT)				6.66E+04			7.70E+03
Waste Oxides Less Na & Si							5.08E+03
HLW							
20 wt. % waste oxide loading							
Blending factor			1	1.2	1.5	2	3.5
Mass of glass required			2.19E+04	2.63E+04	3.28E+04	4.38E+04	7.66E+04
glass formers required MT			1.42E+04	1.86E+04	2.51E+04	3.61E+04	6.89E+04
WOL (- Na2O, - SiO2)			23%	20%	15%	12%	7%
WOL (with all tank wastes)			35%	29%	23%	18%	10%
Glass Formers Required							
B2O3 (MT)			1.83E+03	2.39E+03	3.23E+03	4.64E+03	8.87E+03
Li2O (MT)			5.22E+02	6.83E+02	9.25E+02	1.33E+03	2.54E+03
SiO2 (MT)			1.18E+04	1.54E+04	2.09E+04	3.00E+04	5.73E+04
glass density (MT/m^3)	2.63						
cullet packing fraction	0.7	(LAW only)					
Waste volume (m^3)			8.32E+03	9.99E+03	1.25E+04	1.66E+04	2.91E+04
Canister Volume (m^3)	1.17						
Number of Canisters (2x)			7.11E+03	8.54E+03	1.07E+04	1.42E+04	2.49E+04
Nu. of Canisters /HMP	4						
Number of HMPCs			1.78E+03	2.13E+03	2.67E+03	3.56E+03	6.22E+03
Number of trips @ 10 HMPCs /trip			178	213	267	356	622
HLW Facility Sizing							
Schedule	14 yrs						
Capacity MT/day	8						
Overall efficiency, %			~~35%~~	~~45%~~	~~61%~~	~~88%~~	~~169%~~
Required capacity MT/day (assuming 14 yrs ops, 60% OE)			~~4.63~~	6	~~8~~	~~12~~	~~22~~
Required operating duration yrs (assuming 8 MT/day, 60% OE)			~~12.95~~	11	~~23~~	~~33~~	~~63~~
Required operating duration (2 yrs start up)				13			
LAW							
15 wt. % sodium oxide loading							
Blending factor			1	1.25	1.5	2	3.5
Mass of glass required to achieve 15% wo loading, MT			3.95E+05	4.94E+05	5.92E+05	7.90E+05	1.38E+06
total frit required, MT			3.28E+05	4.27E+05	5.26E+05	7.23E+05	1.32E+06
Glass formers							
Al2O3			1.54E+04	2.01E+04	2.47E+04	3.40E+04	6.18E+04
			4.52E+04	5.88E+04	7.24E+04	9.96E+04	1.81E+05
			2.68E+05	3.48E+05	4.28E+05	5.89E+05	1.07E+06

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Ex Situ-In Situ Comb

glass density (MT/m^3)	2.63										
t packing fraction	0.7										
ste volume (m^3)				2.15E+05	2.68E+05	3.22E+05	4.29E+05	7.51E+05	########		
Number of 5300 m^3 vaults				40	51	61	81	142			
LAW facility sizing											
Schedule, years	14										
Capacity MT/day	120										
Overall efficiency, %				~~64%~~	~~81%~~	~~97%~~	~~129%~~	~~225%~~			
Required capacity MT/day (assuming 15 yrs ops, 60% OE)				~~120~~	~~150~~	~~180~~	~~240~~	~~421~~			
Required operating duration yrs (assuming 120 MT/day, 60% OE)				15	~~19~~	~~23~~	~~30~~	~~53~~			
Operating duration (with 2 yrs start up)				17							

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Sensitivity Analysis ADW 7-30-96

Assumptions:										
1. HLW glass waste oxide loading basis to be ~20 wt% waste oxides (excluding Na2O and SiO2) following a 1.2 blending factor										
2. Using the WHC engineering data package material balance calculate the waste oxide loading										
and adjust mass of the glass produced to achieve a 20 wt % waste oxide loading										
3. LAW glass sodium oxide loading basis is to be 15 wt%										
	Input Stream			LAW			HLW			HLW fraction
	STREAM 1			407	437		314	344		from Intermediat
	solids	liquids		FRIT	GLASS		FRIT	GLASS		Separations
Volume kilo-liters										
Specific Gravity										
Cs and Ba, (MCi)	5.28E+00	6.28E+01			1.00E+01			5.81E+01		0.853113984
Sr and Y, (MCi)	1.05E+02	2.10E+00			6.80E+00			1.00E+02		0.936507937
Tc, (MCi)	5.89E-03	2.61E-02			2.59E-02			5.91E-03		0.185790632
Am, (MCi)	9.51E-02	8.61E-03			8.60E-03			9.52E-02		0.917148362
Np, (MCi)	9.29E-05	1.03E-05			1.03E-05			9.29E-05		0.900193798
Pu-239, (MCi)	2.47E-02	1.67E-03			1.67E-03			2.47E-02		0.936670459
Pu-240, (MCi)	6.28E-03	4.14E-04			4.14E-04			6.28E-03		0.93815357
Pu-241,(MCi)	7.34E-02	1.49E-03			1.48E-03			7.34E-02		0.980235043
Total TRU, (MCi)	2.00E-01	1.22E-02			1.22E-02			2.00E-01		0.942507069
Total MCi	1.11E+02	6.49E+01			2.43E+00			1.73E+02		0.986148321
Total Mass Flow (MT)	1.94E+04	7.10E+05		2.81E+05	3.87E+05		1.36E+04	2.51E+04		
Total Cr, (MT)	1.32E+02	5.15E+01			1.44E+02			3.96E+01		0.215686275
Total Na, (MT)	1.24E+03	6.51E+04			7.18E+04			2.33E+03		0.031431269
Total Si, (MT)	5.24E+02	5.65E+00		1.07E+05	1.07E+05		5.29E+03	5.83E+03		
Total P, (MT)	7.80E+02	8.42E+02			1.35E+03			2.72E+02		0.167694205
Total NO2-, (MT)	7.38E+01	9.54E+03								
Total NO3-, (MT)	1.03E+03	1.06E+05								
AG+	1.38E+00	3.28E-01								
AG2O					3.52E-01			1.48E+00		0.807860262
AL+3	2.37E+03									
AL2O3				1.32E+04	1.94E+04			1.73E+03		0.21815889
AL(OH)4-		4.83E+03								
AM+3	2.77E-02	2.51E-03								
AM2O3					2.76E-03			3.05E-02		0.917017438
AS+5	4.98E-01	7.70E-01								
AS2O5					1.18E+00			7.66E-01		0.393627955
B+3	9.94E-01	5.19E-01								
B2O3					1.67E+00		1.75E+03	1.76E+03		0.856898029
BA+2	3.09E+00	7.91E-01								
BAO					8.81E-01			3.45E+00		0.796582775
BE+2	7.61E-03	8.19E-02								
BEO					2.27E-01			2.16E-02		0.086886565
BI+3	1.96E+02	6.76E+01								
BI2O3					7.52E+01			2.19E+02		0.74439157
CI4	4.53E-04	7.43E-04								
CA+2	1.33E+02	1.67E+01								
CANCRINITE	2.70E+03									
CAO				3.87E+04	3.87E+04			1.89E+02		
CD+2	7.93E+00	2.09E+00								
CDO					2.38E+00			9.06E+00		0.791958042
CE+3	2.35E+02	2.37E+00								
CE2O3					2.79E+00			2.76E+02		0.989992467
CL-	3.49E+00	3.11E+02								
CL2										
CO										
CO2										
CO3-2	2.25E+02	3.37E+03								
CR+3	1.32E+02									
CR2O3					2.11E+02			5.79E+01		0.215321681
CR(OH)4-		1.19E+02								
CS+	9.25E-02	8.19E-01								
CS2O					6.83E-03			9.58E-01		0.992921033
CU+2	7.46E-01	1.77E-01								
CUO					2.21E-01			9.34E-01		0.808658009
CUSO4										
F-	5.97E+01	1.12E+03								
F2										
FE+3	7.63E+02	1.44E+01								
FE2O3					2.06E+01			1.21E+03		0.983260198
H2										
H20		5.07E+05								
H2S										

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HG										
HG+2	9.00E-03	9.49E-01								
I-	2.02E+01	5.46E+02								
I2										
K+	2.10E+01	2.19E-01								
K2O					2.65E-01			2.53E+01		0.989634266
KEROSENE										
LA+3	2.10E+01	2.19E-01								
LA2O3					2.58E-01			2.46E+01		0.989621048
LI+	2.46E-02	5.77E-03								
LI2O					1.24E-02		5.00E+02	5.03E+02		0.995883681
MG+2	1.10E+01	9.65E-01								
MGO					1.60E+00			1.88E+01		0.921568627
MNO2	2.09E+02	2.17E+01			2.16E+01			2.09E+02		0.90633131
MO+6	8.01E-01	4.87E+00								
MOO3					7.29E+00			1.22E+00		0.143360752
N2										
NA+	7.77E+02	6.51E+04								
NA2O					9.68E+04			3.14E+03		0.031418851
NH3										
NI+3	6.57E+00	4.07E+00								
NI2FECN6	5.00E+02									
NI2O3					5.72E+00			9.27E+00		0.618412275
NIO					1.50E-02			2.27E+02		0.999933925
NO										
NO2										
NO2-	7.38E+01	9.54E+03								
NO3-	1.03E+03	1.06E+05								
NP+4	1.32E-01	1.46E-02								
NPO2					1.66E-02			1.50E-01		0.900360144
O2										
OH-	5.00E+03	6.44E+03								
PB+4	3.28E+00	1.96E+00								
PBO2					2.26E+00			3.79E+00		0.626446281
PO4-3	2.39E+03	2.58E+03								
P2O5					3.09E+03			6.22E+02		0.167564655
P2O5:24W	5.21E-01									
PU+4	4.27E-01	2.88E-02								
PUO2					3.26E-02			4.84E-01		0.936895083
S										
SI+4	7.90E+01	5.65E+00								
SIO2				2.29E+05	2.29E+05		1.13E+04	1.25E+04		1
SO2										
SO4-2	3.97E+01	2.01E+03								
SR+2	3.64E+01	3.75E-01								
SRO					4.00E-01			4.29E+01		0.990762125
TCO2										
TCO4-	5.68E-01	2.52E+00								
TC2O7					2.39E+00			5.45E-01		0.185689949
TOC	1.16E+02	1.42E+03								
UO2+2	1.58E+03	8.52E+01								
UO3					9.02E+01			1.67E+03		0.948755823
V+5	1.88E-01	6.20E-02								
V2O5					1.11E-01			3.35E-01		0.751121076
W+6		7.47E-01								
WO2					2.91E-05			4.41E-01		0.999934018
WO3					9.40E-01			2.06E-03		0.002186697
ZN+2	9.45E-01	3.59E+00								
ZNO					4.46E+00			1.19E+00		0.210619469
ZR+4	2.77E+02	4.48E-01								
ZRO2					6.49E-01			6.90E+02		0.999060304
ZRO2:2H2	4.09E+02	2.15E+01								
WHC Data Package Basis:										
Mass LAW waste oxides					106544.7302					
LAW waste loading (waste oxide)					28%					
LAW waste loading (sodium oxide)					25%					
Mass HLW waste oxides								7.26E+03		
HLW waste loading (waste oxides)										
HLW WOL (- Na2O, - SiO2)								29%		
HLW WOL (all tank waste)								46%		
HLW										

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20 wt. % waste oxide loading										
Blending factor				1	1.2	1.5	2	3.5		
Mass of glass required for 12,200 "long" can @ 1.2 Blend , MT				31287.18603	37544.62324	46930.77905	62574.37207	109505.1511		
additional frit required (equals increased glass) MT				6.19E+03	1.24E+04	2.18E+04	3.75E+04	8.44E+04		
total frit required, MT				1.98E+04	2.60E+04	3.54E+04	5.11E+04	9.80E+04		
WOL (- Na2O, - SiO2)				23%	20%	15%	12%	7%		
WOL (with all tank wastes)				37%	31%	25%	18%	11%		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7	(LAW only)								
Waste volume (m^3)				1.19E+04	1.43E+04	1.78E+04	2.38E+04	4.16E+04		
Canister Volume (m^3)	1.17									
Number of Canisters (2x)				1.02E+04	1.22E+04	1.53E+04	2.03E+04	3.56E+04		
Nu. of Canisters /HMPC	4									
Number of HMPCs				2.54E+03	3.05E+03	3.81E+03	5.08E+03	8.90E+03		
Number of trips @ 10 HMPCs /trip				254	305	381	508	890		
HLW Facility Sizing										
Schedule	14 yrs									
Capacity MT/day	20									
Overall efficiency, %				~~31%~~	37%	~~46%~~	~~61%~~	~~107%~~		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~10.20~~	12.25	~~15.31~~	~~20.41~~	~~35.72~~		
Required operating duration yrs (assuming 20 MT/day, 60% OE)					9	~~10.71~~	~~14.29~~	~~25.00~~		
Required operating duration, yrs, including 2 yrs. start up					11					
15 wt % waste oxide loading										
Mass of glass required to achieve 15% wo loading MT				4.84E+04	5.81E+04	7.26E+04	9.68E+04	1.69E+05		
Volume (m^3)				1.84E+04	2.21E+04	2.76E+04	3.68E+04	6.44E+04		
Number of Canisters (1x)	2x	1.17		1.57E+04	1.89E+04	2.36E+04	3.15E+04	5.50E+04		
Additional Glass Formers Req, MT				2.33E+04	3.30E+04	4.75E+04	7.17E+04	1.44E+05		
Total Glass Formers, MT				3.69E+04	4.66E+04	6.11E+04	8.53E+04	1.58E+05		
40 wt % waste oxide loading										
Mass of glass required to achieve 40% wo loading MT				1.81E+04	2.18E+04	2.72E+04	3.63E+04	6.35E+04		
Volume (m^3)				6.90E+03	8.28E+03	1.03E+04	1.38E+04	2.41E+04		
Number of Canisters (1x)	2x			5.90E+03	7.08E+03	8.85E+03	1.18E+04	2.06E+04		
Additional Glass Formers Req, MT				-6.95E+03	-3.32E+03	2.12E+03	1.12E+04	3.84E+04		
Total Glass Formers Req, MT				6.65E+03	1.03E+04	1.57E+04	2.48E+04	5.20E+04		
LAW										
15 wt. % sodium oxide loading										
Blending factor				1	1.25	1.5	2	3.5		
Mass of glass required to achieve 15% wo loading, MT				6.45E+05	8.07E+05	9.68E+05	1.29E+06	2.26E+06		
additional frit required (equals increased glass) MT				2.58E+05	4.20E+05	5.81E+05	9.04E+05	1.87E+06		
total frit required, MT				5.39E+05	7.01E+05	8.62E+05	1.18E+06	2.15E+06		
glass density (MT/m^3)	2.63									
cullet packing fraction	0.7									
Waste volume (m^3)				3.51E+05	3.81E+05	4.68E+05	6.43E+05	1.17E+06		
Number of 5300 m^3 vaults				66	72	88	121	221		
LAW facility sizing										
Schedule, years	14									
Capacity MT/day	200									
Overall efficiency, %				~~63%~~	~~79%~~	~~95%~~	~~126%~~	~~221%~~		
Required capacity MT/day (assuming 14 yrs ops, 60% OE)				~~210.48~~	~~263.10~~	~~315.72~~	~~420.96~~	~~736.68~~		
Required operating duration yrs (assuming 200 MT/day, 60% OE)				15	~~18.42~~	~~22.10~~	~~29.47~~	~~51.57~~		

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Required operating duration, yrs (with 2 yrs start up)				17						
10 wt. % sodium oxide loading										
Blending factor				1	1.25		2	3.5		
Mass of glass required to achieve 10				9.68E+05	1.21E+06		1.94E+06	3.39E+06		
Additional Glass Formers , MT				5.81E+05	8.23E+05		1.55E+06	3.00E+06		
Total Glass Formers, MT				8.62E+05	1.10E+06		1.83E+06	3.28E+06		
Waste volume, m^3				5.26E+05	6.57E+05		1.05E+06	1.84E+06		
Number of 5,300 m^3 vaults				99	124		198	347		
25 wt. % sodium oxide loading										
Blending factor				1	1.25		2	3.5		
Mass of glass required to achive 25 wt % Na2O				3.87E+05	4.84E+05		7.74E+05	1.36E+06		
Additional Glass Formers, MT				0.00E+00	9.70E+04		3.87E+05	9.68E+05		
Total Glass Formers, MT				2.81E+05	3.78E+05		6.68E+05	1.25E+06		
Waste Volume				210320.478	262900.5975		420640.956	736121.673		
Number of 5,300 m^3 vaults				40	50		79	139		

Resou[illegible]ummary

59%		NO ACTION		MINIMAL RETRIEVAL			MINIMAL RETRIEVAL		[illegible]TIVE RETRIEVAL
RESOURCE	PHASE		IN SITU VIT	CLOSE	TOTAL	FILL AND CAP	CLOSE	TOTAL	
LAND,	TOTAL	5.02E+05		2.50E+05	2.50E+05		2.50E+05	2.50E+05	3.71E+05
PERMANENTLY	CONST/OPR	1.88E+05	~~2.10E+05~~			~~2.60E+05~~			3.71E+05
COMMITTED		3.14E+05							
(SQUARE	CLOSURE								
METERS)	TANK STAB								
	BARRIER			2.50E+05			2.50E+05		
LAND,	TOTAL	5.57E+05	6.37E+05	2.00E+05	8.37E+05	2.61E+05	2.00E+05	4.61E+05	1.05E+06
TEMPORARILY	CONST/OPR	3.60E+05	4.40E+05			1.00E+04			8.32E+05
COMMITTED	CLOSURE								
(SQUARE	TANK STAB								
METERS)	BARRIER			2.00E+05			2.00E+05		2.20E+05
	PIT 30 (BORROW)	1.97E+05	1.97E+05			2.51E+05			
	TOTAL			4.77E+05			4.77E+05		6.45E+05
3.00E+00	McGEE (EST)			1.26E+05			1.26E+05		1.46E+05
3.00E+00	PIT 30 (EST)			1.38E+05			1.38E+05		2.64E+05
3.00E+00	VERNITA (EST			2.13E+05			2.13E+05		2.35E+05
WATER (CM)	TOTAL	1.52E+06	1.71E+08	3.80E+04	1.71E+08	2.39E+06	4.13E+04	2.43E+06	1.35E+07
SANITARY	CONSTRUCTION		1.70E+08			5.90E+05			4.19E+05
(CM)	OPERATION		1.20E+06			1.80E+06			2.08E+06
	CLOSURE								
	TANK STAB								
	BARRIER			3.80E+04			3.80E+04		4.56E+04
	ANC EQUIP						3.30E+03		3.30E+03
RAW	CONSTRUCTION	1.70E+04							~~5.50E+06~~
(CM)	OPERATION	1.50E+06							5.50E+06
ENERGY,	TOTAL	1.10E+03	4.46E+03		4.46E+03	1.80E+00		1.80E+00	4.54E+03
ELECTRICAL	CONSTRUCTION	4.40E-01	5.60E+01			1.80E+00			3.80E+01
(GWh)	OPERATION	1.10E+03	4.40E+03			0.00E+00			4.50E+03
	CLOSURE								
GASOLINE (CM)	TOTAL	8.60E+04	1.50E+04	3.00E+02	1.53E+04	9.70E+01	3.01E+02	3.98E+02	4.98E+03
	CONSTRUCTION	8.60E+04	1.50E+04			9.70E+01			4.65E+03

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59%		NO		MINIMAL			MINIMAL			TIVE
		ACTION		RETRIEVAL			RETRIEVAL			RETRIEVAL
				---	---	---	---	---	---	
RESOURCE	PHASE		IN SITU	CLOSE	TOTAL	FILL AND	CLOSE	TOTAL		
			VIT			CAP				
	OPERATION									
	CLOSURE									
	TANK STAB			4.01E+01			4.01E+01			4.01E+01
	BARRIER			2.60E+02			2.60E+02			2.96E+02
	ANC EQUIP						1.20E+00			1.20E+00
---		---	---	---	---	---	---	---		
PROPANE (CM)	CONSTRUCTION	7.50E+03	1.10E+04		1.10E+04					6.00E+02
---	---	---	---	---	---	---	---	---		
DIESEL (CM)	TOTAL	8.50E+04	2.61E+04	4.50E+04	7.11E+04	7.40E+03	5.22E+04	5.96E+04		7.55E+04
	CONSTRUCTION	6.30E+04	2.00E+04			1.30E+03				1.35E+04
	OPERATION	2.20E+04	6.10E+03			6.10E+03				4.17E+03
	CLOSURE									
	TANK STAB						6.38E+03			6.38E+03
	BARRIER			4.50E+04			4.50E+04			5.06E+04
	ANC EQUIP						8.02E+02			8.02E+02
---	---	---	---	---	---	---	---	---		
KEROSENE (CM)	OPERATION									2.90E+04
---	---	---	---	---	---	---	---	---		
MATERIALS	TOTAL	3.50E+05	1.30E+05		1.30E+05		1.90E+04	1.90E+04		3.74E+05
CONCRETE	CONSTRUCTION	3.50E+05	1.30E+05							2.70E+05
(CM)	OPERATION									
	LLW VAULTS									8.00E+04
	HLW CONTAINERS									5.00E+03
	CLOSURE									
	TANK STAB						5.30E+03			5.30E+03
	BARRIER									
	ANC EQUIP						1.37E+04			1.37E+04
---	---	---	---	---	---	---	---	---		
CARBON	TOTAL	1.30E+04	2.60E+05		2.60E+05					8.21E+04
STEEL	CONSTRUCTION	1.30E+04	2.60E+05							5.35E+04
(MT)	OPERATION									
	LLW VAULTS									9.50E+03
	HLW CONTAINERS									1.15E+02
	CLOSURE									
---	---	---	---	---	---	---	---	---		
STAINLESS	TOTAL	2.20E+01								9.50E+03
STEEL,	CONSTRUCTION	2.20E+01								9.50E+03
(MT)	OPERATION									
	CLOSURE									

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BCW 6-30-96

59%		NO		MINIMAL			MINIMAL		[illegible]TIVE
		ACTION		RETRIEVAL			RETRIEVAL		RETRIEVAL
			---	---	---	---	---	---	
RESOURCE	PHASE		IN SITU VIT	CLOSE	TOTAL	FILL AND CAP	CLOSE	TOTAL	
---	---	---	---	---	---	---	---	---	
HASTELLOY/	TOTAL								1.15E+03
INCONEL	CONSTRUCTION								1.15E+03
(MT)	OPERATION								
	CLOSURE								
---	---	---	---	---	---	---	---	---	
FLUX (MT)	TOTAL		1.10E+04		1.10E+04				1.47E+05
ALUMINA	OPERATION								6.50E+03
BORAX	OPERATION								9.00E+02
BULK FRIT	OPERATION								2.60E+01
CALCIUM OXIDE	OPERATION								1.95E+04
FERRIC OXIDE	OPERATION								
LIMESTONE	OPERATION		1.10E+04						
LITHIUM OXIDE	OPERATION								2.50E+02
MAG OXIDE	OPERATION								
SILICA	OPERATION								1.20E+05
---	---	---	---	---	---	---	---	---	
CHEMICALS (MT)	TOTAL		6.80E+03		6.80E+03				9.55E+04
ALUMINUM NITRATE	OPERATION								5.60E+01
AMMONIA	OPERATION		6.80E+03						4.40E+03
ANTIFOAM	OPERATION								
APM	OPERATION								
CMPO	OPERATION								2.50E+00
CPD	OPERATION								
CROWN ETHER	OPERATION								
DCPD	OPERATION								
DECON CHEM	OPERATION								2.65E+03
DICYCLOP	OPERATION								1.70E+03
FLOC	OPERATION								4.25E+01
FORMIC ACID	OPERATION								
FSA	OPERATION								2.36E+03
GLYCOLIC ACID	OPERATION								1.75E+03
HF	OPERATION								
HNO3, 50%	OPERATION								2.10E+03
HYDROXYLAMINE	OPERATION								
NAOH, 50%	OPERATION								1.30E+04
Na3 DTPA	OPERATION								
NPH	OPERATION								3.52E+02
OLIGOMER (MT)	OPERATION								1.70E+03

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59%		NO		MINIMAL			MINIMAL			TIVE	
		ACTION		RETRIEVAL			RETRIEVAL			RETRIEVAL	
				---	---	---	---	---	---		
RESOURCE	PHASE			IN SITU	CLOSE	TOTAL	FILL AND	CLOSE	TOTAL		
				VIT			CAP				
OXOLIC ACID	OPERATION										
OXYGEN	OPERATION										
PEROXIDE	OPERATION										
POTASSIUM PERMANGANAT	OPERATION										
SODIUM BICARB	OPERATION										
SODIUM CARBONATE	OPERATION										
SODIUM NITRATE	OPERATION									2.70E+01	
SODIUM OXALATE	OPERATION										
SULFUR (MT)	OPERATION									6.50E+04	
TBP	OPERATION									3.78E+02	
TSP	OPERATION										
ZINC NITRATE	OPERATION										
---	---	---	---	---	---	---	---	---	---		
IX RESIN (CM)	OPERATION								0.00E+00	1.10E+02	
---	---	---	---	---	---	---	---	---	---		
EXCAVATION	TOTAL	2.70E+06		1.18E+06		1.18E+06	6.90E+05		6.90E+05	1.26E+06	
(CM)	CONSTRUCTION	2.70E+06					6.90E+05			1.26E+06	
	OPERATION										
	CLOSURE										
---	---	---	---	---	---	---	---	---	---		
BACKFILL	TOTAL	2.60E+06								6.00E+05	
(CM)	CONSTRUCTION	2.60E+06								6.00E+05	
	OPERATION										
	CLOSURE										
---	---	---	---	---	---	---	---	---	---		
SILT (CM)	CLOSURE				3.77E+05	3.77E+05		3.77E+05	3.77E+05	4.37E+05	
McGEE RANCH	BARRIER				3.77E+05			3.77E+05		4.37E+05	
---	---	---	---	---	---	---	---	---	---		
SAND/	CONSTRUCTION										
GRAVEL (CM)	CLOSURE			5.90E+05	4.15E+05	1.60E+06		1.17E+06	1.17E+06	1.25E+06	
PIT 30	TANK STAB	5.90E+05		5.90E+05				7.54E+05		7.54E+05	
	BARRIER				4.15E+05			4.15E+05		4.91E+05	
---	---	---	---	---	---	---	---	---	---		
RIPRAP (CM)	CLOSURE				6.38E+05	6.38E+05		6.38E+05	6.38E+05	7.05E+05	
VERNITA RANCH	BARRIER				6.38E+05			6.38E+05		7.05E+05	
---	---	---	---	---	---	---	---	---	---		
ASPHALT (CM)	BARRIER				6.25E+04	6.25E+04		6.25E+04	6.25E+04	6.98E+04	
---	---	---	---	---	---	---	---	---	---		
PERSONNEL	TOTAL	1.08E+05		4.90E+04	9.30E+02	4.99E+04	2.50E+03	1.07E+03	3.57E+03	5.75E+04	

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59%			NO			MINIMAL			MINIMAL		TIVE
			ACTION			RETRIEVAL			RETRIEVAL		RETRIEVAL
					---	---	---	---	---	---	
RESOURCE		PHASE			IN SITU	CLOSE	TOTAL	FILL AND	CLOSE	TOTAL	
					VIT			CAP			
(MAN YEARS		CONSTRUCTION		3.75E+03	2.20E+04			2.50E+03			2.59E+04
@ 2,000 HR		OPERATION		1.04E+05	2.70E+04						2.80E+04
PER YEAR)		CLOSURE									
		TANK STAB							1.40E+02		1.31E+02
		BARRIER				3.30E+02			3.30E+02		2.69E+03
		D&D									
		M&M (HR/YR)				6.00E+02			6.00E+02		7.38E+02
---		---		---	---	---	---	---	---	---	---
SCHEDULE		STAR RD			1995			2000			
		END RD			2002			2002			
		STAR CONST		2037	1998	2.01E+03		2003	2.01E+03		
		END CONST		2042	2016	2.02E+03		2005	2.02E+03		
		STAR CONST		2087		2.03E+03			2.03E+03		
		END CONST		2092		2.03E+03			2.03E+03		
		START OP		2033	2005			2005			
		END OP		2037	2016			2018			
		START OP		2083							
		END OP		2087							
		START DD			2013			2018			
		END DD			2016			2021			
		START MM			2024	2.02E+03		2024	2.02E+03		
		END MM			2124	2.13E+03		2124	2.13E+03		
		START SHIP HLW									
		END SHIP									

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X (5) INT. Sep.

Resor[illegible]ummary

(6) X

59%		EXTENSIVE				EXTENSIVE			
		RETRIEVAL				RETRIEVAL			
		---	---	---	---	---	---	---	---
		WR&T	VIT	CLOSE	TOTAL	WR&T	VIT	CLOSE	TOTAL
RESOURCE	PHASE								
		EX SITU	EX SITU		EX SITU	NO SEP	NO SEP		NO SEP
		VIT	VIT		VIT	SUB ALT	SUB ALT		SUB ALT
==========	==========	=======	=======	=======	=======	=======	=======	=======	=======
LAND,	TOTAL	4.00E+03	7.90E+04	3.30E+05	4.13E+05	4.00E+03	1.00E+04	2.50E+05	2.64E+05
PERMANENTLY	CONST/OPR	4.00E+03	7.90E+04			4.00E+03	1.00E+04		
COMMITTED									
(SQUARE	CLOSURE								
METERS)	TANK STAB								
	BARRIER			3.30E+05				2.50E+05	
---	---	---	---	---	---	---	---	---	---
LAND,	TOTAL	3.20E+04	8.10E+05	2.40E+05	1.08E+06	3.20E+04	6.00E+05	2.00E+05	8.32E+05
TEMPORARILY	CONST/OPR	3.20E+04	8.10E+05			3.20E+04	6.00E+05		
COMMITTED	CLOSURE								
(SQUARE	TANK STAB								
METERS)	BARRIER			2.40E+05				2.00E+05	
	PIT 30 (BORROW)								
---	---	---	---	---	---	---	---	---	---
	TOTAL			8.97E+05				7.28E+05	
3.00E+00	McGEE (EST)			1.75E+05				1.26E+05	
3.00E+00	PIT 30 (EST)			4.53E+05				3.90E+05	
3.00E+00	VERNITA (EST			2.68E+05				2.13E+05	
---	---	---	---	---	---	---	---	---	---
WATER (CM)	TOTAL	2.01E+06	1.26E+07	6.03E+04	1.47E+07	2.01E+06	7.52E+05	4.13E+04	2.80E+06
---	---	---	---	---	---	---	---	---	---
SANITARY	CONSTRUCTION	9.40E+03	4.90E+05			9.40E+03	2.30E+05		
(CM)	OPERATION	2.00E+06	1.10E+06			2.00E+06	6.03E+04		
	CLOSURE								
	TANK STAB								
	BARRIER			5.70E+04				3.80E+04	
	ANC EQUIP			3.30E+03				3.30E+03	
---	---	---	---	---	---	---	---	---	---
RAW	CONSTRUCTION								
(CM)	OPERATION		1.10E+07				4.62E+05		
---	---	---	---	---	---	---	---	---	---
ENERGY,	TOTAL	1.36E+00	9.07E+03		9.07E+03	1.36E+00	4.72E+03		4.72E+03
ELECTRICAL	CONSTRUCTION	7.60E-01	7.30E+01			7.60E-01	3.00E+01		
(GWh)	OPERATION	6.00E-01	9.00E+03			6.00E-01	4.69E+03		
	CLOSURE								
---	---	---	---	---	---	---	---	---	---
GASOLINE (CM)	TOTAL	3.30E+02	7.30E+03	3.91E+02	8.02E+03	3.30E+02	4.80E+03	3.01E+02	5.43E+03
	CONSTRUCTION	3.30E+02	7.30E+03			3.30E+02	4.80E+03		

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59%		EXTENSIVE RETRIEVAL				EXTENSIVE RETRIEVAL			
		---	---	---	---	---	---	---	---
		WR&T	VIT	CLOSE	TOTAL	WR&T	VIT	CLOSE	TOTAL
RESOURCE	PHASE								
		EX SITU VIT	EX SITU VIT		EX SITU VIT	NO SEP SUB ALT	NO SEP SUB ALT		NO SEP SUB ALT
	OPERATION								
	CLOSURE								
	TANK STAB			4.01E+01				4.01E+01	
	BARRIER			3.50E+02				2.60E+02	
	ANC EQUIP			1.20E+00				1.20E+00	
---		---	---	---	---	---	---	---	---
PROPANE (CM)	CONSTRUCTION	1.20E+03			1.20E+03	1.20E+03			1.20E+03
---	---	---	---	---	---	---	---	---	---
DIESEL (CM)	TOTAL	2.02E+03	2.00E+04	6.62E+04	8.82E+04	2.02E+03	1.09E+04	5.22E+04	6.51E+04
	CONSTRUCTION	1.00E+03	2.00E+04			1.00E+03	1.09E+04		
	OPERATION	1.02E+03				1.02E+03			
	CLOSURE								
	TANK STAB			6.38E+03				6.38E+03	
	BARRIER			5.90E+04				4.50E+04	
	ANC EQUIP			8.02E+02				8.02E+02	
---	---	---	---	---	---	---	---	---	---
KEROSENE (CM)	OPERATION		5.80E+04		5.80E+04		5.64E+04		5.64E+04
---	---	---	---	---	---	---	---	---	---
MATERIALS	TOTAL	5.90E+04	6.50E+05	1.90E+04	7.28E+05	5.90E+04	2.25E+06	1.90E+04	2.33E+06
CONCRETE	CONSTRUCTION	5.90E+04	4.80E+05			5.90E+04	2.07E+05		
(CM)	OPERATION						2.04E+06		
	LLW VAULTS		1.60E+05						
	HLW CONTAINERS		1.00E+04						
	CLOSURE								
	TANK STAB			5.30E+03				5.30E+03	
	BARRIER								
	ANC EQUIP			1.37E+04				1.37E+04	
---	---	---	---	---	---	---	---	---	---
CARBON	TOTAL	1.80E+04	1.46E+05		1.64E+05	1.80E+04	2.14E+05		2.32E+05
STEEL	CONSTRUCTION	1.00E+04	9.70E+04			1.00E+04	5.12E+04		
(MT)	OPERATION						1.46E+05		
	LLW VAULTS		1.90E+04						
	HLW CONTAINERS		2.30E+02						
	CLOSURE								
---	---	---	---	---	---	---	---	---	---
STAINLESS	TOTAL	4.00E+03	1.50E+04		1.90E+04	4.00E+03	8.61E+03		1.26E+04
STEEL,	CONSTRUCTION	4.00E+03	1.50E+04			4.00E+03	8.61E+03		
(MT)	OPERATION								
	CLOSURE								

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RPW 7-30-96

59%		EXTENSIVE RETRIEVAL				EXTENSIVE RETRIEVAL			
RESOURCE	PHASE	WR&T	VIT	CLOSE	TOTAL	WR&T	VIT	CLOSE	TOTAL
		EX SITU VIT	EX SITU VIT		EX SITU VIT	NO SEP SUB ALT	NO SEP SUB ALT		NO SEP SUB ALT
HASTELLOY/	TOTAL		2.30E+03		2.30E+03		1.51E+03		1.51E+03
INCONEL	CONSTRUCTION		2.30E+03				1.51E+03		
(MT)	OPERATION								
	CLOSURE								
FLUX (MT)	TOTAL		2.94E+05		2.94E+05		2.50E+05		2.50E+05
ALUMINA	OPERATION		1.30E+04				1.00E+04		
BORAX	OPERATION		1.80E+03				0		
BULK FRIT	OPERATION		5.20E+01				0		
CALCIUM OXIDE	OPERATION		3.90E+04				3.55E+04		
FERRIC OXIDE	OPERATION								
LIMESTONE	OPERATION								
LITHIUM OXIDE	OPERATION		5.00E+02				0		
MAG OXIDE	OPERATION						0		
SILICA	OPERATION		2.40E+05				2.04E+05		
CHEMICALS (MT)	TOTAL		1.91E+05		1.91E+05		1.95E+05		1.95E+05
ALUMINUM NITRATE	OPERATION		1.12E+02						
AMMONIA	OPERATION		8.80E+03				6.98E+03		
ANTIFOAM	OPERATION						0		
APM	OPERATION								
CMPO	OPERATION		5.00E+00						
CPD	OPERATION								
CROWN ETHER	OPERATION								
DCPD	OPERATION								
DECON CHEM	OPERATION		5.30E+03						
DICYCLOP	OPERATION		3.40E+03				0.00E+00		
FLOC	OPERATION		8.50E+01				0.00E+00		
FORMIC ACID	OPERATION								
FSA	OPERATION		4.72E+03						
GLYCOLIC ACID	OPERATION		3.50E+03				0.00E+00		
HF	OPERATION								
HNO3, 50%	OPERATION		4.20E+03				6.30E+02		
HYDROXYLAMINE	OPERATION								
NAOH, 50%	OPERATION		2.60E+04				2.66E+02		
Na3 DTPA	OPERATION								
NPH	OPERATION		7.03E+02						
OLIGOMER (MT)	OPERATION		3.40E+03				0.00E+00		

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59%		EXTENSIVE RETRIEVAL				EXTENSIVE RETRIEVAL			
		---	---	---	---	---	---	---	---
		WR&T	VIT	CLOSE	TOTAL	WR&T	VIT	CLOSE	TOTAL
RESOURCE	PHASE								
		EX SITU VIT	EX SITU VIT		EX SITU VIT	NO SEP SUB ALT	NO SEP SUB ALT		NO SEP SUB ALT
OXOLIC ACID	OPERATION						3.20E+01		
OXYGEN	OPERATION						1.85E+05		
PEROXIDE	OPERATION								
POTASSIUM PERMANGANAT	OPERATION						1.70E+01		
SODIUM BICARB	OPERATION								
SODIUM CARBONATE	OPERATION								
SODIUM NITRATE	OPERATION		5.40E+01				0.00E+00		
SODIUM OXALATE	OPERATION								
SULFUR (MT)	OPERATION		1.30E+05				0		
TBP	OPERATION		7.55E+02						
TSP	OPERATION						1.90E+03		
ZINC NITRATE	OPERATION								
---	---	---	---	---	---	---	---	---	---
IX RESIN (CM)	OPERATION		2.20E+02		2.20E+02		0.00E+00		0.00E+00
---	---	---	---	---	---	---	---	---	---
EXCAVATION	TOTAL		1.70E+06		1.70E+06		7.77E+05		7.77E+05
(CM)	CONSTRUCTION		1.70E+06				7.77E+05		
	OPERATION								
	CLOSURE								
---	---	---	---	---	---	---	---	---	---
BACKFILL	TOTAL		1.20E+06		1.20E+06		5.73E+05		5.73E+05
(CM)	CONSTRUCTION		1.20E+06				5.73E+05		
	OPERATION								
	CLOSURE								
---	---	---	---	---	---	---	---	---	---
SILT (CM)	CLOSURE			5.26E+05	5.26E+05			3.77E+05	3.77E+05
McGEE RANCH	BARRIER			5.26E+05				3.77E+05	
---	---	---	---	---	---	---	---	---	---
SAND/	CONSTRUCTION			3.17E+05					
GRAVEL (CM)	CLOSURE			1.36E+06	1.36E+06			1.17E+06	1.17E+06
PIT 30	TANK STAB			7.54E+05				7.54E+05	
	BARRIER			6.06E+05				4.15E+05	
---	---	---	---	---	---	---	---	---	---
RIPRAP (CM)	CLOSURE			8.05E+05	8.05E+05			6.38E+05	6.38E+05
VERNITA RANCH	BARRIER			8.05E+05				6.38E+05	
---	---	---	---	---	---	---	---	---	---
ASPHALT (CM)	BARRIER			8.07E+04	8.07E+04			6.25E+04	6.25E+04
---	---	---	---	---	---	---	---	---	---
PERSONNEL	TOTAL	5.30E+04	3.50E+04	4.87E+03	9.29E+04	5.20E+04	2.48E+04	1.06E+03	7.79E+04

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59%		EXTENSIVE				EXTENSIVE			
		RETRIEVAL				RETRIEVAL			
		---	---	---	---	---	---	---	---
		WR&T	VIT	CLOSE	TOTAL	WR&T	VIT	CLOSE	TOTAL
RESOURCE	PHASE								
		EX SITU	EX SITU		EX SITU	NO SEP	NO SEP		NO SEP
		VIT	VIT		VIT	SUB ALT	SUB ALT		SUB ALT
(MAN YEARS	CONSTRUCTION	2.00E+04	2.00E+04			2.00E+04	1.50E+04		
@ 2,000 HR	OPERATION	3.30E+04	1.50E+04			3.20E+04	9.80E+03		
PER YEAR)	CLOSURE								
	TANK STAB			7.00E+01				1.40E+02	
	BARRIER			4.20E+03				3.20E+02	
	D&D								
	M&M (HR/YR)			6.00E+02				6.00E+02	
---	---	---	---	---	---	---	---	---	---
SCHEDULE	STAR RD	1995	1995			1995	1995		
	END RD	2003	2018			2003	2005		
	STAR CONST	1998	1998	2.01E+03		1998	1997	2.01E+03	
	END CONST	2017	2007	2.03E+03		2017	2002	2.02E+03	
	STAR CONST								
	END CONST								
	START OP	2001	2004			2001	2005		
	END OP	2024	2023			2024	2019		
	START OP								
	END OP								
	START DD	2012	2019			2012	2019		
	END DD	2026	2028			2026	2023		
	START MM		2023	2.01E+03			2023	2.01E+03	
	END MM		2035	2.13E+03			2077	2.12E+03	
	START SHIP HLW		2024						
	END SHIP		2035						

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59%			EXTENSIVE			PHASE 1		PHASE 1+PHASE 2			
			RETRIEVAL								
			---	---	---	---					
			WR&T	VIT	CLOSE	TOTAL		PHASE 1	PHASE 2	TOTAL	
RESOURCE		PHASE						EXTENDED			
			EXT SEP	EXT SEP		EXT SEP		FOR AN ADD.			
			SUB ALT	SUB ALT		SUB ALT		10 YRS OPS			
==========		==========	=======	=======	=======	=========					= ==
LAND,		TOTAL	4.00E+03	1.20E+05	3.30E+05	4.54E+05	0.00E+00			4.26E+05	
PERMANENTLY		CONST/OPR	4.00E+03	1.20E+05			0.00E+00	1.20E+04	8.40E+04	9.60E+04	
COMMITTED											
(SQUARE		CLOSURE					0.00E+00				
METERS)		TANK STAB					0.00E+00				
		BARRIER			3.30E+05		0.00E+00		3.30E+05	3.30E+05	
---		---	---	---	---	---					
LAND,		TOTAL	3.20E+04	1.30E+06	2.40E+05	1.57E+06	3.30E+05			1.47E+06	
TEMPORARILY		CONST/OPR	3.20E+04	1.30E+06			3.20E+05	3.20E+05	8.40E+05	1.16E+06	
COMMITTED		CLOSURE					0.00E+00	0.00E+00		0.00E+00	
(SQUARE		TANK STAB					0.00E+00	0.00E+00		0.00E+00	
METERS)		BARRIER			2.40E+05		0.00E+00	0.00E+00	2.40E+05	2.40E+05	
		PIT 30 (BORROW)					1.00E+04	1.00E+04	6.00E+04	7.00E+04	
---		---	---	---	---	---					
		TOTAL			9.04E+05		0.00E+00				
3.00E+00		McGEE (EST)			1.78E+05		0.00E+00	0.00E+00	2.10E+05	2.10E+05	
3.00E+00		PIT 30 (EST)			4.56E+05		0.00E+00	0.00E+00	4.50E+05	4.50E+05	
3.00E+00		VERNITA (EST			2.70E+05		0.00E+00	0.00E+00	2.70E+05	2.70E+05	
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WATER (CM)		TOTAL	2.01E+06	3.17E+07	2.05E+05	3.39E+07	2.80E+06			1.36E+07	
---		---	---	---	---	---					
SANITARY		CONSTRUCTION	9.40E+03	5.20E+05			3.90E+05	3.90E+05	2.54E+05	6.44E+05	
(CM)		OPERATION	2.00E+06	1.21E+06			2.20E+05	4.40E+05	2.55E+06	2.99E+06	
		CLOSURE					1.60E+04	1.60E+04		1.60E+04	
		TANK STAB			5.70E+04		0.00E+00	0.00E+00		0.00E+00	
		BARRIER			1.45E+05		0.00E+00	0.00E+00	5.70E+04	5.70E+04	
		ANC EQUIP			3.30E+03		0.00E+00	0.00E+00	3.30E+03	3.30E+03	
---		---	---	---	---	---					
RAW		CONSTRUCTION					0.00E+00	0.00E+00	0.00E+00	0.00E+00	
(CM)		OPERATION		3.00E+07			2.20E+06	4.40E+06	5.50E+06	9.90E+06	
---		---	---	---	---	---					
ENERGY,		TOTAL	1.36E+00	1.67E+04		1.67E+04	1.70E+03			7.79E+03	
ELECTRICAL		CONSTRUCTION	7.60E-01	8.90E+01			5.00E+01	5.00E+01	3.73E+01	8.73E+01	
(GWh)		OPERATION	6.00E-01	1.66E+04			1.60E+03	3.20E+03	4.50E+03	7.70E+03	
		CLOSURE					0.00E+00	0.00E+00		0.00E+00	
---		---	---	---	---	---					
GASOLINE (CM)		TOTAL	3.30E+02	9.40E+03	3.91E+02	1.01E+04	6.80E+03			1.19E+04	
		CONSTRUCTION	3.30E+02	9.40E+03			6.50E+03	6.50E+03	4.71E+03	1.12E+04	

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59%		EXTENSIVE				PHASE 1		PHASE 1+PHASE 2	
		RETRIEVAL							
		---	---	---	---				
		WR&T	VIT	CLOSE	TOTAL		PHASE 1	PHASE 2	TOTAL
RESOURCE	PHASE						EXTENDED		
		EXT SEP	EXT SEP		EXT SEP		FOR AN ADD.		
		SUB ALT	SUB ALT		SUB ALT		10 YRS OPS		
	OPERATION					0.00E+00	0.00E+00		0.00E+00
	CLOSURE					3.30E+02	3.30E+02		3.30E+02
	TANK STAB			4.01E+01		0.00E+00	0.00E+00	4.01E+01	4.01E+01
	BARRIER			3.50E+02		0.00E+00	0.00E+00	3.50E+02	3.50E+02
	ANC EQUIP			1.20E+00		0.00E+00	0.00E+00	1.20E+00	1.20E+00
---		---	---	---	---				
PROPANE (CM)	CONSTRUCTION	1.20E+03			1.20E+03	0.00E+00	0.00E+00	1.20E+03	1.20E+03
---	---	---	---	---	---				
DIESEL (CM)	TOTAL	2.02E+03	2.80E+04	6.72E+04	9.72E+04	3.60E+04			1.17E+05
	CONSTRUCTION	1.00E+03	2.80E+04			1.80E+04	1.80E+04	1.30E+04	3.10E+04
	OPERATION	1.02E+03				2.00E+02	4.00E+02	1.02E+03	1.42E+03
	CLOSURE					1.80E+04	1.80E+04		1.80E+04
	TANK STAB			6.38E+03		0.00E+00	0.00E+00	6.38E+03	6.38E+03
	BARRIER			6.00E+04		0.00E+00	0.00E+00	5.90E+04	5.90E+04
	ANC EQUIP			8.02E+02		0.00E+00	0.00E+00	8.02E+02	8.02E+02
---	---	---	---	---	---				
KEROSENE (CM)	OPERATION		9.36E+04		9.36E+04	9.80E+02	1.96E+03	2.90E+04	3.10E+04
---	---	---	---	---	---				
MATERIALS	TOTAL	5.90E+04	5.90E+05	1.90E+04	6.68E+05	2.40E+04			2.42E+05
CONCRETE	CONSTRUCTION	5.90E+04	4.40E+05			2.40E+04	2.40E+04	2.90E+04	5.30E+04
(CM)	OPERATION								
	LLW VAULTS		1.40E+05			0.00E+00	0.00E+00	1.60E+05	1.60E+05
	HLW CONTAINERS		1.00E+04	(EST)		4.40E+02	4.40E+02	1.00E+04	1.04E+04
	CLOSURE					0.00E+00	0.00E+00		0.00E+00
	TANK STAB			5.30E+03		0.00E+00	0.00E+00	5.30E+03	5.30E+03
	BARRIER					0.00E+00	0.00E+00		0.00E+00
	ANC EQUIP			1.37E+04		0.00E+00	0.00E+00	1.37E+04	1.37E+04
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CARBON	TOTAL	1.80E+04	1.80E+05		1.98E+05	8.30E+04			1.61E+05
STEEL	CONSTRUCTION	1.00E+04	1.30E+05			8.30E+04	8.30E+04	5.85E+04	1.42E+05
(MT)	OPERATION								
	LLW VAULTS		1.60E+04			0.00E+00	0.00E+00	1.90E+04	1.90E+04
	HLW CONTAINERS		2.30E+02	(EST)		2.90E+02	2.90E+02	2.30E+02	5.20E+02
	CLOSURE					0.00E+00	0.00E+00		0.00E+00
---	---	---	---	---	---				
STAINLESS	TOTAL	4.00E+03	1.70E+04		2.10E+04	1.50E+04			2.65E+04
STEEL,	CONSTRUCTION	4.00E+03	1.70E+04			1.50E+04	1.50E+04	1.15E+04	2.65E+04
(MT)	OPERATION								
	CLOSURE								

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59%		EXTENSIVE				PHASE 1		PHASE 1+PHASE 2	
		RETRIEVAL							
		---	---	---	---				
		WR&T	VIT	CLOSE	TOTAL		PHASE 1	PHASE 2	TOTAL
RESOURCE	PHASE						EXTENDED		
		EXT SEP	EXT SEP		EXT SEP		FOR AN ADD.		
		SUB ALT	SUB ALT		SUB ALT		10 YRS OPS		
---	---	---	---	---	---				
HASTELLOY/	TOTAL		1.80E+03		1.80E+03	2.60E+03	2.60E+03	1.15E+03	3.75E+03
INCONEL	CONSTRUCTION		1.80E+03						
(MT)	OPERATION								
	CLOSURE								
---	---	---	---	---	---				
FLUX (MT)	TOTAL		3.55E+05		3.55E+05	1.30E+05	2.60E+05	1.47E+05	4.07E+05
ALUMINA	OPERATION								
BORAX	OPERATION		5.75E+04						
BULK FRIT	OPERATION								
CALCIUM OXIDE	OPERATION		4.10E+03						
FERRIC OXIDE	OPERATION		1.40E+01						
LIMESTONE	OPERATION								
LITHIUM OXIDE	OPERATION		2.10E+03						
MAG OXIDE	OPERATION		4.10E+03						
SILICA	OPERATION		2.87E+05						
---	---	---	---	---	---				
CHEMICALS (MT)	TOTAL		8.86E+05		8.86E+05	5.80E+04	1.16E+05	9.55E+04	2.12E+05
ALUMINUM NITRATE	OPERATION		1.12E+02						
AMMONIA	OPERATION		9.24E+03						
ANTIFOAM	OPERATION								
APM	OPERATION		1.00E+01						
CMPO	OPERATION		5.00E+00						
CPD	OPERATION		4.46E+03						
CROWN ETHER	OPERATION		2.84E+02						
DCPD	OPERATION		4.46E+03						
DECON CHEM	OPERATION		1.40E+04						
DICYCLOP	OPERATION								
FLOC	OPERATION		1.50E+02						
FORMIC ACID	OPERATION		1.47E+03						
FSA	OPERATION		4.72E+03						
GLYCOLIC ACID	OPERATION		7.70E+03						
HF	OPERATION		7.40E+02						
HNO3, 50%	OPERATION		4.65E+05						
HYDROXYLAMINE	OPERATION		9.50E+01						
NAOH, 50%	OPERATION		1.50E+05						
Na3 DTPA	OPERATION		1.96E+02						
NPH	OPERATION		7.03E+02						
OLIGOMER (MT)	OPERATION								

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59%		EXTENSIVE				PHASE 1		PHASE 1+PHASE 2	
		RETRIEVAL							
		---	---	---	---				
		WR&T	VIT	CLOSE	TOTAL		PHASE 1	PHASE 2	TOTAL
RESOURCE	PHASE						EXTENDED		
		EXT SEP	EXT SEP		EXT SEP		FOR AN ADD.		
		SUB ALT	SUB ALT		SUB ALT		10 YRS OPS		
OXOLIC ACID	OPERATION		1.20E+04						
OXYGEN	OPERATION								
PEROXIDE	OPERATION		6.40E+03						
POTASSIUM PERMANGANAT	OPERATION								
SODIUM BICARB	OPERATION		1.25E+04						
SODIUM CARBONATE	OPERATION		1.80E+02						
SODIUM NITRATE	OPERATION								
SODIUM OXALATE	OPERATION		2.09E+04						
SULFUR (MT)	OPERATION		1.70E+05						
TBP	OPERATION		7.55E+02						
TSP	OPERATION								
ZINC NITRATE	OPERATION		4.70E+01						
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IX RESIN (CM)	OPERATION		4.90E+03		4.90E+03	1.40E+01	2.80E+01	1.10E+02	1.38E+02
---	---	---	---	---	---				
EXCAVATION	TOTAL		1.80E+06		1.80E+06				
(CM)	CONSTRUCTION		1.80E+06						
	OPERATION								
	CLOSURE								
---	---	---	---	---	---				
BACKFILL	TOTAL		8.50E+05		8.50E+05				
(CM)	CONSTRUCTION		8.50E+05						
	OPERATION								
	CLOSURE								
---	---	---	---	---	---				
SILT (CM)	CLOSURE			5.35E+05	5.35E+05	0.00E+00	0.00E+00		
McGEE RANCH	BARRIER			5.35E+05				5.26E+05	5.26E+05
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SAND/	CONSTRUCTION					1.20E+04	1.20E+04	1.59E+05	1.71E+05
GRAVEL (CM)	CLOSURE			1.37E+06	1.37E+06	0.00E+00			1.36E+06
PIT 30	TANK STAB			7.54E+05				7.54E+05	
	BARRIER			6.15E+05				6.06E+05	
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RIPRAP (CM)	CLOSURE			8.09E+05	8.09E+05	0.00E+00	0.00E+00		
VERNITA RANCH	BARRIER			8.09E+05				8.05E+05	8.05E+05
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ASPHALT (CM)	BARRIER			8.16E+04	8.16E+04	0.00E+00	0.00E+00	8.07E+04	8.07E+04
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PERSONNEL	TOTAL	5.20E+04	3.30E+04	1.06E+03	8.61E+04				

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59%			EXTENSIVE				PHASE 1		PHASE 1+PHASE 2	
			RETRIEVAL							
			---	---	---	---				
			WR&T	VIT	CLOSE	TOTAL		PHASE 1	PHASE 2	TOTAL
RESOURCE		PHASE						EXTENDED		
			EXT SEP	EXT SEP		EXT SEP		FOR AN ADD.		
			SUB ALT	SUB ALT		SUB ALT		10 YRS OPS		
(MAN YEARS		CONSTRUCTION	2.00E+04	2.60E+04						
@ 2,000 HR		OPERATION	3.20E+04	7.00E+03						
PER YEAR)		CLOSURE								
		TANK STAB			1.40E+02					
		BARRIER			3.20E+02					
		D&D								
		M&M (HR/YR)			6.00E+02					
---		---	---	---	---	---				
SCHEDULE		STAR RD	1995	1995						
		END RD	2003	2018						
		STAR CONST	1998	1998	2.01E+03					
		END CONST	2017	2006	2.06E+03					
		STAR CONST								
		END CONST								
		START OP	2001	2004						
		END OP	2024	2020						
		START OP								
		END OP								
		START DD	2012	2020						
		END DD	2026	2024						
		START MM		2019	2.01E+03					
		END MM		2036	2.16E+03					
		START SHIP HLW								
		END SHIP								

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Resor ummary used to generate values for (9)

59%										
			RETRIEVAL		MAXIMUM RETRIEVAL					
RESOURCE		PHASE	FILL							
			& CAP	CLOSE	PROP		WR&T	VIT	CLOSE	PROP
			%		UNITS		%	%	%	UNITS
==========		==========	========	========	========		========	========	========	==========
LAND,		TOTAL								
PERMANENTLY		CONST/OPR		50%	1.25E+05		50%	100%	50%	2.46E+05
COMMITTED										
(SQUARE		CLOSURE								
METERS)		TANK STAB								
		BARRIER								
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LAND,		TOTAL								
TEMPORARILY		CONST/OPR	60%		6.00E+03		50%	100%		8.26E+05
COMMITTED		CLOSURE								
(SQUARE		TANK STAB		50%	1.00E+05				50%	1.20E+05
METERS)		BARRIER								
		PIT 30 (BORROW)								
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		TOTAL								
3.00E+00		McGEE (EST)		60%	7.54E+04				40%	7.01E+04
3.00E+00		PIT 30 (EST)		60%	8.30E+04				40%	1.81E+05
3.00E+00		VERNITA (EST		60%	1.28E+05				40%	1.07E+05
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WATER (CM)		TOTAL								
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SANITARY		CONSTRUCTION	70%		4.13E+05		60%			5.64E+03
(CM)		OPERATION	60%		1.08E+06		50%			1.00E+06
		CLOSURE								
		TANK STAB		60%	0.00E+00				40%	0.00E+00
		BARRIER		60%	2.28E+04				40%	2.28E+04
		ANC EQUIP		60%	1.98E+03				40%	1.32E+03
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RAW		CONSTRUCTION								
(CM)		OPERATION						50%		5.50E+06
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ENERGY,		TOTAL								
ELECTRICAL		CONSTRUCTION	60%		1.08E+00		50%	50%		3.69E+01
(GWh)		OPERATION	60%		0.00E+00		50%	50%		4.50E+03
		CLOSURE								
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GASOLINE (CM)		TOTAL								
		CONSTRUCTION	70%		6.79E+01		60%	60%		4.58E+03

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59%										
			RETRIEVAL		MAXIMUM RETRIEVAL					
RESOURCE		PHASE	FILL							
			& CAP	CLOSE	PROP		WR&T	VIT	CLOSE	PROP
			%		UNITS		%	%	%	UNITS
		OPERATION								
		CLOSURE								
		TANK STAB		60%	2.41E+01				40%	1.60E+01
		BARRIER		60%	1.56E+02				40%	1.40E+02
		ANC EQUIP		60%	7.20E-01				40%	4.80E-01
---			---	---	---		---	---	---	---
PROPANE (CM)		CONSTRUCTION					50%			6.00E+02
---		---	---	---	---		---	---	---	---
DIESEL (CM)		TOTAL								0.00E+00
		CONSTRUCTION	70%		9.10E+02		60%	60%		1.26E+04
		OPERATION	60%		3.66E+03		50%			5.10E+02
		CLOSURE								
		TANK STAB		60%	3.83E+03				40%	2.55E+03
		BARRIER		60%	2.70E+04				40%	2.36E+04
		ANC EQUIP		60%	4.81E+02				40%	3.21E+02
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KEROSENE (CM)		OPERATION						50%		2.90E+04
---		---	---	---	---		---	---	---	---
MATERIALS		TOTAL								
CONCRETE		CONSTRUCTION					50%	50%		2.70E+05
(CM)		OPERATION								
		LLW VAULTS						50%		8.00E+04
		HLW CONTAINERS						50%		5.00E+03
		CLOSURE								
		TANK STAB		60%	3.18E+03				40%	2.12E+03
		BARRIER								
		ANC EQUIP		60%	8.22E+03				40%	5.48E+03
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CARBON		TOTAL								
STEEL		CONSTRUCTION					50%	50%		5.35E+04
(MT)		OPERATION								
		LLW VAULTS						50%		9.50E+03
		HLW CONTAINERS						50%		1.15E+02
		CLOSURE								
---		---	---	---	---		---	---	---	---
STAINLESS		TOTAL								
STEEL,		CONSTRUCTION					50%	50%		9.50E+03
(MT)		OPERATION								
		CLOSURE								

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59%										
			RETRIEVAL		MAXIMUM RETRIEVAL					
RESOURCE		PHASE	FILL							
			& CAP	CLOSE	PROP		WR&T	VIT	CLOSE	PROP
			%		UNITS		%	%	%	UNITS
---		---	---	---	---		---	---	---	---
HASTELLOY/		TOTAL								
INCONEL		CONSTRUCTION					50%	50%		1.15E+03
(MT)		OPERATION								
		CLOSURE								
---		---	---	---	---		---	---	---	---
FLUX (MT)		TOTAL								
ALUMINA		OPERATION						50%		6.50E+03
BORAX		OPERATION						50%		9.00E+02
BULK FRIT		OPERATION						50%		2.60E+01
CALCIUM OXIDE		OPERATION						50%		1.95E+04
FERRIC OXIDE		OPERATION								
LIMESTONE		OPERATION								
LITHIUM OXIDE		OPERATION						50%		2.50E+02
MAG OXIDE		OPERATION								
SILICA		OPERATION						50%		1.20E+05
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CHEMICALS (MT)		TOTAL								
ALUMINUM NITRATE		OPERATION						50%		5.60E+01
AMMONIA		OPERATION						50%		4.40E+03
ANTIFOAM		OPERATION								
APM		OPERATION								
CMPO		OPERATION						50%		2.50E+00
CPD		OPERATION								
CROWN ETHER		OPERATION								
DCPD		OPERATION								
DECON CHEM		OPERATION						50%		2.65E+03
DICYCLOP		OPERATION						50%		1.70E+03
FLOC		OPERATION						50%		4.25E+01
FORMIC ACID		OPERATION								
FSA		OPERATION						50%		2.36E+03
GLYCOLIC ACID		OPERATION						50%		1.75E+03
HF		OPERATION								
HNO3, 50%		OPERATION						50%		2.10E+03
HYDROXYLAMINE		OPERATION								
NAOH, 50%		OPERATION						50%		1.30E+04
Na3 DTPA		OPERATION								
NPH		OPERATION						50%		3.52E+02
OLIGOMER (MT)		OPERATION						50%		1.70E+03

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59%										
			RETRIEVAL		MAXIMUM RETRIEVAL					
RESOURCE		PHASE	FILL							
			& CAP	CLOSE	PROP		WR&T	VIT	CLOSE	PROP
			%		UNITS		%	%	%	UNITS
OXOLIC ACID		OPERATION								
OXYGEN		OPERATION								
PEROXIDE		OPERATION								
POTASSIUM PERMANGANAT		OPERATION								
SODIUM BICARB		OPERATION								
SODIUM CARBONATE		OPERATION								
SODIUM NITRATE		OPERATION						50%		2.70E+01
SODIUM OXALATE		OPERATION								
SULFUR (MT)		OPERATION						50%		6.50E+04
TBP		OPERATION						50%		3.78E+02
TSP		OPERATION								
ZINC NITRATE		OPERATION								
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IX RESIN (CM)		OPERATION						50%		1.10E+02
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EXCAVATION		TOTAL								
(CM)		CONSTRUCTION	60%		4.14E+05	#		50%		8.50E+05
		OPERATION								
		CLOSURE								
---		---	---	---	---	--	---	---	---	---
BACKFILL		TOTAL								
(CM)		CONSTRUCTION						50%		6.00E+05
		OPERATION								
		CLOSURE								
---		---	---	---	---	--	---	---	---	---
SILT (CM)		CLOSURE								
McGEE RANCH		BARRIER		60%	2.26E+05				40%	2.10E+05
---		---	---	---	---	--	---	---	---	---
SAND/		CONSTRUCTION								
GRAVEL (CM)		CLOSURE								
PIT 30		TANK STAB		60%	4.52E+05				40%	3.02E+05
		BARRIER		60%	2.49E+05				40%	2.42E+05
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RIPRAP (CM)		CLOSURE								
VERNITA RANCH		BARRIER		60%	3.83E+05				40%	3.22E+05
---		---	---	---	---	--	---	---	---	---
ASPHALT (CM)		BARRIER		60%	3.75E+04				40%	3.23E+04
---		---	---	---	---	--	---	---	---	---
PERSONNEL		TOTAL								0.00E+00

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59%										
			RETRIEVAL		MAXIMUM RETRIEVAL					
RESOURCE		PHASE	FILL							
			& CAP	CLOSE	PROP		WR&T	VIT	CLOSE	PROP
			%		UNITS		%	%	%	UNITS
(MAN YEARS		CONSTRUCTION	61%		1.53E+03		61%	61%		2.44E+04
@ 2,000 HR		OPERATION	64%		0.00E+00		58%	59%		2.80E+04
PER YEAR)		CLOSURE								0.00E+00
		TANK STAB		64%	8.96E+01				59%	4.13E+01
		BARRIER		64%	2.11E+02				59%	2.48E+03
		D&D			0.00E+00				59%	0.00E+00
		M&M (HR/YR)		64%	3.84E+02				59%	3.54E+02
---		---	---	---	---		---	---	---	---
SCHEDULE		STAR RD								
		END RD								
		STAR CONST								
		END CONST								
		STAR CONST								
		END CONST								
		START OP								
		END OP								
		START OP								
		END OP								
		START DD								
		END DD								
		START MM								
		END MM								
		START SHIP HLW								
		END SHIP								
			EXEMPT							
				RAD				0.00E+00		
				NON	50%		3.50E+06	1.75E+06		
			NON E							
				RAD	60%		2.70E+07	1.62E+07		
				NON				0.00E+00		
			SUPER					0.00E+00		
							3.05E+07	1.80E+07		
							58.85%			

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Alternative	Location	Remediation Temporary Disturbance hectares	Remediation Temporary Disturbance % Shrub-Steppe	Remediation Shrub-Steppe Impacts hectares	Remediation Permanent Disturbance hectares	Remediation Permenant Dist. % Shrub-Steppe	Remediation Shrub-Steppe Permanent Impact hectares	Post Remediation (Closure) Temporary Disturbance hectares	Temporary Dist. % Shrub-Steppe	Temporary Shrub-Steppe hectares	Permanent Disturbance hectares	Permanent Dist % shrub-steppe	Permanent SS Dist. hectares
No Action													
	Tank Farms	0									17		
Long Term Management													
	Tank Farms										17		
	New Tank Farms	50	20%	10	8	0.2	0						
	Total	50		0	8		0				17		0
In Situ Fill and Cap													
	Tank Farms(operations)	1	0%	0	17	0						0	
	Pit 30 (operations)	25	90%	23									
	Tank Farms (barrier const.)							20	0	0	8		
	Pit 30 (barrier)							14	0.9	13		0.9	
	McGee							16	0.75	12			
	Vernita							21	0.8	17			
	Total	26		23	17			71		42	8		0
In Situ Vitrification													
	Tank Farms (operations)	21	0%	0	17	0						0	
	Power Lines	70	33%	23									
	Pit 30 (operations)	20	90%	18									
	Tank Farms (barrier const.)							20	0	0	8	0	0
	Pit 30 (barrier)							14	0.9	13		0.9	
	McGee (barrier)							16	0.75	12		0.75	
	Vernita (barrier)							21	0.8	17		0.8	
	Total	111		41	17			71		42	8		0
Ex Situ Intermediate Separations													
	Retrieval Annexes	3	0%	0	0.4	0							
	Pit 30 (retrieval annexes)	OK 1	90%	1									
	Vit Plant	84.5 ~~88~~	67%	59	7	0							
	LAW Vaults				11 ~~13~~	0					3 ~~4~~	0	
	Pit 30 (treatment facilities)	35 25	90%	23									
	Tank Farms				17			24	0	0	8	0	
	Pit 30 (post rem)							45 50	0.9	45			
	McGee	0						17 25	0.75	19			
	Vernita	0						29 31	0.8	25			
	Total	117		83	36 ~~37~~			130		89	11 ~~12~~		0
Ex Situ No Separations VIT CALCIN													
	Retrieval Annexes	3	0%	0	0.4	0							
	Pit30 (ret annexes) 1	1	90%	1		0							
	Vit Plant	66 ~~143~~	67%	96	2								
	LAW Vaults	0											
	Pit 30 (treatment facilities) 44	97 ~~88~~ 7	90%	6									
	Tank Farms				17	0		20	0	0	8	0	
	Pit 30 (post rem)						OK	OK 39	0.9	35			
	McGee						OK	OK 16	0.75	12			
	Vernita						OK	OK 21	0.8	17			
	Total	154		103	19			96		64	8		0
Ex Situ Extensive Separations													
	Retrieval Annexes	3	0%	0	0.4								
	Pit30 (ret annexes)	OK 1	90%	1									
	Vit Plant	85	67%	57	7								
	LAW Vaults				9 ~~10~~						4	0	
	Pit 30 (treatment facilities)	31 16	90%	14									
	Tank Farms	0			17			24	0	0	8	0	
	Pit 30 (post rem)	0						45 51	0.9	46			
	McGee							19 ~~25~~	0.75	19			
	Vernita							32 31	0.8	25			

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Land ' Numbers

Alternative	Location	Remediation Temporary Disturbance hectares	Remediation Temporary Disturbance % Shrub-Steppe	Remediation Shrub-Steppe Impacts hectares	Remediation Permanent Disturbance hectares	Remediation Permenant Dist. % Shrub-Steppe	Remediation Shrub-Steppe Permanent Impact hectares	Post Remediation (Closure) Temporary Disturbance hectares	Temporary Dist. % Shrub-Steppe	Temporary Shrub-Steppe hectares	Permanent Disturbance hectares	Permanent Dist % shrub-steppe	Permanent SS Dist. hectares
	Total	105		72	33 ~~34~~			131		90	12		0
Ex Situ/In Situ Combination													
	Retrieval Annexes	2	0%	0	0.2								
	Pit30 (ret annexes) ok	1	90%	1									
	Vit Plant	83 ~~85~~	67%	57	7								
	LAW Vaults				7						2	0	
	Pit 30 (treatment facilities)	17 18	90%	16									
	Tank Farms	0			17			22	0	0	8	0	
	Pit 30 (post rem)	0						48 29	0.9	26			
	McGee							16 21	0.75	16			
	Vernita							26 26	0.8	21			
	Total	104 ~~106~~		74	31			98		63	10		0
Phased Implementation (Phase1)													
	Retrieval Annexes	0											
	Vit Plant	32		20									
	Pit 30	1		1									
	Tank Farms	0											
	Total	33		21	0								
Phased Imp. Total Alternative													
	Retrieval Annexes	3			0.4								
	Pit30 (ret annexes)	1	90%	0.9									
	Vit Plant	88	67%	58.96	7								
	LAW Vaults				13						4		
	Pit 30 (treatment facilities)	22	90%	19.8									
	Tank Farms				17			24	0	0	8		
	Pit 30 (post rem)							50	0.9	45			
	McGee							25	0.75	19			
	Vernita							31	0.8	25			
	Phase 1 Vit Plant				3								

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NO ACTION SCHEDULE										**FEIS SCHEDULE**	
			REV O DATA PACKAGE SCHEDULE			DEIS CHAPTER 3 SCHEDULE					
Continued Operations									1997-2097		
LONG-TERM MANAGEMENT SCHEDULE											
Continued Operations											
Construction											
Waste Retrieval			2032-2039	2082-2089	(7 years each)	2033-2037	2083-2087		2033-2037	2083-2087	
New Tanks			2033-2037	2083-2087	(4 years each)	2033-2037	2083-2087		2033-2037	2083-2087	
Operations			2037-2042	2087-2092	(5 years each)	2037-2042	2087-2092		2037-2042	2087-2092	
D&D			2042-2047	2092-2097	(5 years each)	2042-2047	2092-2097	42-49,92-99 f	2042-2047	2092-2097	
Monitoring & Maintenance			1995-2095		(100 years)	1997-2097			1997-2097		
IN SITU FILL AND CAP SCHEDULE											
Continued Operations			1995-2009	(14 years)		1997-2009			1997-2009		
Research and Development			N/A			N/A			N/A		
Construction			2003-2005	(2 years)		2003-2005			2003-2005		
Operation			2000-2009	(9 years)		2000-2009			2000-2009		
D&D			2009-2012	(3 years)		2009-2012			2009-2012		
Monitoring and Maintenance			2009-2029	(20 years)		2009-2029			2009-2029		
Closure			2012-2029	(17 years)		2012-2029			2012-2029		
Post Closure Monitoring			2029-2129	(100 years)		2029-2129			2029-2129		
IN SITU VITRIFICATION SCHEDULE											
			REV O DATA PACKAGE SCHEDULE			DEIS CHAPTER 3 SCHEDULE			FEIS		
Continued Operations			1995-2013	(18 years)		1997-2013			1997-2013		
Research and Development			1995-2002	(7 years)		1997-2002			1997-2002		
Construction			1998-2016	(18 years)		1998-2016		1999	1998-2016		
Operation			2000-2013	(13 years)		2005-2016			2005-2016		
DST evaporation			2000-2005	(5 years)		2000-2005			2000-2005		
ISV strart up			2005-2008	(3 years)		2005-2008			2005-2008		
ISV operation			2008-2013	(5 years)		2008-2013			2008-2013		
D&D			2013-2016	(3 years)		2013-2016			2013-2016		
Monitoring and Maintenance			2013-2033	(20 years)		2016-2033			2016-2033		
Closure			2016-2033	(17 years)		2016-2033			2016-2033		
Post Closure Monitoring			2033-2133	(100 years)		2033-2133			2033-2133		
EX SITU INTERMEDIATE SEPARATIONS SCHEDULE											
			REV O DATA PACKAGE SCHEDULE			DEIS CHAPTER 3 SCHEDULE					
Continued Operations									1997-2022	(25 yrs)	
Research and Development			1995-2018	(23 years)		1995-2018			1997-2018	(21 yrs)	

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Construction													
	Waste Retrieval and Transfer			1998-2017	(19 years)			1998-2017			1998-2017	(19 yrs)	
	Waste Treatment			1997-2007	(10 years)			1997-2007			1999-2009		
	HLW										2003-2009	(6 yrs)	
	LAW										1999-2004	(5 yrs)	
Operation													
	Waste Retrieval			2001-2023	(22 years)			2001-2024			2001-2022	(21 yrs)	
	Treatment			2004-2023	(19 years)			2004-2024					
	Pretreatment			2004-2019	(15 years)						2004-2022	(18 yrs)	
	LLW Vitrification			2005-2019	(14 years)			2004-2024			2005-2022	(17 yrs)	
	HLW Vitrification			2009-2023	(14 years)			2011-2024			2011-2022	(11 yrs)	
	LLW Disposal			2005-2019	(14 years)						2005-2022		
	HLW Transportation and Disposal			2019-2029	(10 years)			2019-2029			2022-2040	(18 yrs)	
D&D													
	Waste Retrieval facilities			2012-2025	(13 years)			2013-2026			2013-2025	(12 yrs)	
	Treatment Facilities			2019-2028	(9 years)			2024-2033			2022-2031	(9 yrs)	
Monitoring and Maintenance													
	HLW	(assess impacts for 50 yr period)		2023-2029	(6 years)			2024-2029			2022-2040	(18 yrs)	
	LLW Disposal			2023-2034	(11 years)								
Closure				2010-2034	(24 years)			2010-2034			2010-2034	(24 yrs)	
Post Closure Monitoring				2034-2134	(100 years)			2034-2134			2034-2134	(100 yrs)	
EX SITU NO SEPARATIONS (VITRIFICATION AND CALCINATION)													
				REV O DATA PACKAGE SCHEDULE				PDEIS CHAPTER 3 SCHEDULE					
Continued Operations				1995-2018	(23 years)						1997-2020		
Research and Development				1995-2005	(10 years)			1995-2005			1997-2007		
Construction													
	Waste Retrieval and Transfer			1998-2017	(19 years)			1998-2017			1998-2017	(19 yrs)	
	Waste Treatment			1997-2002	(5 years)			1997-2002			1999-2005	(6 yrs)	
Operation													
	Waste Retrieval			2001-2018	(17 years)			2001-2019			2003-2020	(17 yrs)	
	HLW Vitrification			2004-2018	(14 years)			2004-2019			2006-2020	(14 yrs)	
	HLW Transportation and Disposal			2017-2027	(10 years)			2017-2037			2020-2040	(20 yrs)	
D&D													
	Waste Retrieval facilities			2012-2020	(8 years)			2013-2021			2015-2023		
	Treatment Facilities			2018-2023	(5 years)			2019-2024			2020-2025		
Monitoring and Maintenance													
	HLW	(assess impacts for 50 yrs)		2004-2027	(23 years)			2019-2037			2020-2040	(20 yrs)	
Closure				2010-2024	(14 years)			2010-2024			2011-2025	(14 yrs)	
Post Closure Monitoring				2024-2124	(100 years)			2024-2124			2025-2125	(100 yrs)	

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EX SITU EXTENSIVE SEPARATIONS SCHEDULE					
	REV O DATA PACKAGE SCHEDULE		DEIS CHAPTER 3 SCHEDULE		
Continued Operations	1995-2024	(29 years)		1997-2023	
Research and Development	1995-2018	(23 years)	1995-2018	1997-2018	
Construction					
Waste Retrieval and Transfer	1998-2017	(19 years)	1998-2017	1998-2016	(18 yrs)
Waste Treatment	1997-2006	(9 years)	1997-2006	1999-2011	(12 yrs)
HLW				2001-2006	(6 yrs)
LAW				1999-2004	(5 yrs)
Operation					
Waste Retrieval	2001-2024	(23 years)	2001-2024	2003-2023	(20 yrs)
Treatment	2003-2024	(21 years)	2004-2024	2004-2023	
Pretreatment	2003-2018	(15 years)		2004-2023	
LLW Vitrification	2005-2024	(19 years)		2006-2023	(17 yrs)
HLW Vitrification	2005-2019	(14 years)		2013-2023	(10 yrs)
LLW Disposal	2005-2024	(19 years)		2006-2023	
HLW Transportation and Disposal	2020-2029	(9 years)	2020-2029	2022-2025	(3 yrs)
D&D					
Waste Retrieval facilities	2012-2025	(13 years)	2012-2025	2014-2024	
Treatment Facilities	2019-2024	(5 years)	2024-2029	2023-2028	
Monitoring and Maintenance					
HLW	2019-2029	(10 years)	2024-2029	2023-2025	
LLW Disposal	2023-2030	(7 years)			
Closure	2010-2030	(20 years)	2010-2030	2012-2032	
Post Closure Monitoring	2030-2130	(100 years)	2030-2130	2032-2132	
VARIATION - IN SITU/EX SITU COMBINATION SCHEDULE					
Continued Operations	1995-2023	(28 years)		1997-2022	
Research and Development	1995-2018	(23 years)	1995-2018	1997-2018	
Construction					
Waste Retrieval and Transfer	1998-2017	(19 years)	1998-2017	1998-2016	(18 yrs)
Waste Treatment	1997-2007	(10 years)	1997-2007	1999-2008	
HLW				2002-2008	(6 yrs)
LAW				1999-2004	(5 yrs)
Fill & Cap	2003-2005	(2 years)	2003-2005	2003-2005	(2 yrs)
Operation					
Waste Retrieval	2001-2023	(22 years)	2001-2024	2002-2022	(20 yrs)
Treatment	2004-2023	(19 years)	2004-2024	2004-2022	
Pretreatment	2004-2019	(15 years)		2004-2022	
LLW Vitrification	2005-2019	(14 years)		2005-2022	(17 yrs)
HLW Vitrification	2009-2023	(14 years)		2009-2022	(13 yrs)

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	LLW Disposal			2005-2019	(14 years)								
	HLW Transportation and Disposal			2019-2029	(10 years)			2019-2029			2022-2040	(18 yrs)	
	Fill and Cap Operations			2000-2009	(9 years)			2005-2018			2005-2018	(13 yrs)	
D&D								2019-2028					
	Waste Retrieval facilities			2012-2025	(13 years)			2012-2026			2013-2024	(11 yrs)	
	Treatment Facilities			2019-2028	(9 years)			2024-2033			2022-2031		
	Fill and Cap Equipment			2009-2012	(3 years)			2018-2021			2018-2021		
Monitoring and Maintenance													
	HLW			2023-2029	(6 years)			2024-2029			2022-2040		
				2023-2034	(11 years)								
				2009-2029	(20 years)			2018-2034					
Closure				2010-2034	(24 years)			2010-2034			2010-2032		
Post Closure Monitoring				2034-2134	(100 years)			2034-2134			2032-2132		
	IN SITU/EX SITU COMBINATION SCHEDULE												
				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operations				1995-2023	(28 years)						1997-2023	(26 yrs)	
Research and Development				1995-2018	(23 years)			1995-2018			1997-2018		
Construction													
	Waste Retrieval and Transfer			1998-2017	(19 years)			1998-2017			1998-2016		
	Waste Treatment			1997-2007	(10 years)			1997-2007			1999-2009		
	HLW										2003-2009	(6 yrs)	
	LAW										1999-2005	(6 yrs)	
	Fill & Cap			2003-2005	(2 years)			2003-2005			2003-2005		
Operation													
	Waste Retrieval			2001-2023	(22 years)			2001-2024			2002-2022		
	Treatment			2004-2023	(19 years)			2004-2024			2005-2023		
	Pretreatment			2004-2019	(15 years)						2005-2023		
	LLW Vitrification			2005-2019	(14 years)						2006-2023	(17 yrs)	
	HLW Vitrification			2009-2023	(14 years)						2010-2023		
	LLW Disposal			2005-2019	(14 years)						2006-2023		
	HLW Transportation and Disposal			2019-2029	(10 years)			2019-2029			2022-2040		
	Fill and Cap Operations			2000-2009	(9 years)			2005-2018			2005-2018		
D&D								2019-2028					
	Waste Retrieval facilities			2012-2025	(13 years)			2012-2026			2013-2024	(11 yrs)	
	Treatment Facilities			2019-2028	(9 years)			2024-2033			2023-2032	(9 yrs)	
	Fill and Cap Equipment			2009-2012	(3 years)			2018-2021			2018-2021		
Monitoring and Maintenance													
	HLW			2023-2029	(6 years)			2024-2029			2023-2040		
Closure				2010-2034	(24 years)			2010-2034			2011-2035		
Post Closure Monitoring				2034-2134	(100 years)			2034-2134			2035-2135		

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								Phase 1		Phase 2			
PHASED IMPLEMENTATION SCHEDULE											Phase 1	Phase 2	
				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operations											1997-2028		
Research and Development				1995-1998	(3 years)								
Construction				1997-2002	(5 years)								
	Phase 1							1997-2002			1997-2002		
	Retrieval									2004-2020		2004-2020	
	Phase 2									2005-2012		2006-2012	
	HLW											2007-2012	(5 yrs)
	LAW											2006-2011	(5 yrs)
Operation				2002-2012	(10 years)								
	Phase 1							2002-2012					
	LAW Treatment Plants			2002-2012	(10 years)						2002-2012		
	HLW Treatment Plant			2002-2008	(6 years)						2002-2008		
	Phase 2												
	Waste Retrieval									2007-2028		2008-2028	
	Treatment									2011-2028			
	HLW											2012-2028	(16 yrs)
	LAW											2011-2024	(14 yrs)
D&D				2012-1014	(2 years)					2015-2031		2016-2031	
Monitoring and Maintenance													
	HLW											2028-2040	
HLW Transportation												2022-2040	
Closure				2012-2014	(2 years)					2016-2040		2016-2040	
Post Closure M&M										2040-2140		2040-2140	
CAPSULES NO ACTION				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operation								1997-2007			1997-2007		
Research and Development													
Construction													
Operation													
D&D													
Monitoring and Maintenance													
CAPSULES ONSITE DISPOSAL													
				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operation				1995-2028				1997-2028			1997-2028		
Research and Development													
Construction				2002-2009	(7 years)			2002-2009			2002-2009		
Operation				2010-2029	(19 years)			2010-2029			2010-2029		

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D&D													
Monitoring and Maintenance								2029-2129			2029-2129		
	CAPSULES OVERPACK AND SHIP												
				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operation				1995-2028				1997-2028			1997-2028		
Research and Development													
Construction				2002-2009				2002-2009			2002-2009		
Operation				2010-2028				2010-2028			2010-2028		
HLW Transportation and Disposal				2035-2040				2028-2029			2028-2029		
D&D													
Monitoring and Maintenance								2010-2029			2010-2029		
	CAPSULES VITRIFY WITH TANK WASTES												
				REV O DATA PACKAGE SCHEDULE				DEIS CHAPTER 3 SCHEDULE					
Continued Operation								1997-2023			1997-2023		
Research and Development													
Construction								2002-2007			2007-2012		
Operation								2005-2023			2012-2028		
D&D								2024-2029			2028-2033		
Monitoring and Maintenance								2023-2029			2028-2040		
HLW Transporation to Repository											2022-2040		

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		NO ACTION ALTERNATIVE - remediation & closure						
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
			trips	km/trip				
Diesel 1162	Tri-Cities		0.00E+00	0.00E+00		0.00E+00		
steel 7	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
157								
4913	1) mileg est.							
Waste								
	Onsite Truck (km)		0.00E+00					
	Onsite Rail (km)		0.00E+00					
	Offsite Truck (km)		0.00E+00					
	Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	0.00E+00				0.00E+00		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
							Total	2.81E+09

Sheet A-96
RCW 9-30-96

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	0.00E+00	5.00E-02			0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	0.00E+00	5.00E-02		0.00E+00	0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	0.00E+00	9.00E-01			0.00E+00		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
urban truck fat/km		7.50E-09	0.00E+00					
urban truck inj/km		3.70E-07	0.00E+00					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			0.00E+00			
sub truck inj/km		3.80E-07			0.00E+00			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					0.00E+00	
rural truck inj/km		8.00E-07					0.00E+00	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		0.00E+00					
	TOTAL INJURIES		0.00E+00					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.81E+09	8.98E-09	2.52E+01				
	injuries	2.81E+09	7.14E-07	2.00E+03				

Sheet A-97
RDW 7-30-96

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		0.00E+00	2.52E+01	2.52E+01			
	INJURIES		0.00E+00	2.00E+03	2.00E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	0.00E+00	=	0.00E+00			
	LWC =	2.45E-02	0.00E+00	=	0.00E+00			
	Fatality =	3.20E-05	0.00E+00	=	0.00E+00			
							trc	2.29E+03
OPERATION ACCIDENTS							fatal	3.33E+00
		rate	person-yr					
	TRC =	2.20E-02	1.04E+05	=	2.29E+03			
	LWC =	1.10E-02	1.04E+05	=	1.14E+03			
	Fatality =	3.20E-05	1.04E+05	=	3.33E+00			
TOTALS								
	INJUR	4.29E+03						
	FATAL	2.85E+01						

Sheet A-98
BRW 7-30-96

		LONG-TERM MANAGEMENT ALTERNATIVE - remediation & closure						
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		3.24E+04	1.00E+01		3.24E+05		
							Total	3.24E+05
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07		
			trips	km/trip				
	Tri-Cities		2.01E+04	1.40E+02		2.81E+06		
	Portland/Seattle		7.75E+03	8.00E+02		6.20E+06		
							Total	2.28E+07
operation								
	Onsite Truck (km)		3.24E+05					
	Onsite Rail (km)		0.00E+00					
	Offsite Truck (km)		2.28E+07					
	Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	3.75E+03	2.60E+02	1.40E+02	7.41E-01	1.01E+08		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
							Total	2.91E+09

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Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.28E+07	5.00E-02			1.14E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	2.28E+07	5.00E-02		3.24E+05	1.47E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	2.28E+07	9.00E-01			2.06E+07		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.14E+06	0.00E+00	1.47E+06	0.00E+00	2.06E+07	0.00E+00
urban truck fat/km		7.50E-09	8.57E-03					
urban truck inj/km		3.70E-07	4.23E-01					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			1.91E-02			
sub truck inj/km		3.80E-07			5.57E-01			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					1.09E+00	
rural truck inj/km		8.00E-07					1.64E+01	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		1.12E+00					
	TOTAL INJURIES		1.74E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.91E+09	8.98E-09	2.61E+01				
	injuries	2.91E+09	7.14E-07	2.08E+03				

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Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.12E+00	2.61E+01	2.72E+01			
	INJURIES		1.74E+01	2.08E+03	2.09E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.75E+03	=	3.66E+02			
	LWC =	2.45E-02	3.75E+03	=	9.19E+01			
	Fatality =	3.20E-05	3.75E+03	=	1.20E-01		trc	2.65E+03
							fatal	3.45E+00
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	1.04E+05	=	2.29E+03			
	LWC =	1.10E-02	1.04E+05	=	1.14E+03			
	Fatality =	3.20E-05	1.04E+05	=	3.33E+00			
TOTALS				excluding employee traffic				
	INJUR	4.75E+03						
	FATAL	3.07E+01		fatal	4.57E+00			

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RW 7-30-96

		IN SITU FILL AND CAP ALTERNATIVE - remediation & closure						
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip	yr	total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
Grout Fill IMUSTs								
Construction								
Onsite Truck			trips	km/trip		total		
	sand/gravel		2.20E+03	1.00E+01		2.20E+04		
							Total	2.20E+04
Offsite Truck			trips	km/trip		total		
	cement		4.63E+02	1.40E+02		6.48E+04		
	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
			trips/yr	km/trip	yr			
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	6.48E+04
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.03E+05	1.00E-01	1.00E+01	9.03E+05		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.34E+05	1.00E-01	3.20E+01	2.67E+06		

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	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05		
							Total	5.59E+06
Onsite Truck (km)		5.63E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.29E+05						
Offsite Rail (km)		0.00E+00						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	W-314	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops/D&D	2.39E+04	2.60E+02	1.40E+02	7.41E-01	6.45E+08		
Fill Tanks with Gravel								
	Const.	9.50E+01	2.60E+02	1.40E+02	7.41E-01	2.56E+06		
	Ops/D&D	1.51E+03	2.60E+02	1.40E+02	7.41E-01	4.07E+07		
Closure		4.67E+02	2.60E+02	1.40E+02	7.41E-01	1.26E+07		
	total	2.61E+04					Total	7.05E+08
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.29E+05	5.00E-02			6.43E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	1.29E+05	5.00E-02		5.63E+06	5.64E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	1.29E+05	9.00E-01			1.16E+05		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			6.43E+03	0.00E+00	5.64E+06	0.00E+00	1.16E+05	0.00E+00
urban truck fat/km		7.50E-09	4.82E-05					
urban truck inj/km		3.70E-07	2.38E-03					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			7.33E-02			
sub truck inj/km		3.80E-07			2.14E+00			

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sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					6.14E-03	
rural truck inj/km		8.00E-07					9.26E-02	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		7.95E-02					
	TOTAL INJURIES		2.24E+00					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	7.05E+08	8.98E-09	6.33E+00				
	injuries	7.05E+08	7.14E-07	5.03E+02				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		7.95E-02	6.33E+00	6.41E+00			
	INJURIES		2.24E+00	5.03E+02	5.06E+02			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	7.25E+02	=	7.07E+01			
	LWC =	2.45E-02	7.25E+02	=	1.78E+01			
	Fatality =	3.20E-05	7.25E+02	=	2.32E-02			
							trc	6.30E+02
OPERATION ACCIDENTS							fatal	8.36E-01
		rate	person-yr					
	TRC =	2.20E-02	2.54E+04	=	5.59E+02			
	LWC =	1.10E-02	2.54E+04	=	2.80E+02			
	Fatality =	3.20E-05	2.54E+04	=	8.13E-01			
TOTALS				excluding employee traffic				
	INJUR	1.14E+03						
	FATAL	7.25E+00		fatal	9.16E-01			

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	IN SITU VITRIFICATION ALTERNATIVE - remediation & closure							
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip		total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06		
							Total	2.12E+06
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07		
							Total	1.38E+07
Offsite Rail			cars	trip/cars	km/trip	total		
	steel		2.60E+03	5.00E-02	8.00E+02	1.04E+05		
	cement		1.70E+03	5.00E-02	8.00E+02	6.80E+04		
							Total	1.72E+05
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.20E+01	8.74E+06		
							Total	8.74E+06
Offsite Rail			trips/yr	km/trip	yr	total		
	chem.		4.00E+00	8.00E+02	1.20E+01	3.84E+04		
							Total	3.84E+04
Grout Fill IMUSTs (outside tank farm areas)								
Onsite Truck			trips	km/trip		total		
	sand/gravel		7.70E+02	1.00E+01		7.70E+03	Total	7.70E+03
Offsite Truck			trips	km/trip		total		
	cement		1.60E+02	1.40E+02		2.24E+04	Total	2.24E+04
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.34E+05	1.00E-01	3.20E+01	2.67E+06		

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	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05		
							Total	4.69E+06
Onsite Truck (km)		6.83E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		2.27E+07						
Offsite Rail (km)		2.10E+05						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops	1.83E+04	2.60E+02	1.40E+02	7.41E-01	4.94E+08		
Vitrification								
	Const.	2.20E+04	2.60E+02	1.40E+02	7.41E-01	5.93E+08		
	Ops/D&D	8.05E+03	2.60E+02	1.40E+02	7.41E-01	2.17E+08		
Closure		3.19E+02	2.60E+02	1.40E+02	7.41E-01	8.60E+06		
							Total	1.32E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.27E+07	5.00E-02			1.13E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Suburban								
	Truck	2.27E+07	5.00E-02		6.83E+06	7.97E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Rural								
	Truck	2.27E+07	9.00E-01			2.04E+07		
	Rail	2.10E+05	9.00E-01			1.89E+05		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.13E+06	1.05E+04	7.97E+06	1.05E+04	2.04E+07	1.89E+05
urban truck fat/km		7.50E-09	8.50E-03					
urban truck inj/km		3.70E-07	4.19E-01					
urban rail fat/km		1.70E-08		1.79E-04				
urban rail inj/km		3.30E-08		3.47E-04				
sub truck fat.km		1.30E-08			1.04E-01			
sub truck inj/km		3.80E-07			3.03E+00			

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sub rail fat/km		1.70E-08				1.79E-04		
sub rail inj/km		3.30E-08				3.47E-04		
rural truck fat/km		5.30E-08					1.08E+00	
rural truck inj/km		8.00E-07					1.63E+01	
rural rail fat/km		1.70E-08						3.22E-03
rural rail inj/km		3.30E-08						6.25E-03
	TOTAL FATALITIES		1.20E+00					
	TOTAL INJURIES		1.98E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.32E+09	8.98E-09	1.18E+01				
	injuries	1.32E+09	7.14E-07	9.40E+02				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.20E+00	1.18E+01	1.30E+01			
	INJURIES		1.98E+01	9.40E+02	9.60E+02			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.25E+04	=	2.19E+03			
	LWC =	2.45E-02	2.25E+04	=	5.51E+02			
	Fatality =	3.20E-05	2.25E+04	=	7.19E-01			
							trc	2.77E+03
OPERATION ACCIDENTS							fatal	1.56E+00
		rate	person-yr					
	TRC =	2.20E-02	2.64E+04	=	5.80E+02			
	LWC =	1.10E-02	2.64E+04	=	2.90E+02			
	Fatality =	3.20E-05	2.64E+04	=	8.43E-01			
TOTALS				excluding employee traffic				
	INJUR	3.73E+03						
	FATAL	1.46E+01		fatal	2.76E+00			

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	EX SITU INTERMEDIATE SEPARATIONS ALTERNATIVE - remediation & closure							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04		
							Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement W-314		1.00E+02	1.40E+02		1.40E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.69E+05	1.00E+01		1.69E+06		
							Total	1.69E+06
Offsite Truck			trips	km/trip		total		
	concrete		5.45E+04	1.40E+02		7.63E+06		
	steel		1.51E+04	8.00E+02		1.21E+07		
			trips/yr	km/trip	yr			
	miscellaneous		7.54E+03	1.40E+02	1.00E+01	1.06E+07		
							Total	3.03E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.30E+03	8.00E+02	1.90E+01	3.50E+07		
	miscellaneous		6.70E+03	1.40E+02	1.90E+01	1.78E+07		
							Total	5.28E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		2.74E+02	8.00E+02	1.90E+01	4.16E+06		
							Total	4.16E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06		
							Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		

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	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06		
					-		Total	8.45E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.02E+07						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.05E+08						
Offsite Rail (km)		7.90E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	1.73E+04	2.60E+02	1.40E+02	7.41E-01	4.67E+08		
Closure		4.90E+02	2.60E+02	1.40E+02	7.41E-01	1.32E+07		
							Total	2.31E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.05E+08	5.00E-02			5.24E+06		
	Rail	7.90E+06	5.00E-02			3.95E+05		
Suburban								
	Truck	1.05E+08	5.00E-02		1.02E+07	1.54E+07		
	Rail	7.90E+06	5.00E-02			3.95E+05		
Rural								
	Truck	1.05E+08	9.00E-01			9.43E+07		
	Rail	7.90E+06	9.00E-01			7.11E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			5.24E+06	3.95E+05	1.54E+07	3.95E+05	9.43E+07	7.11E+06
urban truck fat/km		7.50E-09	3.93E-02					
urban truck inj/km		3.70E-07	1.94E+00					
urban rail fat/km		1.70E-08		6.71E-03				
urban rail inj/km		3.30E-08		1.30E-02				
sub truck fat.km		1.30E-08			2.01E-01			

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sub truck inj/km		3.80E-07			5.86E+00			
sub rail fat/km		1.70E-08				6.71E-03		
sub rail inj/km		3.30E-08				1.30E-02		
rural truck fat/km		5.30E-08					5.00E+00	
rural truck inj/km		8.00E-07					7.55E+01	
rural rail fat/km		1.70E-08						1.21E-01
rural rail inj/km		3.30E-08						2.35E-01
	TOTAL FATALITIES		5.37E+00					
	TOTAL INJURIES		8.35E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.31E+09	8.98E-09	2.07E+01				
	injuries	2.31E+09	7.14E-07	1.65E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.37E+00	2.07E+01	2.61E+01			
	INJURIES		8.35E+01	1.65E+03	1.73E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.09E+04	=	3.01E+03			
	LWC =	2.45E-02	3.09E+04	=	7.57E+02			
	Fatality =	3.20E-05	3.09E+04	=	9.88E-01		const = ops	
							trc	4.22E+03
OPERATION ACCIDENTS							fatality	2.74E+00
		rate	person-yr					
	TRC =	2.20E-02	5.47E+04	=	1.20E+03			
	LWC =	1.10E-02	5.47E+04	=	6.02E+02			
	Fatality =	3.20E-05	5.47E+04	=	1.75E+00			
TOTALS				excluding employee traffic				
	INJUR	5.95E+03						
	FATAL	2.88E+01		fatal	8.11E+00			

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	EX SITU NO SEPARATIONS ALTERNATIVE - VITRIFICATION - remediation & closure							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.18E+05	1.00E+01		1.18E+06	Total	1.18E+06
Offsite Truck			trips	km/trip		total		
	Try Cities		4.38E+04	1.40E+02		6.13E+06		
	Portland/Seattle		4.34E+04	8.00E+02		3.47E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	5.50E+00	4.00E+06	Total	4.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	Portand/Seattle		4.17E+02	8.00E+02	1.50E+01	5.00E+06		
	miscellaneous		6.85E+03	1.40E+02	1.50E+01	1.44E+07	Total	1.94E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	Portland/Seattle		1.03E+02	8.00E+02	1.50E+01	1.24E+06	Total	1.24E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		1.47E+04	4.28E+03		6.29E+07	Total	6.29E+07
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		

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	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.35E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05	Total	5.68E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		6.91E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		8.60E+07						
Offsite Rail (km)		6.43E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		4.62E+02	2.60E+02	1.40E+02	7.41E-01	1.25E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.82E+09
	total	6.73E+04						

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	8.60E+07	5.00E-02			4.30E+06		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Suburban								
	Truck	8.60E+07	5.00E-02		6.91E+06	1.12E+07		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Rural								
	Truck	8.60E+07	9.00E-01			7.74E+07		
	Rail	6.43E+07	9.00E-01			5.79E+07		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			4.30E+06	3.22E+06	1.12E+07	3.22E+06	7.74E+07	5.79E+07
urban truck fat/km		7.50E-09	3.22E-02					
urban truck inj/km		3.70E-07	1.59E+00					
urban rail fat/km		1.70E-08		5.47E-02				
urban rail inj/km		3.30E-08		1.06E-01				

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sub truck fat.km		1.30E-08			1.46E-01			
sub truck inj/km		3.80E-07			4.26E+00			
sub rail fat/km		1.70E-08				5.47E-02		
sub rail inj/km		3.30E-08				1.06E-01		
rural truck fat/km		5.30E-08					4.10E+00	
rural truck inj/km		8.00E-07					6.19E+01	
rural rail fat/km		1.70E-08						9.84E-01
rural rail inj/km		3.30E-08						1.91E+00
	TOTAL FATALITIES		5.37E+00					
	TOTAL INJURIES		6.99E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.82E+09	8.98E-09	1.63E+01				
	injuries	1.82E+09	7.14E-07	1.30E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.37E+00	1.63E+01	2.17E+01			
	INJURIES		6.99E+01	1.30E+03	1.37E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.60E+04	=	2.54E+03			
	LWC =	2.45E-02	2.60E+04	=	6.38E+02			
	Fatality =	3.20E-05	2.60E+04	=	8.33E-01			
							trc	3.45E+03
OPERATION ACCIDENTS							fat	2.15E+00
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS				excluding employee traffic				
	INJUR	4.81E+03						
	FATAL	2.38E+01		fatal	7.53E+00			

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	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.35E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05	Total	5.68E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		6.06E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.06E+07						
Offsite Rail (km)		1.92E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		4.62E+02	2.60E+02	1.40E+02	7.41E-01	1.25E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.82E+09
	total	6.73E+04						

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	6.06E+07	5.00E-02			3.03E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Suburban								
	Truck	6.06E+07	5.00E-02		6.06E+06	9.09E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Rural								
	Truck	6.06E+07	9.00E-01			5.46E+07		
	Rail	1.92E+07	9.00E-01			1.72E+07		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			3.03E+06	9.58E+05	9.09E+06	9.58E+05	5.46E+07	1.72E+07
urban truck fat/km		7.50E-09	2.27E-02					
urban truck inj/km		3.70E-07	1.12E+00					
urban rail fat/km		1.70E-08		1.63E-02				
urban rail inj/km		3.30E-08		3.16E-02				

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sub truck fat.km		1.30E-08			1.18E-01			
sub truck inj/km		3.80E-07			3.45E+00			
sub rail fat/km		1.70E-08				1.63E-02		
sub rail inj/km		3.30E-08				3.16E-02		
rural truck fat/km		5.30E-08					2.89E+00	
rural truck inj/km		8.00E-07					4.37E+01	
rural rail fat/km		1.70E-08						2.93E-01
rural rail inj/km		3.30E-08						5.69E-01
	TOTAL FATALITIES		3.36E+00					
	TOTAL INJURIES		4.89E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.82E+09	8.98E-09	1.63E+01				
	injuries	1.82E+09	7.14E-07	1.30E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		3.36E+00	1.63E+01	1.97E+01			
	INJURIES		4.89E+01	1.30E+03	1.35E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.60E+04	=	2.54E+03			
	LWC =	2.45E-02	2.60E+04	=	6.38E+02			
	Fatality =	3.20E-05	2.60E+04	=	8.33E-01		trc	3.45E+03
							fatal	2.15E+00
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS								
	INJUR	4.79E+03						
	FATAL	2.18E+01						

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	EX SITU EXTENSIVE SEPARATIONS ALTERNATIVE - remediation & closure							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06	Total	2.12E+06
Offsite Truck			trips	km/trip		total		
	Tri-Cities		1.07E+05	1.40E+02		1.50E+07		
	Portland/Seattle		2.62E+04	8.00E+02		2.10E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	9.00E+00	6.55E+06	Total	4.25E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.17E+03	8.00E+02	1.90E+01	3.30E+07		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07	Total	4.68E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		6.77E+02	8.00E+02	1.90E+01	1.03E+07	Total	1.03E+07
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.00E+01	4.28E+03		1.71E+05	Total	1.71E+05
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		

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	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06	Total	8.45E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.06E+07						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.11E+08						
Offsite Rail (km)		1.06E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	2.58E+04	2.60E+02	1.40E+02	7.41E-01	6.96E+08		
	Ops/D&D	6.95E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08		
Closure		4.90E+02	2.60E+02	1.40E+02	7.41E-01	1.32E+07		
	total	8.12E+04					Total	2.19E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.11E+08	5.00E-02			5.55E+06		
	Rail	1.06E+07	5.00E-02			5.31E+05		
Suburban								
	Truck	1.11E+08	5.00E-02		1.06E+07	1.62E+07		
	Rail	1.06E+07	5.00E-02			5.31E+05		
Rural								
	Truck	1.11E+08	9.00E-01			1.00E+08		
	Rail	1.06E+07	9.00E-01			9.56E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			5.55E+06	5.31E+05	1.62E+07	5.31E+05	1.00E+08	9.56E+06
urban truck fat/km		7.50E-09	4.16E-02					
urban truck inj/km		3.70E-07	2.05E+00					
urban rail fat/km		1.70E-08		9.03E-03				
urban rail inj/km		3.30E-08		1.75E-02				
sub truck fat.km		1.30E-08			2.10E-01			
sub truck inj/km		3.80E-07			6.14E+00			

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sub rail fat/km		1.70E-08				9.03E-03		
sub rail inj/km		3.30E-08				1.75E-02		
rural truck fat/km		5.30E-08					5.30E+00	
rural truck inj/km		8.00E-07					8.00E+01	
rural rail fat/km		1.70E-08						1.63E-01
rural rail inj/km		3.30E-08						3.15E-01
	TOTAL FATALITIES		5.73E+00					
	TOTAL INJURIES		8.85E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.19E+09	8.98E-09	1.97E+01				
	injuries	2.19E+09	7.14E-07	1.56E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.73E+00	1.97E+01	2.54E+01			
	INJURIES		8.85E+01	1.56E+03	1.65E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.69E+04	=	3.60E+03			
	LWC =	2.45E-02	3.69E+04	=	9.04E+02			
	Fatality =	3.20E-05	3.69E+04	=	1.18E+00		trc	4.57E+03
							fatal	2.60E+00
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.44E+04	=	9.76E+02			
	LWC =	1.10E-02	4.44E+04	=	4.88E+02			
	Fatality =	3.20E-05	4.44E+04	=	1.42E+00			
TOTALS				excluding employee traffic				
	INJUR	6.23E+03						
	FATAL	2.80E+01		fatal	8.33E+00			

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		EX SITU COMBINATION ALTERNATIVE - remediation & closure						
RETRIEVAL								
Waste Transport						total		
Onsite Truck						0.00E+00		
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		2.40E+02	1.40E+02	2.00E+01	6.72E+05		
	raw material		2.25E+01	8.00E+02	2.00E+01	3.60E+05		
	equipment		1.25E+01	1.00E+04	2.00E+01	2.50E+06		
	miscellaneous		2.60E+03	1.40E+02	2.00E+01	7.28E+06		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	1.09E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		5.00E+00	8.00E+02	2.00E+01	8.00E+04	Total	8.00E+04
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		8.40E+04	1.00E+01		8.40E+05	Total	8.40E+05
Offsite Truck			trips	km/trip		total		
	concrete		2.30E+04	1.40E+02		3.22E+06		
	steel		9.10E+03	8.00E+02		7.28E+06		
			trips/yr	km/trip	yr			
	miscellaneous		3.15E+03	1.40E+02	1.00E+01	4.41E+06	Total	1.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		1.30E+03	8.00E+02	1.90E+01	1.98E+07		
	miscellaneous		2.60E+03	1.40E+02	1.90E+01	6.92E+06	Total	2.67E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		1.37E+02	8.00E+02	1.90E+01	2.08E+06	Total	2.08E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.18E+02	4.28E+03		1.79E+06	Total	1.79E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.36E+05	1.00E-01	1.00E+01	9.36E+05		
	silt		6.67E+05	1.00E-01	3.00E+01	2.00E+06		
	riprap		1.04E+06	1.00E-01	3.20E+01	3.33E+06		

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	ag/sand		7.78E+05	1.00E-01	1.00E+01	7.78E+05	Total	7.04E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		7.92E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		5.25E+07						
Offsite Rail (km)		3.95E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	6.36E+03	2.60E+02	1.40E+02	7.41E-01	1.72E+08		
	Ops/D&D	2.24E+04	2.60E+02	1.40E+02	7.41E-01	6.04E+08		
Vitrification								
	Const.	1.19E+04	2.60E+02	1.40E+02	7.41E-01	3.21E+08		
	Ops/D&D	1.04E+04	2.60E+02	1.40E+02	7.41E-01	2.81E+08		
Fill tank								
	Const.	5.70E+01	2.60E+02	1.40E+02	7.41E-01	1.54E+06		
	Ops/D&D	9.06E+02	2.60E+02	1.40E+02	7.41E-01	2.44E+07		
Closure		5.74E+02	2.60E+02	1.40E+02	7.41E-01	1.55E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.42E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	5.25E+07	5.00E-02			2.63E+06		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Suburban								
	Truck	5.25E+07	5.00E-02		7.92E+06	1.05E+07		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Rural								
	Truck	5.25E+07	9.00E-01			4.73E+07		
	Rail	3.95E+06	9.00E-01			3.56E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			2.63E+06	1.98E+05	1.05E+07	1.98E+05	4.73E+07	3.56E+06
urban truck fat/km		7.50E-09	1.97E-02					
urban truck inj/km		3.70E-07	9.72E-01					
urban rail fat/km		1.70E-08		3.36E-03				
urban rail inj/km		3.30E-08		6.52E-03				
sub truck fat.km		1.30E-08			1.37E-01			

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sub truck inj/km		3.80E-07			4.01E+00			
sub rail fat/km		1.70E-08				3.36E-03		
sub rail inj/km		3.30E-08				6.52E-03		
rural truck fat/km		5.30E-08					2.51E+00	
rural truck inj/km		8.00E-07					3.78E+01	
rural rail fat/km		1.70E-08						6.05E-02
rural rail inj/km		3.30E-08						1.17E-01
	TOTAL FATALITIES		2.73E+00					
	TOTAL INJURIES		4.29E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.42E+09	8.98E-09	1.28E+01				
	injuries	1.42E+09	7.14E-07	1.02E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		2.73E+00	1.28E+01	1.55E+01			
	INJURIES		4.29E+01	1.02E+03	1.06E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.91E+04	=	1.86E+03			
	LWC =	2.45E-02	1.91E+04	=	4.67E+02			
	Fatality =	3.20E-05	1.91E+04	=	6.10E-01		trc	2.60E+03
							fatal	1.69E+00
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	3.37E+04	=	7.42E+02			
	LWC =	1.10E-02	3.37E+04	=	3.71E+02			
	Fatality =	3.20E-05	3.37E+04	=	1.08E+00			
TOTALS				excluding employee traffic				
	INJUR	3.66E+03						
	FATAL	1.72E+01		fatal	4.42E+00			

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	EX SITU/ IN SITU COMBINATION LOW - remediation & closure					

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	PHASE 1 IMPLEMENTATION SUB-ALTERNATIVE - remediation							
RETRIEVAL								
WASTE TRANSFER SYSTEM UPGRADE (W-314)								
Onsite Truck			trips	km/trip		total		
	borrow		1.38E+03	1.00E+00		1.38E+03	Total	1.38E+03
Offsite Truck								
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04	Total	5.64E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.96E+03	1.00E+01		1.96E+04	Total	1.96E+04
Offsite Truck			trips	km/trip		total		
	concrete		1.20E+03	1.40E+02		1.68E+05		
	steel		7.32E+03	8.00E+02		5.86E+06		
	miscellaneous		3.18E+03	1.40E+02		4.45E+05	Total	6.47E+06
Processing								
Offsite Truck			trips	km/trip		total		
	glassformer/chem		3.50E+03	8.00E+02		2.80E+06		
	glassformer/chem		3.57E+03	1.40E+02		5.00E+05		
	miscellaneous		5.20E+04	1.40E+02		7.28E+06	Total	1.06E+07
Offsite Rail			trips	km/trip		total		
	glassformer/chem		2.18E+02	8.00E+02		1.74E+05	Total	1.74E+05
VITRIFIED HLW TRANSPORT								
SITE RESTORATION								
Onsite Truck			trips	km/trip		total		
	contaminated waste		1.50E+03	1.61E+01		2.42E+04		
	noncont. waste		6.23E+04	1.61E+01		1.00E+06	Total	1.03E+06

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GROUT FILL IMUST								
Onsite Truck (km)		1.05E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.71E+07						
Offsite Rail (km)		1.74E+05						
EMPLOYEE VEHICLE								
		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.07E+04	2.60E+02	1.40E+02	7.41E-01	2.89E+08		
	Ops/D&D	6.93E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08	Total	4.76E+08
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.71E+07	5.00E-02			8.55E+05		
	Rail	1.74E+05	5.00E-02			8.72E+03		
Suburban								
	Truck	1.71E+07	5.00E-02		1.05E+06	1.90E+06		
	Rail	1.74E+05	5.00E-02			8.72E+03		
Rural								
	Truck	1.71E+07	9.00E-01			1.54E+07		
	Rail	1.74E+05	9.00E-01			1.57E+05		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			8.55E+05	8.72E+03	1.90E+06	8.72E+03	1.54E+07	1.57E+05
urban truck fat/km		7.50E-09	6.41E-03					
urban truck inj/km		3.70E-07	3.16E-01					
urban rail fat/km		1.70E-08		1.48E-04				
urban rail inj/km		3.30E-08		2.88E-04				
sub truck fat.km		1.30E-08			2.47E-02			

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sub truck inj/km		3.80E-07			7.23E-01			
sub rail fat/km		1.70E-08				1.48E-04		
sub rail inj/km		3.30E-08				2.88E-04		
rural truck fat/km		5.30E-08					8.16E-01	
rural truck inj/km		8.00E-07					1.23E+01	
rural rail fat/km		1.70E-08						2.67E-03
rural rail inj/km		3.30E-08						5.18E-03
	TOTAL FATALITIES		8.50E-01					
	TOTAL INJURIES		1.34E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	4.76E+08	8.98E-09	4.27E+00				
	injuries	4.76E+08	7.14E-07	3.40E+02				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		8.50E-01	4.27E+00	5.12E+00			
	INJURIES		1.34E+01	3.40E+02	3.53E+02			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.07E+04	=	1.04E+03			
	LWC =	2.45E-02	1.07E+04	=	2.62E+02			
	Fatality =	3.20E-05	1.07E+04	=	3.42E-01		trc	1.20E+03
							fatal	5.64E-01
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	6.93E+03	=	1.52E+02			
	LWC =	1.10E-02	6.93E+03	=	7.62E+01			
	Fatality =	3.20E-05	6.93E+03	=	2.22E-01			
TOTALS								
	INJUR	1.55E+03						
	FATAL	5.68E+00						

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	TOTAL ALTERNATIVE PHASED IMPLEMENTATION 1 AND 2 - remediation & closure							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	borrow (W-314)		1.38E+03	1.00E+01		1.38E+04	Total	2.16E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05		
	steel (W-314)		5.30E+01	8.00E+02		4.24E+04		
	cement (W-314)		1.00E+02	1.40E+02		1.40E+04	Total	2.16E+05
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.44E+05	1.00E+01		1.44E+06	Total	1.44E+06
Offsite Truck			trips	km/trip		total		
	concrete		2.61E+04	1.40E+02		3.65E+06		
	steel		9.70E+03	8.00E+02		7.76E+06		
	miscellaneous		3.11E+04	1.40E+02		4.35E+06	Total	1.58E+07
Processing								
Offsite Truck			trips	km/trip		total		
	glassformer/chem		1.65E+04	8.00E+02		1.32E+07		
	miscellaneous		1.03E+05	1.40E+02		1.44E+07		
	process material		3.00E+04	1.40E+02		4.20E+06	Total	3.18E+07
Offsite Rail			trips	km/trip		total		
	glassformer/chem		3.00E+03	8.00E+02		2.40E+06	Total	2.40E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06	Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		

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	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06		
	grout fill sand IMUST		2.20E+03	1.00E+01		2.20E+04	Total	8.47E+06
Offsite Truck			trips	km/trip		total		
	groutfill cement IMUS		4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		9.92E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.93E+07						
Offsite Rail (km)		6.19E+06						
EMPLOYEE VEHICLE								
Phase 1		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.16E+04	2.60E+02	1.40E+02	7.41E-01	3.13E+08		
	Ops/D&D	6.77E+03	2.60E+02	1.40E+02	7.41E-01	1.83E+08		
Phase 2								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	4.91E+04	2.60E+02	1.40E+02	7.41E-01	1.32E+09		
							Total	2.35E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	6.93E+07	5.00E-02			3.46E+06		
	Rail	6.19E+06	5.00E-02			3.10E+05		
Suburban								
	Truck	6.93E+07	5.00E-02		9.92E+06	1.34E+07		
	Rail	6.19E+06	5.00E-02			3.10E+05		
Rural								
	Truck	6.93E+07	9.00E-01			6.24E+07		
	Rail	6.19E+06	9.00E-01			5.57E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			3.46E+06	3.10E+05	1.34E+07	3.10E+05	6.24E+07	5.57E+06
urban truck fat/km		7.50E-09	2.60E-02					
urban truck inj/km		3.70E-07	1.28E+00					
urban rail fat/km		1.70E-08		5.26E-03				
urban rail inj/km		3.30E-08		1.02E-02				
sub truck fat.km		1.30E-08			1.74E-01			

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sub truck inj/km		3.80E-07			5.09E+00			
sub rail fat/km		1.70E-08				5.26E-03		
sub rail inj/km		3.30E-08				1.02E-02		
rural truck fat/km		5.30E-08					3.31E+00	
rural truck inj/km		8.00E-07					4.99E+01	
rural rail fat/km		1.70E-08						9.47E-02
rural rail inj/km		3.30E-08						1.84E-01
	TOTAL FATALITIES		3.61E+00					
	TOTAL INJURIES		5.65E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.35E+09	8.98E-09	2.11E+01				
	injuries	2.35E+09	7.14E-07	1.68E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		3.61E+00	2.11E+01	2.47E+01			
	INJURIES		5.65E+01	1.68E+03	1.74E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.14E+04	=	3.06E+03			
	LWC =	2.45E-02	3.14E+04	=	7.69E+02			
	Fatality =	3.20E-05	3.14E+04	=	1.00E+00		trc	4.29E+03
							fatal	2.79E+00
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	5.59E+04	=	1.23E+03			
	LWC =	1.10E-02	5.59E+04	=	6.15E+02			
	Fatality =	3.20E-05	5.59E+04	=	1.79E+00			
TOTALS				excluding employee traffic				
	INJUR	6.03E+03						
	FATAL	2.75E+01		fatal	6.40E+00			

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		NO ACTION - CAPSULES - remediation & closure				

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		ONSITE STORAGE ALTERNATIVE - remediation & closure						
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.00E+02	1.00E+01		1.00E+03		
							Total	1.00E+03
Offsite Truck			trips	km/trip		total		
	encasement pipe		1.40E+01	8.00E+02		1.12E+04		
	WESF modification		2.00E+02	1.40E+02		2.80E+04		
							Total	3.92E+04
Capsule Transport								
Onsite Truck			trips	km/trip		total		
	to dry storage		1.84E+02	3.20E+01		5.89E+03		
							Total	5.89E+03
		Onsite Truck (km)		6.89E+03				
		Onsite Rail (km)		0.00E+00				
		Offsite Truck (km)		3.92E+04				
		Offsite Rail (km)		0.00E+00				
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	2.10E+02	2.60E+02	1.40E+02	7.41E-01	5.66E+06		
	Packaging	1.94E+02	2.60E+02	1.40E+02	7.41E-01	5.23E+06		
	Storage	8.90E+02	2.60E+02	1.40E+02	7.41E-01	2.40E+07		
							Total	3.49E+07
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	3.92E+04	5.00E-02			1.96E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	3.92E+04	5.00E-02		6.89E+03	8.85E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	3.92E+04	9.00E-01			3.53E+04		
	Rail	0.00E+00	9.00E-01			0.00E+00		

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Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.96E+03	0.00E+00	8.85E+03	0.00E+00	3.53E+04	0.00E+00
urban truck fat/km		7.50E-09	1.47E-05					
urban truck inj/km		3.70E-07	7.25E-04					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			1.15E-04			
sub truck inj/km		3.80E-07			3.36E-03			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					1.87E-03	
rural truck inj/km		8.00E-07					2.82E-02	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		2.00E-03					
	TOTAL INJURIES		3.23E-02					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	3.49E+07	8.98E-09	3.13E-01				
	injuries	3.49E+07	7.14E-07	2.49E+01				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		2.00E-03	3.13E-01	3.15E-01			
	INJURIES		3.23E-02	2.49E+01	2.50E+01			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.10E+02	=	2.05E+01			

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	LWC =	2.45E-02	2.10E+02	=	5.15E+00			
	Fatality =	3.20E-05	2.10E+02	=	6.72E-03		trc	4.43E+01
							fatal	4.14E-02
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	1.08E+03	=	2.38E+01			
	LWC =	1.10E-02	1.08E+03	=	1.19E+01			
	Fatality =	3.20E-05	1.08E+03	=	3.47E-02			
TOTALS								
	INJUR	6.93E+01						
	FATAL	3.57E-01						

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		OVERPACK AND SHIP ALTERNATIVE - remediation & closure						
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips	km/trip		total		
	encasement pipe		0.00E+00	0.00E+00		0.00E+00		
	WESF modification		2.00E+02	1.40E+02		2.80E+04		
							Total	2.80E+04
Capsule Transport								
Offsite Rail			trips	km/trip		total		
	Yucca		5.00E+00	2.93E+03		1.47E+04		
							Total	1.47E+04
		Onsite Truck (km)		0.00E+00				
		Onsite Rail (km)		0.00E+00				
		Offsite Truck (km)		2.80E+04				
		Offsite Rail (km)		1.47E+04				
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06		
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06		
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06		
							Total	6.50E+06
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.80E+04	5.00E-02			1.40E+03		
	Rail	1.47E+04	5.00E-02			7.33E+02		
Suburban								
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03		
	Rail	1.47E+04	5.00E-02			7.33E+02		
Rural								
	Truck	2.80E+04	9.00E-01			2.52E+04		
	Rail	1.47E+04	9.00E-01			1.32E+04		

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Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.40E+03	7.33E+02	1.40E+03	7.33E+02	2.52E+04	1.32E+04
urban truck fat/km		7.50E-09	1.05E-05					
urban truck inj/km		3.70E-07	5.18E-04					
urban rail fat/km		1.70E-08		1.25E-05				
urban rail inj/km		3.30E-08		2.42E-05				
sub truck fat.km		1.30E-08			1.82E-05			
sub truck inj/km		3.80E-07			5.32E-04			
sub rail fat/km		1.70E-08				1.25E-05		
sub rail inj/km		3.30E-08				2.42E-05		
rural truck fat/km		5.30E-08					1.34E-03	
rural truck inj/km		8.00E-07					2.02E-02	
rural rail fat/km		1.70E-08						2.24E-04
rural rail inj/km		3.30E-08						4.35E-04
	TOTAL FATALITIES		1.61E-03					
	TOTAL INJURIES		2.17E-02					

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	6.50E+06	8.98E-09	5.84E-02				
	injuries	6.50E+06	7.14E-07	4.64E+00				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.61E-03	5.84E-02	6.00E-02			
	INJURIES		2.17E-02	4.64E+00	4.66E+00			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.00E+02	=	9.75E+00			
	LWC =	2.45E-02	1.00E+02	=	2.45E+00			
	Fatality =	3.20E-05	1.00E+02	=	3.20E-03			

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							trc	1.29E+01
OPERATION ACCIDENTS							fatal	7.71E-03
		rate	person-yr					
	TRC =	2.20E-02	1.41E+02	=	3.10E+00			
	LWC =	1.10E-02	1.41E+02	=	1.55E+00			
	Fatality =	3.20E-05	1.41E+02	=	4.51E-03			
TOTALS								
	INJUR	1.75E+01						
	FATAL	6.77E-02						

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		VITRIFY WITH TANK WASTE ALTERNATIVE - remediation & closure						
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips	km/trip		total		
	encasement pipe		0.00E+00	0.00E+00		0.00E+00		
	WESF modification		2.00E+02	1.40E+02		2.80E+04		
							Total	2.80E+04
Capsule Transport								
Onsite Truck			trips	km/trip		total		
	to vitrification plant		1.84E+02	3.20E+01		5.89E+03		
							Total	5.89E+03
		Onsite Truck (km)		5.89E+03				
		Onsite Rail (km)		0.00E+00				
		Offsite Truck (km)		2.80E+04				
		Offsite Rail (km)		0.00E+00				
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06		
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06		
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06		
							Total	6.50E+06
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.80E+04	5.00E-02			1.40E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	2.80E+04	9.00E-01			2.52E+04		
	Rail	0.00E+00	9.00E-01			0.00E+00		

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Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.40E+03	0.00E+00	1.40E+03	0.00E+00	2.52E+04	0.00E+00
urban truck fat/km		7.50E-09	1.05E-05					
urban truck inj/km		3.70E-07	5.18E-04					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			1.82E-05			
sub truck inj/km		3.80E-07			5.32E-04			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					1.34E-03	
rural truck inj/km		8.00E-07					2.02E-02	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		1.36E-03					
	TOTAL INJURIES		2.12E-02					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	6.50E+06	8.98E-09	5.84E-02				
	injuries	6.50E+06	7.14E-07	4.64E+00				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.36E-03	5.84E-02	5.97E-02			
	INJURIES		2.12E-02	4.64E+00	4.66E+00			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.00E+02	=	9.75E+00			
	LWC =	2.45E-02	1.00E+02	=	2.45E+00			
	Fatality =	3.20E-05	1.00E+02	=	3.20E-03		trc	1.29E+01

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							fatal	7.71E-03
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	1.41E+02	=	3.10E+00			
	LWC =	1.10E-02	1.41E+02	=	1.55E+00			
	Fatality =	3.20E-05	1.41E+02	=	4.51E-03			
TOTALS								
	INJUR	1.75E+01						
	FATAL	6.74E-02						

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Table A.2.3.1 Inactive MUSTs Estimated Current Waste Volumes [1]

Tank Designation	Nominal Tank Capacity (Liters)	Solids Volume (Liters)	Liquid Volume (Liters)	Total Waste Volume (Liters)	Comments
231-W-151-001	15,000	0	5,400	5,400	Settling tank, O/S since 1974
231-W-151-002	3,600	40	3,600	3,600	Settling tank, O/S since 1974
241-Z-8	58,000	1,900	0	1,900	Settling tank, O/S since 1962
241-A-302B	51,000	no data	no data	13,600	Interim Isolated. Monitored
241-B-301	136,000	82,000	2,200	84,000	Catch tank, O/S since 1984
241-B-302B	67,000	2,600	16,000	18,600	Catch tank, O/S since 1985
241-BX-302A	67,000	3,200	0	3,200	Catch tank, O/S since 1985
241-BX-302B	43,000	3,600	300	3,900	Catch tank, O/S since 1985
241-BX-302C	43,000	2,400	900	3,300	Catch tank, O/S since 1985
241-C-301	136,000	34,000	5,600	39,600	Catch tank, O/S since 1983
241-S-302A	67,000	no data	no data	19,000	Catch tank, O/S since 1991
241-S-302B	54,000	0	0	0	Emptied
241-SX-302	67,000	4,000	1,100	5,100	Catch tank, O/S since 1983
241-T-301B	136,000	82,000	2,200	84,200	Catch tank, O/S since 1985
241-TX-302A	67,000	9,300	100	9,400	Catch tank, O/S since 1982
241-TX-302B	67,000	no data	no data	5,000	Catch tank, stabilized and isolated in 1954
241-TX-302BR	45,000	no data	no data	no data	Catch tank, contents unknown
241-TX-302XB	50,000	400	900	1,300	Catch tank, O/S since 1985
241-TY-302A	67,000	1,700	0	1,700	Catch tank, O/S since 1981
241-TY-302B	54,000	0	0	0	Emptied
244-BXR-001	190,000	27,000	0	27,000	Uranium recovery tank, O/S since 1957
244-BXR-002	57,000	6,800	1,400	8,200	Uranium recovery tank, O/S since 1957
244-BXR-003	57,000	5,500	1,400	6,900	Uranium recovery tank, O/S since 1957
244-BXR-011	190,000	26,000	400	26,400	Uranium recovery tank, O/S since 1956
244-TXR-001	190,000	8,700	200	8,900	Uranium recovery tank, O/S since 1956
244-TXR-002	57,000	11,000	0	11,000	Uranium recovery tank, O/S since 1956

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Table A.2.3.1 Inactive MUSTs Estimated Current Waste Volumes [1] (cont'd)

Tank Designation	Nominal Tank Capacity (Liters)	Solids Volume (Liters)	Liquid Volume (Liters)	Total Waste Volume (Liters)	Comments
244-TXR-003	57,000	24,600	0	24,600	Uranium recovery tank, O/S since 1956
244-UR-001	190,000	7,000	1,500	8,500	Uranium recovery tank, O/S since 1957
244-UR-002	57,000	8,700	2,200	10,900	Uranium recovery tank, O/S since 1957
244-UR-003	57,000	5,900	0	5,900	Uranium recovery tank, O/S since either 1957 or 1976
244-UR-004	31,000	Minimal	Minimal	Minimal	Volumes unknown. Used for temporary storage of 60 percent nitric acid solutions.
244-ER-311A	N/R	N/R	N/R	N/R	Southwest of B Plant
241-AX-151	N/R	N/R	N/R	N/R	Diverter station with several tanks inside
216-TY-201	N/R	N/R	N/R	N/R	Flush tank, located east of TY Tank Farm
216-BY-201	N/R	N/R	N/R	N/R	Flush tank, located north of BY Tank Farm
242-TA-R1	N/R	N/R	N/R	N/R	Receiver tank for Z Plant
242-T-135	N/R	N/R	N/R	N/R	Outside the 242-T Evaporator, decontamination tank
243S-TK-1	N/R	N/R	N/R	N/R	Decontamination tank
213-W-TK-1	7,100	N/R	N/R	7,100	Decontamination tank, tank may not have received waste in the past.

Notes:

[1] Values with three or more significant digits do not imply a specific accuracy of the stated value.

N/R = Not Reported

O/S = Out of Service

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3.1.1.2 Schedule for Tank Stabilization. To perform tank stabilization with maximum efficiency and minimum cost, there would be two grout plants. Single-shell tanks and their ancillary equipment would be stabilized first, then DSTs and their ancillary equipment. One grout plant would be located in the center of 200 East Area Tank Farms; the other in the center of the 200 West Area Tank Farms. The following tank clusters would be served:

200E	241-T, 241-TX, and 241-TY 241-S, 241-SX, 241-U, and 241-SY
200W	241-A, 241-AX, 241-AW, 241-AP, 241-AY, and 241-AZ 241-B, 241-BX, 241-BY, 241-C, and 241-AN

3.1.1.3 Engineering Cost for Tank Stabilization. The total tank volume of all SSTs and DSTs is approximately 761,000 m^3 (see Appendix A, Table A1); currently, there are approximately 467,000 m^3 of waste in these tanks. The total tank volume of Tank C-106, which is a 530,000 gal tank, was estimated by computer modeling. The value was compared to the tank capacity, which is the amount of waste the tank contains, and a scaling factor of 1.6 was calculated. This scaling factor was used to estimate the size of all other tanks. In the TWRS-EIS extensive pretreatment, no separations, and Tri-Party Agreement alternatives, it is assumed that 99 percent of the SST waste and 99.9 percent of the DST waste will have been retrieved prior to closure. Therefore, there would be 1,355 m^3 of waste and approximately 760,000 m^3 of void space remaining in the tanks.

For every 1 m^3 (35 ft^3) of grout, the constituents of the grout mixture would be as follows: 1,660 kilograms (kgs) (3,660 pounds [lbs]) of sand, 180 kgs (397 lbs) fly ash, 150 kgs (331 lbs) water, 20 kgs (44 lbs) Type I/II portland cement, and 0.45 kg (1.00 lb) of air entrainment additive. Therefore, for 760,000 m^3 of void space, approximately 1,260,000,000 kgs of sand, 137,000,000 kgs of fly ash, 114,000,000 kgs of water, 15,000,000 kgs of cement, and 341,000 kgs of air entrainment additive would be required.

The major constituent for the grout is sand. Sand would be excavated from Pit 30, located between the 200 East and 200 West Areas. The pit currently has a footprint of 20,930 m^2 (5.2 acres), and would be expanded by another 253,000 m^2 (62.5 acres). A one-way trip is approximately 5 kilometers (km) (3 miles [mi]). A bottom-dump (or belly-dump) truck can haul about 7.6 m^3 (10 cubic yards [yd^3]) of sand. Assuming the sand has a density of about 1,280 kg/m^3, almost 164,000 trips would be required. Cement is manufactured in Durkee, Oregon (approximately 291 km [181 mi] from the Tri-Cities) and would be brought by railcar. Each railcar is assumed to carry 90,700 kgs (100 tons) of cement. For 15,000,000 kgs of cement, 165 railcars would be required. The Centralia Steam Plant in Centralia, Washington, which has a one-way trip of 300 km (186 mi), would provide the fly ash in 90,700 kg (100 ton) railcars. For 137,000,000 kgs of fly ash, 1,510 railcars would be necessary.

To store such large quantities of material, storage tanks or silos would have to be constructed for cement and fly ash. These facilities would keep the dry materials from precipitation and

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The success of the filling operation would depend on demonstrating and verifying that required fill distribution and uniformity was achieved. The fill monitoring system would be able to visualize interior tank operations, and a vision system would be able provide imaging through airborne dust. Fill surface elevation measurement and mapping in real time would be available to document the progress of the operation and to verify results. Density and compaction measurement also would be used to verify fill integrity.

3.1.2.3 Engineering Cost for Gravel-Fill Stabilization. The tank waste retrieval process would leave 1 percent waste in the SSTs. The smaller tanks (16 each holding 208 m^3 [55,000 gal]) would be stabilized by grouting rather than gravel fill because they are too small to contain the gravel dispersing mechanism. For this reason, the void volume of the remaining SSTs and DSTs is about 751,000 m^3. This volume of gravel would be removed from Pit 30. The gravel would be transported by end-dump trucks capable of hauling 6 m^3 (10 yd^3) of gravel per trip. Therefore 125,000 trips would be necessary for filling the SSTs and DSTs.

3.2 ANCILLARY EQUIPMENT STABILIZATION

3.2.1 Disposition of Ancillary Equipment

For all alternatives considered in the TWRS EIS except the no disposal action alternative, closure would apply to SSTs, DSTs and the ancillary equipment associated with both groups of tanks. Ancillary equipment would include the following: diversion boxes, catch tanks, valve and pump pits, process pits, diverter stations, receiver vaults, condensate tanks, risers, transfer piping and piping encasements associated with single-shell tank operations. Pipelines would include the following: lines between tanks and to process facilities, air and steam supply lines, raw water lines, and drains. See Figures 3-3 through 3-7 for representative sketches of miscellaneous underground storage tanks.

During closure of tank farms, ancillary equipment items would be stabilized in place (i.e., disposed of). In situ stabilization would consist of filling all voids with an appropriate grout material (a chemical grout or cement grout product). The physical immobilization of contaminants provided by the grout could be augmented by the use of sequestering agents, such as zeolites, that would be capable of chemical bonding with contaminants. If ancillary equipment was plugged at one or more points, several access ports would have to be installed to ensure complete grout filling.

For purposes of assessing the environmental consequences associated with dispositioning of ancillary equipment as part of closure, it is assumed that the entire void volume within the ancillary equipment would be filled with grout (analogous to the grout fill alternative for tanks) and that no ancillary equipment would be excavated, packaged, or disposed of as LLW or mixed waste.

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3.2.2 Description of Ancillary Equipment

Ancillary equipment components are defined in the Tri-Party Agreement as *Resource Conservation and Recovery Act* (RCRA) of 1976 (RCRA 1976) past practice units. Appendix A, Table A3 provides a list of the ancillary equipment associated with SSTs (see Appendix C, the Tri-Party Agreement). In 1993, the Tri-Party Agreement signatories agreed that past practice units within tank farms boundaries (fenceline boundaries) would be closed in accordance with the *Washington Administrative Code* (WAC 173-303-610). This decision was based on the intent to establish a consistent closure approach for SSTs and associated RCRA past practice units (i.e., contiguous ancillary equipment and spill sites) to eliminate redundancies in effort, time, and expense.

RCRA past practice units associated with SSTs include piping and control elements for routing waste to a specific tank or from one tank to another. Although the specific arrangement and connections would vary in detail between the various tank farms, all tank farms would be laid out in the same basic arrangement, where one main diversion box would serve several secondary diversion boxes or valve pits which, in turn, would serve three to nine tanks.

Piping consists primarily of welded-joint schedule 40 or 80 carbon steel (a limited amount of schedule 10 was used in the earlier installations). It varied in diameter from 8 to 15 cm (3 to 6 in.). Piping is buried or is within reinforced concrete encasements underground. A limited amount of double-wall pipe (a pipe within a pipe) also was installed. All pipes received one coat of red lead paint during installation. Underground pipe also received two coats of bitumastic paint and was double-wrapped with tar paper. Many pipe runs are equipped with pressure test connections. As many as 10 percent of the pipe runs, particularly the older schedule 10 pipes, are known or suspected to have leaks. Cathodic protection has been incorporated in some piping systems during the past 10 years; the adequacy of existing cathodic protection has not been verified. Some pipelines have been abandoned in place because of plugging.

The pipe encasement system consists of a monolithic reinforced concrete trough and removable reinforced concrete cover. Encasement wall thicknesses are typically 20 to 25 cm (8 to 10 in.), and cavities are minimally-sized to accommodate the installation of piping with the cover removed. Depth of soil cover over the encasements averages 1.8 to 2.4 m (6 to 8 ft). The encasement runs are sloped at about 1 percent to provide catchment of waste leaks or seepage of surface water runoff, and low points drain to a catch tank or pump or sluice pits. With a slope of only 1 percent, it is likely that shallow ponds occur in some sections of encasement. Swab risers at the low points of the encasement are provided to facilitate contamination monitoring.

Diversion boxes are mainly two-or three-chambered underground vaults. Inlet and outlet chambers provide isolated routing space for the intricate maze of inlet and outlet pipes. Waste flow diversion takes place in the central chamber by jumpers and associated valving. Jumpers, flexible or rigid pipes from 0.02-0.1 m (1 -4 in.) in diameter, are connected to the

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inlet and outlet pipes at the central chamber bulkheads by dry disconnect couplings. Jumper connections are routinely reconfigured to meet specific waste routing requirements. The central chamber perimeter is equipped with interior spray nozzles to provide a remotely activated surface decontamination wash mechanism. Diversion boxes are reinforced concrete with 0.6 m (2 ft) thick walls and 0.6 (2 ft) thick removable covers at grade level. A gantry crane is deployed over the central chamber to facilitate cover removal and equipment handling. The interiors of the diversion boxes were treated with Americoat, a chemical resistant paint, during construction. In some tank farms, valve boxes were installed instead of diversion boxes, but essential design features and functions are the same.

Liquid waste from underground piping is routed to an individual tank through one or more reinforced concrete pits above the tank, except for some very old tanks with side entry connections. Within these pump and sluice pits, dry disconnect jumpers are used for piping connections to pumps, valves, standpipes, etc. Interior spray nozzles provide decontamination washing of the pits. Drainage is directly into the waste tanks.

Several buried catch tanks provide collection points for liquids draining from diversion boxes and some encasements. The tanks, which are cylindrical in shape and constructed of steel, are accessible for sampling and pumping by standpipes.

Risers are vertical pipes connecting to tank domes. They vary in diameter from 2.5 cm to 107 cm (1-42 in.). Individual single-shell tanks may have as few as 6, or as many as 38 risers. Risers provide access for certain types of tank equipment including instrumentation and pumps. Some of the risers may be modified or removed by waste retrieval operations.

In two tank farms, French drains and septic tanks have been installed to collect and disperse surface water runoff from impervious paving and pads.

3.2.3 Development of Engineering Support Data

Void volumes within the past practice units are the combined volumes of tank farm piping, risers, and pits and encasements. The estimates of ancillary void volumes for the 12 SST tank farms are based on detailed analyses of three tank complexes: 241-A, 241-T, and 241-TY. Volume estimates for other farms are based on similarity to 241-A or 241-T. Void volume data for ancillary equipment are summarized in Appendix A, Figures A9-A13 (Boomer et al. 1993).

Void volumes for ancillary equipment associated with DSTs have been estimated based on similarity to the 241-A tank complexarm. Voids were estimated based on a factor of 28/6 times the 241-A tank complex volume. There are 28 DSTs, six of which are located in the 241-A tank complex. The result of this estimation is a void piping volume of approximately 1,120 m^3 (296,000 gal) and a void structure volume of approximately 6,770 m^3 (1.8 million gal) (Boomer et al. 1993).

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Table 5-2A. Comparison of Alternatives by Construction Personnel Requirements for Tank Stabilization with Gravel (Staff Hours).

Construction Personnel	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Design/engineering	n/a	177,000	177,000	177,000	177,000
Construction					
Radiation worker	n/a	65,000	65,000	65,000	65,000
Nonradiation worker	n/a	29,000	29,000	29,000	29,000
Supervisory	n/a	36,000	36,000	36,000	36,000
Total		307,000	307,000	307,000	307,000

Notes:

n/a = not applicable

All staff hours, with the exception of nonradiation construction workers, are based upon the cost estimate by the Westinghouse Hanford Company for gravel fill (March 23, 1993). The cost estimate was computed for a smaller volume of gravel used; therefore, the staff hour values have been scaled to reflect the larger volume of gravel. All workers near the tanks were assumed to be radiation workers (including 1 hopper operator, 1 gravel quality control worker, and 2 belt inspectors); nonradiation workers include the quarry staff (1 loader, 1 grizzley operator, and 2 truck drivers) and one part-time clerical worker (not included in the original estimate, job number 9342GRVL). Maintenance and mechanical support are assumed to be provided by the contractor.

This table includes gravel fill for 133 single-shell tanks (SSTs) and all 28 double-shell tanks. The 16 small SSTs (55,000 gallons each) are not included in these totals as they will be filled with grout rather than gravel.

For additional backup information, see Appendix A, Figure A1 and Table A1 and A2.

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Table 5-2C. Comparison of Alternatives by Construction Personnel Requirements for Ancillary Equipment Stabilization by Concrete (Staff Hours).

Construction Personnel	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Design/engineering	n/a	1330	1330	1330	1330
Construction					
Radiation worker	n/a	940	940	940	940
Nonradiation worker	n/a	970	970	970	970
Supervisory	n/a	470	470	470	470
Total		3710	3710	3710	3710

Notes:

Personnel requirements are based on the ratio of the requirements in Table 2B, that is, 36 percent of personnel are involved with design/engineering, 25 percent are radiation workers, 26 percent are nonradiation workers, and 13 percent are supervisors. The actual numbers were derived from a comparison of the volume of void space to be filled in the ancillary equipment to the volume of void space to be filled in the SSTs and DSTs.

The volume of the ancillary equipment for single-shell tanks (SSTs) is in Appendix A. The ratio of these void volumes to the capacity of all SSTs (10,475 m^3)/ (364,331 m^3) = 2.88 percent. It was assumed that the ratio of the ancillary equipment for the double-shell tanks (DSTs) would be the same. Therefore, (2.88 percent)*(111,586 m^3) = 3,208 m^3. Since it takes 17.31 days to stabilize 10,475 m^3 of SST ancillary equipment, it will take 5.3 days to stabilize 3,208 m^3 of DST ancillary equipment.

For additional backup information, see Appendix A, Tables A3-A7.

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Table 5-3A. Comparison of Alternatives by Tank Stabilization Construction Resource Requirements (Units as Indicated).

Construction Resource	In Situ Disposal[1]	Tank Stabilization by Grout	Tank Stabilization by Gravel	Ancillary Equipment Stabilization
Land (ha) surface committed[2]				
Temporarily	n/a			
Permanently	n/a			
Water (m^3) [3]	n/a	113,000	n/a	3,300
Source of water				
Energy				
Electrical (GWh) [4]	n/a	n/a	n/a	n/a
Propane (m^3)	n/a	n/a	n/a	n/a
Diesel fuel (m^3) [5]	n/a	27,900	6,380	802
Gasoline (m^3) [6]	n/a	40.1	40.1	1.2
Materials				
Concrete fill (m^3)	n/a	760,000	5,300	13,700
Steel (t)	n/a	0	n/a	0
Asphalt (m^3)	n/a	0	n/a	0
Excavation (m^3) [7]	n/a	0	n/a	0
Soil (m^3) [8]	n/a	0	n/a	0
Riprap (m^3) [9]	n/a	0	n/a	0
Gravel/concrete fill (m^3) [10]	n/a	0	754,000	0
Waste debris	n/a	30	30	
Waste water	n/a	0	0	
Sewage	n/a	0	0	

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Table 5-3A. Comparison of Alternatives by Tank Stabilization Construction Resource Requirements (Units as Indicated).

Notes:

ha = hectares
n/a = not applicable
m^3 = cubic meters
GWh = gigawatt hour
t = metric ton

[1]All in situ disposal construction resources are documented in the in situ disposal data package and have not been addressed again in this table.

[2]Land: Permanently committed land is the sum of the barrier areas. The amount of temporarily committed land is used for equipment and materials laydown yards, and was estimated by W. A. Skelly from best engineering judgement. Both of these areas have been expressed in Table 5-3B (Barrier Construction Resource Requirements), and are not repeated here.

[3]Water: The maximum water requirement was assumed to be 50 gallons/yd^2 for barrier construction. The water requirement per barrier is the product of this maximum and the barrier acreage.

[4]Additional major power lines are not required for any of the options.

[5]Diesel fuel: See Appendix A for fuel consumption per day for specified equipment items. This number does not include fuel to run the generator that powers the high efficiency particulate air filter, or fuel to deliver gravel to the site. It only includes the fuel to run one 480 volt, 30 amp generator for the gravel slinger.

[6]Gasoline: Assume 3 light-duty trucks will be used for each barrier; each truck runs 80 miles per day and has an efficiency of 14 miles per gallon. See Tables 5-11 and 5-12 for estimates of barrier schedules; the length of each job was used to calculate the total fuel consumption per barrier.

[7]Excavation: Assumed excavation excludes the removal of material from borrow sites.

[8]Soil: Assumed that soil consists of the upper and lower silt layers of the barrier (layers 1 and 2).

[9]Riprap: Assumed that riprap refers to the basalt layer of the barrier.

[10]Gravel/sand: Assumed this figure is a compilation of all screened aggregate products from Pit 30, including the asphalt base course, the drainage media, and the gravel and sand filter layers of the barrier, as well as the road base.

For additional backup information, see Appendix A, Tables A1-A8.

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Table 5-3B. Comparison of Alternatives by Barrier Construction Resource Requirements (Units as Indicated).

Construction Resource	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Land (ha) surface committed[1]					
Temporarily	20	24	24	20	24
Permanently	17	25	64	17	25
Water (m^3) [2]	38,000	57,000	145,000	38,000	57,000
Source of water					
Energy					
Electrical (GWh) [3]	n/a	n/a	n/a	n/a	n/a
Propane (m^3)	n/a	n/a	n/a	n/a	n/a
Diesel fuel (m^3) [4]	45,000	60,000	142,000	45,000	59,000
Gasoline (m^3) [5]	260	350	830	260	350
Materials					
Concrete (m^3)	0	0	0	0	0
Steel (t)	0	0	0	0	0
Asphalt (m^3)	62,500	81,600	164,000	62,500	80,700
Excavation (m^3) [6]	0	0	0	0	0
Soil (m^3) [7]	377,000	535,000	1,320,000	377,000	526,000
Riprap (m^3) [8]	638,000	809,000	1,480,000	638,000	801,000
Gravel/sand (m^3) [9]	415,000	615,000	2,250,000	415,000	598,000
Waste debris	0	0	0	0	0
Waste water	0	0	0	0	0
Sewage	0	0	0	0	0

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Table 5-3B. Comparison of Alternatives by Barrier Construction Resource Requirements (Units as Indicated).

Notes:

ha = hectares
m^3 = cubic meters
n/a = not applicable
GWh = gigawatt hour
t = metric ton

[1]Land: Permanently committed land is the sum of the barrier areas. The amount of temporarily committed land is used for equipment and materials laydown yards and was estimated by W.A. Skelly.

[2]Water: The maximum water requirement was assumed to be 50 gallons per square yard for barrier construction. The water requirement per barrier is the product of this maximum and the barrier acreage.

[3]Additional major power lines are not required for any of the options.

[4]Diesel fuel: See Appendix A for fuel consumption per day for specified equipment items.

[5]Gasoline: Assume 3 light-duty trucks will be used for each barrier; each truck runs 80 miles per day and has an efficiency of 14 miles per gallon. See Tables 5-11 and 5-12 for estimates of barrier schedules. The length of each job was used to calculate the total fuel consumption per barrier.

[6]Excavation: Excludes excavation of material at borrow sites.

[7]Soil: Assumed that soil consists of the upper and lower silt layers of the barrier (layers 1 and 2).

[8]Riprap: Assumed that riprap refers to the basalt layer of the barrier (layer 6).

[9]Gravel/sand: Assumed this figure is a compilation of all screened aggregate products from Pit 30, including the asphalt base course, the drainage media, and the gravel and sand filter layers of the barrier, as well as the road base.

For additional backup information, see Appendix A, Figures A2, A3, and A4; and Tables A8 and A9.

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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)].

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Table A2. Schedules for Tank Stabilization (Backup to Tables 5-2A, 5-2B, 5-2C, 5-3A, 5-11 and 5-12). Tank Stabilization bv Grout

SCHEDULE FOR TANK STABILIZATION BY GROUT

TANK FARM	NUMBER TANKS	TANK CAPACITY (gal/tank)	HEIGHT (ft)	HEIGHT (m)	LIFTS/ TANK	TOTAL LIFTS PER TANK FARM	SCHEDULE (days)	SCHEDULE (years)
A	6	1000000	43	13	15	90	630	2.5
AN*	7	1160000	48	15	16	112	784	3.1
AP*	8	1160000	48	15	16	128	896	3.6
AW*	6	1160000	48	15	16	96	672	2.7
AX	4	1000000	43	13	15	60	420	1.7
AY*	2	1000000	43	13	15	30	210	0.8
AZ*	2	1000000	43	13	15	30	210	0.8
B	12	530000	28.5	9	10	120	840	3.4
B	4	55000	25	8	9	36	252	1.0
BX	12	530000	28.5	9	10	120	840	3.4
BY	12	756000	36	11	12	144	1008	4.0
C	12	530000	28.5	9	10	120	840	3.4
C	4	55000	25	8	9	36	252	1.0
S	12	756000	36	11	12	144	1008	4.0
SX	15	1000000	43	13	15	225	1575	6.3
SY*	3	1160000	48	15	16	48	336	1.3
T	12	530000	28.5	9	10	120	840	3.4
T	4	55000	25	8	9	36	252	1.0
TX	18	756000	36	11	12	216	1512	6.0
TY	6	756000	36	11	12	72	504	2.0
U	12	530000	28.5	9	10	120	840	3.4
U	4	55000	25	8	9	36	252	1.0
TOTALS:	177			242		2139	14973	59.9

NOTE: (1) Double-shelled tanks are designated by an asterisk after the tank farm letter.

(2) The schedule is based upon a maximum depth of 0.91 m (3 ft) per lift of grout, with a curing time of 7 days between lifts. The 55,000 gallon tanks are 25 ft tall and would need 9 lifts, the 530,000 gallon tanks are 28.5 ft tall and would need 10 lifts, the 756,000 gallon tanks are 36 ft tall and would need 12 lifts, the 1,000,000 gallon tanks are 43 ft tall and would need 15 lifts, and the 1,160,000 gallon tanks are 48 ft tall and would need 15 lifts.

(3) The schedule assumes 40 hour workweeks and 250 days per working year.

SCHEDULE FOR TANK STABILIZATION BY GRAVEL

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)	SCHEDULE (days)
A	6	1000000	3780	22680	1.6	9600000	36288	30
AN*	7	1160000	4364.8	30694	1.6	12992000	49110	40.6
AP*	8	1160000	4364.8	35078	1.6	14848000	56125	46.4
AW*	6	1160000	4364.8	26309	1.6	11136000	42094	34.8
AX	4	1000000	3780	15120	1.6	6400000	24192	40
AY*	2	1000000	3780	7560	1.6	3200000	12096	10
AZ*	2	1000000	3780	7560	1.6	3200000	12096	10
B	12	530000	2003.4	24041	1.6	10176000	38465	31.8
B	4	55000	207.9	832	1.6	352000	1331	2.2
BX	12	530000	2003.4	24041	1.6	10176000	38465	31.8
BY	12	756000	2865.24	34383	1.6	14553600	55013	45.46
C	12	530000	2003.4	24041	1.6	10176000	38465	31.8
C	4	55000	207.9	832	1.6	352000	1331	2.2
S	12	756000	2865.24	34383	1.6	14553600	55013	45.46
SX	15	1000000	3780	56700	1.6	24000000	90720	75
SY*	3	1160000	4364.8	13154	1.6	5568000	21047	17.4
T	12	530000	2003.4	24041	1.6	10176000	38465	31.8
T	4	55000	207.9	832	1.6	352000	1331	2.2
TX	18	756000	2865.24	51574	1.6	21830400	82519	68.22
TY	6	756000	2865.24	17191	1.6	7276800	27506	22.74
U	12	530000	2003.4	24041	1.6	10176000	38465	31.8
U	4	55000	207.9	832	1.6	352000	1331	2.2
TOTALS:	177			475917		201446400	761467	653.92

NOTE: (1) All 55,000 gallon tanks will be grout-filled rather than stabilized with gravel.

(2) Schedule assumes that it takes 5 days (8-hour days) to fill one 1,000,000 tank with gravel. All other schedules (with the exception of the 55,000 gallon tanks) are based on this ratio of time/tank size.

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Table A3. Ancillary Equipment Associated with Single-Shell Tanks (Backup to Tables 5-2C, 5-3A, 5-8, 5-9, 5-11, and 5-12).

TANK FARM	DESIGNATION	EQUIPMENT TYPE
241-A	241-A-152	Diversion Box
	241-A-153	Diversion Box
	241-A-350	Catch Tank
	241-A-417	Condensate Tank
	241-A-A	Diversion Box
	241-A-B	Diversion Box
241-AX	241-AX-151	Diversion Box
	241-AX-152-CT	Catch Tank
	241-AX-152-DS	Diverter Station
	241-AX-155	Diversion Box
	241-AX-501	Valve Pit
	241-AX-A	Diversion Box
	241-A-B	Diversion Box
241-B	241-B-151	Diversion Box
	241-B-152	Diversion Box
	241-B-153	Diversion Box
	241-B-252	Diversion Box
	241-B-301B	Catch Tank
	241-BR-152	Diversion Box
241-BY	241-BYR-152	Diversion Box
	241-BYR-153	Diversion Box
	241-BYR-154	Diversion Box
	242-B-151	Diversion Box
	244-BXR	Receiving Vault
	2607-EB	Septic Tank
241-BX	241-BX-153	Diversion Box
	241-BX-302A	Catch Tank
	241-BXR-151	Diversion Box
	241-BXR-152	Diversion Box
	241-BXR-143	Diversion Box
241-C	241-C-151	Diversion Box
	241-C-152	Diversion Box
	241-C-153	Diversion Box
	241-C-252	Catch Tank
	241-C-301C	Diversion Box
	241-CR-151	Diversion Box
	241-CR-152	Diversion Box
	241-CR-153	Diversion Box
	241-ER-153	Diversion Box
	2607-ED	Septic Tank
	2607-EG	Septic Tank
	2607-EJ	Septic Tank
241-S	241-S-151	Diversion Box
	241-S-152	Diversion Box
	241-S-302B	Catch Tank
	241-S-A	Valve Pit
	241-S-B	Valve Pit
	241-S-C	Valve Pit
	241-S-D	Valve Pit
241-SX	241-SX-151	Diversion Box
	241-SX-152	Diversion Box
241-T	241-T-151	Diversion Box
	241-T-152	Diversion Box
	241-T-153	Diversion Box
	241-T-252	Diversion Box
	241-T-301	Catch Tank
	241-T-302	Catch Tank
	241-TR-152	Diversion Box
	241-TR-153	Diversion Box
241-TY	241-TY-153	Diversion Box
	241-TY-302A	Catch Tank
	241-TY-302B	Catch Tank
	241-T-151	Diversion Box
	2607-WTX	Septic Tank
241-TX	241-TX-153	Diversion Box
	241-TX-302A	Catch Tank
	241-TXR-152	Diversion Box
	241-TXR-153	Diversion Box
241-U	241-U-153	Diversion Box
	241-U-252	Diversion Box
	241-U-301	Catch Tank
	241-U-A	Diversion Box
	241-U-B	Diversion Box
	241-U-C	Diversion Box
	241-U-D	Diversion Box
	241-UR-151	Diversion Box
	241-UR-152	Diversion Box
	241-UR-153	Diversion Box
	241-UR-154	Diversion Box
	244-UR	Receiving Vault
	2607-WUT	Septic Tank

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Table A4. 241-A Tank Farm Estimated Piping/Structure Voids
(Backup to Tables 5-2C, 5-3A, 5-8, 5-9, 5-11, and 5-12).

EQUIPMENT	DESCRIPTION (inch diam)	VOID VOLUME (cu m)	SURFACE AREA OF VOID SPACE IN STRUCTURE (sq m)
Piping	1.5	0.64	62.60
	2	2.93	222.77
	3	13.85	709.01
	4	22.68	885.62
	6	48.91	1342.41
	10	12.46	193.32
	12	16.91	23.52
Risers	4	1.83	71.16
	8	2.50	51.10
	12	5.32	69.68
	20	4.16	33.44
	42	19.03	882.92
Test Wells	8	40.89	603.85
Vapor Header	20	12.13	97.55
	24	35.57	247.95
SUBTOTAL:		239.81	5496.90
Diversion Box	241-A-152	290.56	446.48
Valve Pit	241-A-A & 241-A-B	26.90	72.46
Transfer Box	241-A-153	12.91	37.16
Header Support	Beams/Pilasters		
Encasement		8.55	19.69
Encasement	241-a	57.69	413.68
Encasement	Between Tanks	111.81	210.70
Encasement		5.30	61.96
Encasement		8.10	113.06
Encasement		10.37	127.64
Encasement		25.32	194.72
Encasement Support	Footings/Pilasters/Bolsters		
Sluice/Distributor Pits		89.63	299.60
Pump Pits		139.56	348.56
Leak Detection Casing		441.96	483.27
Thermal Probe Casing		221.77	223.89
SUBTOTAL:		1450.43	3052.87
TOTAL:		1690.24	8549.77

NOTE: (1) Piping includes both encased pipe and direct buried pipe.

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Table A5. 241-T Tank Farm Estimated Piping/Structure Voids
(Backup to Tables 5-2C, 5-3A, 5-8, 5-9, 5-11 and 5-12).

EQUIPMENT	DESCRIPTION (inch diam)	VOID VOLUME (cu m)	SURFACE AREA OF VOID SPACE IN STRUCTURE (sq m)
Piping	6	27.64	709.20
	3	16.28	821.70
	2	3.31	243.21
Test Well	6	23.79	611.28
Salt Well/Caisson	60	33.42	87.51
Riser	4	1.93	74.69
	12	21.47	271.83
	42	9.52	441.46
SUBTOTAL:		137.36	3260.88
Pits	(9)	163.89	382.93
Diversion/Pump Pit	(5)	244.97	445.92
Diversion Box	241-TR-152	210.70	324.22
Salt Well Pad			18.58
Encasement	241-T-151 & 241-T-152	12.89	118.45
Encasement	Cascade	50.98	401.33
SUBTOTAL:		683.43	1691.43
TOTAL:		820.79	4952.31

NOTE: (1) Piping includes both encased and direct buried pipe.

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Table A6. 241-TY Tank Farm Estimated Piping/Structure Voids
(Backup to Tables 5-2C, 5-3A, 5-8, 5-9, 5-11 and 5-12).

EQUIPMENT	DESCRIPTION (inch diam)	VOID VOLUME (cu m)	SURFACE AREA OF VOID SPACE IN STRUCTURE (sq m)
Piping	1.5	0.71	63.82
	2	0.42	33.17
	3	7.73	397.70
	4	0.59	23.41
	6	2.44	63.26
	8	0.79	15.70
Test Well	6	8.16	209.58
Salt Well/Caisson	60	3.34	8.73
Riser	4	1.05	40.88
	12	10.59	134.15
	42	12.69	588.61
SUBTOTAL:		48.51	1579.01
Pits	(6)	112.15	274.24
Pump Pits	(2)	22.80	60.76
Diversion Box	241-TY-153	210.70	324.22
Encasement		44.75	366.96
Encasement		6.80	59.46
Pipe Support	Beams/Footings/Pilasters		
Salt Well Pad			1.86
SUBTOTAL:		397.20	1087.50
TOTAL:		445.71	2666.51

NOTE: (1) Piping includes both encased pipe and direct buried pipe.

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Table A7. Summary of Estimated Single-Shell Tank RCRA PPU Void Volumes (Backup to Tables 5-2C, 5-8, 5-9, 5-11 and 5-12).

TANK FARM	PIPING/RISER VOID VOLUME (cu m)	PITS, BOXES, ETC VOID VOLUMES (cu m)	TOTAL VOID VOLUME (cu m)	SCHEDULE (days)
241-A*	239.9	1450.4	1690.3	2.79
241-AX	158.3	957.3	1115.6	1.84
241-B	137.4	683.4	820.8	1.36
241-BX	109.9	546.7	656.6	1.09
241-BY	109.9	546.7	656.6	1.09
241-C	137.4	683.4	820.8	1.36
241-S	109.9	546.7	656.6	1.09
241-SX	137.4	683.4	820.8	1.36
241-T*	137.4	683.4	820.8	1.36
241-TX	192.3	956.8	1149.1	1.90
241-TY*	48.5	397.2	445.7	0.74
241-U	137.4	683.4	820.8	1.36
TOTAL:	1655.5	8819.1	10474.6	17.31

NOTE:

(1) Tank farms which are followed by an asterisk indicate that these void volumes were directly calculated from the preceding tables. All other void volumes were obtained from a scaling factor based on the other tanks' similarities to tanks A and T.

(2) The schedule is derived from the schedule for stabilizing the tanks with grout: the total m^3 of grout volume was divided by the total time for grouting to find a scaling factor. This scaling factor is (761,467 cu m)/(1259.04 days) = 605 cu m/day. All PPU void volumes were divided by this scaling factor to arrive at a preliminary schedule. 10% was added as a contingency factor to the DSTs, in order to compensate for differences in ancillary equipment that may be present.

(3) This schedule assumes 5-day workweeks of 8-hour days.

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The crushed aggregate would be obtained from Pit 30 and delivered to four stockpiles in tank farm areas. Each stockpile would serve the following tank farms:

200E	241-T, 241-TX, and 241-TY 241-S, 241-SX, 241-U, and 241-SY
200W	241-A, 241-AX, 241-AW, 241-AP, 241-AY, and 241-AZ 241-B, 241-BX, 241-BY, 241-C, and 241-AN

Each stockpile would be served by a loader equipped with tires for loading a conveyor network. The network would serve one tank at a time. Because the time to fill a tank a tank is no more than a few operating days, the conveyor runs would be assembled from mobile sections to be repositioned by a crane, as required. After Pit 30 is finished being used for borrow material, it will be filled in until the land is returned to its original contours.

Gravel would be distributed in the tank with a slinger, a mechanism that is suspended in the tank, typically from the center riser. The slinger would capture gravel on a fast-moving horizontal belt, then throw it as it slowly rotated. The belt speed, belt angle, gravel feed rate, and rotational speed would be the primary controlling parameters. A hopper, mounted directly above the slinger, would be fed from the conveyor system and, in turn, would feed the slinger through a quick-acting isolation valve. The valve would not be used to control feed flow to the slinger but would be to isolate the slinger from the ambient environment if tank differential pressure was threatened.

Feed to the hopper would work with the isolation valve. An enclosure, placed around the slinger/hopper assembly, would serve as a confinement buffer not a confinement zone. Conditions could require more than one slinger in a tank. Installed hardware, which could not be removed, might require more than one slinger. The availability of existing risers versus the difficulty of installing new risers also could drive the decision to use more than one slinger. These somewhat smaller slingers could operate like the larger, center-mounted unit. For the purposes of this report, it is assumed that all tanks would use a larger, center-mounted unit. Sacrificial material vibrators could be strategically placed within the tanks to assure maximum fill in critical areas.

3.1.2.2 Special Gravel-Fill Requirements. The heating, ventilating and air conditioning system used must provide sufficient capacity and controls to assure that process operations could not upset the tank pressure differential. Gravel filling would generate a considerable volume of airborne particulates that would have to be separated and removed from the exhaust stream. A series of cyclone separators would be used to remove the particulate from the exhaust before passing through a dual-stage testable HEPA-filter system. Used HEPA filters may be disposed of inside the tanks in order to avoid separate waste disposal costs. There may be other costs associated with such in situ disposal, but they have not been calculated.

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The success of the filling operation would depend on demonstrating and verifying that required fill distribution and uniformity was achieved. The fill monitoring system would be able to visualize interior tank operations, and a vision system would be able provide imaging through airborne dust. Fill surface elevation measurement and mapping in real time would be available to document the progress of the operation and to verify results. Density and compaction measurement also would be used to verify fill integrity.

3.1.2.3 Engineering Cost for Gravel-Fill Stabilization. The tank waste retrieval process would leave 1 percent waste in the SSTs. The smaller tanks (16 each holding 208 m^3 [55,000 gal]) would be stabilized by grouting rather than gravel fill because they are too small to contain the gravel dispersing mechanism. For this reason, the void volume of the remaining SSTs and DSTs is about 751,000 m^3. This volume of gravel would be removed from Pit 30. The gravel would be transported by end-dump trucks capable of hauling 6 m^3 (10 yd^3) of gravel per trip. Therefore 125,000 trips would be necessary for filling the SSTs and DSTs.

3.2 ANCILLARY EQUIPMENT STABILIZATION

3.2.1 Disposition of Ancillary Equipment

For all alternatives considered in the TWRS EIS except the no disposal action alternative, closure would apply to SSTs, DSTs and the ancillary equipment associated with both groups of tanks. Ancillary equipment would include the following: diversion boxes, catch tanks, valve and pump pits, process pits, diverter stations, receiver vaults, condensate tanks, risers, transfer piping and piping encasements associated with single-shell tank operations. Pipelines would include the following: lines between tanks and to process facilities, air and steam supply lines, raw water lines, and drains. See Figures 3-3 through 3-7 for representative sketches of miscellaneous underground storage tanks.

During closure of tank farms, ancillary equipment items would be stabilized in place (i.e., disposed of). In situ stabilization would consist of filling all voids with an appropriate grout material (a chemical grout or cement grout product). The physical immobilization of contaminants provided by the grout could be augmented by the use of sequestering agents, such as zeolites, that would be capable of chemical bonding with contaminants. If ancillary equipment was plugged at one or more points, several access ports would have to be installed to ensure complete grout filling.

For purposes of assessing the environmental consequences associated with dispositioning of ancillary equipment as part of closure, it is assumed that the entire void volume within the ancillary equipment would be filled with grout (analogous to the grout fill alternative for tanks) and that no ancillary equipment would be excavated, packaged, or disposed of as LLW or mixed waste.

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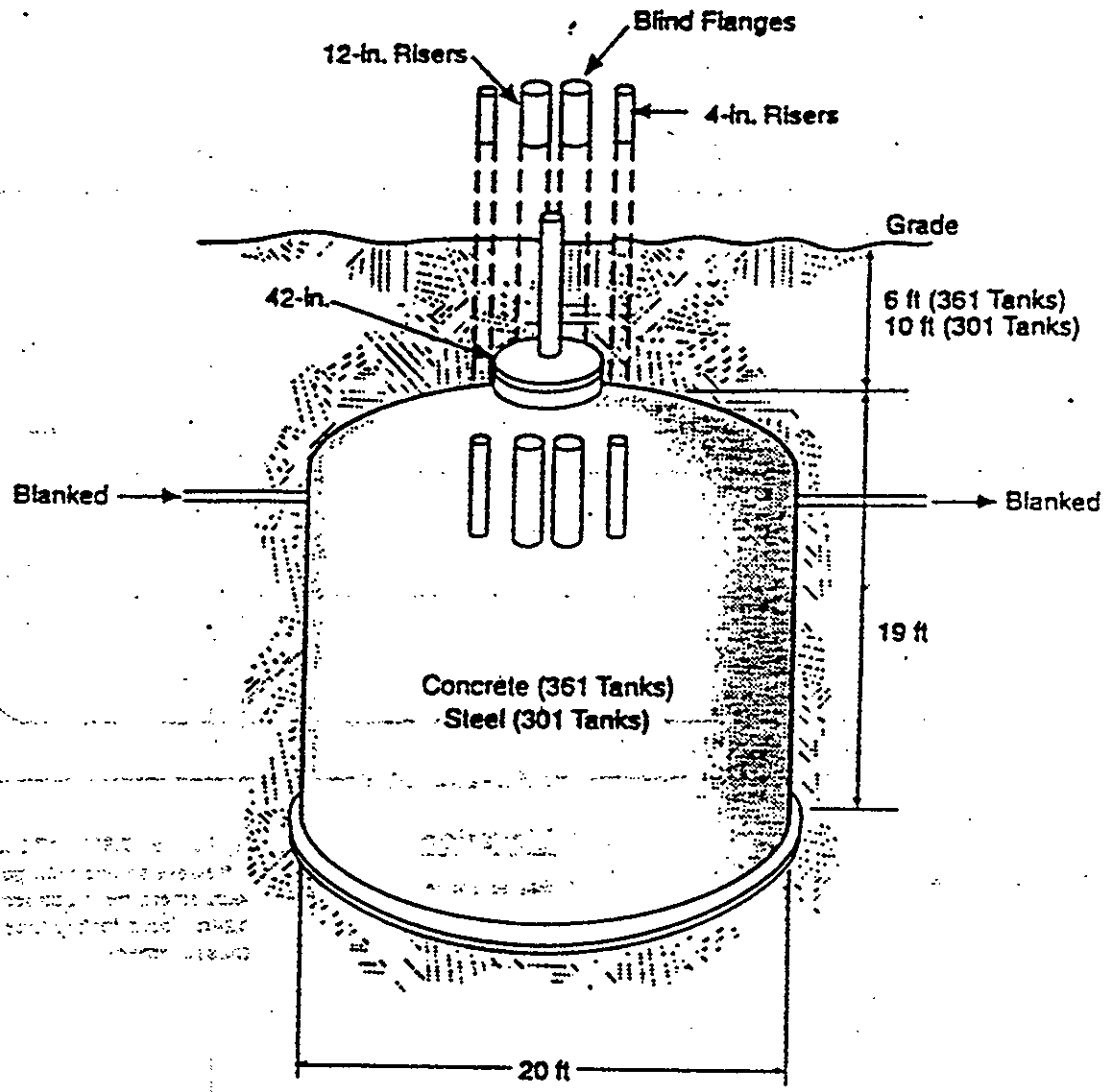
Figure 3-3. 301 Series Catch Tanks and Settling Tanks 241-B-361, 241-T-361 and 241-U-361.



Note: 4-in. central riser is not present in 301 series catch tanks

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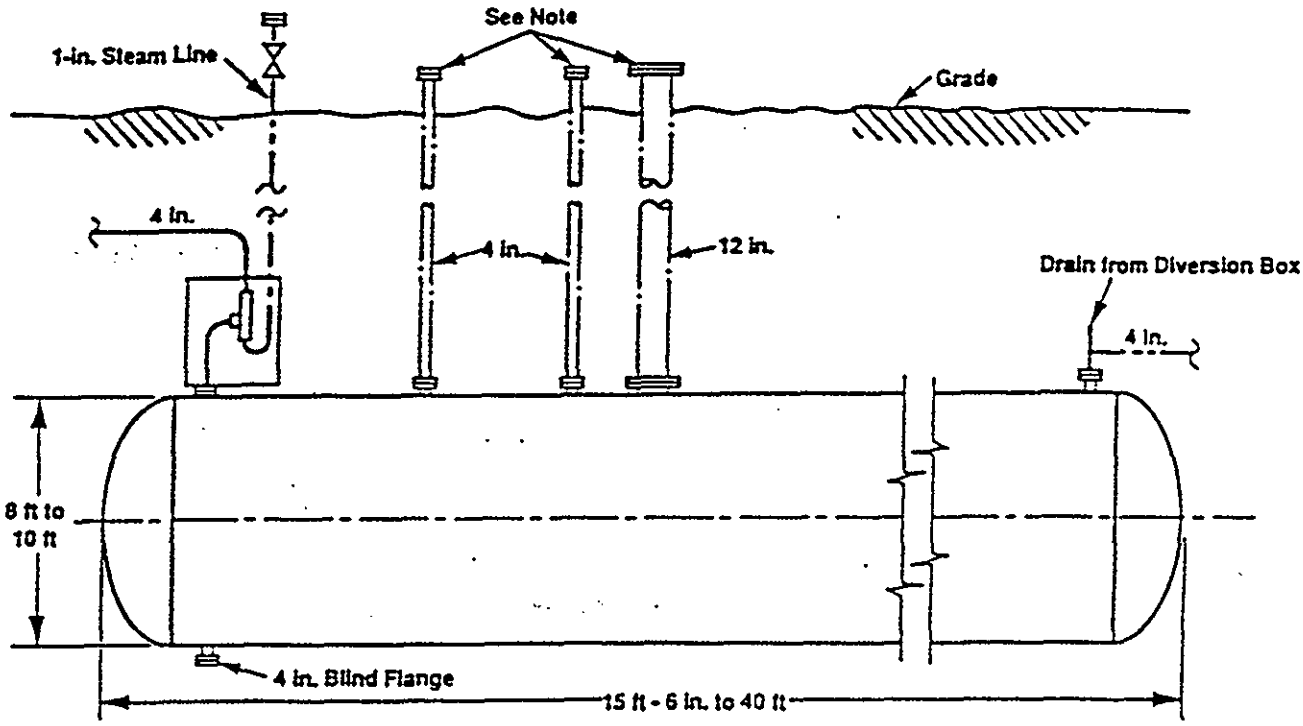
Figure 3-4. 302 Series Catch Tank.



Elevation

Scale: None

Capacity Range: 7,800 - 17,680 gallons
Note: All risers sealed with gaskets.
4-in. risers for thermocouples.
12-in. risers for dip tube liquid level measurement.

Source: Nelisen (1992)

39203001.1

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Figure 3-5. 244-BXR Vault and Tanks.

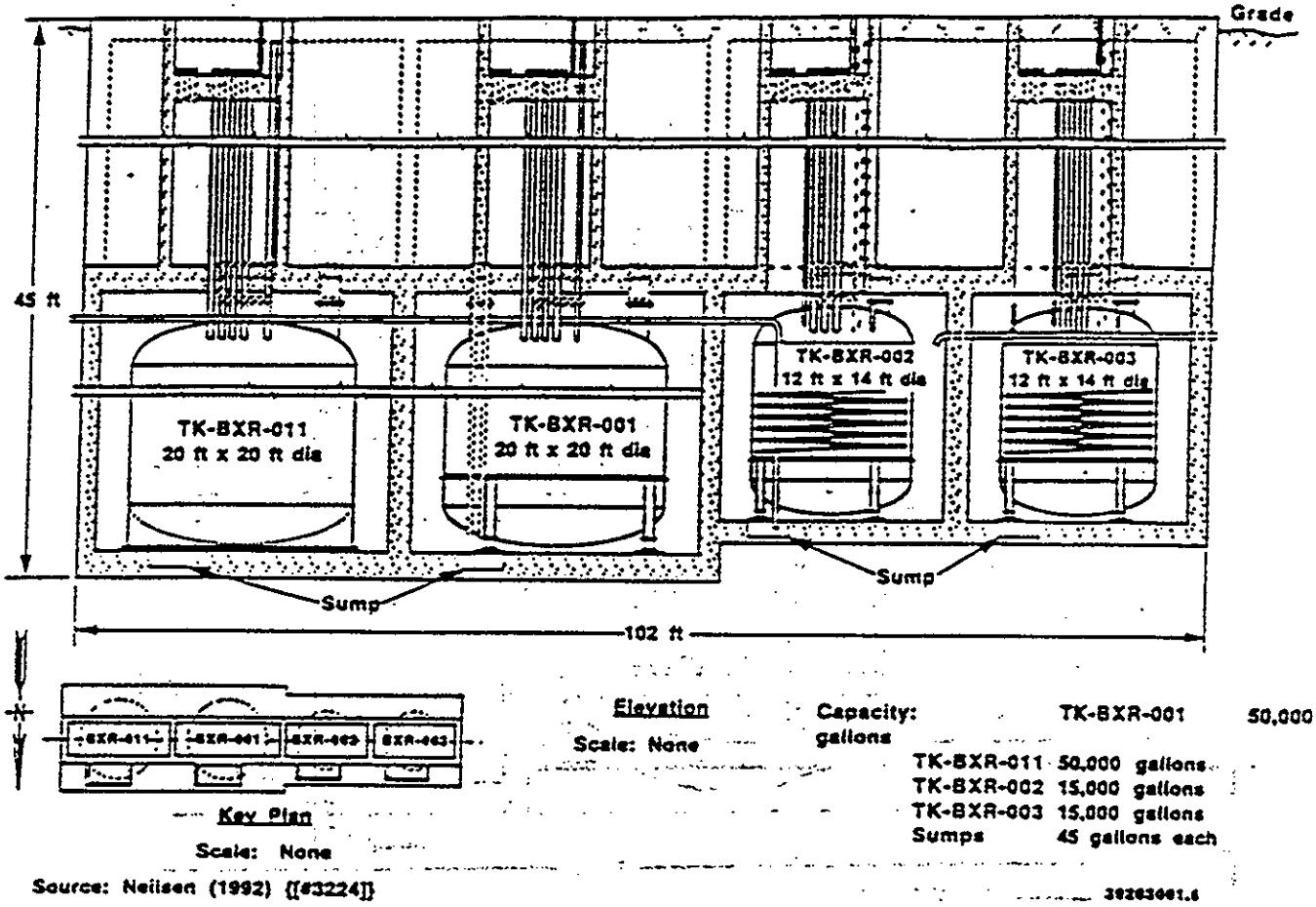

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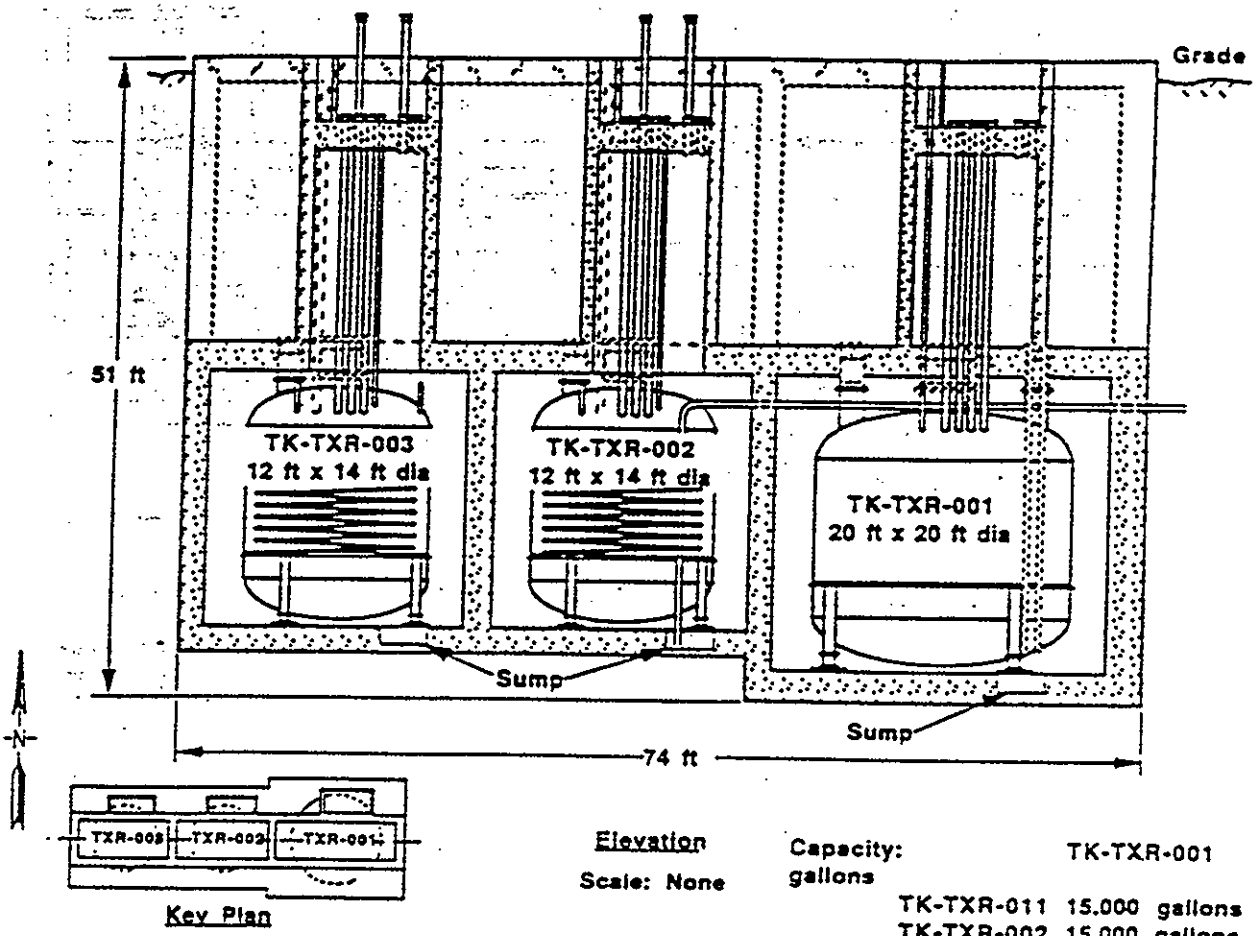
Figure 3-6. 244-TXR Vault and Tanks.



Capacity: gallons		
	TK-TXR-001	50,000
	TK-TXR-011	15,000 gallons
	TK-TXR-002	15,000 gallons
	Sumps	45 gallons each

Source: Neilsen (1992) {[#3224]}

39203001.7

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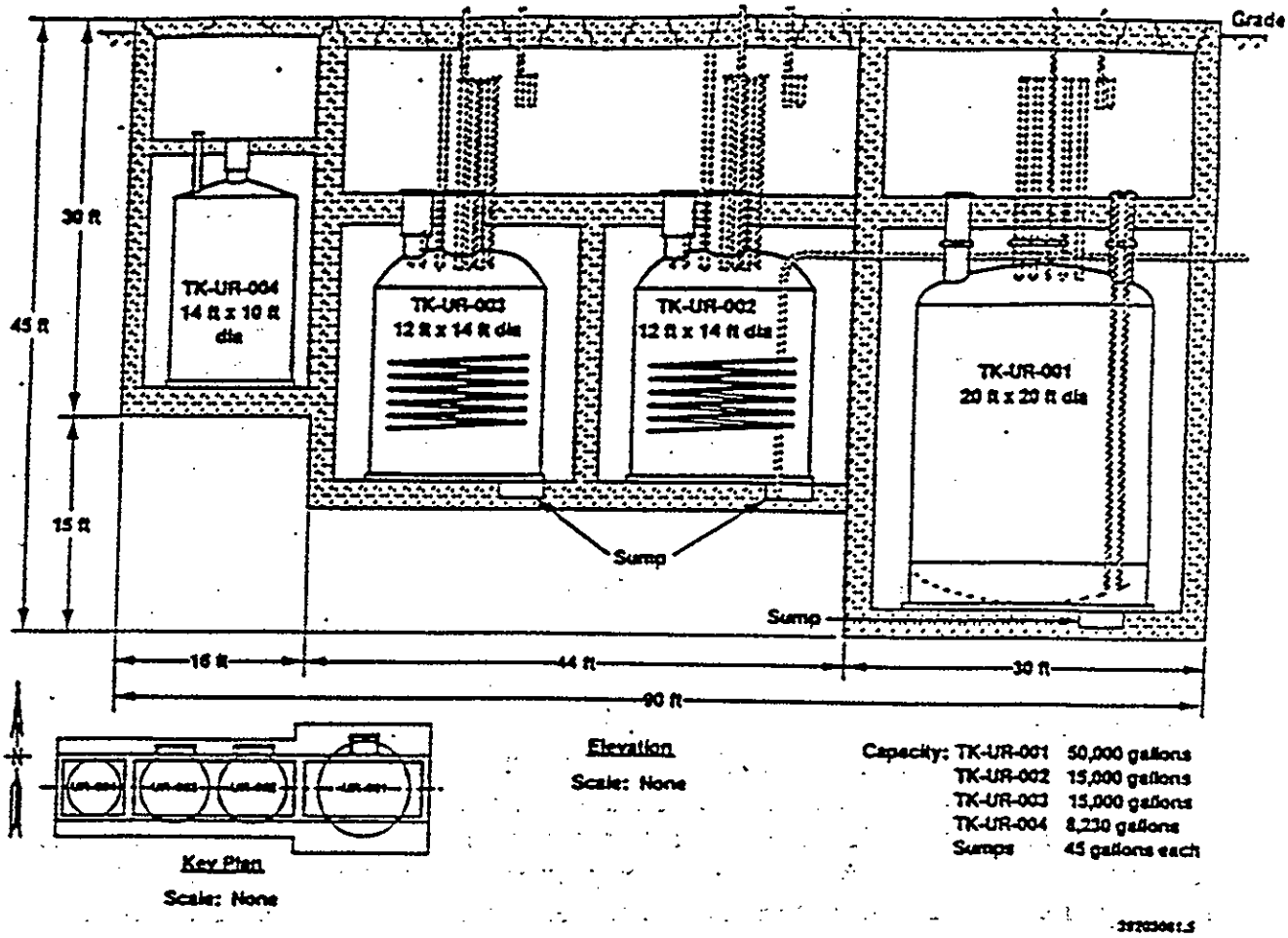
Figure 3-7. 244-UR Vault and Tanks.



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3.2.2 Description of Ancillary Equipment

Ancillary equipment components are defined in the Tri-Party Agreement as *Resource Conservation and Recovery Act* (RCRA) of 1976 (RCRA 1976) past practice units. Appendix A, Table A3 provides a list of the ancillary equipment associated with SSTs (see Appendix C, the Tri-Party Agreement). In 1993, the Tri-Party Agreement signatories agreed that past practice units within tank farms boundaries (fenceline boundaries) would be closed in accordance with the *Washington Administrative Code* (WAC 173-303-610). This decision was based on the intent to establish a consistent closure approach for SSTs and associated RCRA past practice units (i.e., contiguous ancillary equipment and spill sites) to eliminate redundancies in effort, time, and expense.

RCRA past practice units associated with SSTs include piping and control elements for routing waste to a specific tank or from one tank to another. Although the specific arrangement and connections would vary in detail between the various tank farms, all tank farms would be laid out in the same basic arrangement, where one main diversion box would serve several secondary diversion boxes or valve pits which, in turn, would serve three to nine tanks.

Piping consists primarily of welded-joint schedule 40 or 80 carbon steel (a limited amount of schedule 10 was used in the earlier installations). It varied in diameter from 8 to 15 cm (3 to 6 in.). Piping is buried or is within reinforced concrete encasements underground. A limited amount of double-wall pipe (a pipe within a pipe) also was installed. All pipes received one coat of red lead paint during installation. Underground pipe also received two coats of bitumastic paint and was double-wrapped with tar paper. Many pipe runs are equipped with pressure test connections. As many as 10 percent of the pipe runs, particularly the older schedule 10 pipes, are known or suspected to have leaks. Cathodic protection has been incorporated in some piping systems during the past 10 years; the adequacy of existing cathodic protection has not been verified. Some pipelines have been abandoned in place because of plugging.

The pipe encasement system consists of a monolithic reinforced concrete trough and removable reinforced concrete cover. Encasement wall thicknesses are typically 20 to 25 cm (8 to 10 in.), and cavities are minimally-sized to accommodate the installation of piping with the cover removed. Depth of soil cover over the encasements averages 1.8 to 2.4 m (6 to 8 ft). The encasement runs are sloped at about 1 percent to provide catchment of waste leaks or seepage of surface water runoff, and low points drain to a catch tank or pump or sluice pits. With a slope of only 1 percent, it is likely that shallow ponds occur in some sections of encasement. Swab risers at the low points of the encasement are provided to facilitate contamination monitoring.

Diversion boxes are mainly two-or three-chambered underground vaults. Inlet and outlet chambers provide isolated routing space for the intricate maze of inlet and outlet pipes. Waste flow diversion takes place in the central chamber by jumpers and associated valving. Jumpers, flexible or rigid pipes from 0.02-0.1 m (1 -4 in.) in diameter, are connected to the

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inlet and outlet pipes at the central chamber bulkheads by dry disconnect couplings. Jumper connections are routinely reconfigured to meet specific waste routing requirements. The central chamber perimeter is equipped with interior spray nozzles to provide a remotely activated surface decontamination wash mechanism. Diversion boxes are reinforced concrete with 0.6 m (2 ft) thick walls and 0.6 (2 ft) thick removable covers at grade level. A gantry crane is deployed over the central chamber to facilitate cover removal and equipment handling. The interiors of the diversion boxes were treated with Americoat, a chemical resistant paint, during construction. In some tank farms, valve boxes were installed instead of diversion boxes, but essential design features and functions are the same.

Liquid waste from underground piping is routed to an individual tank through one or more reinforced concrete pits above the tank, except for some very old tanks with side entry connections. Within these pump and sluice pits, dry disconnect jumpers are used for piping connections to pumps, valves, standpipes, etc. Interior spray nozzles provide decontamination washing of the pits. Drainage is directly into the waste tanks.

Several buried catch tanks provide collection points for liquids draining from diversion boxes and some encasements. The tanks, which are cylindrical in shape and constructed of steel, are accessible for sampling and pumping by standpipes.

Risers are vertical pipes connecting to tank domes. They vary in diameter from 2.5 cm to 107 cm (1-42 in.). Individual single-shell tanks may have as few as 6, or as many as 38 risers. Risers provide access for certain types of tank equipment including instrumentation and pumps. Some of the risers may be modified or removed by waste retrieval operations.

In two tank farms, French drains and septic tanks have been installed to collect and disperse surface water runoff from impervious paving and pads.

3.2.3 Development of Engineering Support Data

Void volumes within the past practice units are the combined volumes of tank farm piping, risers, and pits and encasements. The estimates of ancillary void volumes for the 12 SST tank farms are based on detailed analyses of three tank complexes: 241-A, 241-T, and 241-TY. Volume estimates for other farms are based on similarity to 241-A or 241-T. Void volume data for ancillary equipment are summarized in Appendix A, Figures A9-A13 (Boomer et al. 1993).

Void volumes for ancillary equipment associated with DSTs have been estimated based on similarity to the 241-A tank complexarm. Voids were estimated based on a factor of 28/6 times the 241-A tank complex volume. There are 28 DSTs, six of which are located in the 241-A tank complex. The result of this estimation is a void piping volume of approximately 1,120 m^3 (296,000 gal) and a void structure volume of approximately 6,770 m^3 (1.8 million gal) (Boomer et al. 1993).