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

EDMC NUMBER: 0047100

DOCUMENT NUMBER: NA

SECTION 1 OF _____

0047100

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering/ In Situ Fill and Cap Cost

ORIGINATOR Colin Henderson DATE 11/3/95

REVISION NO. 0

OBJECTIVE Identify the cost for the In Situ Fill and Cap Alternative discussed in the EIS.

METHODOLOGY Use the In Situ Treatment and disposal data package to identify applicable components to the fill and cap alternative addressed in the EIS. Use Closure package for basis

ASSUMPTIONS Radio-frequency drying is removed from the fill & cap alternative. Current ops cost developed from components for Program Management, Upgrades, Characterization from the Intermediate Separations data package. The M&O component of current ops is taken from tank farms operations data for the TWRS EIS (spreadsheet developed by WHC). W-314 Upgrades included in Current Ops.

(Continue on another sheet if necessary)

J.C. Henderson
SIGNATURE

MAR 1997 RECEIVED TWMC
JACOBS\FORMS\CALCOVR.SHT

CALCULATION & RESULTS ATTACHED

Characterization Sept 1999.
Upgrades 1998-2004
Safety 9/1998

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

SUMMARY:

Current Operations

From TPA Data Package (WHC-SD-WM-EV-104 Rev. B)

Program Management	= $1,180	
Op & Maint	$2,293	Up thru Yr 2009
Tank Farm Safety	= $440	
Tank Farm Upgrades	= $1,720	
Characterization	$933	
	$6566	

R&D Cost - $0

Capital Cost

Treatment - $25		In Situ Package Table 7-18 Footnote 2
Closure - $116		Closure Package Table 5-9
Total Capital	→ $141	

Operating Cost

Treatment	$274	In Situ Package Table 7-19 Foot Note 2.
Monitoring & Maint.	!	Closure data package Table 5-10
Total Operating Cost	$275	

Total Cost $6,982

In Situ Treatment and Disposal of Radioactive Waste in Hanford Site Underground Storage Tanks Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement

C. M. McConville

Date Published
July 1995

RECEIVED
6 1995

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse Hanford Company
P.O Box 1970
Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

JUL 19 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of

1. EDT No 612

2. To: (Receiving Organization) TWRS Compliance Plans	3. From: (Originating Organization) Process Design	4. Related EDT No.: 608723
5. Proj./Prog./Dept./Div.: Tank Waste Remediation System	6. Cog. Engr.: C. M. McConville	7. Purchase Order No.: n/a
8. Originator Remarks: This engineering data package provides supporting data for preparation of the TWRS Environmental Impact Statement (TWRS EIS). Data in this document addresses the In Situ Disposal Alternative for tank waste. Other alternatives addressed in the TWRS EIS include the Tri-Party Agreement Alternative, the No Separations Alternative, the Extensive Separations Alternative, and the No Disposal Action Alternative. Additional data supporting the In Situ Disposal Alternative are provided in the Closure Engineering Data Package (WHC-SD-WM-EV-107). Environmental, Safety, and QA approvals required by WHC-CM-3-5 Section 12.7 were obtained on Rev. 3 of this document (EDT 608723). Changes in this revision, relative to Rev. 3, primarily involved revisions to the data tables and backup data to incorporate updated information relating to staffing requirements for operations, estimated air emissions during construction and operations, radionuclide inventory in the final waste form, construction equipment requirements, and operating costs.		9. Equip./Component No.: n/a
		10. System/Bldg./Facility: n/a
11. Receiver Remarks:		12. Major Assm. Dwg. No.: n/a
		13. Permit/Permit Application No.: n/a
		14. Required Response Date: n/a

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-EV-101		0	In Situ Treatment and Disposal of Radioactive Waste in Hanford Site Underground Storage Tanks Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement	E/S/Q	2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.
2	1	Cog.Eng. C. L. McConville			
2	1	Cog. Mgr. J. S. Garfield			
		QA (approved by J. Weber, on EDT 608723) page 2 of this EDT			
		Safety (approved by J. M. Garcia, on EDT 608723) page 2 of this EDT			
		Env. (approved by R. H. Engelmann, on EDT 608723) page 2 of this EDT			

18.	19.	20.	21. DOE APPROVAL (if required)
C. M. McConville 7-17-95 Signature of EDT Originator Date	L. E. Borneman 7/18/95 Authorized Representative for Receiving Organization Date	J. S. Garfield 7-17-95 Cognizant Manager Date	Ctrl. No. [ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments [x] Not Required per Waiver WA-557

Table 7-15. Comparison of Alternatives by Decommissioning of Contaminated Treatment Facilities and Equipment (Metric Tons).[1]

Item	In Situ Chemical Stabilization[2]	Drying and Gravel Fill[3]	In Situ Vitrification[4]
Steel Quantity	2.6 E5	1.6 E3	2.6 E5
Concrete Quantity	3.2 E5	—	3.2 E5
Soil Quantity	8.8 E5	—	8.8 E5
Disposition	low-level waste burial grounds	low-level waste burial grounds	low-level waste burial grounds

Notes:

[1]All Tank Farm Confinement Facilities (TFCF) and everything contained under the TFCFs are assumed to be contaminated.

[2]TFCF = 2.6 E5 metric tons steel
= 3.2 E5 metric tons concrete
= 8.8 E5 metric tons soil

Mixing Equipment = 7.5 E2 metric tons steel

[3]Assumes 20 percent of drying systems become contaminated:
= 1.6 E3 metric tons steel

[4]TFCF = 2.6 E5 metric tons steel
= 3.2 E5 metric tons concrete
= 8.8 E5 metric tons soil

Assumes 90 percent of in situ vitrification equipment becomes contaminated:
= 8.2 E2 metric tons steel

Table 7-16. Comparison of Alternatives by Process Module: Overall Cost (Millions of 1994 Dollars).

Notes: (Continued)

[2]Drying and gravel fill

242-A	
Operating cost =	$130 million
Capital cost =	$0
Radio Frequency Drying	
Operating cost =	$180 million
Capital cost =	$121 million
Research and development =	$ 10 million
Gravel Fill	
Operating cost =	$150 million
Capital cost =	$ 25 million

[3]In Situ Vitrification

242-A	
Operating cost =	$130 million
Capital cost =	$0
Vitrification (includes TFCF)	
Operating cost =	$2,400 million
Capital cost =	$4,700 million
Research and development =	$ 67 million

See Table 7-18 for Capital Costs and Table 7-19 for Operating Costs.

[4]Due to rounding, totals do not equal sum of numbers in column.

Table 7-18. Comparison of Alternatives by Capital Cost Component (Millions of 1994 Dollars).

Capital Cost Component	In Situ Chemical Stabilization[1]	Drying and Gravel Fill[2]	In Situ Vitrification[3]
Labor	2,600	5	2,800
Materials/Supplies	1,450	11	1,550
Equipment	20	110	50
Local Purchases	260	21	280
Total	4,300	150	4,700

Notes:

[1]Tables M4-5 (Stabilization by Grout Capital Cost) and F7-7 (Tank Farm Confinement Capital Cost) of the *Tank Waste Technical Options Report* (Boomer et al. 1993) were used as a basis.

242-A Evaporator
Capital cost = 0

Tank Farm Confinement Facility
Labor = $2,600 million
M/S = $1,700 million
Equipment = $0
{Local purchases = 0.15(M/S + Equipment)}
Total = $4,300 million

Grout mixing
Labor = $ 5.6 million
M/S = $13 million
Equipment = $21.5 million
{Local purchases = 0.15 (M/S + Equipment)}
Total = $40 million

[2]SD-WM-TI-111 Rev 1 (Higley 1985), was used as a basis for one radio frequency drying system. Forty-five systems are used. Table M5-5 (Stabilization by Gravel Capital Cost Estimate) of the *Tank Waste Technical Options Report* was used as a basis for the Gravel Fill estimate.

242-A Evaporator
Capital cost = 0

Table 7-19. Comparison of Alternatives by Operating Cost Component (Millions of 1994 Dollars). (5 sheets)

Operating Cost Component	In Situ Chemical Stabilization[1]	Drying and Gravel Fill	In Situ Vitrification
Labor	300	200	500
Materials/Supplies	10	28	100
Equipment	110	33	24
Local purchases	20	10	22
Startup	370	92	250
Decontamination and decommissioning	1,600	110	1,600
Total[4]	2,400	274 470	2,500

Notes:

[1]In situ chemical stabilization
242-A Evaporator = 5-year operating life
Total operating cost = $127 million
Annual operating cost = $15 million

Following numbers based on previous operation of 242-A Evaporator:
Labor = 59 Exempt x 130,000 per year = $8 million per year x 5 years = $40 million
60 Nonexempt x 50,000 per year = $3 million per year x 5 years = $15 million
Materials/Supplies = $1 million per year x 5 years = $ 5 million
Equipment (Upgrade cost = $13 million) = $3 million per year x 5 years = $15 million
{Local purchases = 15% of (Materials/Supplies + Equipment)}
Total = $15 million per year = $75 million
Startup = 2 years operating cost
= 2 ($15 million)
= $30 million

Decontamination and decommissioning = 2 years operating labor + 0.3 (capital cost)
= 2 ($11 million) + 0.3(0)
= $22 million

Tank Farm Confinement Facility (TFCF) (Grout) = 2-year operating life
Total operating cost = $2100 million
Annual operating cost = $153 million

Table 7-19. Comparison of Alternatives by Operating Cost Component (Millions of 1994 Dollars). (5 sheets)

Notes: (Continued)

[2]Drying and Gravel Fill

242-A Evaporator = 5-year operating life
Total operating cost = $177 million
Annual operating cost = $15 million

Following numbers based on previous operation of 242-A Evaporator:
Labor = 59 exempt x 130,000 per year = $8 million per year x 5 yr = $40 million
60 nonexempt x 50,000 per year = $3 million per year x 5 yr = $15 million
Materials/Supplies = $1 million per year x 5 yr = $ 5 million
Equipment (Upgrade cost = $13 million) = $3 million per year x 5 yr = $15 million
{Local purchases = 15% of (Materials/Supplies + Equipment)}
Total = $15 million per year = $75 million

Startup = 2 years operating cost
= 2 ($15 million)
= $30 million

Decontamination and decommissioning = 2 years operating labor + 0.3(capital cost)
= 2 ($11 million) + 0.3(0)
= $22 million

Radio Frequency Drying = 9-year operating life
Total operating cost = $183 million
Annual operating cost = $12 million

Labor 13 Exempt x 130,000 per year = $1.7 million per year x 9 yr = $15 million
3 Nonexempt x 50,000 per year = $0.2 million per year x 9 yr = $ 2 million
77 Bargaining units x 90,000 per year = $6.9 million per year x 9 yr = $62 million
Total Labor = $9 million per year = $80 million

Materials/Supplies
Electricity = 1.1E8 kwh x $0.025/kwh = $2.8 million per year x 9 yr = $25 million
Water (includes potable water for all drying and gravel fill staff)
= 1.1 E6 m^3 x $3/$m^3$ = $370,000 per year x 9yr = $ 3 million
Equipment = 0
{Local purchases = 15% of (Materials/Supplies + Equipment)}
Total = $12 million = $108 million
Startup = 2($12 million) = $24 million
Decontamination and decommissioning = 2($9 million) + 0.3($121 million) = $54 million

Gravel Fill = 4-year operating life
Total operating cost = $147 million
Annual operating cost = $19 million

Table 7-19. Comparison of Alternatives by Operating Cost Component (Millions of 1994 Dollars). (5 sheets)

Notes: (Continued)

Following numbers based on Tables M9-5 and M9-6 of the *Tank Waste Technical Options Report*.
Labor 292 exempt x 130,000/year = $38 million per year x 5 yr = $190 million
131 nonexempt x 50,000/year = $ 7 million per year x 5 yr = $ 35 million
437 Bargaining units x 90,000/year = $39 million per year x 5 yr = $195 million
Labor Total = $84 million per year = $420 million

Materials/Supplies

Water (includes potable water for all in situ vitrification staff)	= 1.2 E6 m^3 x $3/$m^3$ = $3.6 million
Electricity	= 4.4 E9 kwh x $0.025/kwh = $110 million
Limestone	= 1.1 E7 kg x $0.09/kg = $990,000
Propane	= 1.1 E7 kg x $0.02/kg = $220,000
Ammonia	= 6.8 E5 kg x $0.38/kg = $260,000
M/S Total	= $23 million per year x 5yr = $115 million
Equipment	= $2.4 million (1993) x 1.05 = $2.5 million per year x 5yr = $ 12.5 million
Total	= $110 million per year = $545 million

Startup = 2($110 million) = $220 million
Decontamination and decommissioning = 2($84 million) + 0.3($4650 million) = $1563 million

Costs associated with routine tank farm operations, TWRS program management, characterization, tank farm upgrades, single shell tank salt well pumping, and tank farm safety issue resolution are not included in these totals.

[a]Due to rounding, totals do not equal sum of numbers in columns.

Boomer, K. D., S. K. Baker, A. L. Boldt, J. D. Galbraith, J. S. Garfield, C. E. Golberg, B. A. Higley, L. J. Johnson, M. J. Kupfer, R. M. Marusich, R. J. Parazin, A. N. Praga, G. W. Reddick, E. J. Slaathaug, L. M. Swanson, T. L. Waldo, C. E. Worcester, 1993, *Tank Waste Technical Options Report*, WHC-EP-0616, Westinghouse Hanford Company, Richland, Washington.

Table 7-21. Comparison of Alternatives by Overall Schedule (Calendar Year Start/Completion Date).

Activity	In Situ Chemical Stabilization	Drying and Gravel Fill	In Situ Vitrification
Construction[1]	1998-2013	2003-2005	1998-2016
Operation[2]	2005-2013	2005-2018	2005-2016
Monitoring and maintenance[3]	2024-2124	2024-2124	2024-2124
Decontamination and decommissioning[4]	2010-2013	2018-2021	2013-2016
Research and development[5]	n/a	2000-2002	1995-2002

Notes:

[1]The construction periods for in situ chemical stabilization and in situ vitrification (ISV) continue throughout operations due to construction of the Tank Farm Confinement Facilities. The in situ drying option requires gravel excavation and construction of the gravel distributor.

[2]The operating periods shown here include an additional 3 years for startup.

[3]Monitoring and maintenance takes place after closure (placement of barriers) for a period of 100 years. Monitoring and maintenance upon completion of in situ disposal is discussed in the *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Statement* (Scanlon et al. 1995).

[4]It is assumed that decontamination and decommissioning will take 3 years to complete for all in situ alternatives, and is considered the "shutdown period" mentioned in Table 7-25.

[5]Radio frequency drying will require two years of research and development, based on engineering judgement. The ISV alternative will require seven years research and development as shown in PNL-7499 (Koegler 1990).

Koegler, S. L., 1990, *Underground Tank Vitrification Project Plan*, PNL-7499, Pacific Northwest Laboratory, Richland, Washington.

Scanlon, P. L., H. Hampt, W. A. Skelly, 1995, *Closure Technical Data Package for the Tank Waste Remediation System*, Draft, Westinghouse Hanford Company, Richland, Washington.

8.1 IN SITU VITRIFICATION

The following tables from the *Tank Waste Technical Options Report* (Boomer et al. 1993) were used as a basis for the in situ vitrification option:

Tank Farm Confinement Facility
Table F7-7 Capital Cost Estimate

The Tank Farm Confinement Facility (TFCF) has been sized according to five different tank farm configurations (2x2, 2x3, 3(4)x4, 3x5, 4x5). The 18 tank farms will require:
4 (2x2); 3 (2x3); 9 (3x4); 1 (3x5); 1 (4x5)

Vitrification
Table M9-4 Capital Cost Estimate
Table M9-5 Operating Expense Summary
Table M9-6 Staffing
Table M9-4 was modified to include 4 ISV systems and sand excavation costs.

A percent distribution of ISV operating staff hours over the operating life (including startup and decontamination and decommissioning) is shown in Figure 8-1.

Sand would be excavated onsite to avoid frit purchasing and shipping costs. Existing Pit 30, located between 200 East and 200 West Areas, would be used to excavate 540,000 m^3 of sand required for filling the tank void spaces. This estimate was taken from the in situ chemical stabilization (ISCS) option. It assumes that excavating and crushing equipment will already be in place from other contracts. As a result, no construction work would be necessary.

Total tank volume = 740,000 m^3
Total waste volume = 201,000 m^3
Total void volume = 540,000 m^3 = frit (sand) requirement
(based on the *Technical Options Report and Tank Farm Surveillance and Waste Status Summary Report* for April 1994)

Process water required for the ISV process is assumed negligible.

The entire tank farms would be vitrified to an 18m depth, including areas between the tanks. The total vitrified volume would equal 3.8E6 m^3.

ISV operating life equals 5 years, based on the assumption that it takes 3 weeks to vitrify one tank. Four ISV systems would be purchased with at least 2 in continuous operation at all times.

Seven years of research and development are required before mega-scale ISV could be implemented. This research and development will cost $67,000,000 as shown in PNL-7499 (Koegler 1990).

8.2 IN SITU CHEMICAL STABILIZATION

The in situ chemical stabilization option would use all the materials, equipment, and labor shown for the "grout fill" option of the *Tank Waste Technical Options Report*. However, because the grout fill option is for empty tanks, additional equipment and labor would be required for mixing grout with the waste.

Additional unit process steps:

Construction of 18 TFCF
15-m (48-ft)-diameter dome penetration of 161 tanks
Employment of grout mixing system (4-m [12-ft]-diameter auger with grout injector)

The following tables from the *Tank Waste Technical Options Report* were used as a basis for including the additional steps:

Tank Farm Confinement Facility

Table F7-7 Capital Cost Estimate
Table F7-8 Operating Expense Summary
Table F7-9 Staffing

Dome penetration is considered "operation" rather than "construction." It was assumed that the TFCF operating staff would perform the 15-m (48-ft) dome penetrations; Tables F7-8 and F7-9 were modified accordingly.

Additional TFCF Labor:
35 operations managers (exempt)
120 operators (bargaining unit)

The TFCF has been sized according to five different tank farm sizes (2x2, 2x3, 3(4)x4, 3x5, 4x5). The 18 tank farms will require:
4 (2x2); 3 (2x3); 9 (3x4); 1 (3x5); 1 (4x5)

Grout Mixing

Table M4-5 Capital Cost Estimate
Table M4-6 Operating Expense Summary
Table M4-7 Staffing

Because sand is the largest quantity constituent, it would be excavated onsite from existing Pit 30, located between 200 East and 200 West Areas. The sand excavation estimate is considered a capital cost and assumes that excavating and crushing equipment would already be in place from other contracts.

ISCS operating life = 2 years, based on the following assumptions:

2.5 hours to drill 1 well
37 wells/tank
161 tanks
200 days for moving and setting up
Continuous operation of 2 mixing systems and 2 batch plants at all times

The TFCF operating life must be 12 years because stabilization takes place under the TFCF, and the TFCF operating staff performs the dome penetrations.

The total grouted waste volume is equal to the volume of all 177 tanks = 7.4E5 m^3.

8.3 DRYING AND GRAVEL FILL

The drying and gravel fill option would use all the materials, equipment, and labor shown for the radio frequency drying option in the *Hanford Defense Waste Environmental Impact Statement Working Papers-Existing Tank Waste* (Higley 1985), and the "gravel fill" option of the *Tank Waste Technical Options Report*. However, the radio frequency drying option has been modified with additional labor and equipment to include the DSTs.

The following tables from the *Tank Waste Technical Options Report* were used as a basis for including the gravel fill:

Table M5-5 Capital Cost Estimate
Table M5-7 Operating Expense Summary
Table M5-8 Staffing

A percent distribution of drying and gravel fill operating staff hours over the operating life (including startup and decontamination and decommissioning) is shown in Figure 8-3.

The total dried waste volume = 50,000 m^3. This volume was calculated by estimating a new salt cake volume from the total moles of Na in double-shell slurry feed and dilute noncomplexed waste. The sludge volume was assumed to remain the same.

Total tank volume = 740,000 m^3
Total waste volume = 50,000 m^3
Total void volume = 690,000 m^3 = Total gravel requirement

WHC-SD-WM-EV-107, Rev
UC-203

Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Statement

P. L. Kline
H. Hampt
W. A. Skelly

Date Published
July 1995

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse Hanford Company
P.O Box 1970
Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

JUL 19 1995

ENGINEERING DATA TRANSMITTAL

1. EDT № 6126

2. To: (Receiving Organization) TWRS Compliance Plans	3. From: (Originating Organization) Geotechnical Development Projects	4. Related EDT No.: n/a
5. Proj./Prog./Dept./Div.: Tank Waste Remediation System	6. Cog. Engr.: P. L. Kline	7. Purchase Order No.: n/a
8. Originator Remarks: This engineering data package provides supporting data for preparation of the TWRS Environmental Impact Statement. Data in this document complements data provided in separate documentation for the No Separations Alternative, the Extensive Separations Alternative, the Tri-Party Agreement Alternative, and the In Situ Disposal Alternative. Environmental, Safety, and QA approvals required by WHC-CM-3-5 Section 12.7 were obtained on Rev. 3 of this document. The only significant changes in this revision, relative to Rev. 3, involved changes to data tables addressing construction staffing requirements and costs.		9. Equip./Component No.: n/a 10. System/Bldg./Facility: n/a
11. Receiver Remarks:		12. Major Assm. Dwg. No.: n/a 13. Permit/Permit Application No.: n/a 14. Required Response Date: n/a

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-EV-107		0	Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Statement	E/S/Q	2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.
2	1	Cog.Eng., P. L. Kline			
2	1	Cog. Mgr. J. G. Field			
		QA (approved by J. Weber, on EDT dated 3/6/95 attached)			
		Safety (approved by J. M. Garcia, on EDT dated 3/6/95 attached)			
		Env. (approved by R. H. Engelmann, on EDT attached)			

18.	19.	20.	21. DOE APPROVAL (if required)
P. L. Kline 7/15/95 Signature of EDT Originator Date	L. E. Borneman 7/15/95 Authorized Representative for Receiving Organization Date	J. G. Field Cognizant Manager Date	Ctrl. No. [ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments [x] Not Required per Waiver WA-557

1	/	Cog.Mgr.	L.E. Borneman	2/28/95	32-06		
1	/	QA	J. Weber	3/6/95	51-57		
1	/	Safety	J.M. Garcia		23-09		
1	/	Env.	R.H. Engelbeam		H6-26		
1	/	Disp.Pro.	J.O. Honeyman		S7-81		

18.	19.	20.	21. DOE APPROVAL (if required)
P.L. Scanlon 2/28/95 Signature of EDT Originator Date	L.E. Borneman 2/28/95 Authorized Representative for Receiving Organization Date	L.E. Borneman 2/28/95 Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

80-7400-172-2 (04/94) GEF097

Table 5-8. Comparison of Alternatives by Process Module: Capital Cost (Millions of 1995 Dollars).[1,2,3,4]

Process Module	In Situ Disposal	Extensive Pretreatment Option A Grout/gravel	Extensive Pretreatment Option B Grout/gravel	No Separations Grout/gravel	Tri-Party Agreement Preferred Alternative Grout/gravel
Barrier construction[5]	$86	$113	$237	$86	$111
Emptied SST closure[6]	n/a	$26.6/$14.6	$26.6/$14.6	$26.6/$14.6	$26.6/$14.6
Emptied DST closure[7]	n/a	$4.4/$2.6	$4.4/$2.6	$4.4/$2.6	$4.4/$2.6
Total	$86	$144/$130	$268/$254	$117/$103	$142/$128

Notes:

SST = single-shell tank
DST = double-shell tank

[1]The cost of gravel was estimated from Appendix A, Cost Barrier Materials and was figured at $22 per cubic meter ($m^3$) for 756,000 m^3 of material, or $16,600,000. There are 16 55,000-gallon tanks that would be stabilized with the same grout mixture used for stabilizing the ancillary equipment. These tanks have a total void volume of 5,324 m^3. The cost of this grout was estimated at $0.14 per kilogram (kg) for Type I/II cement, $0.04/kg for fly ash, and $18.50/$m^3$ for sand from Pit 30. For 106,500 kg of cement, the cost would be $14,900; 958,000 kg of fly ash would cost $38,300; and 5,160,000 kg of sand (3,225 m^3 of sand) would cost $59,700. The total cost of this grout is $112,900. The cost of the water was not calculated. The cost of the air entrainment additive was unknown but assumed to be negligible.

[2]The cost of concrete was estimated at $0.14/kg for Type I/II cement, $0.04/kg for fly ash, and $18.50/$m^3$ for sand from Pit 30. For 15,000,000 kg of cement, the cost would be $2,100,000; 137,000,000 kg of fly ash would cost $5,480,000; 1,260,000,000 kg of sand (1,300,000 m^3 of sand) would cost $23,200,000. The total cost of this grout is $30,780,000. The cost of the water was not calculated. The cost of the air entrainment additive was unknown but assumed to be negligible.

[3]The cost of solidifying the ancillary equipment is based on the same grout formula as in notes 1 and 2. There is 13,700 m^3 of void space in the ancillary equipment for the SSTs and the DSTs. The SST ancillary equipment void space is 10,500 m^3, and the DST ancillary equipment void space is 3,200 m^3. For SST ancillary equipment, 210,000 kg of cement would cost $29,400; 1,890,000 kg of fly ash would cost $75,600; 17,400,000 kg of sand (10,900 m^3 of sand) would cost $201,500. The total cost of stabilizing the ancillary SST equipment would be $306,500. For DST ancillary equipment, 64,000 kg of cement would cost $8,960; 576,000 kg of fly ash would cost $23,000; 5,312,000 kg of sand (3,320 m^3 of sand) would cost $61,400. The total cost of stabilizing the ancillary DST equipment is $93,360. The cost of water was not calculated. The cost of the air entrainment additive was unknown but assumed to be negligible.

[4]The costs for monitoring and maintenance are reflected in Table 5-10 and were not included in these costs.

Table 5-9. Comparison of Alternatives by Capital Cost Component (Millions of 1995 Dollars).

Capital Cost Component	In Situ Disposal	Extensive Pretreatment Option A Grout/gravel	Extensive Pretreatment Option B Grout/gravel	No Separations Grout/gravel	Tri-Party Agreement Preferred Alternative Grout/gravel
Labor[1]	$30.6	$54.1/$57.1	$105/$107.3	$43.9/$46.9	$53.6/$56.6
Materials/supplies[2]	$28.5	$42.9/$37.4	$81.1/$75.6	$34.1/$28.6	$42.5/$37.0
Equipment[3]	n/a	$0.25/$0.35	$0.25/$0.35	$0.25/$0.35	$0.25/$0.35
Local purchases[4]	$57.5	$43.5/$35.1	$130/$121	$82.9/$74.5	$42.5/$34.1
Total	~~$117~~ $116	$141/$130	$316/$304	$161/$150	$139/$128

Notes:

n/a = not applicable

[1]Average wage for an exempt employee at TWRS is $57.11/hour, for a non-exempt employee is $22.35/hour, and for a bargaining unit employee is $41.31/hour (based on overhead, the common support pool and general and administrative rates found in Soft Reporting on November 11, 1994 for organization code 70000). Labor costs were calculated taking the staff hours from Tables 5-2A through 5-2D and multiplying by the average wage. Ancillary equipment stabilization and barrier construction labor costs were included in both grout and gravel stabilization. It was assumed that all design, engineering, and supervisory personnel were exempt, and that all radiation and nonradiation workers were bargaining unit employees.

[2]Materials and supplies include the tank and ancillary equipment stabilization materials and the materials used in barrier construction over the tanks and over the LLW Vaults (in the Extensive Pretreatment and TPA Preferred Alternatives). They include only materials that cannot be bought locally (asphalt, asphalt coating and geotextile fabric for the barrier; fly ash for the grout mix). All other materials for stabilization and barrier construction are listed in local purchases. These numbers were calculated from Appendix A, Barrier Cost by Component. Asphalt would cost $27,800,000 for tank barriers, $45,300,000 for extensive pretreatment grout, $8,500,000 for extensive pretreatment glass, and $8,100,000 for the Tri-Party Agreement glass. Geotextiles would cost $717,000 for tank barriers, $1,700,000 for extensive pretreatment grout, $284,000 for extensive pretreatment glass, and $268,000 for Tri-Party Alternative glass. Fly ash would cost $5,600,000 for the grout stabilization option (both for tanks and ancillary equipment); it would cost $137,000 for the gravel stabilization option (for the 55,000-gallon tanks and for ancillary equipment). The cost of the grout option is listed first, and the cost of the gravel option is listed second.

Table 5-10. Comparison of Alternatives by Monitoring and Maintenance Cost Component (Millions of 1995 Dollars).[1,2]

Monitoring and Maintenance Cost Component	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Labor[3]	0.39	0.40	0.40	0.39	0.40
Materials/supplies[4]	0.011	0.012	0.016	0.011	0.012
Equipment[3,5]	0.030	0.030	0.030	0.030	0.030
Local purchases[4]					
Total	0.43	0.44	0.45	0.43	0.44

Notes:

[1]See Appendix A for details on the calculations.

[2]Monitoring and maintenance applies to all phases of the closure package (tank stabilization, ancillary equipment stabilization, and barrier construction).

[3]The labor rates are based on an average wage of $130,000 per year for supervisors, and $60,000 per year for laborers and a clerk/secretary.

[4]All materials and supplies are local purchases.

[5]Equipment costs are based on one tractor with attachments and three pickup trucks, to be replaced once every five years.

For additional backup information, see Appendix A, Figures A2, A3, and A4; and Tables A8 and A9.

Table 5-12. Comparison of Alternatives by Unit Process: Sequence of Construction (Calendar Year: Start/Completion Date).[1]

Unit Process	In Situ Disposal: Chemical, Vitrification	Extensive Pretreatment Option A[3]	Extensive Pretreatment Option B[3]	No Separations	Tri-Party Agreement Preferred Alternative
Barrier construction	2013,2016/ 2030,2033	2024/2060	2024/2030	n/a	2028/2034
Emptied SST closure[4]	n/a	2010/2024	2010/2024	2010/2024	2010/2024
Emptied DST closure[5]	n/a	2019/2023	2019/2023	2018/2022	2023/2027

Notes:

n/a = not applicable
SST = single-shell tank
DST = double-shell tank

[1]Based on WHC-EP-0616, *Tank Waste Technical Options Report*, (Boomer et al. 1993).

[2]The start/completion dates for barrier construction for the in-situ disposal alternative is based on WHC-SD-WM-EV-101 (McConville 1995). In situ chemical stabilization decontamination and decommissioning ends in 2013, and barrier construction over the tanks begins immediately after that task; it ends in 2030. In situ vitrification decontamination and decommissioning ends in 2016, and barrier construction over the tanks begins immediately after that task. It ends in 2033. 2016-2033

[3]The start and completion dates for barrier construction for the extensive pretreatment alternatives and the Tri-Party Agreement preferred alternative are based upon the assumption that no barrier construction over the low-level waste vaults can begin until decontamination and decommissioning activities for the facilities end.

[4]The start and completion dates for emptied SST closure are based on the Tank Farm Retrieval Sequence schedule found in WHC-SD-WM-ER-193. This schedule is reproduced in Appendix A. These figures reflect work occurring sequentially (that is, no parallel operations were used). Tank stabilization and ancillary equipment stabilization begin as soon as Tank Farm retrieval operations end; barrier construction begins as soon as tanks and ancillary equipment are stabilized.

[5]The start and completion dates for emptied DST closure are based upon the assumption that no tank or ancillary equipment stabilization can begin until treatment operations end, and no barrier construction can begin until tanks and ancillary equipment have been stabilized for each tank cluster. This assumption was used because no schedule was generated for the retrieval sequence of the DSTs. These figures reflect work occurring sequentially (that is, no parallel operations were used).

For additional backup information, see Appendix A, Tables A1-A9 and A-11.

Table A11. Barrier Cost by Component (1994 Dollars)
(Backup for Table 5-1, 5-2D, 5-8 and 5-9).

BACKUP FOR BARRIER COST BY COMPONENT
(IN 1994 DOLLARS)

MATERIAL	241-A	241-AX	241-B	241-BX	241-BY	241-C	241-S	241-SX	241-T	241-TX	241-TY	241-U
Dsl Design	128,328	98,238	217,428	209,901	212,377	252,130	214,450	250,906	217,428	370,621	129,580	217,785
Eng/Impact	256,652	196,475	434,856	419,809	424,754	504,860	428,912	513,815	434,856	641,242	259,160	464,571
SRDI Test	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759
ENG SUBTOTAL	444,737	354,472	802,043	689,472	696,890	817,049	703,127	830,482	802,043	1,021,622	448,499	766,015
Site Work	76,377	58,706	172,756	136,295	140,182	177,304	142,070	174,752	172,756	241,596	77,322	167,975
Base Course	43,653	33,757	83,314	71,072	71,897	85,173	72,587	86,743	83,314	107,758	44,274	81,610
Asphalt	1,096,842	844,178	2,088,454	1,777,317	1,797,943	2,129,938	1,815,190	2,169,204	2,088,454	2,694,759	1,107,162	2,045,832
Drain Gravel	91,837	71,460	170,807	146,155	147,801	174,096	148,187	177,408	170,807	214,831	92,666	167,430
Batch	1,202,706	945,832	2,147,732	1,858,531	1,874,404	2,186,453	1,884,407	2,234,904	2,147,732	2,710,535	1,213,411	2,108,115
Gravel Filter	46,891	34,881	109,292	89,737	90,973	111,885	92,061	113,354	109,292	147,461	49,475	100,013
Sand Filter	32,341	22,969	73,108	59,898	60,735	74,859	61,466	75,812	73,108	98,895	32,772	71,298
Geotextile	25,329	17,983	57,168	46,853	47,505	58,558	48,079	59,301	57,168	77,357	25,635	55,770
Lower Sift	140,791	97,030	337,469	272,907	276,872	340,007	280,559	349,531	337,469	463,456	142,014	326,034
Upper Sift	175,202	122,872	405,196	330,242	334,981	415,123	339,145	420,026	405,196	551,469	177,362	384,934
Road	9,374	7,483	13,600	12,483	12,558	13,758	12,614	14,207	13,600	15,796	9,440	13,444
CON SUBTOTAL	2,943,389	2,257,571	5,659,114	4,603,570	4,659,946	5,773,150	4,907,349	5,875,242	5,659,114	7,327,814	2,872,173	5,541,855
TOTAL	3,388,126	2,612,043	6,461,157	5,293,042	5,356,836	6,590,199	5,610,476	6,705,724	6,461,157	8,349,536	3,420,672	6,326,470

MATERIAL	241-AN	241-AP	241-AW	241-AY	241-AZ	241-SY	EX PRE OPT B	EX PRE OPT A	TPA GLASS	TOTALS
Dsl Design	180,130	168,913	134,841	68,730	68,730	100,770	5,154,499	1,038,855	983,431	11,157,583
Eng/Impact	360,660	337,825	269,683	133,460	133,460	201,540	11,713,798	2,077,708	1,966,867	22,315,164
SRDI Test	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	59,759	1,254,938
ENG SUBTOTAL	601,049	566,497	464,283	259,949	259,949	362,069	17,930,456	3,178,323	3,010,060	34,727,686
Site Work	115,947	101,290	80,757	40,402	40,402	60,224	14,400,406	1,265,455	1,144,322	18,869,690
Base Course	61,238	57,465	46,038	23,178	23,178	34,607	1,810,810	340,763	323,395	3,586,724
Asphalt	1,531,415	1,437,028	1,151,226	579,820	579,820	865,423	45,265,770	8,521,531	8,087,188	89,693,695
Drain Gravel	126,527	119,274	96,224	50,124	50,124	73,174	3,528,842	675,589	641,877	7,140,040
Batch	1,621,323	1,546,969	1,257,165	677,616	677,616	967,401	50,662,065	7,835,675	7,473,761	85,246,595
Gravel Filter	75,005	67,954	52,009	20,116	20,116	36,064	3,145,201	537,960	507,183	5,565,529
Sand Filter	49,874	45,167	34,473	13,090	13,090	23,763	2,136,698	363,657	342,727	3,759,962
Geotextile	39,090	35,330	26,967	10,239	10,239	18,603	1,671,353	284,457	268,080	2,941,104
Lower Sift	225,326	200,592	150,661	50,600	50,600	100,731	10,776,043	1,763,667	1,677,545	18,389,664
Upper Sift	274,365	246,546	186,919	67,667	67,667	127,293	12,768,394	2,065,062	1,944,652	21,320,393
Road	11,341	11,341	9,574	6,340	6,340	6,007	72,454	29,599	29,064	332,624
CON SUBTOTAL	4,131,552	3,866,957	3,092,133	1,539,194	1,539,194	2,315,310	133,555,045	23,703,635	22,440,040	254,765,649
TOTAL	4,732,601	4,433,454	3,556,416	1,799,143	1,799,143	2,677,379	151,165,501	26,879,958	25,450,100	289,493,335

NOTE. (1) The above design and construction costs are 1993 dollars escalated by a 2.9% inflation factor, and include a 15% contingency.

(2) The costs for EPT Option A, EPT Option B, and TPA Glass do not include the costs for barriers over the tank farms; they are strictly the costs of the barriers over the LLW Vaults.

TPA Data Pkg.

Table 9-17. Overall Cost Component. (Millions of 1995 Dollars)

Cost Component	Tri-Party Agreement Preferred Alternative
Capital	3,600[1]
Operating	3,900[2]
Research and development	630[3]
Repository fee	1,750
Other related costs	8,600[4]
Total	$18,500

Notes:

[1]Total capital cost includes 40% contingency. Contingency is excluded from other costs.

[2]Includes start-up, decontamination and decommissioning, and monitoring and maintenance costs.

[3]Pg. 130 of Boomer 1994, which was based on a draft of the *Tank Waste Remediation System Multi-Year Program Plan* (MYPP) (WHC 1994).

[4]Other related costs are costs defined in the MYPP that should be included in the total costs, but are not directly related to operations. These costs are:

Program management	$1,180
Operations and maintenance	4,290
Tank farm safety	440
Tank farm upgrades	1,720
Characterization	933
Total	$8,563

(SIS 4342)

Round to $8,600 million. These costs are taken as total unescalated costs from the MYPP.

Boomer, K. D., J. M. Colby, T. W. Crawford, J. S. Garfield, C. E. Golberg, C. E. Leach, D. E. Mitchell, F. D. Nankani, E. J. Slaathaug, L. M. Swanson, T. L. Waldo, and C. M. Winkler, 1994, *Tank Waste Remediation System Facility Configuration Study*, WHC-SD-WM-ES-295, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *Tank Waste Remediation System Multi-Year Program Plan*, WHC-SP-1101, Westinghouse Hanford Company, Richland, Washington.

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Closure - Borrow Site Requirements and Affected Areas - Changes due to Revised Waste loading.

ORIGINATOR C Henderson DATE 1/30/96

REVISION NO. 0

OBJECTIVE For the Ex-Situ - Alternatives that involve LAW disposal - Calculate the change in borrow requirements and the new Area disturbed to accommodate the new LAW Vaults

METHODOLOGY Using the revised Vault Areas scale the Changes in borrow material for the barriers.

ASSUMPTIONS Noted

(Continue on another sheet if necessary)

SIGNATURE

Checked by RDW 2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

Table 5-3B. Comparison of Alternatives by Barrier Construction Resource Requirements (Units as Indicated). NEW BASE CASE

Construction Resource	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative	INT. Sepe
Land (ha) surface committed[1]						
Temporarily	20	24	24	20	24	
Permanently	17	~~25~~	64	17	25	
Water (m^3) [2]	38,000	72000 ~~57,000~~	145,000	38,000	72000 ~~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	72000 ~~60,000~~	142,000	45,000	72,000 ~~59,000~~	70200
Gasoline (m^3) [5]	260	420 ~~350~~	830	260	420 ~~350~~	
Materials						
Concrete (m^3)	0	0	0	0	0	
Steel (t)	0	0	0	0	0	
Asphalt (m^3)	62,500	97,000 ~~81,600~~	164,000	62,500	97,000 ~~80,700~~	95200
Excavation (m^3) [6]	0	0	0	0	0	
Soil (m^3) [7]	377,000	645,000 ~~535,000~~	1,320,000	377,000	645,000 ~~526,000~~	
Riprap (m^3) [8]	638,000	931,000 ~~809,000~~	1,480,000	638,000	931,000 801,000	
Gravel/sand (m^3) [9]	415,000	744,000 ~~615,000~~	2,250,000	415,000	744000 ~~598,000~~	
Waste debris	0	0	0	0	0	
Waste water	0	0	0	0	0	
Sewage	0	0	0	0	0	

NOTE THE ORIGINAL BARRIER ESTIMATES for the Intermediate Separations and extensive separations were Based on 46 VAULTS not 40. The new Requirement is for 83 Vaults ⇒ the ratio is 83/46 = 1.8 so the VAULT Related barrier requirements should go up by a factor of 1.8.

NOTE: No SEPARATIONS = Barriers over the tank farms only, TPA & Extensive Pretreat equal Barriers over TANKS + Vaults. Changes due to increases in vault size are Calculated as: INT Sep = No Sep + (INT Sep - No Sep)

EXT Pretreat = No Sep + (EXT Sep - No Sep)

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~~ COMBO
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	55,000 ~~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 ~~59,000~~
Gasoline (m^3) [5]	260	350	830	260	340 ~~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	80,000 ~~80,700~~
Excavation (m^3) [6]	0	0	0	0	0
Soil (m^3) [7]	377,000	535,000	1,320,000	377,000	511,000 ~~526,000~~
Riprap (m^3) [8]	638,000	809,000	1,480,000	638,000	785,000 ~~801,000~~
Gravel/sand (m^3) [9]	415,000	615,000	2,250,000	415,000	580,000 ~~598,000~~
Waste debris	0	0	0	0	0
Waste water	0	0	0	0	0
Sewage	0	0	0	0	0

NOTE THE EXSITU INSITU COMBINATION ALTERNATIVE LAW VAULT AREA IS 1/2 OF the Modified OR New Base Case Intermediate Separations alt. The No Separations Alt Resources represent Tank farm barriers only & therefore the requirements for the Combo alt = No Sep + 1/2 (Intermediate Sep − No Sep)

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~~ Phased Imp Total Alt
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	72000 ~~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	72000 ~~59,000~~
Gasoline (m^3) [5]	260	350	830	260	420 ~~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	97000 ~~80,700~~
Excavation (m^3) [6]	0	0	0	0	0
Soil (m^3) [7]	377,000	535,000	1,320,000	377,000	645000 ~~526,000~~
Riprap (m^3) [8]	638,000	809,000	1,480,000	638,000	931000 ~~801,000~~
Gravel/sand (m^3) [9]	415,000	615,000	2,250,000	415,000	744000 ~~598,000~~
Waste debris	0	0	0	0	0
Waste water	0	0	0	0	0
Sewage	0	0	0	0	0

the BARRier Requirements for the Phased Implementation Alt are the SAME as the Intermediate Separations Alt

Table 3.6.1 Borrow Site Summary - Materials Used During Construction and Operations

Alternative	Borrow Type	Amount (m^3 [ft^3])	Location
No Action (Tank Waste)	N/A	N/A	N/A
Long-Term Management	N/A	N/A	N/A
In Situ Fill and Cap	Aggregate	690,000 (2.5E+07)	Pit 30
In Situ Vitrification	Sand	540,000 (1.9E+07)	Pit 30
Ex Situ Intermediate Separations	Aggregate	317,000 (1.1E+07)	Pit 30
Ex Situ No Separations - Vitrification - Calcination	 Aggregate Aggregate	 123,000 (4.4E+06) 123,000 (4.4E+06)	 Pit 30 Pit 30
Ex Situ Extensive Separations	Aggregate	372,000 (1.3E+07)	Pit 30
Ex Situ/In Situ Combination	Aggregate	410,000 (1.5E+07)	Pit 30
Phased Implementation (Phase 1 only)	Aggregate	12,000 (4.3E+05)	Pit 30
Phased Implementation (Phase 2)	Aggregate	159,000 (5.7E+06)	Pit 30

Notes:
N/A = Not Applicable

Table 3.6.2 Borrow - Materials Used for Backfill of Empty Tanks for all Ex Situ Alternatives

Alternative	Method	Kind	Amount (m^3 [ft^3])	Location
Ex Situ (all)	Tank Stabilization	Aggregate	754,000 (2.7E+07)	Pit 30
Ex Situ/In Situ Combination	Tank Stabilization	Aggregate	354,000 ~~452,000~~ (1.6E+07)	Pit 30
Phased Implementation (Phase 2)	Tank Stabilization	Aggregate	754,000 (2.7E+07)	Pit 30

Table 3.6.3 Borrow - Materials Used for Construction of Hanford Barriers

Alternative	Borrow Kind	Amount (m^3 [ft^3])	Location
In Situ Fill and Cap, In Situ Vitrification, Ex Situ No Separations [1]	Silt Riprap Aggregate/Sand	377,000 (1.3E+07) 638,000 (2.3E+07) 415,000 (1.5E+07)	McGee Ranch Vernita Quarry Pit 30
Ex Situ Intermediate Separations, Extensive Separations, or Phased Implementation (Phase 2) [2]	Silt 645,000 Riprap 931,000 Aggregate/Sand 744,000	~~530,000~~ (~~1.9E+07~~ 2.3E+07) ~~805,000~~ (~~2.9E+07~~ 3.2) ~~606,000~~ (~~2.2E+07~~ 2.7)	McGee Ranch Vernita Quarry Pit 30
Ex Situ/In Situ Combination	Silt 511,000 Riprap 785,000 Aggregate/Sand 580,000	~~436,000~~ (~~1.6E+07~~ 1.9) ~~490,000~~ (~~1.7E+07~~ 2.1) ~~700,000~~ (2.5E+07)	McGee Ranch Vernita Quarry Pit 30

Notes:
[1] Includes materials to construct barriers over tank farms.
[2] Includes materials to construct barriers over tank farms and the LAW disposal vaults.
N/A = Not Applicable

2.1E7

700,000

490,000

The change in temporary land impacts at the borrow sites due to the changes in waste loading → bigger LAW VAULTS → Larger Barriers → More Borrow.

IN SITU Alternatives = No Change.

Ex SITU INT. SEPARATIONS. + EXTENSIVE SEP + Phased Imp.

McGEE Area = $\frac{645000\ m^3}{3\ m\ depth} = 2.15E5\ m^2 \times \frac{1\ ha}{10{,}000\ m^2} = 22\ ha$

McGee Area = 22 ha total

Old McGee = 18 ha the Increase = 4 ha.

Pit 30 = $\frac{744000\ m^3}{3\ m} \times \frac{1}{10000} = 25\ ha.$

OLD Pit30 Reqmt = 20 ha ⇒ Increase = 5 ha.

Vernita Area = $\frac{931000\ m^3}{3} \times \frac{1}{10000} = 31\ ha$

Old Vernita Area = 27 ha. ⇒ Increase = 4 ha

COMBINATION ALT.

McGee = $\frac{511{,}000}{3} \times \frac{1}{10^4} = 17\ ha$ OLD = 15 ⇒ Increase = 2

Vernita = $\frac{785000}{3} \times \frac{1}{10^4} = 26\ ha$ OLD = 16 ha ⇒ Increase = 10 ha

Pit 30 = $\frac{580000}{3} \times \frac{1}{10^4} = 19\ ha$ OLD = 23 Increase = −4 ha.

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Number of Canisters, Trips, and Curie Concentrations in the HLW for RadTran input. Perform for all Ex Situ alternatives.

ORIGINATOR Colin Henderson DATE 1/27/96

REVISION NO. 1 (2/9/96)

OBJECTIVE Using New Baseline Assumptions for waste loading and Canister size and Blending factor Calculate the Number of Canisters, trips and Isotopic Concentration in the HLW product

METHODOLOGY Use WHC Rev 0 data packages to determine Curies/m^3 in the old Case waste and Ratio By the change in Volume to determine Conc for new base Case. Combination alt. Calculated based on % recovered on an isotope by isotope basis.

ASSUMPTIONS Noted.

(Continue on another sheet if necessary)

J C Henderson
SIGNATURE

checked by
RGW 2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

1. HLW glass for any of the ex situ alternatives involving separations is calculated at 20 wt % waste oxides. The waste oxides exclude silica and sodium.
2. The HLW for the No Separations case is calculated at 20 wt % sodium oxide.
Note: EA glass limits are 17% Na2O and 4.3% Li2O and each Li2O is equivalent to 2 Na2O so the EA glass is equivalent to 25% Na2O without any Li2O. The privatization RFP states that the HLW glass will be 25 wt % waste oxides not counting the Na2O or SiO2.
3. The LAW glass composition is calculated at 15 wt % Na2O.
4. The canister size for all HLW is set at 0.62 m^3 (1X canister)
5. The material balances contained in the WHC data packages were used to calculate the waste oxides for the HLW and LAW streams.
6. Sensitivity analysis will be done for the Intermediate Separations alternative at 15 wt %, and 40 wt % waste oxide loading.
7. The material balance for the Intermediate Separations case was used for the Phased Implementation alternative and was modified to account for additional radionuclide separations.
8. For purposes of interim onsite storage and transportation to the repository 4 of the 1x cans are assumed to be placed into an HMPC or similar packaging and would be repackaged at the repository.

No Separations WHC data package values					
			Vitrification		
Radionuclide Inventory			No Separations		
			HLW Glass (WHC data pkg)		
			Total Curies		
Am-241			1.04E+05		
Am-243			3.32E+01		
Cm-244			1.18E+02		
Cs-137			3.49E+07		
Ni-63			2.69E+05		
Np-237			6.97E+01		
Pu-238			1.08E+03		
Pu-239			2.64E+04		
Pu-240			6.70E+03		
Pu-241			7.49E+04		
Ru-106			3.79E-02		
Sm-151			6.30E+05		
Sn-126			6.27E+02		
Sr-90			4.36E+07		
Tc-99			3.21E+04		
U-233			1.21E-02		
U-234			2.12E-01		
U-235			2.06E+01		
U-238			4.81E+02		
Zr-93			3.94E+03		
Total (m3)			1.36E+05		
Note: Curies from decay daughter products not included					

No Separations Alternative New Base Case (1/26/96)					
	20 wt% sodium oxide loading, 1.5 blending factor				
			Vitrification		**Calcination**
			Radionuclide		Radionuclide
			Concentration		Concentration
			Curies /m^3		Curies /m^3
Am-241			2.86E-01		1.55E+00
Am-243			9.12E-05		4.94E-04
Cm-244			3.24E-04		1.76E-03
Cs-137			9.58E+01		5.19E+02
Ni-63			7.39E-01		4.00E+00
Np-237			1.91E-04		1.04E-03
Pu-238			2.97E-03		1.61E-02
Pu-239			7.25E-02		3.93E-01
Pu-240			1.84E-02		9.97E-02
Pu-241			2.06E-01		1.11E+00
Ru-106			1.04E-07		5.64E-07
Sm-151			1.73E+00		9.38E+00
Sn-126			1.72E-03		9.33E-03
Sr-90			1.20E+02		6.49E+02
Tc-99			8.81E-02		4.78E-01
U-233			3.32E-08		1.80E-07
U-234			5.82E-07		3.15E-06
U-235			5.66E-05		3.07E-04
U-238			1.32E-03		7.16E-03
Zr-93			1.08E-02		5.86E-02
Total (m3)			3.64E+05		6.72E+04
Number of 0.62 m^3 canisters			5.87E+05		166,000 ~~108388~~
Number of 0.62 m^3 canisters per HMPC			4		4
Number of trips to the repository			14690		4150 ~~2710~~
Based on 10 HMPCs per train and rounded to nearest 10 trips					
Note: Curies from decay daughter products not included					

Revised 2/9/96

Intermediate Separations WHC data package values

Radionuclide Inventory	Low-Level Waste Glass Ci/m3	High-Level Waste Glass Ci/m3
Am-241	3.90E-02	1.00E+01
Am-243	1.30E-05	3.20E-03
C-14		
Cm-244	4.70E-06	5.90E-03
Cs-135	4.80E-06	1.50E-02
Cs-137	1.20E+00	3.70E+03
I-129		
Ni-63	2.60E-02	2.80E+01
Np-237	3.20E-05	6.60E-03
Pu-238	3.10E-04	1.10E-01
Pu-239	7.60E-03	2.60E+00
Pu-240	1.90E-03	6.70E-01
Pu-241	6.70E-03	7.80E+00
Ra-226		
Ru-106	8.50E-09	3.80E-06
Sm-151	3.10E-02	6.60E+01
Sn-126	7.20E-04	5.00E-02
Sr-90	4.30E+00	5.60E+03
Tc-99	1.20E-01	6.30E-01
Th-230	2.30E-12	4.10E-09
U-233	2.80E-09	1.20E-06
U-234	4.90E-08	2.10E-05
U-235	4.80E-06	2.10E-03
U-238	1.10E-04	4.80E-02
Zr-93	1.60E-05	4.10E-01
Total (m3)	2.20E+05	9.40E+03

Note: Curies from decay daughter products not included

Intermediate Separations New Base Case (1/26/96)			
20 wt% waste oxide loading, 1.5 blending factor			
		Sensitivity @	Sensitivity@
	Base Case	15 wt% loading	40 wt% loading
Radionuclide Inventory	HLW	HLW	HLW
	glass	glass	glass
	Ci/m^3	Ci/m^3	Ci/m^3
Am-241	4.54E+00	3.41E+00	9.08E+00
Am-243	1.45E-03	1.09E-03	2.91E-03
C-14	0.00E+00	0.00E+00	0.00E+00
Cm-244	2.68E-03	2.01E-03	5.36E-03
Cs-135	6.81E-03	5.11E-03	1.36E-02
Cs-137	1.68E+03	1.26E+03	3.36E+03
I-129	0.00E+00	0.00E+00	0.00E+00
Ni-63	1.27E+01	9.54E+00	2.54E+01
Np-237	3.00E-03	2.25E-03	5.99E-03
Pu-238	5.00E-02	3.75E-02	9.99E-02
Pu-239	1.18E+00	8.86E-01	2.36E+00
Pu-240	3.04E-01	2.28E-01	6.09E-01
Pu-241	3.54E+00	2.66E+00	7.08E+00
Ra-226	0.00E+00	0.00E+00	0.00E+00
Ru-106	1.73E-06	1.29E-06	3.45E-06
Sm-151	3.00E+01	2.25E+01	5.99E+01
Sn-126	2.27E-02	1.70E-02	4.54E-02
Sr-90	2.54E+03	1.91E+03	5.09E+03
Tc-99	2.86E-01	2.15E-01	5.72E-01
Th-230	1.86E-09	1.40E-09	3.72E-09
U-233	5.45E-07	4.09E-07	1.09E-06
U-234	9.54E-06	7.15E-06	1.91E-05
U-235	9.54E-04	7.15E-04	1.91E-03
U-238	2.18E-02	1.63E-02	4.36E-02
Zr-93	1.86E-01	1.40E-01	3.72E-01
Total (m3)	2.07E+04	2.76E+04	1.03E+04
Number of 0.62 m^3 canisters	3.34E+04	4.45E+04	1.67E+04
Number of 0.62 m^3 can/HMPC	4	4	4
Number of HMPCs	8347	11129	4173
Number of trips to the repository	840	1110	420
Based on 10 HMPCs per train and rounded to nearest 10 trips			
Note: Curies from decay daughter products not included			

		Extensive Separations Data Package values							
		Note: data package values modified by ECN to Rev 0 data package							
		Radionuclide Inventory			HLW Glass		LLW Glass		
					Base Case (A-1)		Base Case (A-1A)		
					Ci/m3		Ci/m3		
		Am-241			2.09E+02		7.34E-04		
		Am-243			6.69E-02		2.35E-07		
		C-14			0.00E+00		0.00E+00		
		Cm-244			2.30E-01		4.56E-06		
		Cs-135			2.91E-01		9.16E-07		
		Cs-137			7.02E+04		2.21E-01		
		I-129			0.00E+00		0.00E+00		
		Ni-63			8.47E+00		1.83E+00		
		Np-237			1.40E-01		1.87E-05		
		Pu-238			2.15E+00		7.80E-05		
		Pu-239			5.25E+01		1.90E-03		
		Pu-240			1.33E+01		4.84E-04		
		Pu-241			1.49E+02		5.41E-03		
		Ra-226			5.40E-10		7.20E-16		
		Ru-106			7.58E-05		1.01E-10		
		Sm-151					1.68E-03		
		Sn-126			1.25		1.67E-06		
		Sr-90			1.07E+05		3.72E-02		
		Tc-99			6.43E+01		1.06E-03		
		Th-230			7.80E-08		1.04E-13		
		U-233			3.68E-08		5.19E-11		
		U-234			6.76E-07		9.10E-10		
		U-235			6.57E-05		8.84E-08		
		U-238			1.53E-03		2.06E-06		
		Zr-93			9.59E-02		2.68E-02		
		total m3			496		1.47E+05		
							solid		
		Note: Curies from decay daughter products not included							

Extensive Separations alternative New Base Case (1/26/96)

20 wt% waste oxide loading, 1.5 blending factor

Extensive Separations Data Package values

Radionuclide Inventory	HLW Glass Base Case (A-1) Ci/m3
Am-241	1.06E+02
Am-243	3.41E-02
C-14	0.00E+00
Cm-244	1.17E-01
Cs-135	1.48E-01
Cs-137	3.58E+04
I-129	0.00E+00
Ni-63	4.31E+00
Np-237	7.13E-02
Pu-238	1.09E+00
Pu-239	2.67E+01
Pu-240	6.77E+00
Pu-241	7.59E+01
Ra-226	2.75E-10
Ru-106	3.86E-05
Sm-151	0.00E+00
Sn-126	6.37E-01
Sr-90	5.45E+04
Tc-99	3.27E+01
Th-230	3.97E-08
U-233	1.87E-08
U-234	3.44E-07
U-235	3.35E-05
U-238	7.79E-04
Zr-93	4.88E-02
total m3	9.74E+02

Number of 0.62 m^3 canisters	1.57E+03
Number of 0.62 m^3 can/HMPC	4
Number of HMPCs	393
Number of trips to the repository	40

Based on 10 HMPCs per train and rounded to nearest 10 trips

Note: Curies from decay daughter products not included

Phased Implementation alternative New Base Case (1/26/96)			
	20 wt % waste oxide loading, 1.5 blending factor		
			Base Case
	Radionuclide Inventory		HLW
			glass
			Ci/m^3
	Am-241		5.01E+00
	Am-243		1.60E-03
	C-14		0.00E+00
	Cm-244		2.68E-03
	Cs-135		6.81E-03
	Cs-137		1.68E+03
	I-129 *		0.00E+00
	Ni-63		1.27E+01
	Np-237		3.00E-03
	Pu-238		5.15E-02
	Pu-239		1.26E+00
	Pu-240		3.19E-01
	Pu-241		3.57E+00
	Ra-226		0.00E+00
	Ru-106		1.73E-06
	Sm-151		3.00E+01
	Sn-126		2.27E-02
	Sr-90		2.56E+03
	Tc-99		1.54E+00
	Th-230		1.86E-09
	U-233		5.45E-07
	U-234		9.54E-06
	U-235		9.54E-04
	U-238		2.18E-02
	Zr-93		1.86E-01
	Total (m3)		2.07E+04
Number of 0.62 m^3 canisters			3.34E+04
Number of 0.62 m^3 can/HMPC			4
Number of HMPCs			8347
Number of trips to the repository			840
Based on 10 HMPCs per train and rounded to nearest 10 trips			
Note: Curies from decay daughter products not included			

Ex Situ / In Situ Combination Alternative New Base Case (1/26/96)

20 wt% waste oxide loading, 1.5 blending factor

Radionuclide Inventory	HLW glass	Sel Ret. Recovery fraction
	Ci/m^3	
Am-241	6.97E+00	7.67E-01
Am-243	2.67E-03	9.20E-01
C-14	0.00E+00	9.00E-01
Cm-244	5.04E-03	9.40E-01
Cs-135	1.16E-02	8.50E-01
Cs-137	2.96E+03	8.80E-01
I-129	0.00E+00	9.00E-01
Ni-63	2.03E+01	8.00E-01
Np-237	5.58E-03	9.32E-01
Pu-238	3.97E-02	3.97E-01
Pu-239	1.48E+00	6.27E-01
Pu-240	3.69E-01	6.07E-01
Pu-241	4.01E+00	5.65E-01
Ra-226	0.00E+00	8.30E-01
Ru-106	1.28E-06	3.70E-01
Sm-151	4.32E+01	7.20E-01
Sn-126	3.32E-02	7.30E-01
Sr-90	3.56E+03	7.00E-01
Tc-99	5.15E-01	9.00E-01
Th-230	3.05E-09	8.20E-01
U-233	8.72E-07	8.00E-01
U-234	1.54E-05	8.10E-01
U-235	1.74E-03	9.10E-01
U-238	3.92E-02	9.00E-01
Zr-93	2.49E-01	6.70E-01
Total (m3)	1.03E+04	

Number of 0.62 m^3 canisters	1.67E+04
Number of 0.62 m^3 can/HMPC	4
Number of HMPCs	4174
Number of trips to the repository	420

Based on 10 HMPCs per train and rounded to nearest 10 trips

Note the combination alt. retrieval fraction is calculated from the % of SST and DST inventory recovered as follows: recovery fraction = (curies recovered from SSTs + Curies from DSTs) divided by (total curies in the SSTs+total curies in DSTs)

The combination alternative volume of HLW glass is 1/2 of the Intermediate Separations

Note: Curies from decay daughter products not included

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Change in interim Storage Requirements for No Separations With Revised Waste Loadings & 0.62 m³ Canisters

ORIGINATOR Colin Henderson DATE 1/29/96

REVISION NO. 0

OBJECTIVE Calculate the new Area required for interim HLW storage and Layout Required Area On site plan

METHODOLOGY Calc New Area Using the revised quantities of HMPCs.

ASSUMPTIONS No Separations would use the 0.62 m³ Canisters, and place 4 Canisters in an HMPC for onsite Storage.

(Continue on another sheet if necessary)

J.C. Henderson
SIGNATURE

Checked by R. [illegible]
2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

Based on the New Waste Loading and Higher Volumes of HLW and LAW the two Areas that will affect the temporary and permanent land use Commitments will be the interim onsite Storage requirements for HLW, the increase in number of LAW Vaults, and the additional Surface Area of LAW Disposal that will require A Hanford barrier.

1) No SEPARATIONS VITRIFICATION:

OLD CASE 3 INTERIM STORAGE PADS.

2@ 139m x 525m

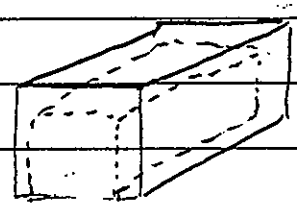
1@ 139m x 292m

HMPC 5m long x 2m dia.

The Concrete Shielding Casks are 90.7 mt/cask (No Sep. Pg 6-8 Fig 9)

$\rho_{concrete} \approx 2.3\ mt/m^3$

Volume Concrete / Shielding Cask $= \frac{90.7}{2.3}\ m^3 = 39.4\ m^3$.



Add .3m to HMPC for Clearance

INSIDE of BOX is then 5.3m x 2.3m

let t = wall thickness in m

then Volume $= 3 \times [(5.3+2t)\times(2.3+t)\times t]$
$+ [(2.3+2t)\times(2.3+t)\times t] \times 2$

$= 3\left[(12.2+5.3t+4.6t+2t^2)\,t\right]$
$+ \left[(5.29+2.3t+5.29t+2t^2)\,t\right] 2$

$= 36.6t + 15.9t^2 + 13.8t^2 + 6t^3 + 10.58t + 4.6t^2 + 10.58t^2 + 4t^3$

$= 47.18t + 44.88t^2 + 10t^3 = 39.4m^3$

$\Rightarrow 10t^3 + 44.88t^2 + 47.18t - 39.4 = 0$

t is $\approx 0.5m$

foot print of a shielding Cask is then $\approx$ 3m x 3m with the casks standing on end.

x check Old Numbers 21,400 Canisters x $9m^2$ = $192600m^2$

Area of pads scaled from dwg = 187000

The New Requirement for No Separations will then be 146856 HMPC's

Assume that a thinner walled shielding cask would be used such that the footprint was 2.5m x 2.5m then the Area Req for interim storage is:

146900 HMPC x 2.5^2 = 920,000 m^2

Add 10% to allow some spacing

No Sep. Vit. Area Required = $1.012 \times 10^6 m^2$

Increased New Area = 825,400 m^2 For Vitrification

Calcination 38687 HMPC x $(2.5m)^2$ = 241,800 m^2 x 1.1 = 266,000

old Requirement was $\approx$ ½ No Sep Vit = ½(186,600) = 93300 m^2

$\Rightarrow$ Increase = 172,700 m^2 for Calcination

The Interim Storage Requirement for No Separations is then:

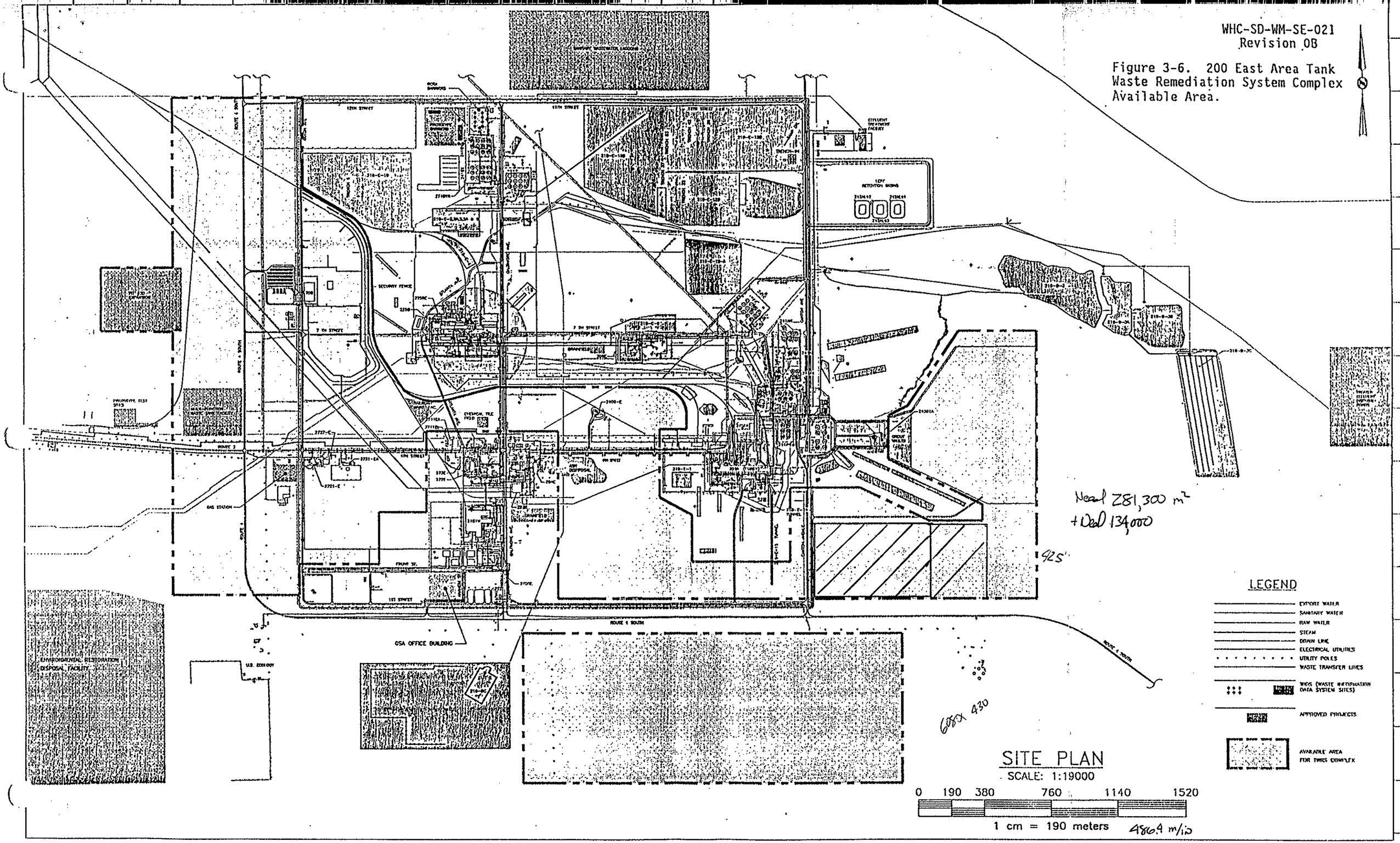
Vitrification = 1.012×10^6 m^2
this is an increase of 825400 m^2
83 ha

Calcination = 266,000 m^2
this is an increase of 172,700 m^2
17.27 → 18 ha

The total delta between No Sep Vit & No Sep Calcination is

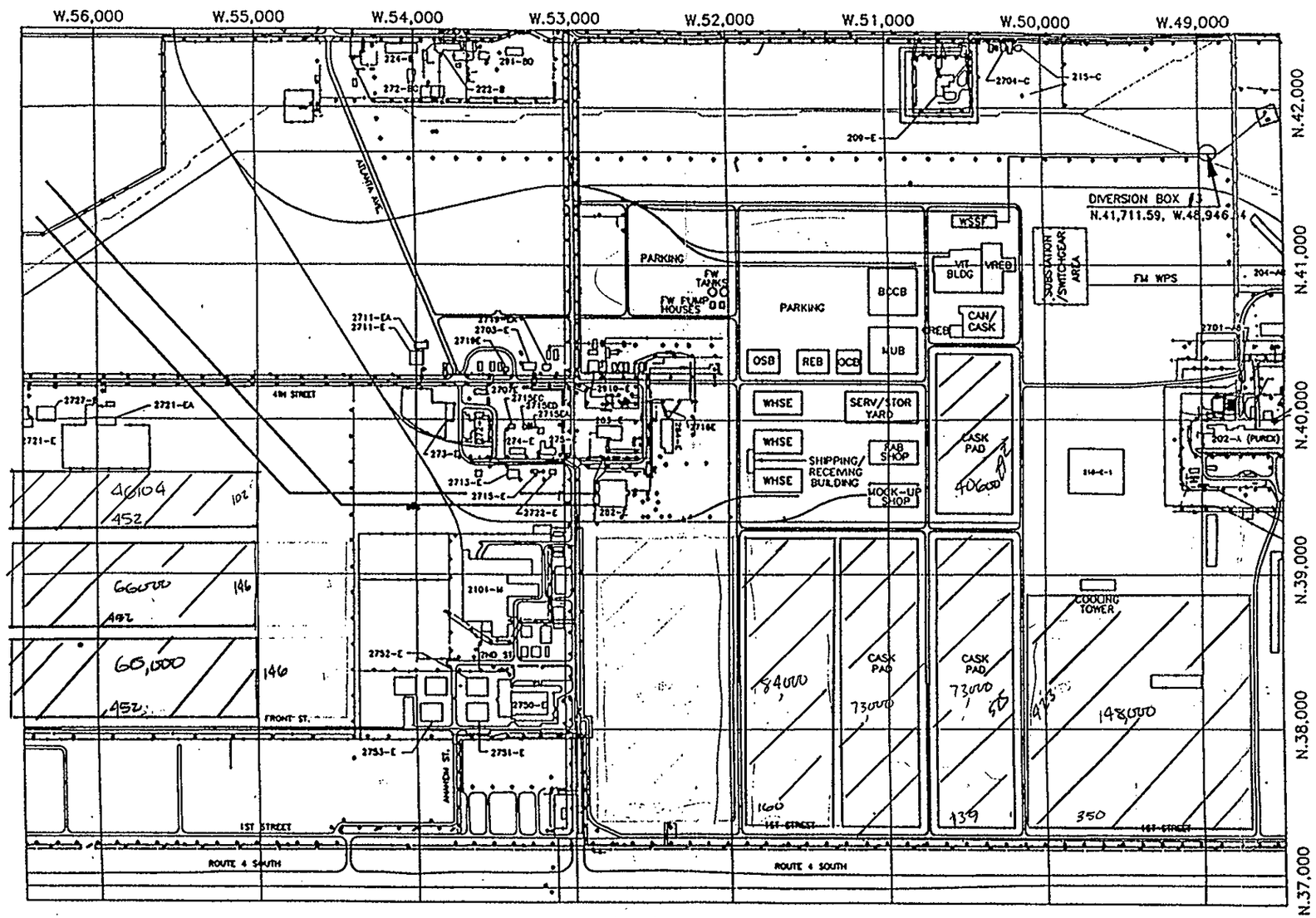
$1.012 \times 10^6 - 266{,}000 = 746000$
$= \underline{75 \text{ ha}}$

Figure 3-6. 200 East Area Tank Waste Remediation System Complex Available Area.



NOTE: THIS MAP IS FOR REFERENCE ONLY. DO NOT USE FOR CONSTRUCTION OR ENGINEERING PURPOSES.	ICF KAISER HANFORD COMPANY MAPPING SERVICES	CADFILE: ZRBT0343 DATE: 1-3-95	CUSTOMER: AL SHORD DRAWN BY: RAFAEL TORRES	TITLE: 200 EAST TWRS COMPLEX AVAILABLE AREA 3-11/3-12

Figure 5-2. Site Plan.



LEGEND

BCCB	BULK HANDLING & COLD CHEMICAL MAKE-UP BUILDING
CAN/CASK	CASK/CANISTER FACILITY
CREB	CASK/CANISTER REGULATED ENTRANCE BUILDING
FAB	FABRICATION
FW	FIREWATER
MUB	MECHANICAL UTILITIES BUILDING
OCB	OPERATIONS CONTROL BUILDING
OSB	OPERATIONS SUPPORT BUILDING
REB	REGULATED ENTRANCE BUILDING
WSSF	WASTE STAGING AND SAMPLING FACILITY
SERV/STOR	SERVICE/STORAGE
VIT BLDG	VITRIFICATION BUILDING
VREB	VITRIFICATION REGULATED ENTRANCE BUILDING
WHSE	WAREHOUSE

CASE 8A EIS

200 EAST AREA

(730,704 m²)

INTERIM HLW Storage.

233.5 m/in

U.S.DEPARTMENT OF ENERGY

FLUOR DANIEL, INC. ADVANCED TECHNOLOGY DIVISION

EIS NO PRETREATMENT SITE PLAN

ALT8A03A

26.10M:ACD2:10 C2:SS

ENGINEERING RELEASE

REFERENCE DRAWINGS

NOT USED ON

J. SMITH

1:3000

436303

2013

NONE

NOT REQD

ES-ALT8A-03

1

0

DISTRIBUTION CODE: 5-5/5-6

ACAD

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Change in Interim Storage for HLW & LAW Vault Areas for the Ex Situ/In Situ Combination alt & Phased Imp. Alt

ORIGINATOR Colin Henderson DATE 1/30/96

REVISION NO. 0

OBJECTIVE Calculate the additional area required for the Combination and Phased Imp. Alternatives based on Lower waste loading

METHODOLOGY noted

ASSUMPTIONS noted

(Continue on another sheet if necessary)

Checked by RGW 2-13-96

J C Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

The Additional Area required for Interim HLW Storage and LAW disposal vaults for the Ex Situ/In Situ Combination alternative.

Based on the Calc for the Intermediate Separations Alternative the Interim storage PAd provided would be sufficient providing the HMPC's are stored onend. Thus no Change in HLW interim storage pad.

The number of LAW disposal Vaults will go from 20 to 42 due to the revised waste loading and the 1.25 blending factor.

This would require an additional

$69160 \times 1/2 = 35000 m^2$ of Area.

(from Int Sep Calc)

Phased Imp.

The Area required for interim HLW storage for the Phased Implementation Phase I would not change from current projections.

The ~~total~~ Phased Implementation alternative would have the same Area requirements as the Intermediate Separation alternative.

Interim HLW Storage Area of 64800 m^2
Low Vault Area = 147,000 m^2

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Change in interim Storage and Disposal Vault Areas for the Intermediate Separations Alt.

ORIGINATOR Colin Henderson DATE 1/29/96

REVISION NO. 0

OBJECTIVE Calculate the additional area Required For Intermediate Separations based on lower Waste loading and smaller Canister size

METHODOLOGY noted

ASSUMPTIONS noted

(Continue on another sheet if necessary)

JColHenderson
SIGNATURE

Checked by NEW 2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

Based on the Revised Waste loading and higher Volumes of HLW AND LAW the two areas of HLW interim Storage and LAW disposal VAULT AREA WILL INCREASE.

For The INTERMEDIATE SEPARATIONS Alternative the New Volumes are:

HLW = 33386 CANISTERS / 8350 HMPC's

LAW = 83 disposal VAULTS @ 5300 m^3 each.

The additional LAW vaults require an additional 69160 m^2 of Area

INTERIM HLW STORAGE REQUIRES ~ 2.5m x 2.5m PER Shielded HMPC.

CURRENT LAYOUT HAS 64800 m^2 storage Space

REQUIRED STORAGE SPACE IS:

Space = 8350 HMPCs x 6.25 m^2 x 110%

= 57400 m^2

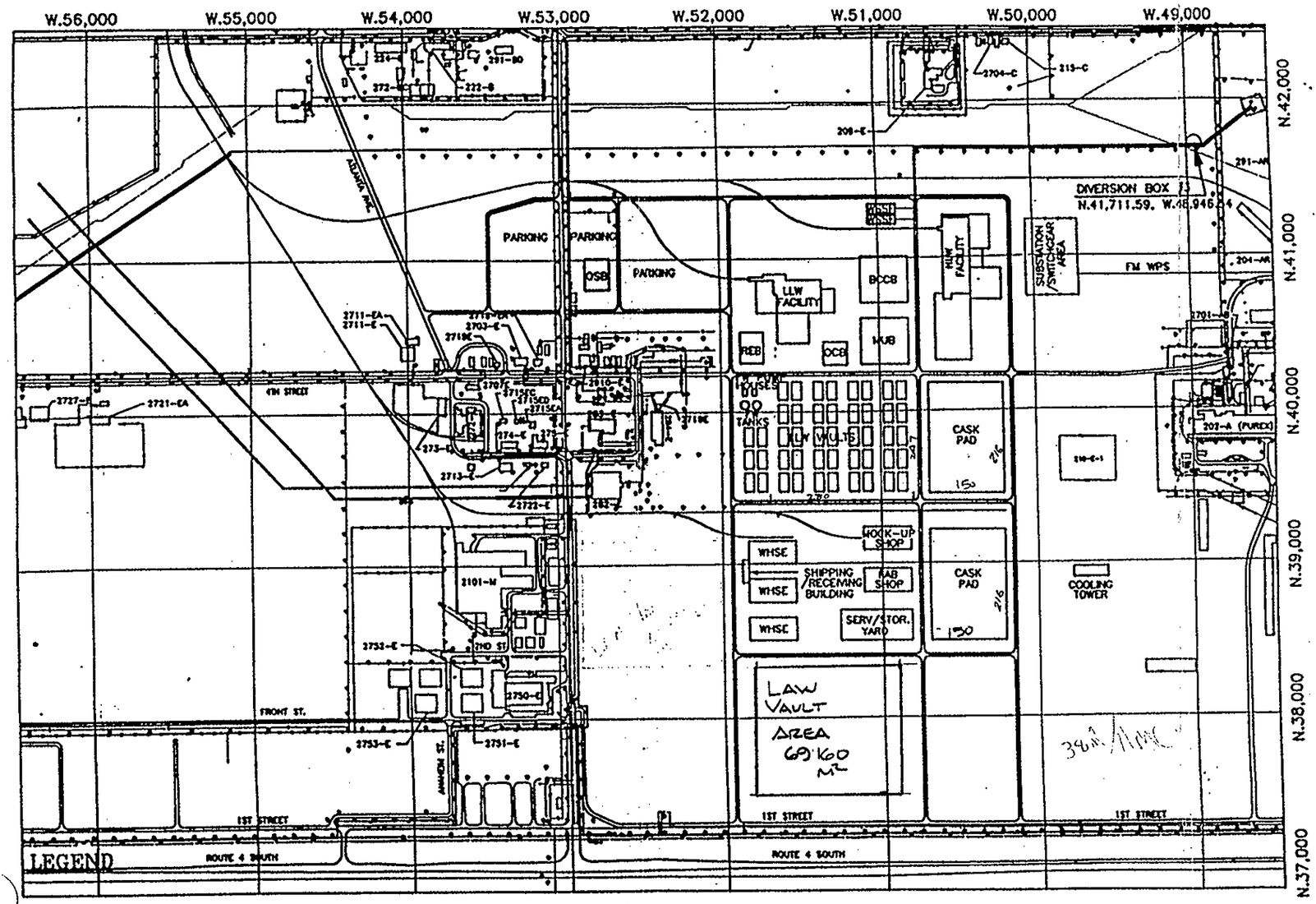
⇒ EXISTING PAD AREA IS ADEQUATE FOR INTERIM STORAGE of HLW

Note the existing (Rev 0 data pkg) Provides

64800 m^2 / 1700 HMPC ≈ 38 m^2 / HMPC

Which is sufficient to ALLOW storage of the HMPCs on their side. With the higher number of canisters the HMPC's would have to be placed on the pad with the canister in an upright orientation. (Similar to Assumption made for No SEPARATIONS)

Figure 8-1. Site Plan.



LEGEND

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

CASE 8A EIS

200 EAST AREA

247 m/in.

U.S.DEPARTMENT OF ENER

FLUOR DANIEL, INC. ADVANCED TECHNOLOGY DIVISION

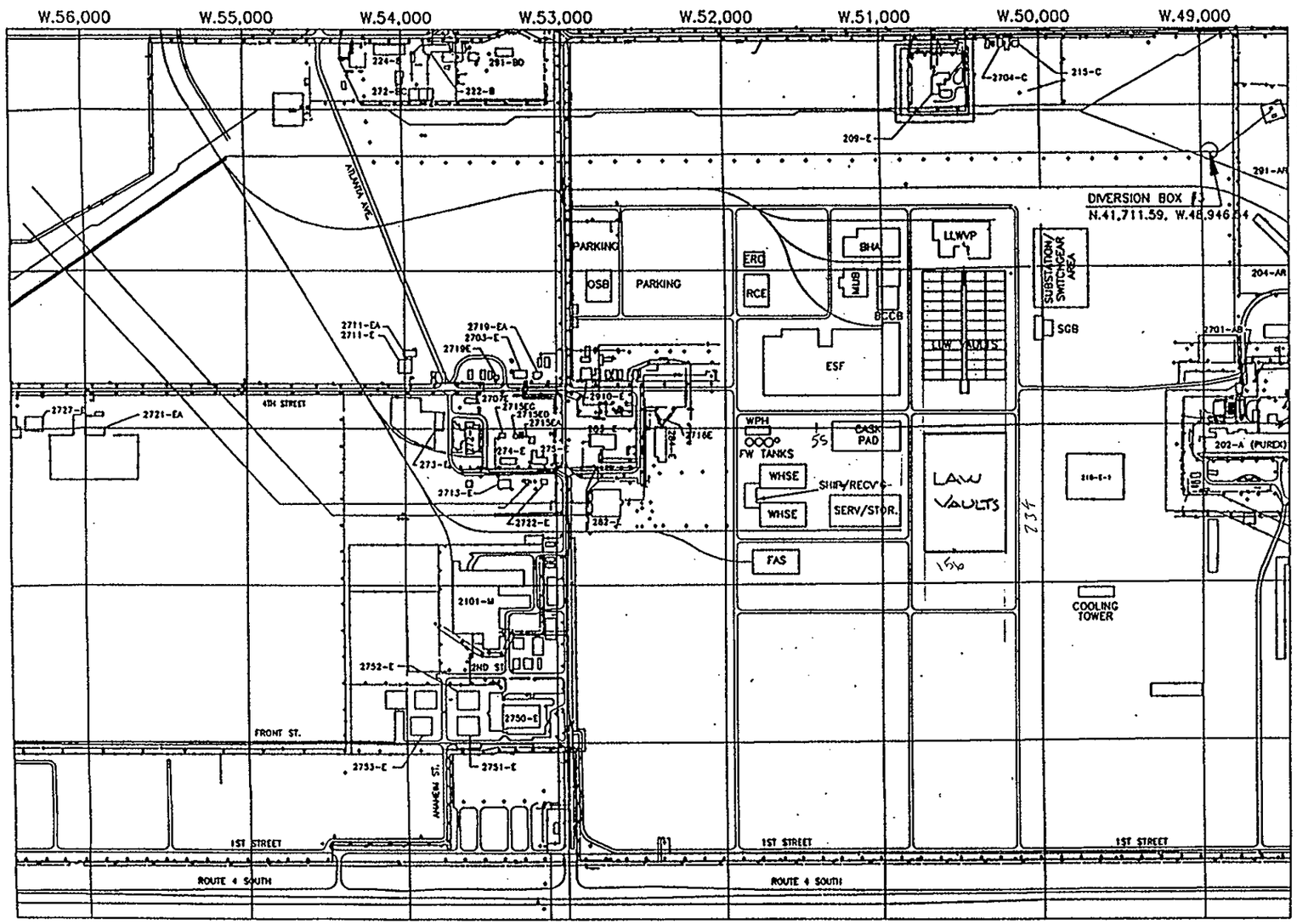
EIS
TPA PREFERRRED ALTERNA
SITE PLAN

1:3000

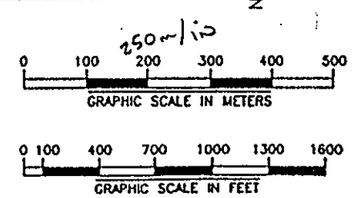
ES-ALT8A-03 2

8-3/8-4

Figure 8-1. Site Layout for Extensive Separation Alternative with Low-Level Waste Vitrification.



200 EAST AREA



LEGEND

BCCB	BULK HANDLING & COLD CHEMICAL MAKE-UP BUILDING
BHA	BULK HANDLING AREA
ERC	EMERGENCY RESPONSE CENTER
ESF	EXTENSIVE SEPARATIONS FACILITY/HLWVP
FW TANKS	FIRE WATER TANKS
	HLWVP PROCESS
	HCHA/CANISTER/CASK/HANDLING ANNEX
	HCBB/CONTACT FILTER BUILDING
	ANALYTICAL LAB
	CONDENSATE COLLECTION ANNEX
FAS	FABRICATION & ASSEMBLY SHOP
WPH	WATER PUMPHOUSE
LLWVP	LLW TREATMENT
	LOW SOURCE TERM
MUB	MECHANICAL UTILITY BUILDING
OSB	OPERATIONS SUPPORT BUILDING
RCE	REGULATED TWRS COMPLEX ENTRY
SERV/STOR	SERVICE/STORAGE
SGB	SWITCHGEAR BUILDING/ TRANSFORMER PAD
SHIP/RECV'G	SHIPPING/RECEIVING BUILDING
WHSE	WAREHOUSE

NOTE:

1. 200 ACRES DISTURBED AREA FOR SITE ARRANGEMENT.

REFERENCE DRAWINGS

NEXT USED ON

ENGINEERING RELEASE

U.S.DEPARTMENT OF ENERGY

E18 EXTENSIVE SEPARATIONS ALTERNATIVE WITH LLW GLASS SITE PLAN

TANK WASTE REMEDIATION SYSTEM

1:3000

NONE

NOT REQD

ACAD

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Change in interim Storage & LAW VAULT Areas for the Extensive Separations Case

ORIGINATOR Cain Henderson DATE 1/29/96

REVISION NO. 0

OBJECTIVE Calculate the additional Area Required for Extensive Separations based on lower waste loading

METHODOLOGY noted

ASSUMPTIONS noted

(Continue on another sheet if necessary)

JCal Henderson
SIGNATURE

Checked by RAW 2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

EXTENSIVE SEPARATIONS Change in LAW Vault AREA
AND HLW Storage Pad Required for interim Storage

HLW 1571 CANISTERS OR 393 HMPCs
LAW 83 VAULTS

Existing (RONO DATA Pkg) HLW Storage
Pad equals 6800 m^2

Required storage Space:
393 x (3x3) x 1.10 = 3890
Req for upright stacking.

⇒ Existing Pad is sufficient for
Interim Storage.

Additional LAW VAULTS = 36500 m^2

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGR/COST - TANK WASTE ALTERNATIVES - COST UNCERTAINTY

ORIGINATOR D. Stein DATE 2/8/96

REVISION NO. Ø 1 CH. 3/25/96

OBJECTIVE DETERMINE RANGE ESTIMATE FOR ALTERNATIVES

METHODOLOGY USE DECISION SCIENCE CORP (DSC) RANGE ESTIMATING PROGRAM for PERSONAL COMPUTERS (REP/PC)

ASSUMPTIONS RANGES FOR CRITICAL COST ITEMS ASSUMED, PROBABILTY OF COST EQUAL TO OR LESS ASSUMED PER ATTACHED BASES.

OUTPUT FILES INCLUDED

(Continue on another sheet if necessary)

SEE Attached Revision Description

SIGNATURE D L Stein

CHECKED: CH. 2/21/96.

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SET

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

CALCULATION: COST UNCERTAINTY

Rev 1 changes:

- Revised Cost Uncertainty to reflect the latest operations cost. (Revised due to canister/waste loading)
- Revised Ex Situ Cases to for repository fee @ $360,000/canister (1995 dollars) also included cost uncertainty calculations for ex situ alternatives
- Included additional characterization cost in the In Situ filled Cap, In Situ Vitrification, and Ex Situ/In Situ Combination alternative. (903 million in the In Situ F&Cap and ISV alt., 542 million in the Combo alt.)

RECEIVED MAR 21 1996

Stein, David

From: Stein, David
To: Henderson, Colin
Subject: Hanford TWEIS Alternatives Cost Update
Date: Wednesday, March 20, 1996 1:35PM

Following are Hanford TWEIS Alternatives cost updates with corrections for Treatment Operating Costs. These corrections were noted in the engineering calculations dated 2/20/96, but were never transferred to the final cost tables until now. The operating costs corrections are also presented here for your comparison.

TABLE 1

	PREVIOUS OPERATING COSTS (MILLIONS)	CORRECTED OPERATING COSTS(MILLIONS)
Intermediate Separations	$5,577	$5,509
No Separations(Vitrification)	$23,273	$22,742
No Separations(Calcination)	$8,182	$7,548
ExSitu/InSitu Combination	$2,672	$2,638

TABLE 2

ALTERNATIVE	TOTAL COST(WITH REPOSITORY FEE@$360,000 PER CANISTER) TARGET VALUE (MILLIONS)	95% CONFIDENCE RANGE (MILLIONS)
Intermediate Separations	$37,818	$30,399 ---- $40,552
No Separations(Vitrification)	$252,669	$69,475 ---- $252,669
No Separations(Calcination)	$85,815	$38,789 ---- $86,141
ExSitu/InSitu Combination	$25,526	$22,990 ---- $27,913

TABLE 3

ALTERNATIVE	COST EXCLUDING REPOSITORY FEE TARGET VALUE (MILLIONS)	95% CONFIDENCE RANGE (MILLIONS)
Intermediate Separations	$25,798	$23,775 ---- $29,741
No Separations(Vitrification)	$41,209	$25,560 ---- $43,559
No Separations(Calcination)	$26,015	$22,157 ---- $28,708
ExSitu/InSitu Combination	$19,516	$17,956 ---- $22,407

These changes should bring the alternatives up to date. Let me know if I can do anything else.

Stein, David

From: Stein, David
To: Henderson, Colin
Subject: TWEIS Cost Uncertainty Update
Date: Monday, March 18, 1996 10:04AM

Following are Hanford TWEIS Alternatives Cost Uncertainty updates which include an increase for tank characterization costs ($903 million for InSitu Fill & Cap and InSitu Vitrification and 60% of $903 or $542 million for InSitu/ExSitu Combo):

ALTERNATIVE	TARGET VALUE (millions)	95% CONFIDENCE RANGE (millions)
InSitu Fill & Cap	$7,884	$6,972 — $8,815
InSitu Vitrification	$16,578	$16,185 — $23,840
InSitu/ExSitu Combo with Repository Fee @ $360,000 per canister($6,010 million)	$25,560	$22,996 — $27,947
InSitu/ExSitu Combo without Repository Fee	$19,550	$17,968 — $22,441
InSitu/ExSitu Combo with Repository Fee @ $5,000 million(Feb 96)	$24,550	$22,466 — $27,151

After reviewing the cost components of the Repository Fee in the TRW Report, I can confirm that there was no double counting when compared to the Westinghouse Data Packages. The Repository Fee included a cost for an outer barrier for the HLW package in which it is placed before insertion into the vault. This outer barrier is either in addition to the MPC or replaces the MPC, I cannot determine which.

RECEIVED
MAR 19 1996

RECEIVED
MAR 14 1996

Stein, David

From: Stein, David
To: Henderson, Colin
Subject: Hanford TWEIS Alternatives Cost Uncertainty
Date: Wednesday, March 13, 1996 12:51PM

Following are Hanford TWEIS Alternatives Cost Uncertainty Tables with and without Repository Fee (fee has been calculated using $360,000 per canister per latest directive):

TABLE 1

ALTERNATIVE	TOTAL ALTERNATIVE COST(WITH REPOSITORY FEE) TARGET VALUE (millions)	95% CONFIDENCE RANGE (millions)
Intermediate Separations	$37,886	$30,465 — $40,598
No Separations (Vitrification)	$253,200	$69,971 — $253,200
No Separations (Calcination)	$86,449	$39,406 — $86,548
Extensive Separations	$28,544	$27,477 — $36,471
ExSitu/InSitu Combination	$25,018	$22,691 — $27,197
Phased Implementation	$38,728	$31,843 — $41,756
Junior Combo	$19,461	$18,512 — $22,053

Note: For most alternatives, repository fee is so high that it dominates the cost uncertainty. I would recommend that the repository fee be considered as a separate item with no range included and just a note as to how it was calculated; e.g. $360,000 charge per canister.

TABLE 2

ALTERNATIVE	ALTERNATIVE REMEDIATION COST(EXCLUDES REP FEE) TARGET VALUE (millions)	95% CONFIDENCE RANGE (million)
Intermediate Separations	$25,866	$23,818 — $29,808
No Separations (Vitrification)	$41,740	$25,628 — $44,074
No Separations (Calcination)	$26,649	$22,276 — $29,269
Extensive Separations	$27,979	$26,580 — $35,476
ExSitu/InSitu Combination	$19,008	$17,742 — $21,774
Phased Implementation	$26,708	$25,000 — $31,109
Junior Combo	$16,331	$15,089 — $18,633

I will send copies of the model output by Fed Ex this afternoon. Give me a call if you have any questions.

Henderson, Colin

From: Stein, David
To: Henderson, Colin
Subject: Hanford TWEIS Alternatives Cost Update
Date: Wednesday, March 20, 1996 1:35PM

Following are Hanford TWEIS Alternatives cost updates with corrections for Treatment Operating Costs. These corrections were noted in the engineering calculations dated 2/20/96, but were never transferred to the final cost tables until now. The operating costs corrections are also presented here for your comparison.

TABLE 1

	PREVIOUS OPERATING COSTS (MILLIONS)	CORRECTED OPERATING COSTS(MILLIONS)
Intermediate Separations	$5,577	$5,509
No Separations(Vitrification)	$23,273	$22,742
No Separations(Calcination)	$8,182	$7,548
ExSitu/InSitu Combination	$2,672	$2,638

TABLE 2

ALTERNATIVE	TOTAL COST(WITH REPOSITORY FEE@$360,000 PER CANISTER) TARGET VALUE (MILLIONS)	95% CONFIDENCE RANGE (MILLIONS)
Intermediate Separations	$37,818	$30,399 ----- $40,552
No Separations(Vitrification)	$252,669	$69,475 ----- $252,669
No Separations(Calcination)	$85,815	$38,789 ----- $86,141
ExSitu/InSitu Combination	$25,526	$22,990 ----- $27,913

TABLE 3

ALTERNATIVE	COST EXCLUDING REPOSITORY FEE TARGET VALUE (MILLIONS)	95% CONFIDENCE RANGE (MILLIONS)
Intermediate Separations	$25,798	$23,775 ----- $29,741
No Separations(Vitrification)	$41,209	$25,560 ----- $43,559
No Separations(Calcination)	$26,015	$22,157 ----- $28,708
ExSitu/InSitu Combination	$19,516	$17,956 ----- $22,407

These changes should bring the alternatives up to date. Let me know if I can do anything else.

Henderson, Colin

From: Stein, David
To: Henderson, Colin
Subject: TWEIS Cost Uncertainty Update
Date: Monday, March 18, 1996 10:04AM

Following are Hanford TWEIS Alternatives Cost Uncertainty updates which include an increase for tank characterization costs ($903 million for InSitu Fill & Cap and InSitu Vitrification and 60% of $903 or $542 million for InSitu/ExSitu Combo):

ALTERNATIVE	TARGET VALUE (millions)	95% CONFIDENCE RANGE (millions)
InSitu Fill & Cap	$7,884	$6,972 --- $8,815
InSitu Vitrification	$16,578	$16,185 --- $23,840
InSitu/ExSitu Combo with Repository Fee @ $360,000 per canister($6,010 million)	$25,560	$22,996 --- $27,947
InSitu/ExSitu Combo without Repository Fee	$19,550	$17,968 --- $22,441
InSitu/ExSitu Combo with Repository Fee @ $5,000 million(Feb 96)	$24,550	$22,466 --- $27,151

After reviewing the cost components of the Repository Fee in the TRW Report, I can confirm that there was no double counting when compared to the Westinghouse Data Packages. The Repository Fee included a cost for an outer barrier for the HLW package in which it is placed before insertion into the vault. This outer barrier is either in addition to the MPC or replaces the MPC, I cannot determine which.

Henderson, Colin

From: Stein, David
To: Henderson, Colin
Subject: Capsule Alternatives Cost Revision(Repository Fee Change)
Date: Monday, March 18, 1996 1:54PM

Incorporating the revised Repository Fee method ($360,000 per canister) results in the following for the Capsule Alternatives:

	CAPSULE ALTERNATIVES	
	OVERPACK AND SHIP (millions)	VITRIFY WITH TANK WASTE (millions)
Current Operations	$377	$315
R&D	$14	$5
Capital	$32	$36
Operating	$34	$46
M&M	-----	$1
D&D	$6	$6
Repository Fee	$144	$232
Total	$607	$641

JACOBS ENGINEERING GROUP INC.

DATE 2/8/96 SUBJECT SHEET NO. 1-2

BY D Stein CHKD. JOB NO.

Cost Uncertainty

Cost uncertainty for the various tank waste treatment alternatives has been evaluated using Decision Science Corporation (DSC) Range Estimating Program for personal computers (REP/PC). Typically, Range Estimating applies to one time decisions such as capital investments, engineering cost estimates, and competitive bids. The Range Estimating Program has enjoyed a long and successful record of use since its introduction by DSC in the early 1970s. It has been applied to thousands of diverse problems

by thousands of users. A small sampling of industries using REP/PC includes government, defense, engineering construction, and research.

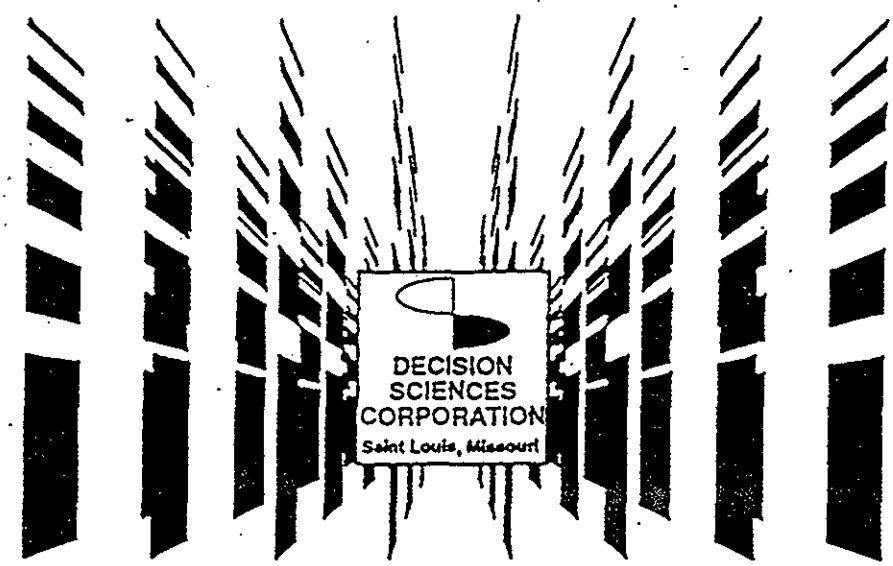
Range Estimating is user friendly and its input heuristics allow the user to specify a simple range rather than require selection of a probability density function. Range Estimating's output heuristics clearly identify, quantify, and rank the risks and opportunities in the decision making problem.

REP/PC™

Range Estimating Program for personal computers

User's Guide

Version 4.0
(July 1993)



Providing crystal-clear perspectives
for sound management decisions

Technical Support

Telephone: 314/739-2662 Facsimile: 314/536-1001

First Edition
July 1993

Copyright
© Decision Sciences Corporation, 1993. All rights reserved. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language in any form by any means without the written permission of Decision Sciences Corporation.

Software License Notice

The REP/PC License, signed by a representative of your organization, specifies the permitted and prohibited uses of this software, its trade secret heuristics, and this guide. Any unauthorized duplication or use of any of these materials, in whole or in part, in print or in any other storage and retrieval systems, is forbidden. *Use of REP/PC outside of the country identified in your REP/PC License is strictly prohibited.*

Trademarks

REP and REP/PC are trademarks of Decision Sciences Corporation. MS-DOS is a registered trademark of Microsoft Corporation. Windows is a trademark of Microsoft Corporation. IBM is a registered trademark of International Business Machines Corporation.

JACOBS ENGINEERING GROUP INC.

DATE 2/5/96 SUBJECT HANFORD TWRS PROPOSED DEIS SHEET NO. 1-4

BY D Stein CHKD. JOB NO.

BASIS FOR PROB/RANGE ELEMENTS

NUM	ELEMENT
1	CURRENT OPERATIONS (ALL ALTERNATIVES)
	PROB 50%
	RANGE −20%, +20%
COMMENT:	CONTINUATION OF CURRENT OPERATIONS BASED ON HISTORICAL COSTS. BASIC AMBIVALENCE SHOWN IN PROBABILITY AND RANGE.
2	R+D (WASTE RET. + TRANSFER)
3	R+D (TREATMENT)
6	CAPITAL (CLOSURE)
9	M+M
COMMENT:	NON-CRITICAL FOR ALL ALTERNATIVES

NOTE: THE BASES ESTIMATED HEREIN WERE DISCUSSED AND AGREED UPON IN 2/4/96 MEETING OF → Stein, C Henderson, D Murray (all from JEG). Reviewed and confirmed by L. Selby (JEG cost engr/estimator) on 2/8/96

JACOBS ENGINEERING GROUP INC.

DATE 2/5/94 SUBJECT SHEET NO. 2-4

BY D. Chen CHKD. JOB NO.

NUM	ELEMENT
4	CAPITAL (WASTE RET. + TRANSFER) (ALL ALTERNATIVES)
	PROB 50%
	RANGE −20%, +70%
7	OPERATING (WASTE RET. + TRANSFER) (ALL ALTERNATIVES)
	PROB 50%
	RANGE −20%, +70%

COMMENT: BASIC AMBIVALENCE RE PROBABILITIES. PESSIMISTIC VIEW OF HIGH RANGE DUE TO DIFFICULTY WITH METHODS TO RETRIEVE AND TRANSFER FOR CERTAIN TANKS AND HIGHER CAPITAL REQUIREMENTS AND LONGER OPERATIONAL PERIOD.

SHEET NO. 3-4

JOB NO.

SUBJECT

DATE 2/5/96

BY DSteinCHKD.

JACOBS ENGINEERING GROUP INC.

Num	ELEMENT	ALTERNATIVE: LONG TERM MANAGE	NO SEP VITR.	NO SEP CALC.	INTER SEP + IN SITU / EXSITU COMBO	PHASED IMPL.	EXT. SEP.	In Situ VITR.
5	CAPITAL (TREATMENT)							
	PROB	50%	50%	50%	40%	40%	30%	15%
	RANGE	-20%, +20%	-20%, +50%	-20%, +50%	-20%, +100%	-20%, +100%	-20%, +150%	-10%, +300%

Comments: STARTING WITH AMBIVALENCE, PROB. DECREASES WITH COMPLEXITY OF PROCESSES + UNKNOWNS. RANGE ON LOW SIDE STANDARD AT 20% DUE TO 40% CONTINGENCY ALREADY INCLUDED IN CAPITAL. ONLY -10% FOR IN SITU VITR. DUE TO PESSIMISM ON PROCESS. RANGE ON HIGH SIDE INCREASES DUE TO COMPLEXITY OF PROCESSES AND UNKNOWNS.

8	OPERATING (TREATMENT)							
	PROB	NON-CRITICAL	75%	75%	65%	65%	55%	15%
	RANGE		-80%, +0%	-60%, +0%	-25%, +0%	-25%, +0%	-15%, +0%	-10%, +200%

Comments: PROB. DECREASES WITH LOWER QUANTITIES OF HLW GLASS GENERATED BY ALTERNATIVE DUE TO LARGE COST EFFECT OF # OF CANISTERS WHICH IS NEAR MAXIMUM FOR BASIS USED HEREIN. IN SITU COSTS VIEWED PESSIMISTICALLY. UPPER RANGE OF +0% DUE TO HIGHEST COSTS USED IN BASIS HEREIN (LOWEST WASTE OXIDE LOADING, SMALLEST CANISTER, HIGH STAFFING). LOWER RANGE BASED ON OP. COSTS FOR NOV 1995 SCENARIO (MORE LIKELY). IN SITU VITR. VIEWED PESSIMISTICALLY DUE TO LONGER OPERATION AND ADDITIONAL GLASS RAW MATERIALS.

JACOBS ENGINEERING GROUP INC.

DATE 2/5/96 SUBJECT

BY [illegible] CHKD.

SHEET NO. 4-4

JOB NO.

NUM	ELEMENT	ALTERNATIVE					
		NO. SEP VITR	NO. SEP CALC.	INTER. SEP.	IN SITU/ EX SITU	PHASED IMPL.	EXT. SEP.
10	REPOSITORY FEE						
	PROB.	100%	100%	100%	100%	100%	0%
	RANGE	-80%, +0%	-60%, +0%	-40%, +0%	-38%, +0%	-40%, +0%	-0%, +0%

Comments: WITH THE LOW WASTE OXIDE LOADING USED AS A BASIS HERE, AND THE SMALLEST CANISTER SIZE USED AS A BASIS HERE, IT IS BELIEVED THAT THE REPOSITORY FEES ARE AT THE MAXIMUM PROBABLE. THE EXCEPTION IS EXT. SEP. WHERE REPOSITORY COSTS ARE ESSENTIALLY CONSTANT DUE TO SMALL VOLUME OF HLW WASTE FOR ANY SCENARIO. THE LOW RANGE HAS BEEN SET AT REPOSITORY FEE FOR NON 1995 REPORT USING LARGER CANISTERS AND HIGHER WASTE OXIDE LOADING.

EXPENSE ELEMENTS		
Pessimism	Absolute	0%
	Extreme	5%, 10%, 15%
	Moderate	20%, 25%, 30%
	Slight	35%, 40%, 45%
Ambivalence		50%
Optimism	Slight	55%, 60%, 65%
	Moderate	70%, 75%, 80%
	Extreme	85%, 90%, 95%
	Absolute	100%

PROFIT ELEMENTS		
Pessimism	Absolute	100%
	Extreme	85%, 90%, 95%
	Moderate	70%, 75%, 80%
	Slight	55%, 60%, 65%
Ambivalence		50%
Optimism	Slight	35%, 40%, 45%
	Moderate	20%, 25%, 30%
	Extreme	5%, 10%, 15%
	Absolute	0%

The Range

A range of possible values is specified for each critical element in the plan. The range is determined by specifying the lowest and highest values the critical element can assume. These lowest and highest values are set so far apart that there is greater than a 98% probability that the actual value of the critical element will materialize within the resulting range. Specifically, the "lowest" value is set so low that there is less than 1 chance in 100 that the actual value will be any lower; similarly, the "highest" value is set so high that there is less than a 1% probability that the actual value will be any higher. Thinking of it another way, the odds are about 99 to 1 against the actual value being lower than the lowest value. Also, the odds are about 99 to 1 against the actual value being higher than the highest value. Qualitatively speaking, the lowest and highest values are set far enough out such that they capture the "rather improbable" but not the "slightly absurd." Quite obviously, if there is substan-

tial uncertainty about the actual value of the critical element, its range will be quite broad. Conversely, a lesser degree of uncertainty will be reflected as a narrower range for the critical element.

NOTE: The lowest and highest values are completely independent of the probability factor. It is quite possible that a given critical element could have a fairly small difference between its target and lowest value and yet have a high probability of its actual value materializing in that narrow part of the range. Examples of this often occur in expense elements where it is not unusual to have a very small chance of the actual exceeding the target but, if it does, the amount by which it can exceed it is very large. Such a range is said to be "highly skewed."

Some people have difficulty with the idea of supplying a range; some even claim that the range is nothing more than a lot of guesswork. But that's precisely why the range is valuable in decision-making; it involves a lot of educated guessing by qualified people. On the other hand, the single-point value involves only a little guessing -- so little, in fact, that it can lead to serious errors in decision-making. There is nothing wrong with guessing. Nobel prizes have been awarded for shrewd guessing! Put another way: with the range, the decision-maker will be approximately correct; with the traditional single-point value, exactly wrong!

February 8, 1996

To: Mark Nelson/David Stein

From: Larry Selby

Subject: Review of REP-PC Risk Analyses

I have reviewed the input of the ten remediation scenarios and generally find them within reasonable ranges. I changed the input of one of the more complicated senarios, generally widening the spread between low and high, (usually by increasing the high end). The results were reasonably close (within about 5 %) which pretty much verifies the suitability of the variables as entered in the program. Certainly the target estimate numbers are not within an accuracy of 5% of total cost at the Order of Magnitude level of the estimates. At this point, very little is to be gained by changing the model and re-running the program.

I would recommend that at some appropriate future time a group of 4 to 6 individuals, most familiar with each of the processes meet, and re-evaluate the entries used in developing the model and then re-run the program. One of these individuals should be one of the estimating team who is familiar the the details of how the estimate (target amount) was developed. Additionally, the smaller items should be dropped, as they tend to distort the results, although they would not affect the actual total cost. I would also warn to resist the temptation to group the small items and treat them as a single item to make the arithmetic appear correct. This also distorts the results. Having used this program a number of times over the past few years I have found that we are frequently too optimistic in entering the highest cost. This number should be the cost that the group is 99% certain cannot or will not be exceeded by even the worst of circumstances. I would also recommend that at the Order of Magnitude estimate level, the contingency applied by the estimator should be considered as a real cost and not considered in arriving at the highest possible cost. More often than not that contingency is required in progressing to estimates prepared from detailed design documents.

REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 02-06-96

DATA : ~~ExSitu Exten.~~ No Action Case 01
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		14300	50	11440	17160
2	R&D Waste Ret. & Transfer		0		0	0
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		0		0	0
5	Capital Treament		0		0	0
6	Capital Closure		0		0	0
7	Operations Waste Ret. & Transfer		0		0	0
8	Operations Treatment		0		0	0
9	M & M		0		0	0
10	Repository Fee		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		14300		11440 (THEORETICALS)	17160

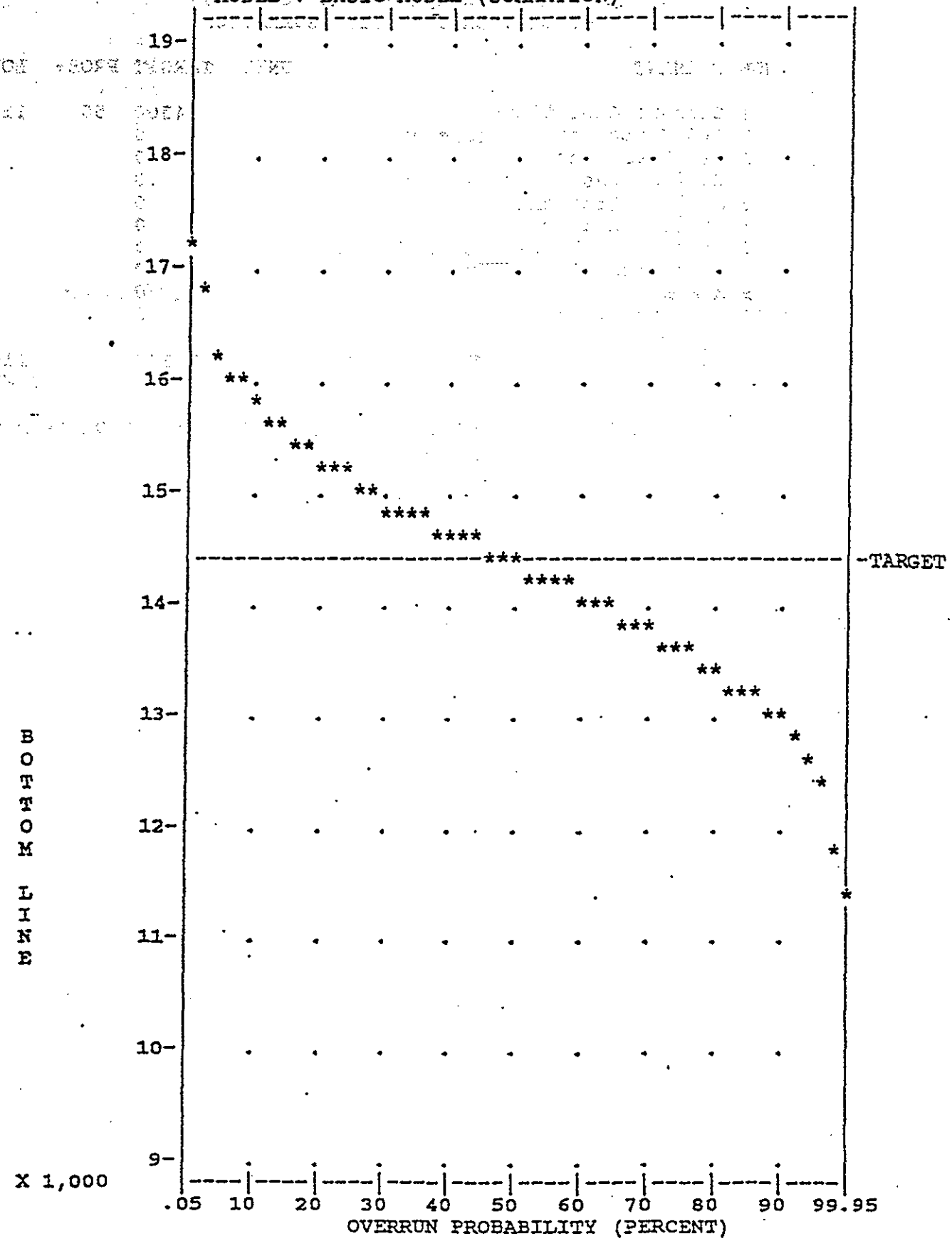
+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

Output file for Range Estimate Tank Waste Alternatives

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 02-06-96

DATA : ExSitu Exten. Case 01

MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver-4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 02-06-96

DATA : ExSitu Exten. Case 01
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
14300	51 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
1	Current Operations NET EFFECT OF FROZEN ELEMENTS		----------|	++++++++++++

REP/PC (Ver-4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 02-06-96

DATA : ExSitu Exten. Case 01
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE
100	PCT	2860	20.0 PCT
99.95	"	2849	19.9 "
95	"	1783	12.5 "
90	"	1430	10.0 "
85	"	1176	8.2 "
80	"	954	6.7 "
75	"	797	5.6 "
70	"	578	4.0 "
65	"	450	3.2 "
60	"	311	2.2 "
55	"	177	1.2 "
50	"	15	.1 "
45	"	-123	-.9 "
40	"	-263	-1.8 "
35	"	-382	-2.7 "
30	"	-576	-4.0 "
25	"	-716	-5.0 "
20	"	-896	-6.3 "
15	"	-1167	-8.2 "
10	"	-1377	-9.6 "
5	"	-1745	-12.2 "
0.05	"	-2839	-19.8 "
0	"	-2860	-20.0 "

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 02-06-96

Long-Term Mgmt.

DATA : ExSitu Exten. Case 02

MODEL : BASIC MODEL (SUMMATION)

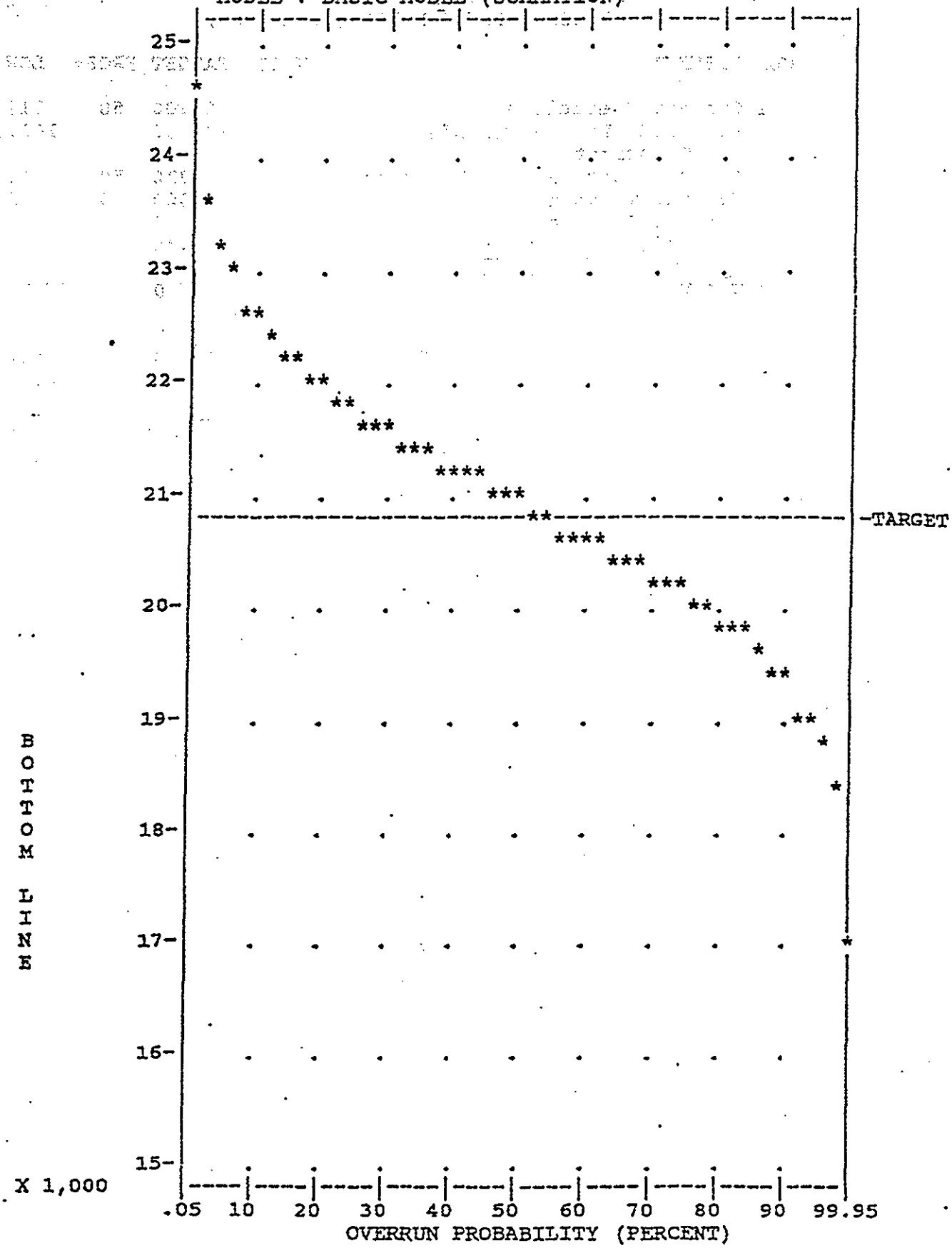
NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		14300	50	11440	17160
2	R&D Waste Ret. & Transfer		100.00		100.00	100.00
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		1930	50	1544	3281
5	Capital Treament		4000	50	3200	4800
6	Capital Closure		0		0	0
7	Operations Waste Ret. & Transfer		440		440	440
8	Operations Treatment		0		0	0
9	M & M		0		0	0
10	Repository Fee		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		20770		16724 (THEORETICALS)	25781

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 02-06-96

DATA : ExSitu Exten. Case 02

MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 02-06-96

DATA : ExSitu Exten. Case 02
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
20770	54 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
1	Current Operations		----------	++++++++++++
4	Capital Waste Ret. & Transfer		-------	++
5	Capital Treament		----	++++
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 02-06-96

DATA : ExSitu Exten. Case 02
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	5011	24.1	PCT
99.95	"	3750	18.1	"
95	"	2327	11.2	"
90	"	1771	8.5	"
85	"	1413	6.8	"
80	"	1159	5.6	"
75	"	958	4.6	"
70	"	741	3.6	"
65	"	597	2.9	"
60	"	442	2.1	"
55	"	301	1.5	"
50	"	141	.7	"
45	"	-30	-.1	"
40	"	-201	-1.0	"
35	"	-360	-1.7	"
30	"	-512	-2.5	"
25	"	-697	-3.4	"
20	"	-886	-4.3	"
15	"	-1109	-5.3	"
10	"	-1464	-7.0	"
5	"	-1894	-9.1	"
0.05	"	-3857	-18.6	"
0	"	-4046	-19.5	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

FILENAME=C:\CASE03.OUT 03/18/9

08:37:4

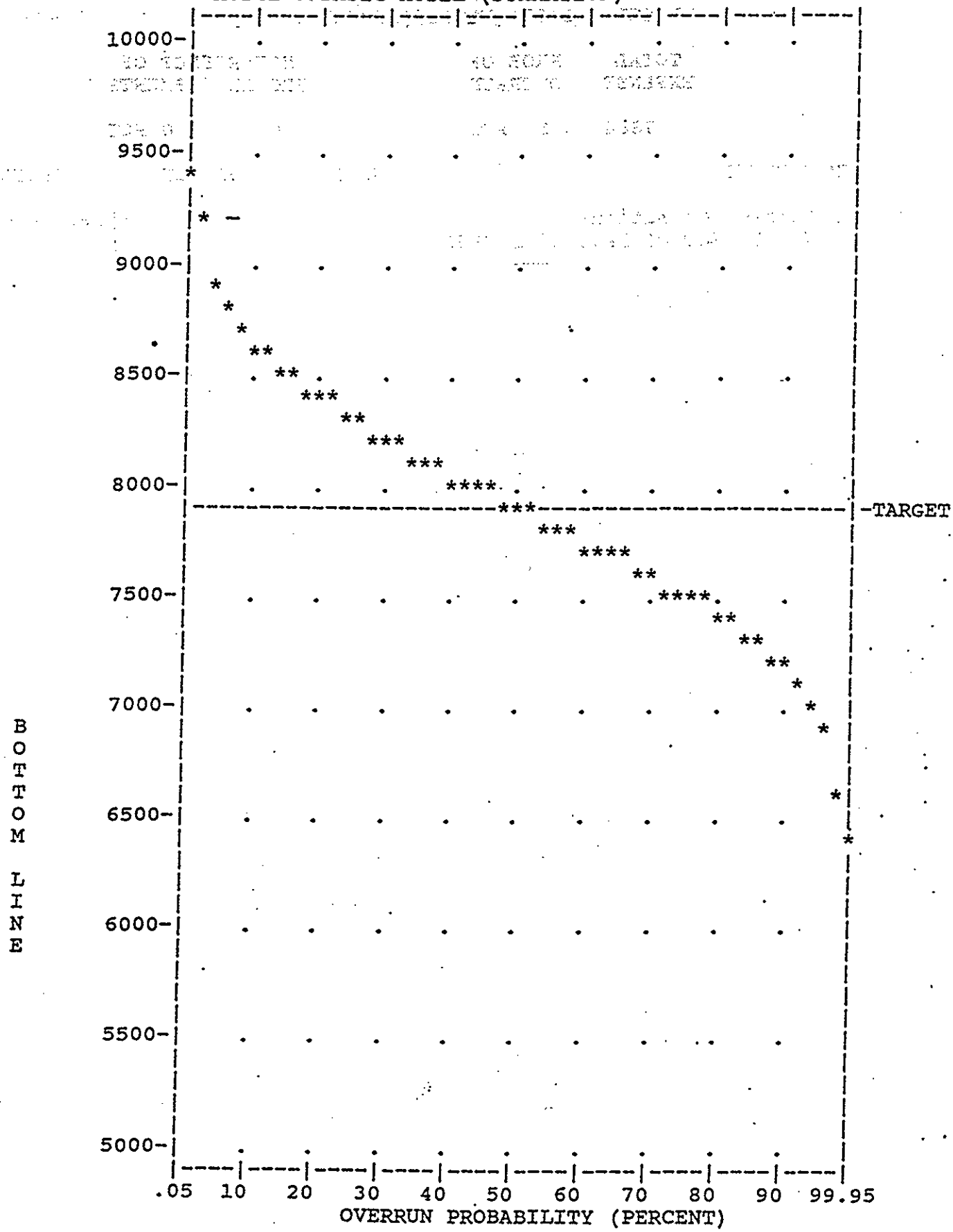
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-18-96

DATA : InSitu Fill & Cap Case 03
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		7469	50	5975	8963
2	R&D Waste Ret. & Transfer		0		0	0
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		0		0	0
5	Capital Treament		25.00		25.00	25.00
6	Capital Closure		116.00		116.00	116.00
7	Operations Waste Ret. & Transfer		0		0	0
8	Operations Treatment		274		274	274
9	M & M		0		0	0
10	Repository Fee		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		7884		6390 (THEORETICALS)	9378

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 - GRAPHICAL OVERRUN PROFILE : 03-18-96
DATA : InSitu Fill & Cap Case 03
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-18-96

DATA : InSitu Fill & Cap Case 03
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
7884	51 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
1	Current Operations NET EFFECT OF FROZEN ELEMENTS		----------|	|++++++++++++

DATA : InSitu Fill & Cap Case 03
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	1494	19.0	PCT
99.95	"	1488	18.9	"
95	"	931	11.8	"
90	"	747	9.5	"
85	"	614	7.8	"
80	"	498	6.3	"
75	"	416	5.3	"
70	"	302	3.8	"
65	"	235	3.0	"
60	"	163	2.1	"
55	"	92	1.2	"
50	"	8	.1	"
45	"	-64	-.8	"
40	"	-138	-1.7	"
35	"	-200	-2.5	"
30	"	-301	-3.8	"
25	"	-374	-4.7	"
20	"	-468	-5.9	"
15	"	-610	-7.7	"
10	"	-719	-9.1	"
5	"	-912	-11.6	"
0.05	"	-1483	-18.8	"
0	"	-1494	-18.9	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

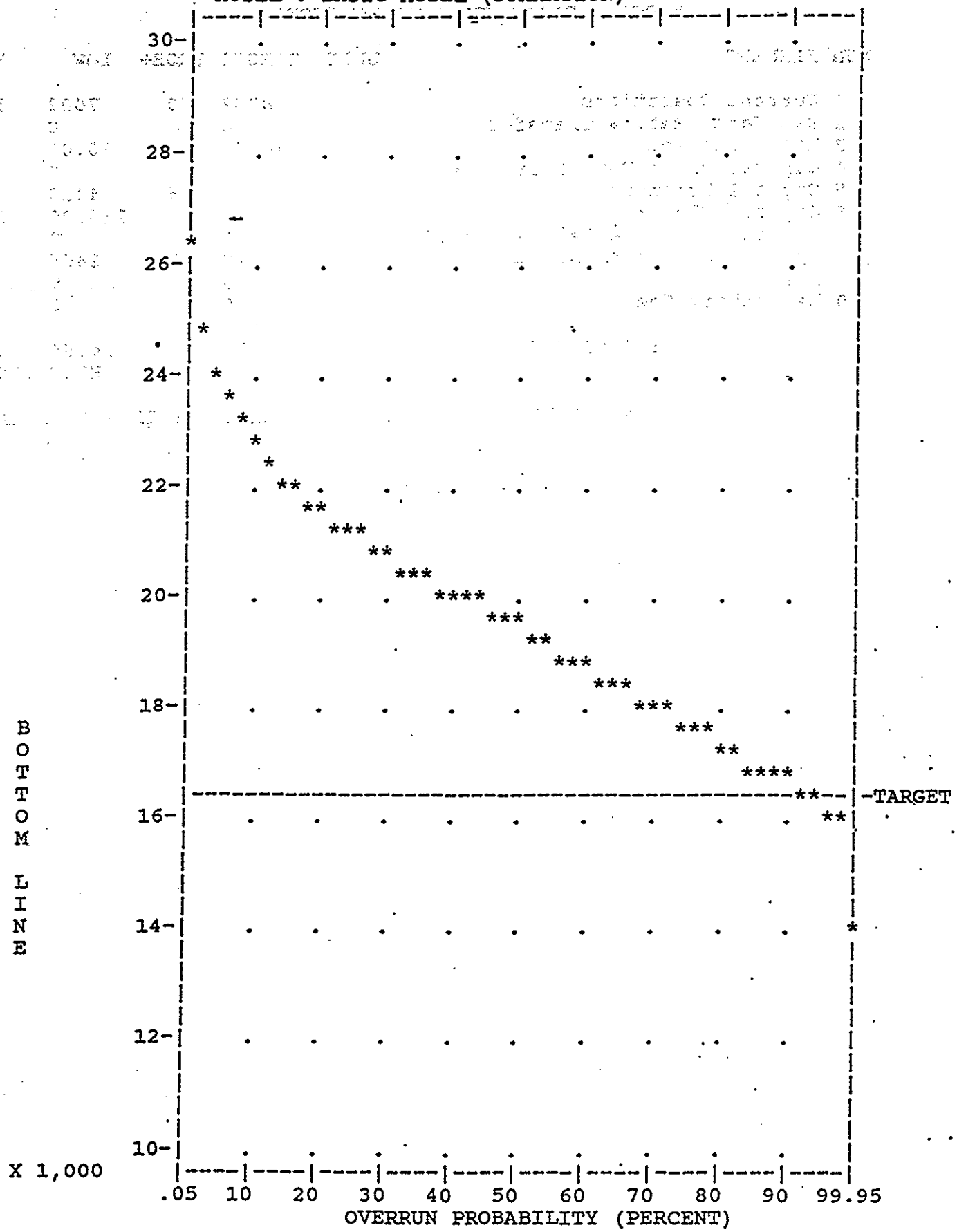
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-18-96

DATA : InSitu Vitrification Case 04
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8752	50	7002	10502
2	R&D Waste Ret. & Transfer		0		0	0
3	R&D Treatment		70.00		70.00	70.00
4	Capital Waste Ret. & Transfer		0		0	0
5	Capital Treament		4900	15	4410	9600
6	Capital Closure		116.00		116.00	116.00
7	Operations Waste Ret. & Transfer		0		0	0
8	Operations Treatment		2740	15	2466	8220
9	M & M		0		0	0
10	Repository Fee		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		16578		14064 (THEORETICALS)	28508

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-18-96
DATA : InSitu Vitrification Case 04
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-18-96

DATA : InSitu Vitrification Case 04
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
16578	90 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT   CORRECT        PROTECT

  8 Operations Treatment                          --------------|
  5 Capital Treament                               -----------|
  1 Current Operations                                      --|++
    NET EFFECT OF FROZEN ELEMENTS                             |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-18-96

DATA : InSitu Vitrification Case 04
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	11930	72.0	PCT
99.95	"	9748	58.8	"
95	"	7262	43.8	"
90	"	6052	36.5	"
85	"	5434	32.8	"
80	"	4922	29.7	"
75	"	4538	27.4	"
70	"	4138	25.0	"
65	"	3768	22.7	"
60	"	3494	21.1	"
55	"	3220	19.4	"
50	"	2848	17.2	"
45	"	2500	15.1	"
40	"	2153	13.0	"
35	"	1766	10.7	"
30	"	1359	8.2	"
25	"	1104	6.7	"
20	"	718	4.3	"
15	"	321	1.9	"
10	"	29	.2	"
5	"	-393	-2.4	"
0.05	"	-2400	-14.5	"
0	"	-2514	-15.2	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

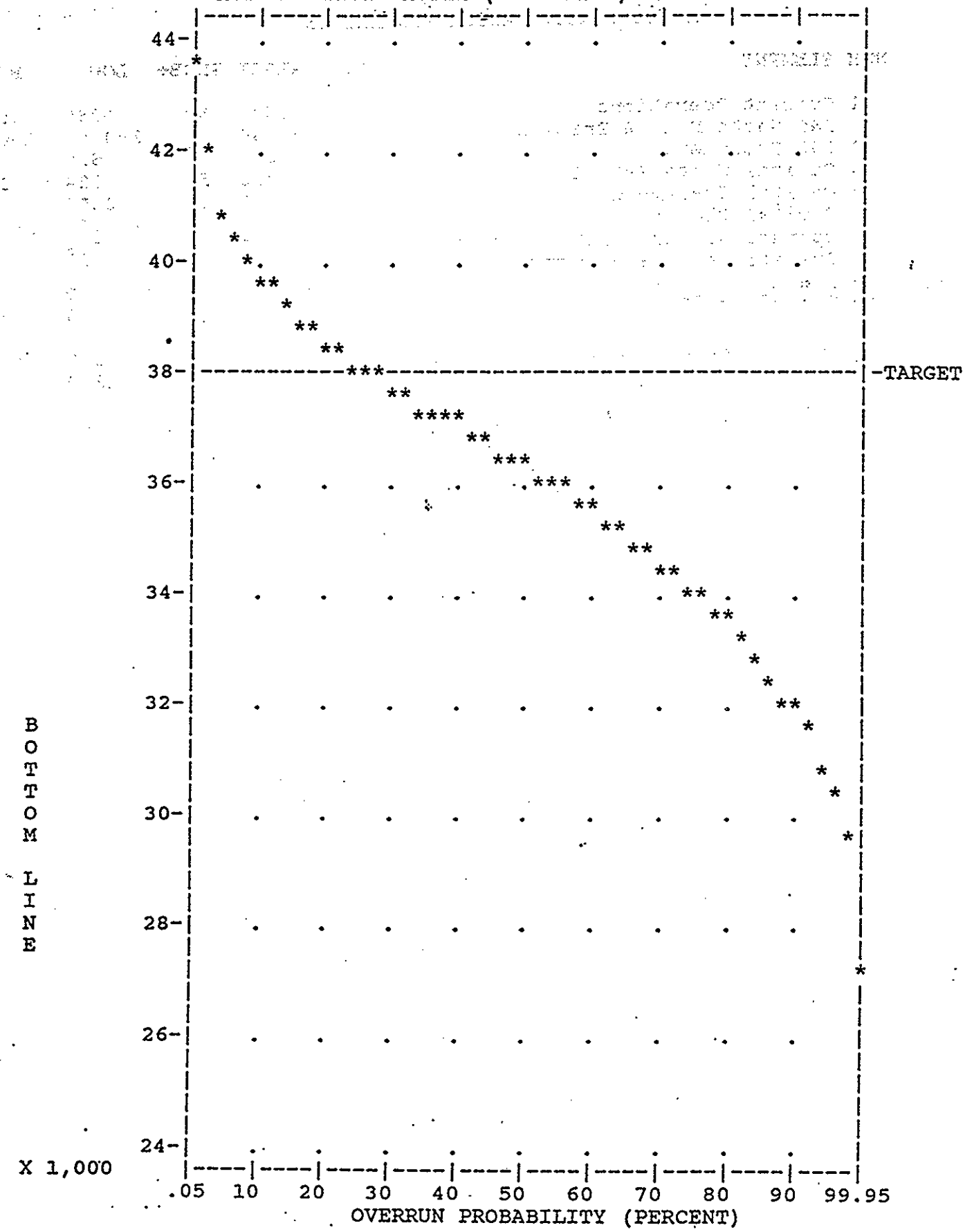
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : Inter Sep Case 05
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		630		630	630
4	Capital Waste Ret. & Transfer		2280	50	824	3876
5	Capital Treatment		3600	40	2880	7200
6	Capital Closure		169.00		169.00	169.00
7	Operations Waste Ret. & Transfer		4820	50	3856	8194
8	Operations Treatment		5509	65	4183	5510
9	M & M		0		0	0
10	Repository Fee		12020	95	3900	12030
	TOTAL EXPENSE (INPUT TO REP/PC)		37818		23512 (THEORETICALS)	48119

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : Inter Sep Case 05
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : Inter Sep Case 05
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
37818	29 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
10	Repository Fee			++++++++++++
5	Capital Treatment		----	+
7	Operations Waste Ret. & Transfer		---	+
4	Capital Waste Ret. & Transfer		-	+
1	Current Operations		-	+
8	Operations Treatment			+
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : Inter Sep Case 05
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	10301	27.2	PCT
99.95	"	5713	15.1	"
95	"	2734	7.2	"
90	"	1887	5.0	"
85	"	1256	3.3	"
80	"	678	1.8	"
75	"	191	.5	"
70	"	-125	-.3	"
65	"	-490	-1.3	"
60	"	-804	-2.1	"
55	"	-1135	-3.0	"
50	"	-1576	-4.2	"
45	"	-1889	-5.0	"
40	"	-2362	-6.2	"
35	"	-2778	-7.3	"
30	"	-3219	-8.5	"
25	"	-3857	-10.2	"
20	"	-4403	-11.6	"
15	"	-5223	-13.8	"
10	"	-6014	-15.9	"
5	"	-7419	-19.6	"
0.05	"	-10733	-28.4	"
0	"	-14306	-37.8	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

FILENAME=C:\CASE05NF.OUT 03/20/96

10:35:58

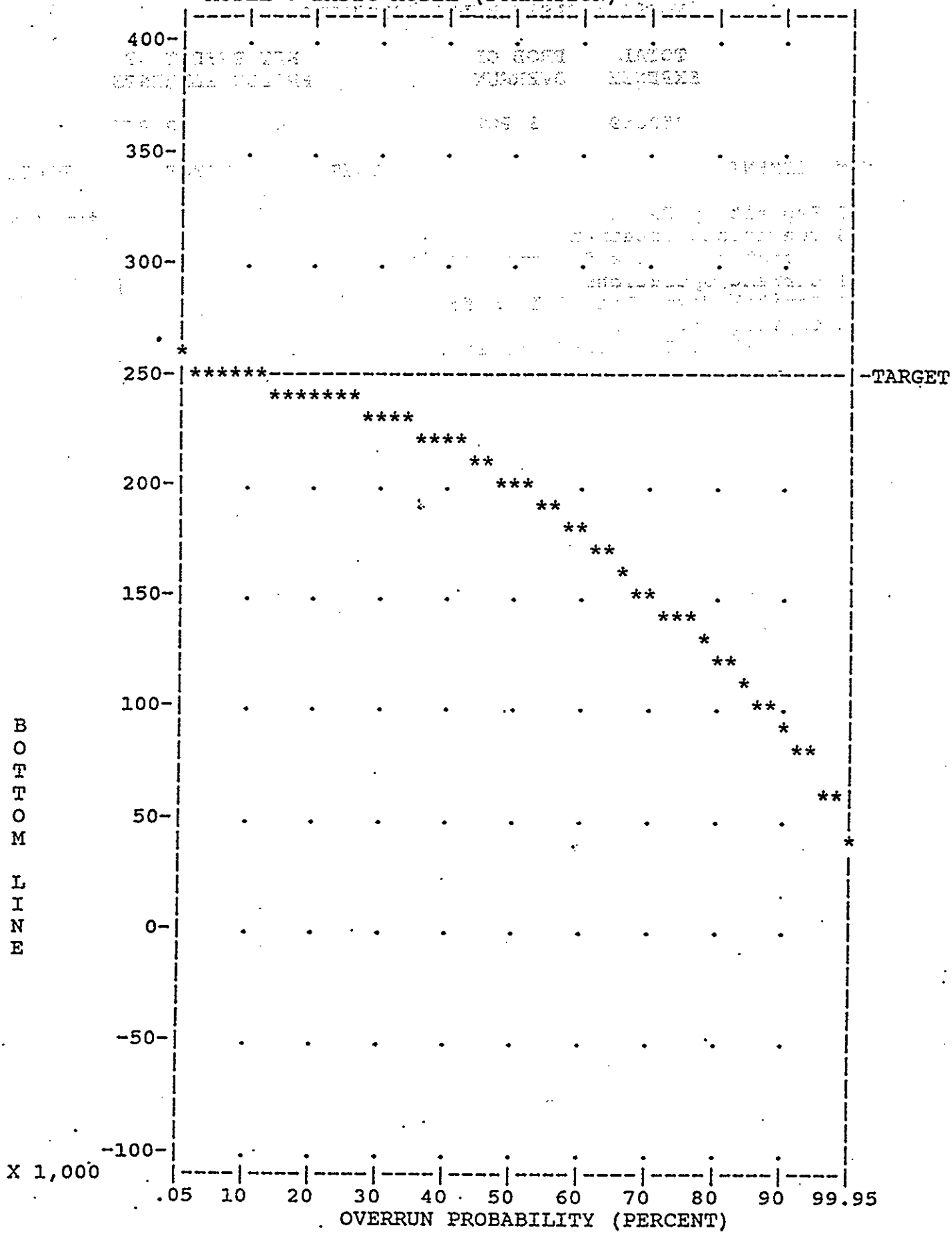
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : No Sep Vitr Case 06
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8325	50	6660	9990
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		280		280	280
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		2610	50	2088	3915
6	Capital Closure		152.00		152.00	152.00
7	Operations Waste Ret. & Transfer		4630	50	3704	7871
8	Operations Treatment		22742	75	4654	22743
9	M & M		0		0	0
10	Repository Fee		211460	95	12900	211461
	PREVIOUS ELEMENT HAS UNUSUAL DATA HOWEVER REP/PC USED THOSE VALUES					
	TOTAL EXPENSE (INPUT TO REP/PC)		252669		32452 (THEORETICALS)	260478

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : No Sep Vitr Case 06
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : No Sep Vitr Case 06
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
252669	3 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
10	Repository Fee			++++++++++++
8	Operations Treatment			+
7	Operations Waste Ret. & Transfer			
1	Current Operations			
4	Capital Waste Ret. & Transfer			
5	Capital Treatment			
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : No Sep Vitr Case 06
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7809	3.1	PCT
99.95	"	3990	1.6	"
95	"	-1501	-.6	"
90	"	-4789	-1.9	"
85	"	-8473	-3.3	"
80	"	-12164	-4.8	"
75	"	-16547	-6.5	"
70	"	-21637	-8.6	"
65	"	-28309	-11.2	"
60	"	-33361	-13.2	"
55	"	-42447	-16.8	"
50	"	-52209	-20.7	"
45	"	-63127	-25.0	"
40	"	-74327	-29.4	"
35	"	-88544	-35.0	"
30	"	-102986	-40.8	"
25	"	-114820	-45.4	"
20	"	-129425	-51.2	"
15	"	-149380	-59.1	"
10	"	-163222	-64.6	"
5	"	-183194	-72.5	"
0.05	"	-212325	-84.0	"
0	"	-220217	-87.2	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

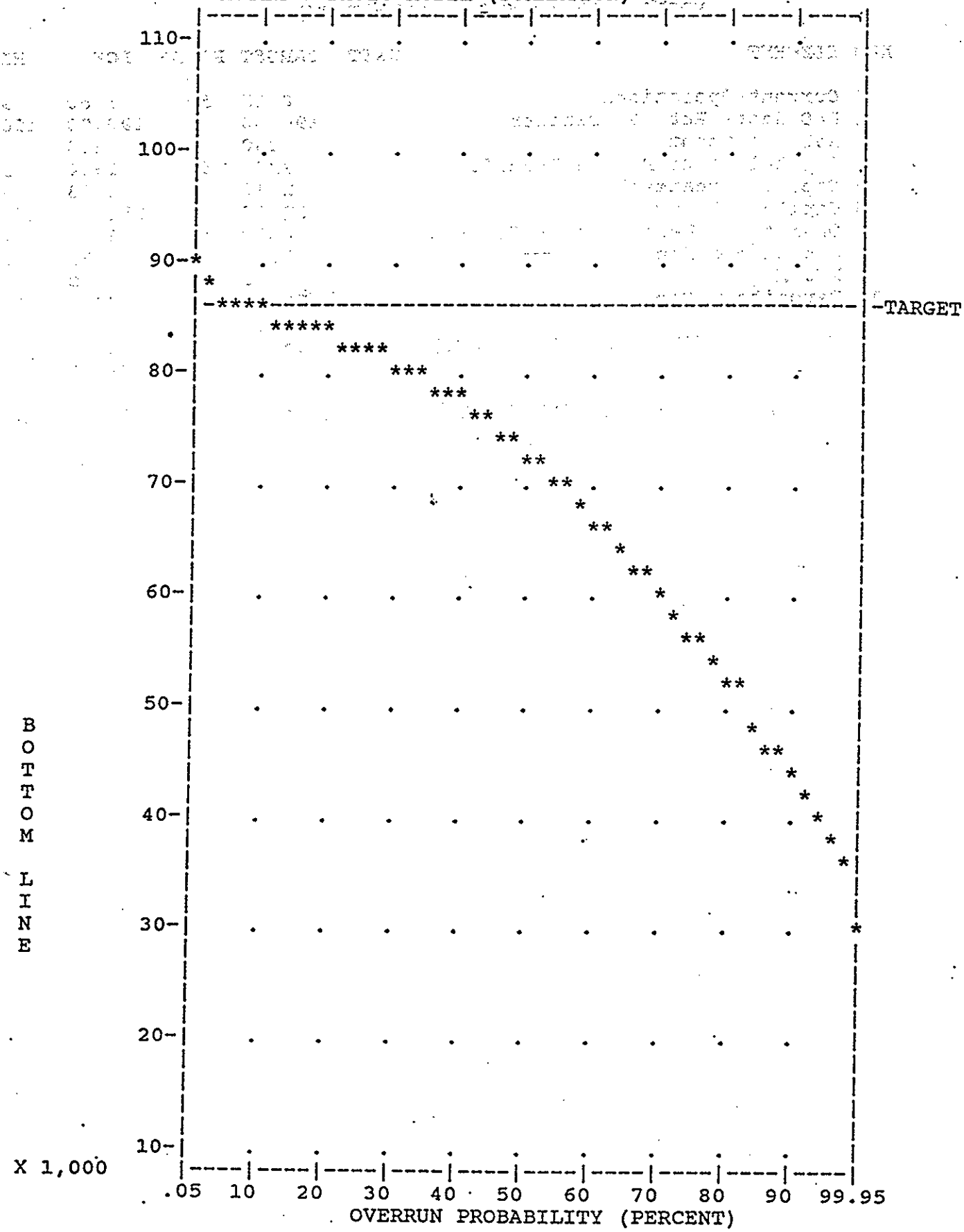
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : No Sep Calc Case 07
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8325	50	6660	9990
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		280		280	280
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		2610	50	2088	3915
6	Capital Closure		152.00		152.00	152.00
7	Operations Waste Ret. & Transfer		4630	50	3704	7871
8	Operations Treatment		7548	75	3273	7549
9	M & M		0		0	0
10	Repository Fee		59800	95	7800	59801
	TOTAL EXPENSE (INPUT TO REP/PC)		85815		25971 (THEORETICALS)	93624

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : No Sep Calc Case 07
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : No Sep Calc Case 07
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
85815	6 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
10	Repository Fee			++++++++++++
8	Operations Treatment			+
7	Operations Waste Ret. & Transfer			
1	Current Operations			
4	Capital Waste Ret. & Transfer			
5	Capital Treatment			
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : No Sep Calc Case 07
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7809	9.1	PCT
99.95	"	4249	5.0	"
95	"	326	.4	"
90	"	-756	-.9	"
85	"	-1644	-1.9	"
80	"	-2508	-2.9	"
75	"	-3447	-4.0	"
70	"	-5048	-5.9	"
65	"	-6593	-7.7	"
60	"	-8327	-9.7	"
55	"	-10467	-12.2	"
50	"	-13198	-15.4	"
45	"	-16026	-18.7	"
40	"	-18841	-22.0	"
35	"	-22543	-26.3	"
30	"	-26095	-30.4	"
25	"	-29353	-34.2	"
20	"	-33295	-38.8	"
15	"	-38344	-44.7	"
10	"	-42251	-49.2	"
5	"	-47026	-54.8	"
0.05	"	-55313	-64.5	"
0	"	-59844	-69.7	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

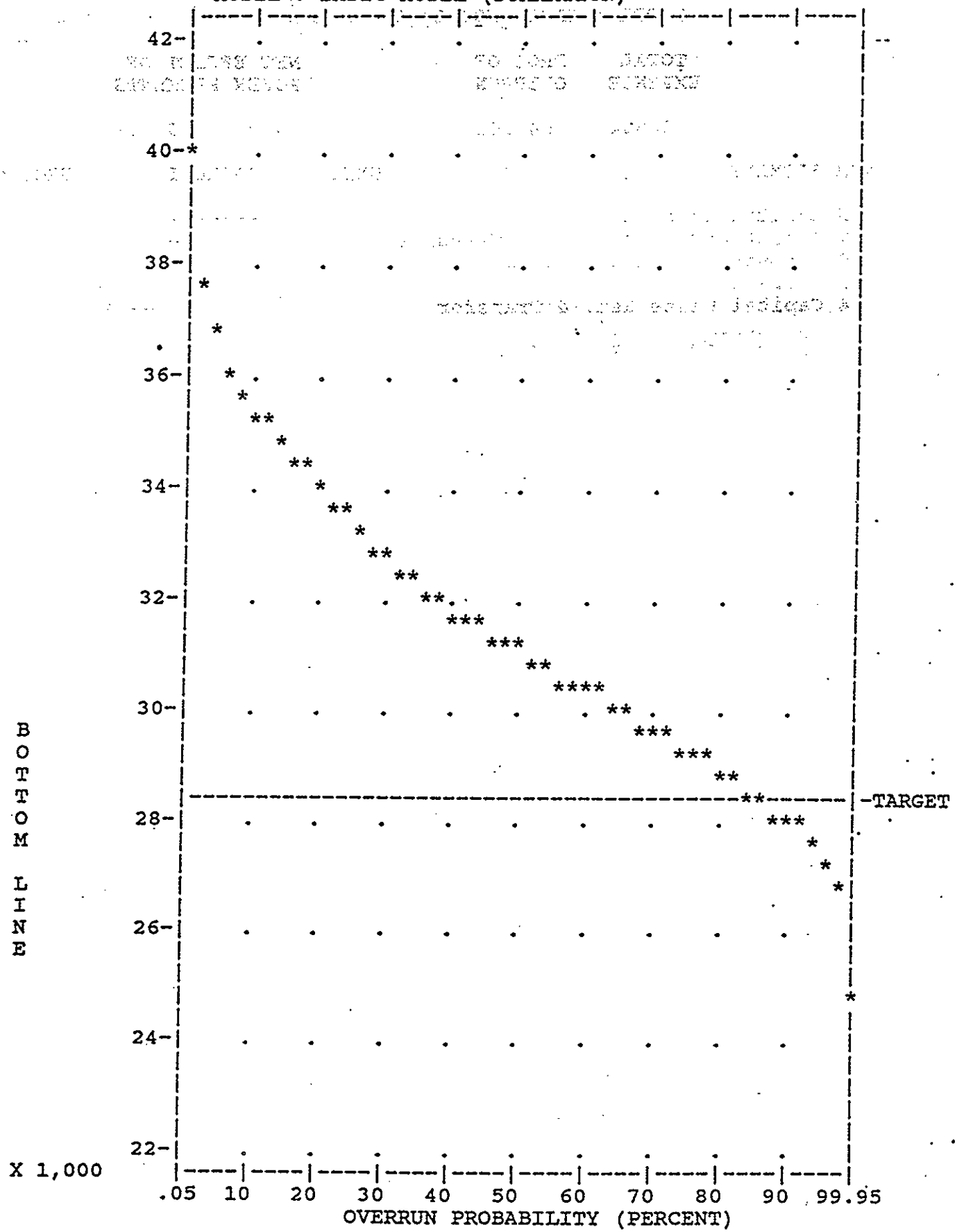
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-13-96

DATA : Ext Sep Case 08
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		1300		1300	1300
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		5202	30	4162	13005
6	Capital Closure		170.00		170.00	170.00
7	Operations Waste Ret. & Transfer		4820	50	3856	8194
8	Operations Treatment		5417	55	4604	5418
9	M & M		0		0	0
10	Repository Fee		565	40	564	3400
	TOTAL EXPENSE (INPUT TO REP/PC)		28544		23550 (THEORETICALS)	45873

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-13-96
DATA : Ext Sep Case 08
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-13-96

DATA : Ext Sep Case 08
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
28544	84 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT     CORRECT        PROTECT

  5 Capital Treatment                            --------------|+
  7 Operations Waste Ret. & Transfer                     ----|+
 10 Repository Fee                                       ----|
  1 Current Operations                                     --|++
  4 Capital Waste Ret. & Transfer                          --|+
  8 Operations Treatment                                     |+
    NET EFFECT OF FROZEN ELEMENTS                            |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-13-96

DATA : Ext Sep Case 08
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	17329	60.7	PCT
99.95	"	11338	39.7	"
95	"	7927	27.8	"
90	"	6814	23.9	"
85	"	6107	21.4	"
80	"	5523	19.4	"
75	"	4877	17.1	"
70	"	4178	14.6	"
65	"	3680	12.9	"
60	"	3235	11.3	"
55	"	2834	9.9	"
50	"	2499	8.8	"
45	"	2127	7.5	"
40	"	1804	6.3	"
35	"	1445	5.1	"
30	"	1052	3.7	"
25	"	706	2.5	"
20	"	366	1.3	"
15	"	-106	-.4	"
10	"	-555	-1.9	"
5	"	-1067	-3.7	"
0.05	"	-3712	-13.0	"
0	"	-4994	-17.5	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

FILENAME=C:\CASE09.OUT 03/12/9

14:38:3

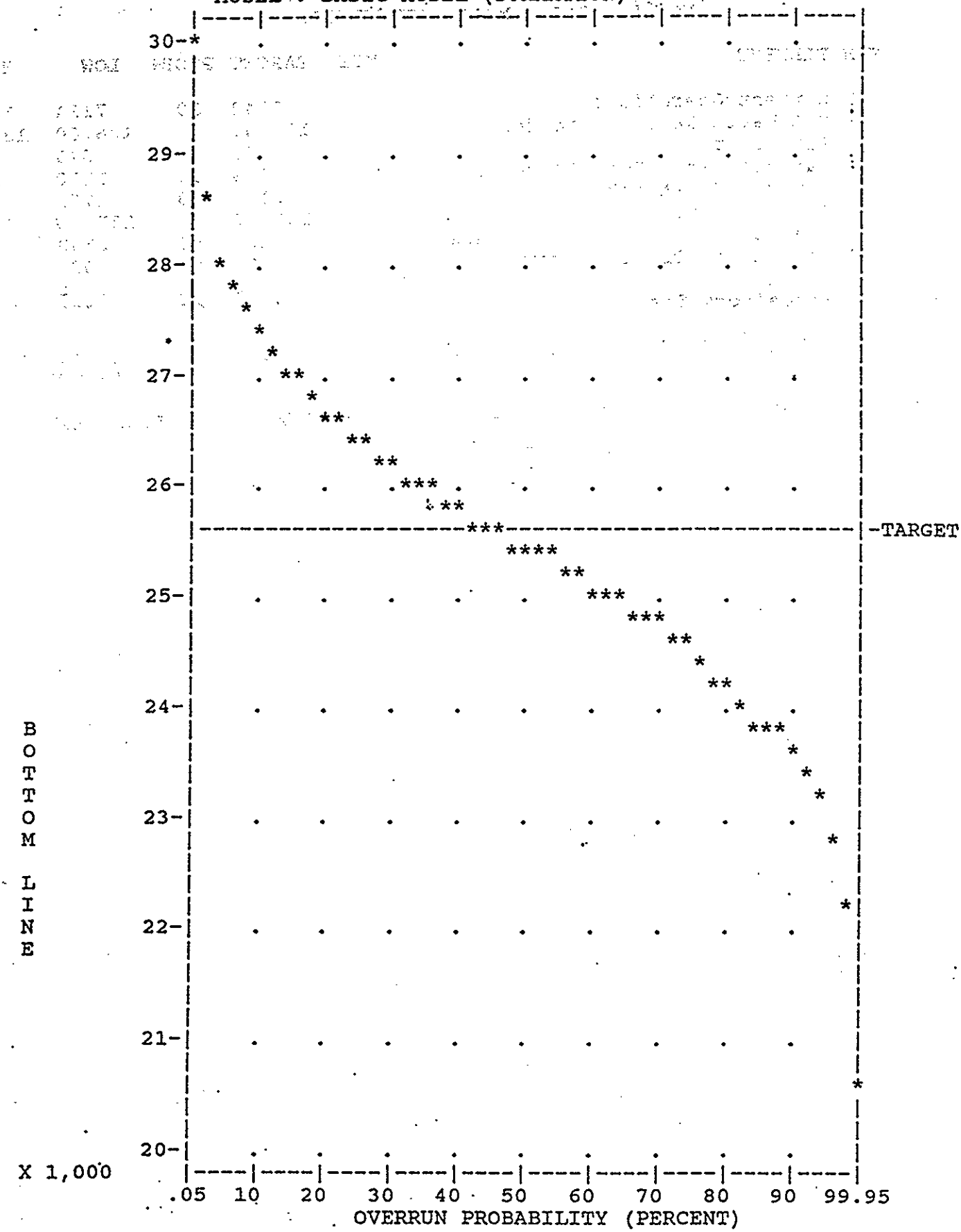
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : ExSitu/InSitu Combo Case 09
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		9142	50	7114	10970
2	R&D Waste Ret. & Transfer		186.00		186.00	186.00
3	R&D Treatment		670		670	670
4	Capital Waste Ret. & Transfer		1388	50	1110	2360
5	Capital Treatment		2189	40	1751	4378
6	Capital Closure		137.00		137.00	137.00
7	Operations Waste Ret. & Transfer		3166	50	2533	5382
8	Operations Treatment		2638	65	2004	2639
9	M & M		0		0	0
10	Repository Fee		6010	95	3750	6011
	TOTAL EXPENSE (INPUT TO REP/PC)		25526		19255 (THEORETICALS)	32733

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : ExSitu/InSitu Combo Case 09
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : ExSitu/InSitu Combo Case 09
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
25526	47 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
10	Repository Fee			++++++++++++
1	Current Operations		------	++++++
5	Capital Treatment		--------	+
7	Operations Waste Ret. & Transfer		-------	++
4	Capital Waste Ret. & Transfer		---	+
8	Operations Treatment			+++
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : ExSitu/InSitu Combo Case 09
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7207	28.2	PCT
99.95	"	4454	17.5	"
95	"	2387	9.4	"
90	"	1865	7.3	"
85	"	1475	5.8	"
80	"	1164	4.6	"
75	"	864	3.4	"
70	"	643	2.5	"
65	"	429	1.7	"
60	"	231	.9	"
55	"	58	.2	"
50	"	-96	-.4	"
45	"	-252	-1.0	"
40	"	-444	-1.7	"
35	"	-649	-2.5	"
30	"	-823	-3.2	"
25	"	-1056	-4.1	"
20	"	-1420	-5.6	"
15	"	-1666	-6.5	"
10	"	-1921	-7.5	"
5	"	-2536	-9.9	"
0.05	"	-4837	-18.9	"
0	"	-6271	-24.6	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

FILENAME=C:\CASE09NF.OUT 03/20/96

10:45:32

REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-12-96

DATA : Phased Impl Case 10
MODEL : BASIC MODEL (SUMMATION)

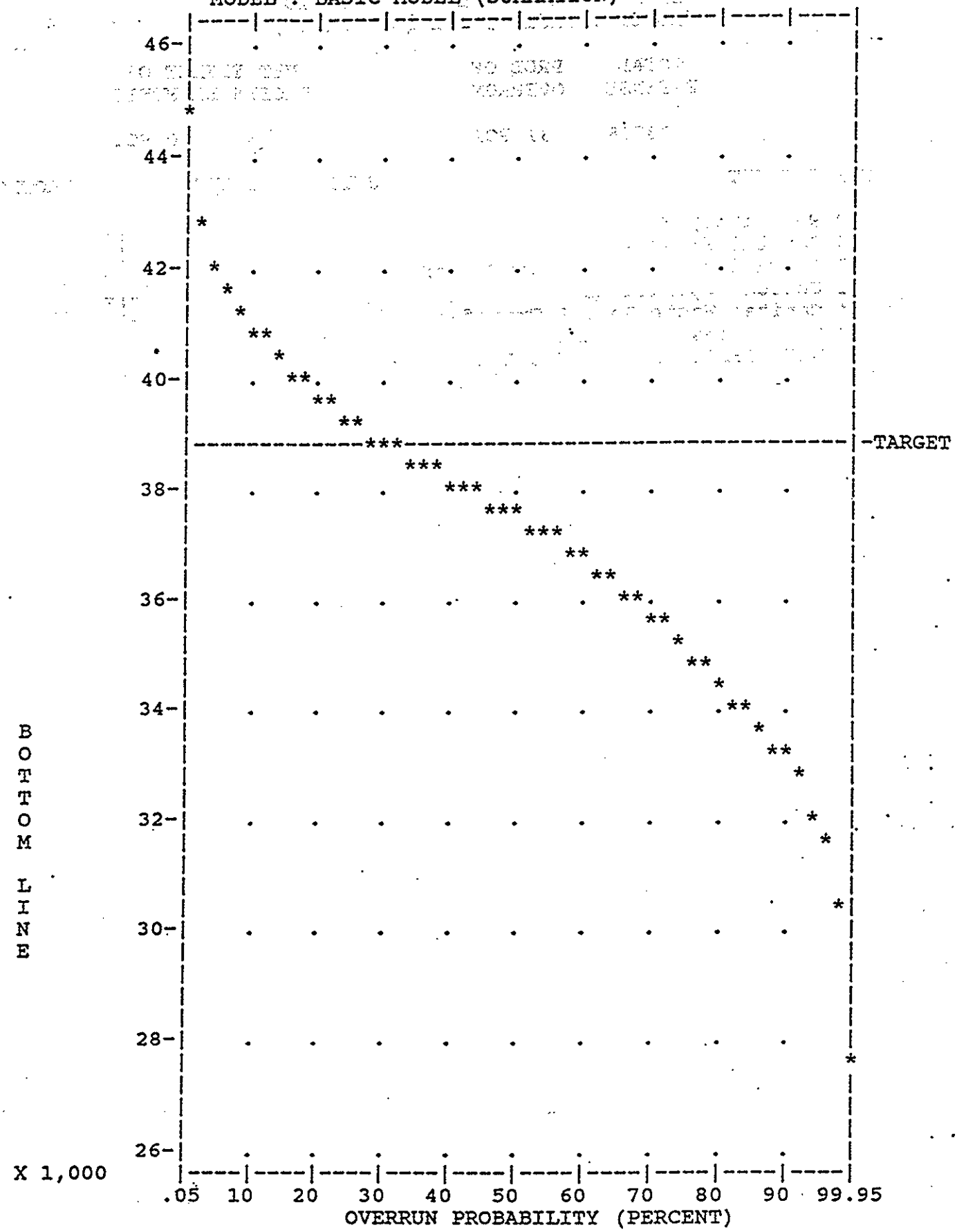
NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		4483	40	3586	8966
6	Capital Closure		211.00		211.00	211.00
7	Operations Waste Ret. & Transfer		3990	50	3192	6783
8	Operations Treatment		6954	50	5215	6955
9	M&M		0		0	0
10	Repository Fee		12020	95	3900	12021
	TOTAL EXPENSE (INPUT TO REP/PC)		38728		24998 (THEORETICALS)	49322

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-12-96

DATA : Phased Impl Case 10

MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-12-96

DATA : Phased Impl Case 10
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
38728	31 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT     CORRECT        PROTECT

 10 Repository Fee                                            |+++++++++++++
  5 Capital Treatment                                   ------|+
  7 Operations Waste Ret. & Transfer                       --|+
  1 Current Operations                                      -|+
  4 Capital Waste Ret. & Transfer                           -|
  8 Operations Treatment                                     |+
    NET EFFECT OF FROZEN ELEMENTS                            |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-12-96

DATA : Phased Impl Case 10
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	10594	27.4	PCT
99.95	"	6055	15.6	"
95	"	3028	7.8	"
90	"	2224	5.7	"
85	"	1507	3.9	"
80	"	992	2.6	"
75	"	461	1.2	"
70	"	45	.1	"
65	"	-244	-.6	"
60	"	-563	-1.4	"
55	"	-874	-2.3	"
50	"	-1238	-3.2	"
45	"	-1672	-4.3	"
40	"	-2126	-5.5	"
35	"	-2580	-6.7	"
30	"	-3006	-7.8	"
25	"	-3665	-9.5	"
20	"	-4292	-11.1	"
15	"	-4912	-12.7	"
10	"	-5717	-14.8	"
5	"	-6885	-17.8	"
0.05	"	-11080	-28.6	"
0	"	-13730	-35.4	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

JACOBS ENGINEERING GROUP INC.

DATE 2/12/96 SUBJECT SHEET NO.

BY D. Stein CHKD. JOB NO.

Phased Implementation (latest version)

Target Value $32,953

95% Confidence Range $30,226 – $36,542

FORM 61-005-1 (4/81)

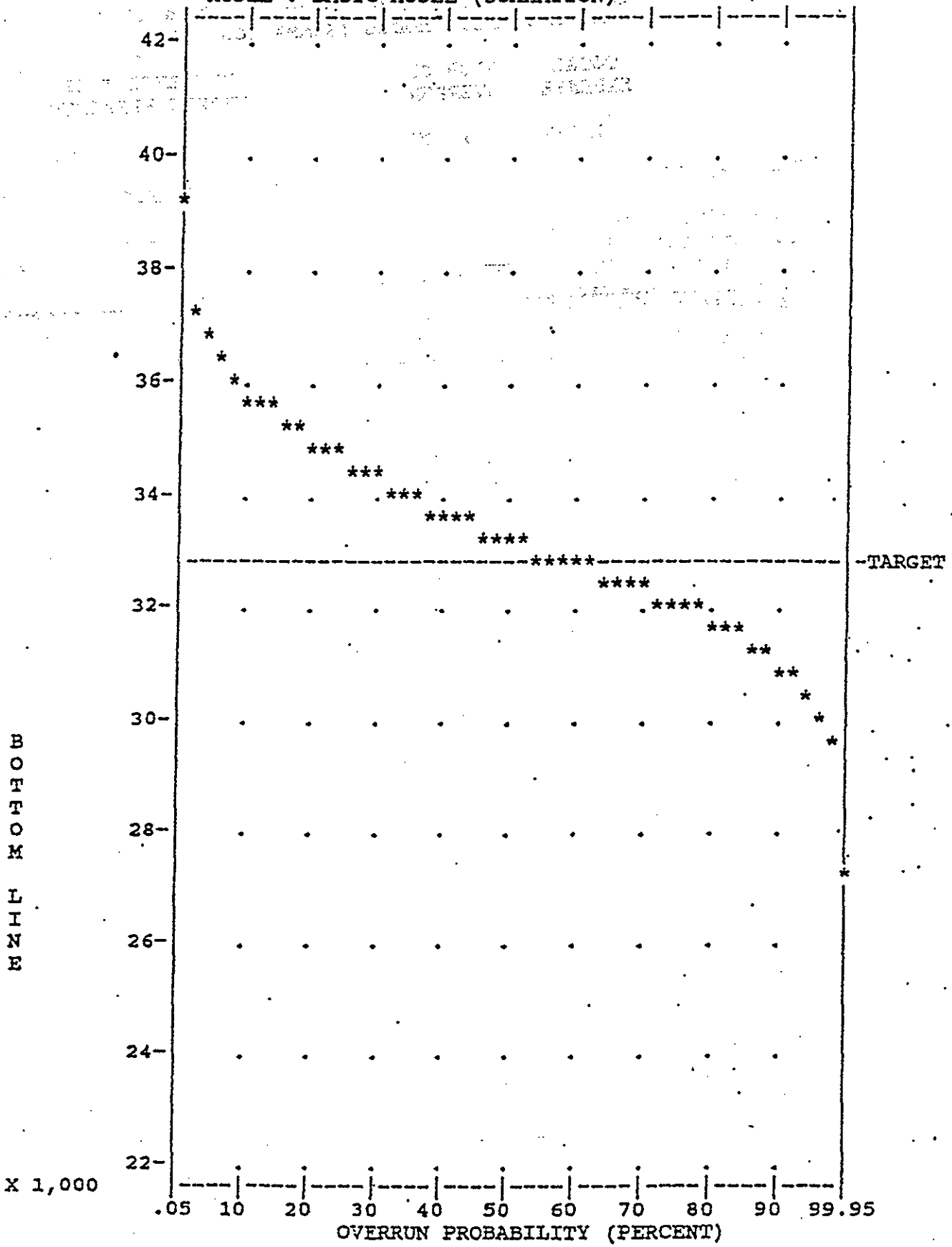
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 02-12-96

DATA : ExSitu Exten. Sepa.r. Case 10
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treament		4305	40	4244	8610
6	Capital Closure		211.00		211.00	211.00
7	Operations Waste Ret. & Transfer		3990	50	3192	6783
8	Operations Treatment		6877	50	5158	6878
9	M & M		0		0	0
10	Repository Fee		6500	95	3900	6501
	TOTAL EXPENSE (INPUT TO REP/PC)		32953		25599 (THEORETICALS)	43369

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 02-12-96
DATA : ExSitu Exten. Sepa.r. Case 10
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 02-12-96

DATA : ExSitu Exten. Sepa.r. Case 10
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
32953	55 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
5	Capital Treament		----------	
10	Repository Fee			++++++++++++
7	Operations Waste Ret. & Transfer		--------	++
1	Current Operations		----	++++
4	Capital Waste Ret. & Transfer		----	+
8	Operations Treatment			++++
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 02-12-96

DATA : ExSitu Exten. Sepa.r. Case 10
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	10416	31.6	PCT
99.95	"	6159	18.7	"
95	"	3589	10.9	"
90	"	2782	8.4	"
85	"	2385	7.2	"
80	"	1960	6.0	"
75	"	1599	4.9	"
70	"	1282	3.9	"
65	"	935	2.8	"
60	"	709	2.2	"
55	"	422	1.3	"
50	"	223	.7	"
45	"	2	.0	"
40	"	-257	-.8	"
35	"	-452	-1.4	"
30	"	-682	-2.1	"
25	"	-936	-2.8	"
20	"	-1178	-3.6	"
15	"	-1518	-4.6	"
10	"	-1968	-6.0	"
5	"	-2727	-8.3	"
0.05	"	-5765	-17.5	"
0	"	-7354	-22.3	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

OUTPUT
FOR CASES
EXCLUDING
REPOSITORY
FEE

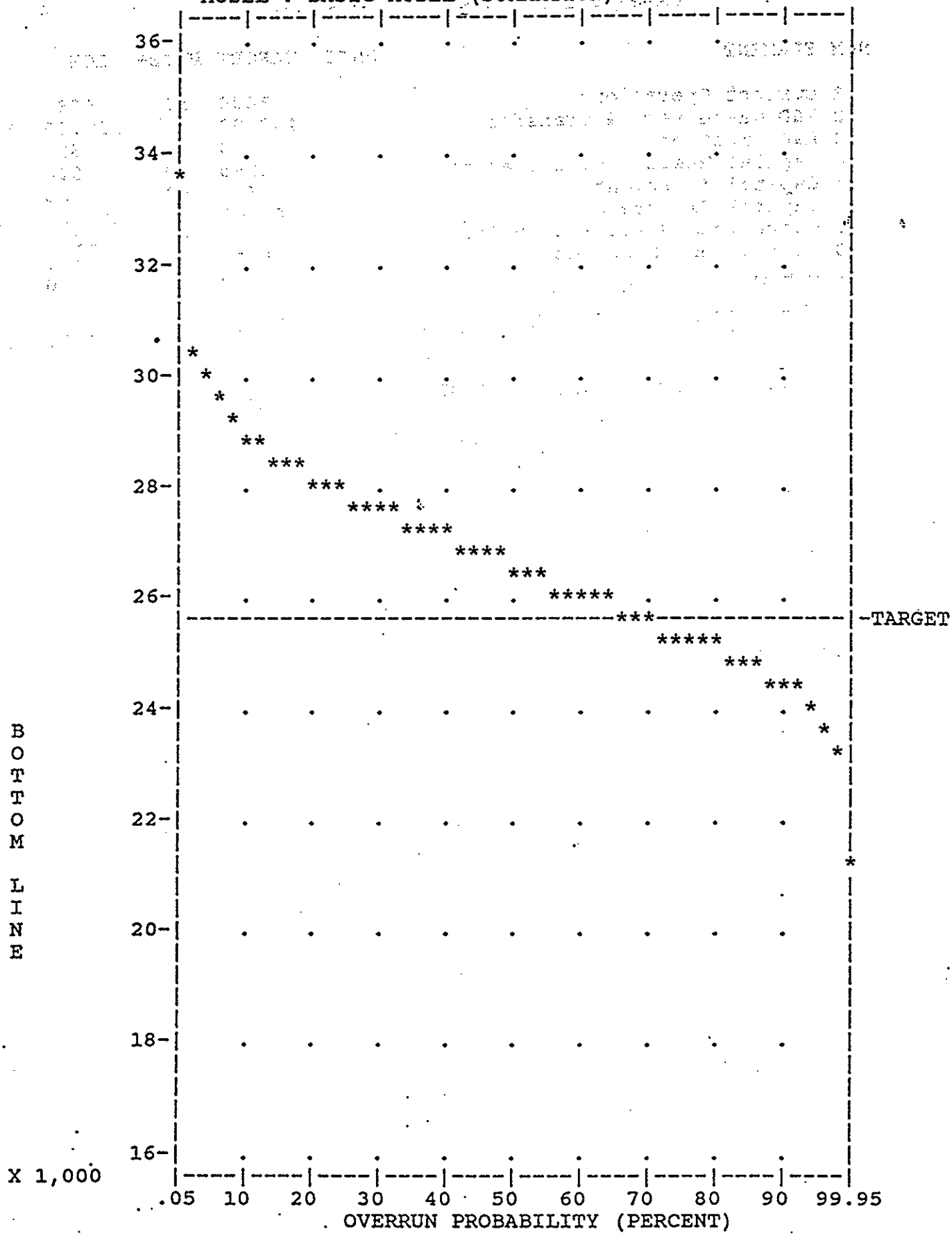
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : Inter Sep w/o Rep Fee Case 05
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		630		630	630
4	Capital Waste Ret. & Transfer		2280	50	824	3876
5	Capital Treatment		3600	40	2880	7200
6	Capital Closure		169.00		169.00	169.00
7	Operations Waste Ret. & Transfer		4820	50	3856	8194
8	Operations Treatment		5509	65	4183	5510
9	M & M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		25798		19612 (THEORETICALS)	36089

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : Inter Sep w/o Rep Fee Case 05
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : Inter Sep w/o Rep Fee Case 05
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
25798	64 PCT	0 = .0 PCT

```
NUM ELEMENT                                  UNIT    CORRECT        PROTECT

  5 Capital Treatment                              -------------|++
  7 Operations Waste Ret. & Transfer                 -----------|+++
  4 Capital Waste Ret. & Transfer                        -----|++++
  1 Current Operations                                   -----|+++++
  8 Operations Treatment                                      |+++++
    NET EFFECT OF FROZEN ELEMENTS                             |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : Inter Sep w/o Rep Fee Case 05
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	10291	39.9	PCT
99.95	"	7963	30.9	"
95	"	3943	15.3	"
90	"	3111	12.1	"
85	"	2633	10.2	"
80	"	2307	8.9	"
75	"	1991	7.7	"
70	"	1739	6.7	"
65	"	1466	5.7	"
60	"	1218	4.7	"
55	"	973	3.8	"
50	"	690	2.7	"
45	"	431	1.7	"
40	"	239	.9	"
35	"	-23	-.1	"
30	"	-313	-1.2	"
25	"	-574	-2.2	"
20	"	-779	-3.0	"
15	"	-1115	-4.3	"
10	"	-1391	-5.4	"
5	"	-2023	-7.8	"
0.05	"	-4609	-17.9	"
0	"	-6186	-24.0	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

FILENAME=C:\CASE06.OUT 03/20/96

10:37:51

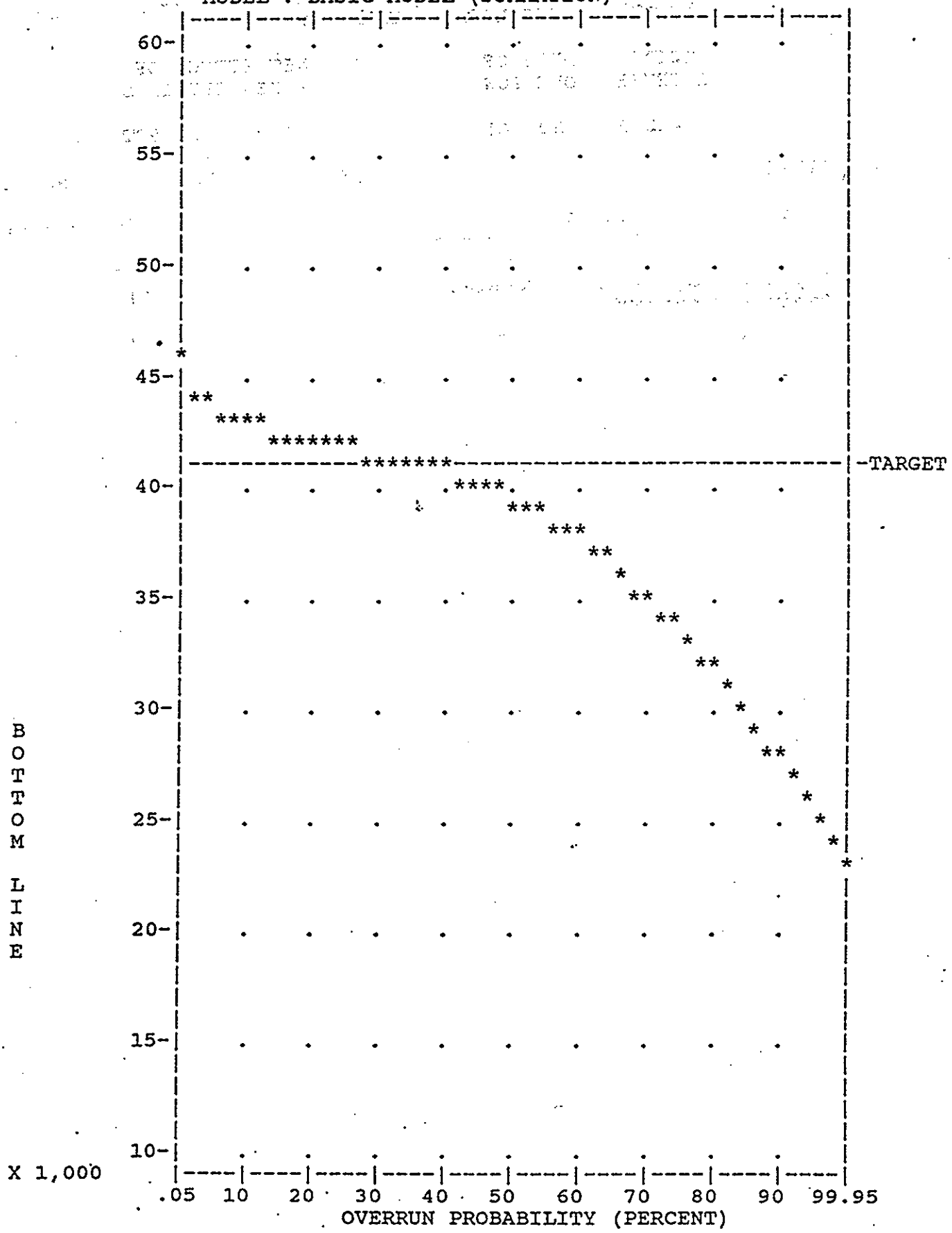
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : No Sep Vitr w/o Rep Fee Case 06
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8325	50	6660	9990
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		280		280	280
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		2610	50	2088	3915
6	Capital Closure		152.00		152.00	152.00
7	Operations Waste Ret. & Transfer		4630	50	3704	7871
8	Operations Treatment		22742	75	4654	22743
9	M & M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		41209		19552 (THEORETICALS)	49017

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : No Sep Vitr w/o Rep Fee Case 06
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : No Sep Vitr w/o Rep Fee Case 06
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
41209	30 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT     CORRECT       PROTECT

  8 Operations Treatment                                        |+++++++++++++
  7 Operations Waste Ret. & Transfer                         --|
  1 Current Operations                                        -|+
  4 Capital Waste Ret. & Transfer                             -|
  5 Capital Treatment                                         -|
    NET EFFECT OF FROZEN ELEMENTS                              |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : No Sep Vitr w/o Rep Fee Case 06
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7808	19.0	PCT
99.95	"	5239	12.7	"
95	"	2350	5.7	"
90	"	1717	4.2	"
85	"	1181	2.9	"
80	"	758	1.8	"
75	"	434	1.1	"
70	"	11	.0	"
65	"	-328	-.8	"
60	"	-661	-1.6	"
55	"	-1173	-2.8	"
50	"	-1723	-4.2	"
45	"	-2528	-6.1	"
40	"	-3554	-8.6	"
35	"	-4767	-11.6	"
30	"	-6349	-15.4	"
25	"	-7709	-18.7	"
20	"	-9489	-23.0	"
15	"	-11441	-27.8	"
10	"	-13652	-33.1	"
5	"	-15649	-38.0	"
0.05	"	-18707	-45.4	"
0	"	-21657	-52.5	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

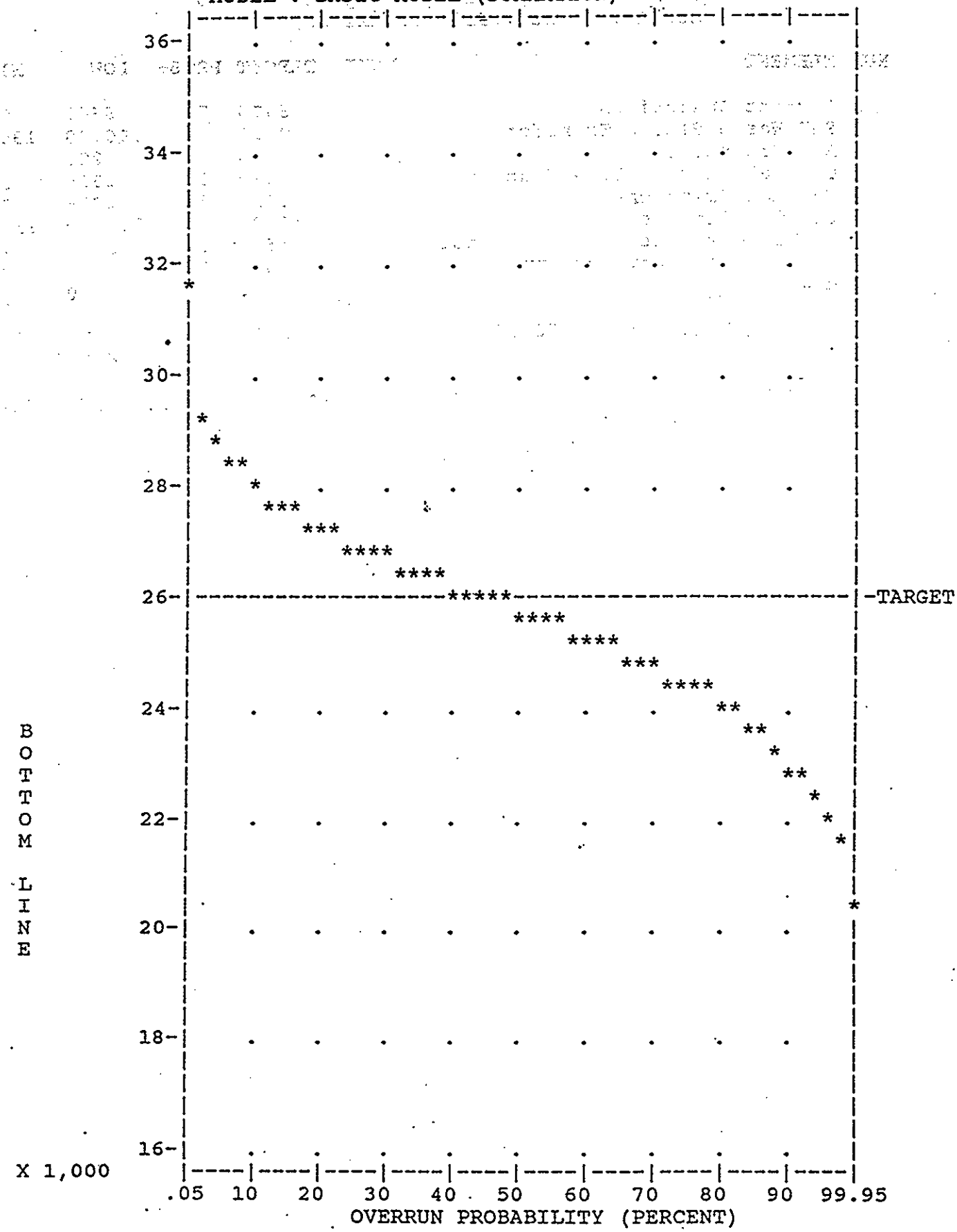
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : No Sep Calc w/o Rep Fee Case 07
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8325	50	6660	9990
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		280		280	280
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		2610	50	2088	3915
6	Capital Closure		152.00		152.00	152.00
7	Operations Waste Ret. & Transfer		4630	50	3704	7871
8	Operations Treatment		7548	75	3273	7549
9	M & M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		26015		18171 (THEORETICALS)	33823

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : No Sep Calc w/o Rep Fee Case 07
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : No Sep Calc w/o Rep Fee Case 07
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
26015	43 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT     CORRECT        PROTECT

  8 Operations Treatment                                        |+++++++++++++
  7 Operations Waste Ret. & Transfer                   -------|++
  1 Current Operations                                    ---|+++
  4 Capital Waste Ret. & Transfer                         ---|+
  5 Capital Treatment                                     ---|+
    NET EFFECT OF FROZEN ELEMENTS                            |
```

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : No Sep Calc w/o Rep Fee Case 07
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7808	30.0	PCT
99.95	"	5486	21.1	"
95	"	2693	10.4	"
90	"	1989	7.7	"
85	"	1557	6.0	"
80	"	1194	4.6	"
75	"	905	3.5	"
70	"	630	2.4	"
65	"	425	1.6	"
60	"	155	.6	"
55	"	-69	-.3	"
50	"	-288	-1.1	"
45	"	-511	-2.0	"
40	"	-711	-2.7	"
35	"	-1004	-3.9	"
30	"	-1349	-5.2	"
25	"	-1607	-6.2	"
20	"	-1940	-7.5	"
15	"	-2366	-9.1	"
10	"	-3105	-11.9	"
5	"	-3858	-14.8	"
0.05	"	-5774	-22.2	"
0	"	-7844	-30.1	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

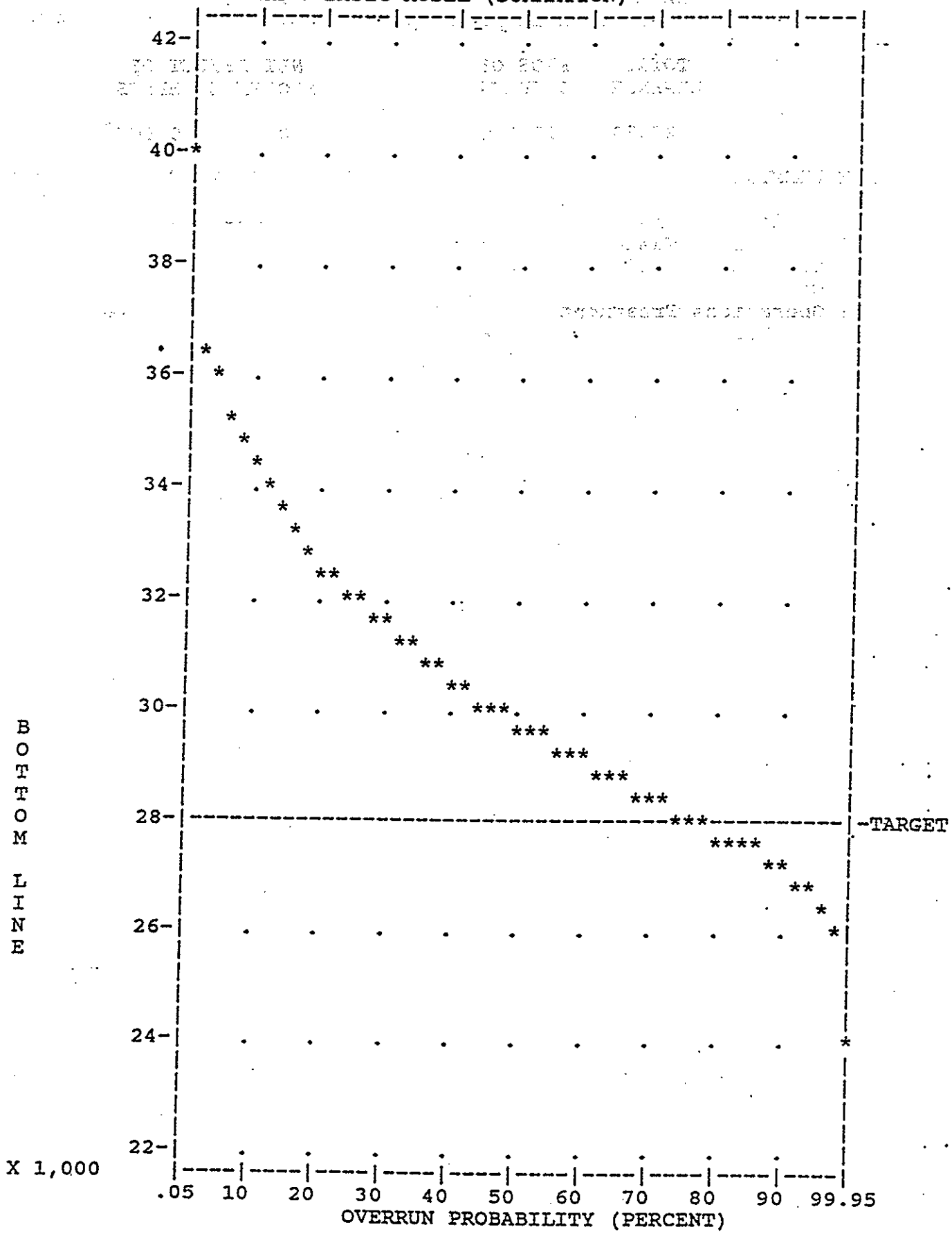
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-12-96

DATA : Ext Sep w/o Rep Fee Case 08
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		1300		1300	1300
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treament		5202	30	4162	13005
6	Capital Closure		170.00		170.00	170.00
7	Operations Waste Ret. & Transfer		4820	50	3856	8194
8	Operations Treatment		5417	55	4604	5418
9	M & M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		27979		22986 (THEORETICALS)	42473

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-12-96
DATA : Ext Sep w/o Rep Fee Case 08
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-12-96

DATA : Ext Sep w/o Rep Fee Case 08
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
27979	77 PCT	0 = .0 PCT

```
NUM ELEMENT                                UNIT     CORRECT        PROTECT

  5 Capital Treament                              --------------|+
  7 Operations Waste Ret. & Transfer                       -----|+
  1 Current Operations                                       --|++
  4 Capital Waste Ret. & Transfer                            --|+
  8 Operations Treatment                                       |+
    NET EFFECT OF FROZEN ELEMENTS                              |
```

DATA : Ext Sep w/o Rep Fee Case 08
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	14494	51.8	PCT
99.95	"	12109	43.3	"
95	"	7497	26.8	"
90	"	6282	22.5	"
85	"	5365	19.2	"
80	"	4615	16.5	"
75	"	3930	14.1	"
70	"	3464	12.4	"
65	"	3018	10.8	"
60	"	2545	9.1	"
55	"	2144	7.7	"
50	"	1739	6.2	"
45	"	1391	5.0	"
40	"	1061	3.8	"
35	"	755	2.7	"
30	"	477	1.7	"
25	"	146	.5	"
20	"	-185	-.7	"
15	"	-497	-1.8	"
10	"	-814	-2.9	"
5	"	-1399	-5.0	"
0.05	"	-3851	-13.8	"
0	"	-4993	-17.8	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

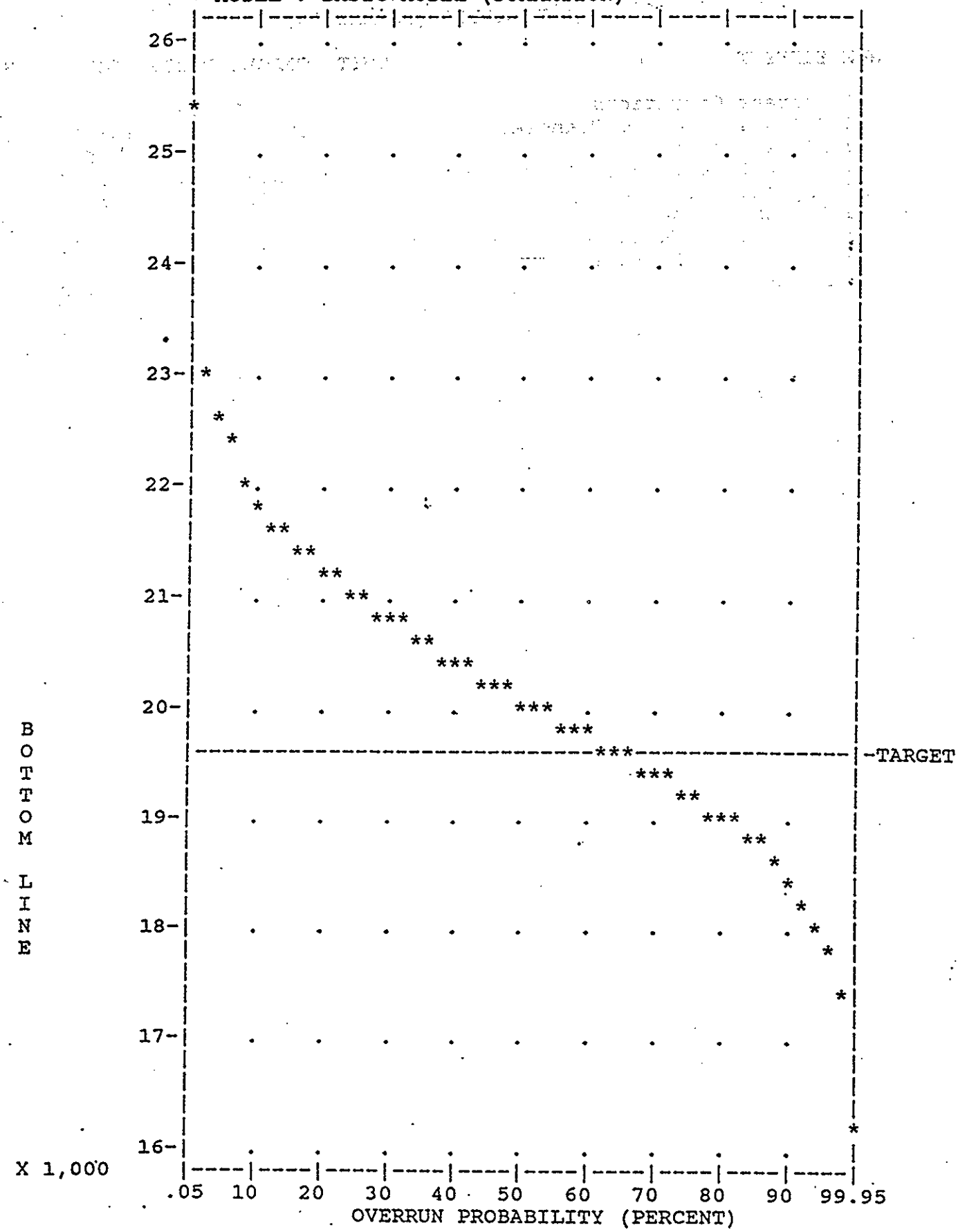
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-20-96

DATA : ExSitu/InSituCombo w/o RF Case09
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		9142	50	7114	10970
2	R&D Waste Ret. & Transfer		186.00		186.00	186.00
3	R&D Treatment		670		670	670
4	Capital Waste Ret. & Transfer		1388	50	1110	2360
5	Capital Treatment		2189	40	1751	4378
6	Capital Closure		137.00		137.00	137.00
7	Operations Waste Ret. & Transfer		3166	50	2533	5382
8	Operations Treatment		2638	65	2004	2639
9	M & M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		19516		15505 (THEORETICALS)	26722

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-20-96
DATA : ExSitu/InSituCombo w/o RF Case09
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-20-96

DATA : ExSitu/InSituCombo w/o RF Case09
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
19516	66 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
1	Current Operations		----------	++++++++++
5	Capital Treatment		----------	++
7	Operations Waste Ret. & Transfer		----------	+++
4	Capital Waste Ret. & Transfer		-----	+
8	Operations Treatment			++++
	NET EFFECT OF FROZEN ELEMENTS			

REP/PC (Ver 4.0) - MGMT REPORT 4 CONTINGENCY PROFILE : 03-20-96

DATA : ExSitu/InSituCombo w/o RF Case09
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	7206	36.9	PCT
99.95	"	5794	29.7	"
95	"	2891	14.8	"
90	"	2316	11.9	"
85	"	2023	10.4	"
80	"	1750	9.0	"
75	"	1491	7.6	"
70	"	1253	6.4	"
65	"	1085	5.6	"
60	"	907	4.7	"
55	"	718	3.7	"
50	"	542	2.8	"
45	"	367	1.9	"
40	"	211	1.1	"
35	"	38	.2	"
30	"	-137	-.7	"
25	"	-323	-1.7	"
20	"	-488	-2.5	"
15	"	-726	-3.7	"
10	"	-1025	-5.2	"
5	"	-1560	-8.0	"
0.05	"	-3250	-16.6	"
0	"	-4011	-20.5	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

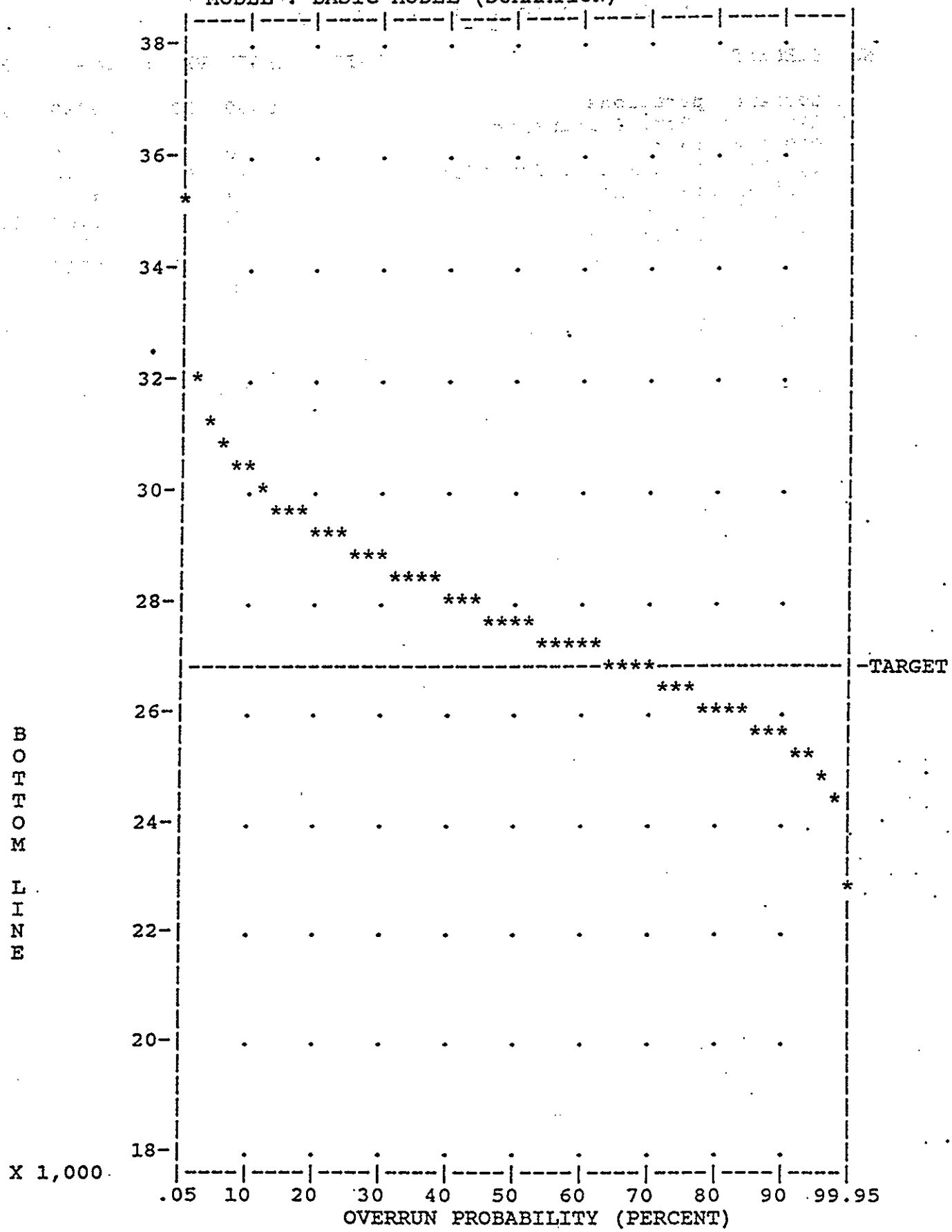
REP/PC (Ver 4.0) - MGMT REPORT 1 RANGE ESTIMATE : 03-12-96

DATA : Phased Impl w/o Rep Fee Case10
MODEL : BASIC MODEL (SUMMATION)

NUM	ELEMENT	UNIT	TARGET	PROB+	LOW	HIGH
1	Current Operations		8600	50	6880	10320
2	R&D Waste Ret. & Transfer		190.00		190.00	190.00
3	R&D Treatment		0		0	0
4	Capital Waste Ret. & Transfer		2280	50	1824	3876
5	Capital Treatment		4483	40	3586	8966
6	Capital Closure		211.00		211.00	211.00
7	Operations Waste Ret. & Transfer		3990	50	3192	6783
8	Operations Treatment		6954	50	5215	6955
9	M&M		0		0	0
	TOTAL EXPENSE (INPUT TO REP/PC)		26708		21098 (THEORETICALS)	37301

+ PROBABILITY THAT ACTUAL VALUE WILL BE EQUAL TO OR LESS THAN TARGET

REP/PC (Ver 4.0) - MGMT REPORT 2 GRAPHICAL OVERRUN PROFILE : 03-12-96
DATA : Phased Impl w/o Rep Fee Case10
MODEL : BASIC MODEL (SUMMATION)



REP/PC (Ver 4.0) - MGMT REPORT 3 GRAPHICAL PRIORITY PROFILE : 03-12-96

DATA : Phased Impl w/o Rep Fee Case10
MODEL : BASIC MODEL (SUMMATION)

TOTAL EXPENSE	PROB OF OVERRUN	NET EFFECT OF FROZEN ELEMENTS
26708	69 PCT	0 = .0 PCT

NUM	ELEMENT	UNIT	CORRECT	PROTECT
5	Capital Treatment		----------|	++
7	Operations Waste Ret. & Transfer		-------|	++
1	Current Operations		----|	++++
4	Capital Waste Ret. & Transfer		----|	+
8	Operations Treatment		|	++++
	NET EFFECT OF FROZEN ELEMENTS		|	

DATA : Phased Impl w/o Rep Fee Case10
MODEL : BASIC MODEL (SUMMATION)

TO BE THIS CONFIDENT OF NOT HAVING COST OVERRUN		ADD THIS CONTINGENCY ABSOLUTE	RELATIVE	
100	PCT	10593	39.7	PCT
99.95	"	8381	31.4	"
95	"	4401	16.5	"
90	"	3515	13.2	"
85	"	3043	11.4	"
80	"	2637	9.9	"
75	"	2279	8.5	"
70	"	1945	7.3	"
65	"	1676	6.3	"
60	"	1401	5.3	"
55	"	1088	4.1	"
50	"	847	3.2	"
45	"	629	2.4	"
40	"	413	1.6	"
35	"	187	.7	"
30	"	-40	-.1	"
25	"	-379	-1.4	"
20	"	-610	-2.3	"
15	"	-850	-3.2	"
10	"	-1246	-4.7	"
5	"	-1708	-6.4	"
0.05	"	-4019	-15.0	"
0	"	-5610	-21.0	"

(ABOVE RESULTS DERIVED FROM 1000 SIMULATIONS)

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Safety: Nonradiological /Nontoxicological Occupational Accidents Including transportation - includes closure

ORIGINATOR Michael Harker DATE ~~02/12/96~~ 7-28-96

REVISION NO. ~~0~~ 1

OBJECTIVE Show injuries and fatalities from construction operation, and transportation accidents. Replaces Old Calcs. for the TWRS EIS Rev. ~~0~~ 1

METHODOLOGY See attachments

ASSUMPTIONS See attachments

Occupational injury and fatality rates - taken from the Occupational Injuries Summary Report, January - Dec. 1993 DOE/EH/01570-H5. Truck and Rail Transport incidence rates - taken from Non-Radiological Impacts of Transporting Radioactive Material. SAND81-1703 1982. Employee Transportation incidence rates - taken from 1993 Washington State Highway Accident Report. Round trip distance from Tri-Cities=1.40E+02 km; from Portland/Seattle = 8.00E+02 km. Carpool factor of 1.35/car from SIS EIS DOE/EIS-0212 1994.

(Continue on another sheet if necessary)

3-18-96
SIGNATURE/DATE

C. Henderson 3-19-96
CHECKED/DATE

CALCULATION & RESULTS ATTACHED

Loretta Cow 8/-

JACOBS\FORMS\NONTOX.RAD\CALCVR.SHT

	NO ACTION						
Truck and Rail Transport							
				Total Distance			
				onsite		offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	grub/clear	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	burial	0.00E+00	0.00E+00	0.00E+00			
	consumab	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				0.00E+00
	steel	0.00E+00	0.00E+00				0.00E+00
Construction-annex	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	consumab	0.00E+00	0.00E+00			0.00E+00	
	cement &						
	steel	0.00E+00	0.00E+00				0.00E+00
Remediate -Vit plant							
Construction	grub/clear	0.00E+00	0.00E+00	0.00E+00			
	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	burial	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	consumab	0.00E+00	0.00E+00			0.00E+00	
	cement &						
	steel	0.00E+00	0.00E+00				0.00E+00
Operation	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	burial	4.91E+03	1.60E+01	7.86E+04			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	diesel	1.16E+03	1.40E+02			1.63E+05	
	kerosene	0.00E+00	0.00E+00			0.00E+00	
	glass form	0.00E+00	0.00E+00			0.00E+00	
	IX resins	0.00E+00	0.00E+00			0.00E+00	
	NH3	0.00E+00	0.00E+00			0.00E+00	
	HNO3	0.00E+00	0.00E+00			0.00E+00	
	NaOH	0.00E+00	0.00E+00			0.00E+00	
	steel	7.40E+01	1.40E+02			1.04E+04	
Closure							
Grout tank domes,	sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &	concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.	diesel	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks	gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier	silt	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	basalt	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	asphalt	0.00E+00	0.00E+00			0.00E+00	
	fabric	0.00E+00	0.00E+00			0.00E+00	
				truck-on	rail-on	truck-off	rail-off
TOTAL km				7.86E+04		1.73E+05	0.00E+00

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	1.73E+05	5.00E-02			8.65E+03
	Rail	0.00E+00	5.00E-02			0.00E+00
Suburban	Truck	1.73E+05	5.00E-02		7.86E+04	8.73E+04
	Rail	0.00E+00	5.00E-02			0.00E+00
Rural	Truck	1.73E+05	9.00E-01			1.56E+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
		8.65E+03	0.00E+00	8.73E+04	0.00E+00	1.56E+05	0.00E+00
urban truck fat/km	7.50E-09	6.49E-05					
urban truck inj/km	3.70E-07	3.20E-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			1.13E-03			
sub truck inj/km	3.80E-07			3.32E-02			
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					8.25E-03	
rural truck inj/km	8.00E-07					1.25E-01	
rural rail fat/km	1.70E-08						0.00E+00
rural rail inj/km	3.30E-08						0.00E+00
				truck fat =	9.45E-03		
				truck inj =	1.61E-01		
	TOTAL FATALITIES	9.45E-03		rail fat =	0.00E+00		
	TOTAL INJURIES	1.61E-01		rail inj =	0.00E+00		

EMPLOYEE VEHICLE

Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
Vitrification								
	Const.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Ops/D&D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	1.04E+05					Total km	2.81E+09

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

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	9.45E-03	2.52E+01	2.52E+01
INJURIES	1.61E-01	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		const + ops	
							trc	2.29E+03
OPERATION ACCIDENTS							fatality	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				excluding employee traffic				
	INJUR	4.29E+03						
	FATAL	2.85E+01		fatal	3.33E+00			

	LONG TERM MANAGEMENT						
Truck and Rail Transport							
				Total Distance			
				onsite		offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314	sand/grav	3.25E+02	1.00E+01	3.25E+03			
	excavation	2.29E+03	4.00E+00	9.17E+03			
	backfill	2.75E+03	4.00E+00	1.10E+04			
	grub/clear	3.43E+02	1.60E+01	5.49E+03			
	concrete	6.42E+02	6.00E+00	3.85E+03			
	burial	1.30E+01	1.60E+01	2.08E+02			
	consumab	3.00E+00	1.40E+02			4.20E+02	
	cement	1.10E+01	8.00E+02				8.80E+03
	steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	consumab	0.00E+00	0.00E+00			0.00E+00	
	cement &						
	steel	0.00E+00	0.00E+00				0.00E+00
New tanks							
Construction	grub/clear	6.00E+03	1.60E+01	9.60E+04			
	excavation	4.42E+05	4.00E+00	1.77E+06			
	backfill	4.26E+05	4.00E+00	1.70E+06			
	sand/grav	3.07E+04	1.00E+01	3.07E+05			
	concrete	4.81E+04	6.00E+00	2.89E+05			
	burial	4.80E+03	1.60E+01	7.68E+04			
	diesel	7.87E+03	1.40E+02			1.10E+06	
	consumab	2.40E+03	1.40E+02			3.36E+05	
	cement	9.63E+02	8.00E+02				7.70E+05
	steel	2.98E+02	8.00E+02				2.38E+05
Operation	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	burial	4.91E+03	1.60E+01	7.86E+04			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	diesel	1.16E+03	1.40E+02			1.63E+05	
	kerosene	0.00E+00	0.00E+00			0.00E+00	
	glass form	0.00E+00	0.00E+00			0.00E+00	
	IX resins	0.00E+00	0.00E+00			0.00E+00	
	NH3	0.00E+00	0.00E+00			0.00E+00	
	HNO3	0.00E+00	0.00E+00			0.00E+00	
	NaOH	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				
	steel	7.40E+01	1.40E+02			1.04E+04	
	chemicals	0.00E+00	0.00E+00				0.00E+00
Closure							
Grout tank domes,	sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &	concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.	diesel	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks	gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier	silt	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	basalt	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	asphalt	0.00E+00	0.00E+00			0.00E+00	
	fabric	0.00E+00	0.00E+00			0.00E+00	
				truck-on	rail-on	truck-off	rail-off
TOTAL km				4.35E+06		1.61E+06	1.04E+06

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	1.61E+06	5.00E-02			8.05E+04
	Rail	1.04E+06	5.00E-02			5.18E+04
Suburban	Truck	1.61E+06	5.00E-02		4.35E+06	4.43E+06
	Rail	1.04E+06	5.00E-02			5.18E+04
Rural	Truck	1.61E+06	9.00E-01			1.45E+06
	Rail	1.04E+06	9.00E-01			9.33E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		8.05E+04	5.18E+04	4.43E+06	5.18E+04	1.45E+06	9.33E+05
urban truck fat/km	7.50E-09	6.04E-04					
urban truck inj/km	3.70E-07	2.98E-02					
urban rail fat/km	1.70E-08		8.81E-04				
urban rail inj/km	3.30E-08		1.71E-03				
sub truck fat.km	1.30E-08			5.76E-02			
sub truck inj/km	3.80E-07			1.68E+00			
sub rail fat/km	1.70E-08				8.81E-04		
sub rail inj/km	3.30E-08				1.71E-03		
rural truck fat/km	5.30E-08					7.68E-02	
rural truck inj/km	8.00E-07					1.16E+00	
rural rail fat/km	1.70E-08						1.59E-02
rural rail inj/km	3.30E-08						3.08E-02
				truck fat =	1.35E-01		
				truck inj =	2.87E+00		
	TOTAL FATALITIES	1.53E-01		rail fat =	1.76E-02		
	TOTAL INJURIES	2.91E+00		rail inj =	3.42E-02		

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		
Vitrification								
	Const.	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	Ops/D&D	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total emp	1.08E+05					Total km	2.91E+09

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

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	1.53E-01	2.61E+01	2.63E+01
INJURIES	2.91E+00	2.08E+03	2.08E+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		const + ops	
							trc	2.65E+03
OPERATION ACCIDENTS							fatality	3.45E+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				excluding employee traffic				
	INJUR	4.73E+03						
	FATAL	2.97E+01		fatal	3.45E+00			

			IN SITU FILL AND CAP					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Remediate -fill/cap								
Construction		grub/clear	2.25E+03	1.60E+01	3.60E+04			
		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		burial	2.40E+03	1.60E+01	3.84E+04			
		diesel	7.40E+01	1.40E+02			1.04E+04	
		consumab	1.20E+03	1.40E+02			1.68E+05	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Operation - tank fill		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	4.91E+03	1.60E+01	7.86E+04			
		sand/grav	6.17E+04	1.00E+01	6.17E+05			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	3.22E+02	1.40E+02			4.51E+04	
		kerosene	0.00E+00	0.00E+00			0.00E+00	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	0.00E+00	0.00E+00			0.00E+00	
		HNO3	0.00E+00	0.00E+00			0.00E+00	
		NaOH	0.00E+00	0.00E+00			0.00E+00	
		cement,						
		steel, &						
		chemicals	0.00E+00	0.00E+00				0.00E+00
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.82E+02	1.40E+02			5.35E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	3.09E+04	3.00E+01	9.26E+05			
		sand/grav	3.47E+04	1.00E+01	3.47E+05			
		basalt	5.22E+04	3.20E+01	1.67E+06			
		diesel	2.39E+03	1.40E+02			3.35E+05	
		asphalt	5.12E+03	1.40E+02			7.16E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					3.78E+06		1.33E+06	3.04E+04

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	1.33E+06	5.00E-02			6.65E+04		
	Rail	3.04E+04	5.00E-02			1.52E+03		
Suburban	Truck	1.33E+06	5.00E-02		3.78E+06	3.85E+06		
	Rail	3.04E+04	5.00E-02			1.52E+03		
Rural	Truck	1.33E+06	9.00E-01			1.20E+06		
	Rail	3.04E+04	9.00E-01			2.74E+04		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			6.65E+04	1.52E+03	3.85E+06	1.52E+03	1.20E+06	2.74E+04
urban truck fat/km		7.50E-09	4.99E-04					
urban truck inj/km		3.70E-07	2.46E-02					
urban rail fat/km		1.70E-08		2.58E-05				
urban rail inj/km		3.30E-08		5.02E-05				
sub truck fat.km		1.30E-08			5.00E-02			
sub truck inj/km		3.80E-07			1.46E+00			
sub rail fat/km		1.70E-08				2.58E-05		
sub rail inj/km		3.30E-08				5.02E-05		
rural truck fat/km		5.30E-08					6.34E-02	
rural truck inj/km		8.00E-07					9.58E-01	
rural rail fat/km		1.70E-08						4.65E-04
rural rail inj/km		3.30E-08						9.03E-04
					truck fat =	1.14E-01		
					truck inj =	2.45E+00		
	TOTAL FATALITIES		1.14E-01		rail fat =	5.17E-04		
	TOTAL INJURIES		2.45E+00		rail inj =	1.00E-03		

EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	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 emp	2.61E+04					Total km	7.05E+08

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	1.14E-01	6.33E+00	6.44E+00
	INJURIES	2.45E+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		const + ops	
							trc	6.30E+02
OPERATION ACCIDENTS							fatality	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	7.28E+00		fatal	8.36E-01			

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		const + ops	
							trc	2.77E+03
OPERATION ACCIDENTS							fatality	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	3.72E+03						
	FATAL	1.36E+01		fatal	1.56E+00			

		EX SITU INTERMEDIATE SEPARATIONS						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavatio	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant								
Construction		grub/clear	5.50E+03	1.60E+01	8.80E+04			
		excavatio	2.78E+05	4.00E+00	1.11E+06			
		backfill	1.97E+05	4.00E+00	7.86E+05			
		sand/grav	4.22E+04	1.00E+01	4.22E+05			
		concrete	7.89E+04	6.00E+00	4.74E+05			
		burial	2.28E+04	1.60E+01	3.65E+05			
		diesel	1.45E+03	1.40E+02			2.03E+05	
		consumab	9.00E+03	1.40E+02			1.26E+06	
		cement &						
		steel	1.64E+02	8.00E+02				1.31E+05
Operation		excavatio	4.00E+05	4.00E+00	1.60E+06			
		backfill	1.95E+05	4.00E+00	7.79E+05			
		burial	6.49E+03	1.60E+01	1.04E+05			
		sand/grav	4.16E+04	1.00E+01	4.16E+05			
		concrete	7.79E+04	6.00E+00	4.67E+05			
		diesel	3.80E+02	1.40E+02			5.32E+04	
		kerosene	3.78E+03	1.40E+02			5.29E+05	
		glass form	1.71E+04	1.40E+02			2.40E+06	
		IX resins	3.00E+00	1.40E+02			4.20E+02	
		NH3	4.38E+02	8.00E+02			3.50E+05	
		HNO3	1.85E+02	8.00E+02			1.48E+05	
		NaOH	1.14E+03	8.00E+02			9.15E+05	
		cement,						
		steel, &						
		chemicals	3.79E+02	8.00E+02				3.03E+05
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.84E+02	1.40E+02			5.38E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier		silt	4.25E+04	3.00E+01	1.28E+06			
		sand/grav	4.72E+04	1.00E+01	4.72E+05			
		basalt	7.19E+04	3.20E+01	2.30E+06			
		diesel	3.35E+03	1.40E+02			4.69E+05	
		asphalt	7.05E+03	1.40E+02			9.87E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					1.15E+07		7.72E+06	4.81E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	7.72E+06	5.00E-02			3.86E+05
	Rail	4.81E+05	5.00E-02			2.40E+04
Suburban	Truck	7.72E+06	5.00E-02		1.15E+07	1.19E+07
	Rail	4.81E+05	5.00E-02			2.40E+04
Rural	Truck	7.72E+06	9.00E-01			6.95E+06
	Rail	4.81E+05	9.00E-01			4.33E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		3.86E+05	2.40E+04	1.19E+07	2.40E+04	6.95E+06	4.33E+05
urban truck fat/km	7.50E-09	2.89E-03					
urban truck inj/km	3.70E-07	1.43E-01					
urban rail fat/km	1.70E-08		4.09E-04				
urban rail inj/km	3.30E-08		7.93E-04				
sub truck fat.km	1.30E-08			1.54E-01			
sub truck inj/km	3.80E-07			4.51E+00			
sub rail fat/km	1.70E-08				4.09E-04		
sub rail inj/km	3.30E-08				7.93E-04		
rural truck fat/km	5.30E-08					3.68E-01	
rural truck inj/km	8.00E-07					5.56E+00	
rural rail fat/km	1.70E-08						7.36E-03
rural rail inj/km	3.30E-08						1.43E-02
				truck fat =	5.25E-01		
				truck inj =	1.02E+01		
	TOTAL FATALITIES	5.33E-01		rail fat =	8.17E-03		
	TOTAL INJURIES	1.02E+01		rail inj =	1.59E-02		

EMPLOYEE VEHICLE

		person-yr	trip/yr	km/trip	car pool	total		
Retrieval								
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+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 emp	8.58E+04					Total km	2.31E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	2.31E+09	8.98E-09	2.08E+01
injuries	2.31E+09	7.14E-07	1.65E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	5.33E-01	2.08E+01	2.13E+01
INJURIES	1.02E+01	1.65E+03	1.66E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.11E+04	=	3.03E+03			
	LWC =	2.45E-02	3.11E+04	=	7.61E+02			
	Fatality =	3.20E-05	3.11E+04	=	9.94E-01		const + ops	
							trc	4.23E+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	5.89E+03						
	FATAL	2.40E+01		fatal	2.74E+00			

		EX SITU NO SEPARATIONS - VITRIFICATION						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.36E+03	1.00E+01	5.36E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant								
Construction		grub/clear	4.25E+03	1.60E+01	6.80E+04			
		excavation	1.30E+05	4.00E+00	5.21E+05			
		backfill	9.38E+04	4.00E+00	3.75E+05			
		sand/grav	1.90E+04	1.00E+01	1.90E+05			
		concrete	3.55E+04	6.00E+00	2.13E+05			
		burial	1.69E+04	1.60E+01	2.70E+05			
		diesel	8.30E+02	1.40E+02			1.16E+05	
		consumab	6.00E+03	1.40E+02			8.40E+05	
		cement &						
		steel	8.20E+01	8.00E+02				6.56E+04
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	6.35E+03	1.60E+01	1.02E+05			
		sand/grav	2.17E+05	1.00E+01	2.17E+06			
		concrete	4.06E+05	6.00E+00	2.44E+06			
		diesel	2.00E+01	1.40E+02			2.80E+03	
		kerosene	4.48E+03	1.40E+02			6.27E+05	
		glass form	1.31E+04	1.40E+02			1.83E+06	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	3.08E+02	8.00E+02			2.46E+05	
		HNO3	2.80E+01	8.00E+02			2.24E+04	
		NaOH	1.20E+01	8.00E+02			9.60E+03	
		cement,						
		steel, &						
		chemicals	6.92E+02	8.00E+02				5.54E+05
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.83E+02	1.40E+02			5.36E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier		silt	3.09E+04	3.00E+01	9.26E+05			
		sand/grav	3.47E+04	1.00E+01	3.47E+05			
		basalt	5.22E+04	3.20E+01	1.67E+06			
		diesel	2.39E+03	1.40E+02			3.35E+05	
		asphalt	5.13E+03	1.40E+02			7.18E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					1.01E+07		5.15E+06	6.66E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	5.15E+06	5.00E-02			2.58E+05		
	Rail	6.66E+05	5.00E-02			3.33E+04		
Suburban	Truck	5.15E+06	5.00E-02		1.01E+07	1.04E+07		
	Rail	6.66E+05	5.00E-02			3.33E+04		
Rural	Truck	5.15E+06	9.00E-01			4.64E+06		
	Rail	6.66E+05	9.00E-01			5.99E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			2.58E+05	3.33E+04	1.04E+07	3.33E+04	4.64E+06	5.99E+05
urban truck fat/km		7.50E-09	1.93E-03					
urban truck inj/km		3.70E-07	9.54E-02					
urban rail fat/km		1.70E-08		5.66E-04				
urban rail inj/km		3.30E-08		1.10E-03				
sub truck fat.km		1.30E-08			1.35E-01			
sub truck inj/km		3.80E-07			3.94E+00			
sub rail fat/km		1.70E-08				5.66E-04		
sub rail inj/km		3.30E-08				1.10E-03		
rural truck fat/km		5.30E-08					2.46E-01	
rural truck inj/km		8.00E-07					3.71E+00	
rural rail fat/km		1.70E-08						1.02E-02
rural rail inj/km		3.30E-08						1.98E-02
					truck fat =	3.83E-01		
					truck inj =	7.74E+00		
	TOTAL FATALITIES		3.94E-01		rail fat =	1.13E-02		
	TOTAL INJURIES		7.77E+00		rail inj =	2.20E-02		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+08		
	Ops/D&D	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/D&D	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		
	total emp	6.73E+04					Total km	1.82E+09

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		3.94E-01	1.63E+01	1.67E+01			
	INJURIES		7.77E+00	1.30E+03	1.30E+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		const + ops	
							trc	3.45E+03
OPERATION ACCIDENTS							fatality	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	4.75E+03						
	FATAL	1.88E+01		fatal	2.15E+00			

			EX SITU NO SEPARATIONS - CALCINATION					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Cal plant								
Construction		grub/clear	4.25E+03	1.60E+01	6.80E+04			
		excavation	1.30E+05	4.00E+00	5.21E+05			
		backfill	9.38E+04	4.00E+00	3.75E+05			
		sand/grav	1.82E+04	1.00E+01	1.82E+05			
		concrete	3.39E+04	6.00E+00	2.03E+05			
		burial	1.69E+04	1.60E+01	2.70E+05			
		diesel	8.30E+02	1.40E+02			1.16E+05	
		consumab	6.00E+03	1.40E+02			8.40E+05	
		cement &						
		steel	8.60E+01	8.00E+02				6.88E+04
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	6.35E+03	1.60E+01	1.02E+05			
		sand/grav	8.59E+04	1.00E+01	8.59E+05			
		concrete	1.60E+05	6.00E+00	9.63E+05			
		diesel	8.00E+00	1.40E+02			1.12E+03	
		kerosene	5.55E+02	1.40E+02			7.77E+04	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	1.59E+03	8.00E+02			1.27E+06	
		HNO3	2.80E+01	8.00E+02			2.24E+04	
		NaOH	1.20E+01	8.00E+02			9.60E+03	
		cement,						
		steel, &						
		chemicals	2.57E+02	8.00E+02				2.06E+05
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.83E+02	1.40E+02			5.36E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier		silt	3.09E+04	3.00E+01	9.26E+05			
		sand/grav	3.47E+04	1.00E+01	3.47E+05			
		basalt	5.22E+04	3.20E+01	1.67E+06			
		diesel	2.39E+03	1.40E+02			3.35E+05	
		asphalt	5.13E+03	1.40E+02			7.18E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					7.30E+06		3.80E+06	3.21E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	3.80E+06	5.00E-02			1.90E+05
	Rail	3.21E+05	5.00E-02			1.60E+04
Suburban	Truck	3.80E+06	5.00E-02		7.30E+06	7.49E+06
	Rail	3.21E+05	5.00E-02			1.60E+04
Rural	Truck	3.80E+06	9.00E-01			3.42E+06
	Rail	3.21E+05	9.00E-01			2.89E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		1.90E+05	1.60E+04	7.49E+06	1.60E+04	3.42E+06	2.89E+05
urban truck fat/km	7.50E-09	1.42E-03					
urban truck inj/km	3.70E-07	7.03E-02					
urban rail fat/km	1.70E-08		2.73E-04				
urban rail inj/km	3.30E-08		5.29E-04				
sub truck fat.km	1.30E-08			9.73E-02			
sub truck inj/km	3.80E-07			2.85E+00			
sub rail fat/km	1.70E-08				2.73E-04		
sub rail inj/km	3.30E-08				5.29E-04		
rural truck fat/km	5.30E-08					1.81E-01	
rural truck inj/km	8.00E-07					2.74E+00	
rural rail fat/km	1.70E-08						4.91E-03
rural rail inj/km	3.30E-08						9.53E-03
				truck fat =	2.80E-01		
				truck inj =	5.65E+00		
	TOTAL FATALITIES	2.85E-01		rail fat =	5.45E-03		
	TOTAL INJURIES	5.66E+00		rail inj =	1.06E-02		

EMPLOYEE VEHICLE

Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+08		
	Ops/D&D	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/D&D	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		
	total emp	6.73E+04					Total km	1.82E+09

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	2.85E-01	1.63E+01	1.66E+01
INJURIES	5.66E+00	1.30E+03	1.30E+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		const + ops	
							trc	3.45E+03
OPERATION ACCIDENTS							fatality	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	4.75E+03						
	FATAL	1.87E+01		fatal	2.15E+00			

		EX SITU EXTENSIVE SEPARATIONS					
Truck and Rail Transport							
					Total Distance		
					onsite	offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	6.25E+02	2.00E+01	1.25E+04			
	diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314	sand/grav	3.25E+02	1.00E+01	3.25E+03			
	excavation	2.29E+03	4.00E+00	9.17E+03			
	backfill	2.75E+03	4.00E+00	1.10E+04			
	grub/clear	3.43E+02	1.60E+01	5.49E+03			
	concrete	6.42E+02	6.00E+00	3.85E+03			
	burial	1.30E+01	1.60E+01	2.08E+02			
	consumab	3.00E+00	1.40E+02			4.20E+02	
	cement	1.10E+01	8.00E+02				8.80E+03
	steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex	sand/grav	5.18E+03	1.00E+01	5.18E+04			
	concrete	9.66E+03	6.00E+00	5.80E+04			
	diesel	7.10E+01	1.40E+02			9.94E+03	
	consumab	2.40E+03	1.40E+02			3.36E+05	
	cement &						
	steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant							
Construction	grub/clear	8.25E+03	1.60E+01	1.32E+05			
	excavation	2.95E+05	4.00E+00	1.18E+06			
	backfill	1.39E+05	4.00E+00	5.57E+05			
	sand/grav	3.86E+04	1.00E+01	3.86E+05			
	concrete	7.21E+04	6.00E+00	4.32E+05			
	burial	1.88E+04	1.60E+01	3.01E+05			
	diesel	1.98E+03	1.40E+02			2.77E+05	
	consumab	7.00E+03	1.40E+02			9.80E+05	
	cement &						
	steel	1.87E+02	8.00E+02				1.50E+05
Operation	excavation	4.00E+05	4.00E+00	1.60E+06			
	backfill	1.95E+05	4.00E+00	7.79E+05			
	burial	6.55E+03	1.60E+01	1.05E+05			
	sand/grav	3.41E+04	1.00E+01	3.41E+05			
	concrete	6.37E+04	6.00E+00	3.82E+05			
	diesel	3.81E+02	1.40E+02			5.33E+04	
	kerosene	9.89E+03	1.40E+02			1.38E+06	
	glass form	1.58E+04	1.40E+02			2.21E+06	
	IX resins	5.60E+01	1.40E+02			7.84E+03	
	NH3	4.07E+02	8.00E+02			3.26E+05	
	HNO3	2.05E+04	8.00E+02			1.64E+07	
	NaOH	6.60E+03	8.00E+02			5.28E+06	
	cement,						
	steel, &						
	chemicals	4.75E+02	8.00E+02				3.80E+05
Closure							
Grout tank domes,	sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &	concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.	diesel	3.83E+02	1.40E+02			5.36E+04	
	cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks	gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier	silt	4.64E+04	3.00E+01	1.39E+06			
	sand/grav	4.76E+04	1.00E+01	4.76E+05			
	basalt	7.84E+04	3.20E+01	2.51E+06			
	diesel	3.38E+03	1.40E+02			4.73E+05	
	asphalt	7.69E+03	1.40E+02			1.08E+06	
	fabric	2.00E+00	8.00E+02			1.60E+03	
				truck-on	rail-on	truck-off	rail-off
TOTAL km				1.14E+07		2.88E+07	5.76E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	2.88E+07	5.00E-02			1.44E+06		
	Rail	5.76E+05	5.00E-02			2.88E+04		
Suburban	Truck	2.88E+07	5.00E-02		1.14E+07	1.28E+07		
	Rail	5.76E+05	5.00E-02			2.88E+04		
Rural	Truck	2.88E+07	9.00E-01			2.60E+07		
	Rail	5.76E+05	9.00E-01			5.18E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.44E+06	2.88E+04	1.28E+07	2.88E+04	2.60E+07	5.18E+05
urban truck fat/km		7.50E-09	1.08E-02					
urban truck inj/km		3.70E-07	5.34E-01					
urban rail fat/km		1.70E-08		4.90E-04				
urban rail inj/km		3.30E-08		9.50E-04				
sub truck fat.km		1.30E-08			1.67E-01			
sub truck inj/km		3.80E-07			4.87E+00			
sub rail fat/km		1.70E-08				4.90E-04		
sub rail inj/km		3.30E-08				9.50E-04		
rural truck fat/km		5.30E-08					1.38E+00	
rural truck inj/km		8.00E-07					2.08E+01	
rural rail fat/km		1.70E-08						8.81E-03
rural rail inj/km		3.30E-08						1.71E-02
					truck fat =	1.55E+00		
					truck inj =	2.62E+01		
	TOTAL FATALITIES		1.56E+00		rail fat =	9.79E-03		
	TOTAL INJURIES		2.62E+01		rail inj =	1.90E-02		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+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 emp	8.14E+04					Total km	2.20E+09

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.20E+09	8.98E-09	1.97E+01				
	injuries	2.20E+09	7.14E-07	1.57E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.56E+00	1.97E+01	2.13E+01			
	INJURIES		2.62E+01	1.57E+03	1.59E+03			

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.71E+04	=	3.61E+03			
	LWC =	2.45E-02	3.71E+04	=	9.08E+02			
	Fatality =	3.20E-05	3.71E+04	=	1.19E+00		const + ops	
							trc	4.59E+03
OPERATION ACCIDENTS							fatality	2.60E+00
		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	6.18E+03						
	FATAL	2.39E+01		fatal	2.60E+00			

			EX SITU/IN SITU COMBINATION 1					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	2.00E+01	0.00E+00			
		diesel	0.00E+00	1.40E+02			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	2.59E+03	1.00E+01	2.59E+04			
		concrete	4.83E+03	6.00E+00	2.90E+04			
		diesel	4.30E+01	1.40E+02			6.02E+03	
		consumab	1.80E+03	1.40E+02			2.52E+05	
		cement &						
		steel	9.00E+00	8.00E+02				7.20E+03
Remediate -Vit plant								
Construction		grub/clear	5.25E+03	1.60E+01	8.40E+04			
		excavation	2.07E+05	4.00E+00	8.26E+05			
		backfill	9.83E+04	4.00E+00	3.93E+05			
		sand/grav	2.43E+04	1.00E+01	2.43E+05			
		concrete	4.54E+04	6.00E+00	2.72E+05			
		burial	1.47E+04	1.60E+01	2.36E+05			
		diesel	1.87E+03	1.40E+02			2.62E+05	
		consumab	5.60E+03	1.40E+02			7.84E+05	
		cement &						
		steel	8.70E+01	8.00E+02				6.96E+04
Operation		excavation	1.20E+05	4.00E+00	4.79E+05			
		backfill	8.22E+04	4.00E+00	3.29E+05			
		burial	6.56E+03	1.60E+01	1.05E+05			
		sand/grav	2.19E+04	1.00E+01	2.19E+05			
		concrete	4.09E+04	6.00E+00	2.46E+05			
		diesel	4.48E+02	1.40E+02			6.27E+04	
		kerosene	2.13E+03	1.40E+02			2.99E+05	
		glass form	1.16E+04	1.40E+02			1.62E+06	
		IX resins	2.00E+00	1.40E+02			2.80E+02	
		NH3	1.94E+02	8.00E+02			1.55E+05	
		HNO3	9.30E+01	8.00E+02			7.44E+04	
		NaOH	5.72E+02	8.00E+02			4.58E+05	
		cement,						
		steel, &						
		chemicals	2.26E+02	8.00E+02				1.81E+05
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.83E+02	1.40E+02			5.36E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier		silt	3.86E+04	3.00E+01	1.16E+06			
		sand/grav	4.21E+04	1.00E+01	4.21E+05			
		basalt	6.42E+04	3.20E+01	2.06E+06			
		diesel	2.81E+03	1.40E+02			3.93E+05	
		asphalt	6.41E+03	1.40E+02			8.97E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					7.81E+06		5.32E+06	2.88E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	5.32E+06	5.00E-02			2.66E+05
	Rail	2.88E+05	5.00E-02			1.44E+04
Suburban	Truck	5.32E+06	5.00E-02		7.81E+06	8.08E+06
	Rail	2.88E+05	5.00E-02			1.44E+04
Rural	Truck	5.32E+06	9.00E-01			4.79E+06
	Rail	2.88E+05	9.00E-01			2.59E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		2.66E+05	1.44E+04	8.08E+06	1.44E+04	4.79E+06	2.59E+05
urban truck fat/km	7.50E-09	1.99E-03					
urban truck inj/km	3.70E-07	9.84E-02					
urban rail fat/km	1.70E-08		2.45E-04				
urban rail inj/km	3.30E-08		4.75E-04				
sub truck fat.km	1.30E-08			1.05E-01			
sub truck inj/km	3.80E-07			3.07E+00			
sub rail fat/km	1.70E-08				2.45E-04		
sub rail inj/km	3.30E-08				4.75E-04		
rural truck fat/km	5.30E-08					2.54E-01	
rural truck inj/km	8.00E-07					3.83E+00	
rural rail fat/km	1.70E-08						4.41E-03
rural rail inj/km	3.30E-08						8.55E-03
				truck fat =	3.61E-01		
				truck inj =	7.00E+00		
	TOTAL FATALITIES	3.66E-01		rail fat =	4.90E-03		
	TOTAL INJURIES	7.01E+00		rail inj =	9.50E-03		

EMPLOYEE VEHICLE

		person-yr	trip/yr	km/trip	car pool	total		
Retrieval								
	Const.	4.24E+03	2.60E+02	1.40E+02	7.41E-01	1.14E+08		
	Ops/D&D	1.63E+04	2.60E+02	1.40E+02	7.41E-01	4.38E+08		
Vitrification and fill and cap								
	Const.	1.60E+04	2.60E+02	1.40E+02	7.41E-01	4.32E+08		
	Ops/D&D	3.63E+04	2.60E+02	1.40E+02	7.41E-01	9.78E+08		
Closure		4.80E+02	2.60E+02	1.40E+02	7.41E-01	1.29E+07		
	total emp	7.32E+04					Total km	1.97E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	1.97E+09	8.98E-09	1.77E+01
injuries	1.97E+09	7.14E-07	1.41E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	3.66E-01	1.77E+01	1.81E+01
INJURIES	7.01E+00	1.41E+03	1.42E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.07E+04	=	2.02E+03			
	LWC =	2.45E-02	2.07E+04	=	5.08E+02			
	Fatality =	3.20E-05	2.07E+04	=	6.63E-01		const + ops	
							trc	3.18E+03
OPERATION ACCIDENTS							fatality	2.34E+00
		rate	person-yr					
	TRC =	2.20E-02	5.25E+04	=	1.16E+03			
	LWC =	1.10E-02	5.25E+04	=	5.78E+02			
	Fatality =	3.20E-05	5.25E+04	=	1.68E+00			
TOTALS				excluding employee traffic				
	INJUR	4.59E+03						
	FATAL	2.04E+01		fatal	2.34E+00			

			EX SITU/IN SITU COMBINATION 2					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	1.82E+03	1.00E+01	1.82E+04			
		concrete	3.39E+03	6.00E+00	2.03E+04			
		diesel	3.10E+01	1.40E+02			4.34E+03	
		consumab	1.20E+03	1.40E+02			1.68E+05	
		cement &						
		steel	7.00E+00	8.00E+02				5.60E+03
Remediate -Vit plant								
Construction		grub/clear	3.70E+03	1.60E+01	5.92E+04			
		excavation	1.45E+05	4.00E+00	5.79E+05			
		backfill	6.88E+04	4.00E+00	2.75E+05			
		sand/grav	1.49E+04	1.00E+01	1.49E+05			
		concrete	2.78E+04	6.00E+00	1.67E+05			
		burial	1.04E+04	1.60E+01	1.67E+05			
		diesel	9.91E+02	1.40E+02			1.39E+05	
		consumab	4.00E+03	1.40E+02			5.60E+05	
		cement &						
		steel	5.80E+01	8.00E+02				4.64E+04
Operation		excavation	1.20E+05	4.00E+00	4.79E+05			
		backfill	8.22E+04	4.00E+00	3.29E+05			
		burial	6.49E+03	1.60E+01	1.04E+05			
		sand/grav	1.52E+04	1.00E+01	1.52E+05			
		concrete	2.83E+04	6.00E+00	1.70E+05			
		diesel	2.26E+02	1.40E+02			3.16E+04	
		kerosene	1.24E+03	1.40E+02			1.73E+05	
		glass form	6.76E+03	1.40E+02			9.46E+05	
		IX resins	1.00E+00	1.40E+02			1.40E+02	
		NH3	1.30E+02	8.00E+02			1.04E+05	
		HNO3	5.40E+01	8.00E+02			4.32E+04	
		NaOH	3.32E+02	8.00E+02			2.66E+05	
		cement,						
		steel, &						
		chemicals	1.21E+02	8.00E+02				9.68E+04
Closure								
Grout tank domes,		sand/grav	1.66E+03	1.00E+01	1.66E+04			
MUSTs, &		concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.		diesel	3.83E+02	1.40E+02			5.36E+04	
		cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks		gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier		silt	3.48E+04	3.00E+01	1.04E+06			
		sand/grav	3.93E+04	1.00E+01	3.93E+05			
		basalt	5.88E+04	3.20E+01	1.88E+06			
		diesel	2.72E+03	1.40E+02			3.80E+05	
		asphalt	5.77E+03	1.40E+02			8.07E+05	
		fabric	2.00E+00	8.00E+02			1.60E+03	
					tuck-on	rail-on	truck-off	rail-off
TOTAL km					6.67E+06		3.68E+06	1.79E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	3.68E+06	5.00E-02			1.84E+05		
	Rail	1.79E+05	5.00E-02			8.96E+03		
Suburban	Truck	3.68E+06	5.00E-02		6.67E+06	6.86E+06		
	Rail	1.79E+05	5.00E-02			8.96E+03		
Rural	Truck	3.68E+06	9.00E-01			3.31E+06		
	Rail	1.79E+05	9.00E-01			1.61E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		1.84E+05	8.96E+03	6.86E+06	8.96E+03	3.31E+06	1.61E+05
urban truck fat/km	7.50E-09	1.38E-03					
urban truck inj/km	3.70E-07	6.80E-02					
urban rail fat/km	1.70E-08		1.52E-04				
urban rail inj/km	3.30E-08		2.96E-04				
sub truck fat.km	1.30E-08			8.92E-02			
sub truck inj/km	3.80E-07			2.61E+00			
sub rail fat/km	1.70E-08				1.52E-04		
sub rail inj/km	3.30E-08				2.96E-04		
rural truck fat/km	5.30E-08					1.75E-01	
rural truck inj/km	8.00E-07					2.65E+00	
rural rail fat/km	1.70E-08						2.74E-03
rural rail inj/km	3.30E-08						5.32E-03
				truck fat =	2.66E-01		
				truck inj =	5.32E+00		
	TOTAL FATALITIES	2.69E-01		rail fat =	3.05E-03		
	TOTAL INJURIES	5.33E+00		rail inj =	5.91E-03		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.44E+03	2.60E+02	1.40E+02	7.41E-01	3.88E+07		
	Ops/D&D	9.16E+03	2.60E+02	1.40E+02	7.41E-01	2.47E+08		
Vitrification								
	Const.	1.60E+04	2.60E+02	1.40E+02	7.41E-01	4.32E+08		
	Ops/D&D	2.66E+04	2.60E+02	1.40E+02	7.41E-01	7.17E+08		
Closure		4.30E+02	2.60E+02	1.40E+02	7.41E-01	1.16E+07		
	total emp	5.36E+04					Total km	1.45E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	1.45E+09	8.98E-09	1.30E+01
injuries	1.45E+09	7.14E-07	1.03E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	2.69E-01	1.30E+01	1.33E+01
INJURIES	5.33E+00	1.03E+03	1.04E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.79E+04	=	1.74E+03			
	LWC =	2.45E-02	1.79E+04	=	4.38E+02			
	Fatality =	3.20E-05	1.79E+04	=	5.72E-01		const + ops	
							trc	2.53E+03
OPERATION ACCIDENTS							fatality	1.72E+00
		rate	person-yr					
	TRC =	2.20E-02	3.58E+04	=	7.87E+02			
	LWC =	1.10E-02	3.58E+04	=	3.93E+02			
	Fatality =	3.20E-05	3.58E+04	=	1.14E+00			
TOTALS				excluding employee traffic				
	INJUR	3.57E+03						
	FATAL	1.50E+01		fatal	1.72E+00			

		PHASE I IMPLEMENTATION						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &	0.00E+00	0.00E+00				
		steel	0.00E+00	0.00E+00				0.00E+00
Remediate -Vit plant								
Construction		grub/clear	8.00E+02	1.60E+01	1.28E+04			
		excavation	4.50E+04	4.00E+00	1.80E+05			
		backfill	5.51E+03	4.00E+00	2.21E+04			
		sand/grav	2.09E+03	1.00E+01	2.09E+04			
		concrete	3.93E+03	6.00E+00	2.36E+04			
		burial	3.60E+03	1.60E+01	5.76E+04			
		diesel	1.30E+03	1.40E+02			1.81E+05	
		consumab	1.60E+03	1.40E+02			2.24E+05	
		cement &						
		steel	8.90E+01	8.00E+02				7.12E+04
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	6.65E+02	1.60E+01	1.06E+04			
		sand/grav	5.32E+02	1.00E+01	5.32E+03			
		concrete	9.94E+02	6.00E+00	5.96E+03			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		kerosene	5.20E+01	1.40E+02			7.28E+03	
		glass form	4.11E+03	1.40E+02			5.75E+05	
		IX resins	1.00E+00	1.40E+02			1.40E+02	
		NH3	7.90E+01	8.00E+02			6.32E+04	
		HNO3	3.80E+01	8.00E+02			3.04E+04	
		NaOH	2.31E+02	8.00E+02			1.85E+05	
		cement,						
		steel, &						
		chemicals	4.80E+01	8.00E+02				3.84E+04
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
Vit waste transport								
temporary storage		HLW	1.07E+02	1.00E+01	1.07E+03			
storage		LAW	6.10E+03	2.00E+00	1.22E+04			
					truck-on	rail-on	truck-off	rail-off
TOTAL km					3.85E+05		1.27E+06	1.38E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	1.27E+06	5.00E-02			6.33E+04
	Rail	1.38E+05	5.00E-02			6.88E+03
Suburban	Truck	1.27E+06	5.00E-02		3.85E+05	4.49E+05
	Rail	1.38E+05	5.00E-02			6.88E+03
Rural	Truck	1.27E+06	9.00E-01			1.14E+06
	Rail	1.38E+05	9.00E-01			1.24E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		6.33E+04	6.88E+03	4.49E+05	6.88E+03	1.14E+06	1.24E+05
urban truck fat/km	7.50E-09	4.75E-04					
urban truck inj/km	3.70E-07	2.34E-02					
urban rail fat/km	1.70E-08		1.17E-04				
urban rail inj/km	3.30E-08		2.27E-04				
sub truck fat.km	1.30E-08			5.83E-03			
sub truck inj/km	3.80E-07			1.70E-01			
sub rail fat/km	1.70E-08				1.17E-04		
sub rail inj/km	3.30E-08				2.27E-04		
rural truck fat/km	5.30E-08					6.04E-02	
rural truck inj/km	8.00E-07					9.12E-01	
rural rail fat/km	1.70E-08						2.11E-03
rural rail inj/km	3.30E-08						4.09E-03
				truck fat =	6.67E-02		
				truck inj =	1.11E+00		
	TOTAL FATALITIES	6.90E-02		rail fat =	2.34E-03		
	TOTAL INJURIES	1.11E+00		rail inj =	4.54E-03		

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		
Const.	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
Ops/D&D	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
total emp	1.76E+04					Total km	4.76E+08

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	6.90E-02	4.27E+00	4.34E+00
INJURIES	1.11E+00	3.40E+02	3.41E+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		const + ops	
							trc	1.20E+03
OPERATION ACCIDENTS							fatality	5.64E-01
		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				excluding employee traffic				
	INJUR	1.54E+03						
	FATAL	4.90E+00		fatal	5.64E-01			

		TOTAL ALTERNATIVE					
Truck and Rail Transport							
				Total Distance			
				onsite		offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	6.25E+02	2.00E+01	1.25E+04			
	diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314	sand/grav	3.25E+02	1.00E+01	3.25E+03			
	excavation	2.29E+03	4.00E+00	9.17E+03			
	backfill	2.75E+03	4.00E+00	1.10E+04			
	grub/clear	3.43E+02	1.60E+01	5.49E+03			
	concrete	6.42E+02	6.00E+00	3.85E+03			
	burial	1.30E+01	1.60E+01	2.08E+02			
	consumab	3.00E+00	1.40E+02			4.20E+02	
	cement	1.10E+01	8.00E+02				8.80E+03
	steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex	sand/grav	5.18E+03	1.00E+01	5.18E+04			
	concrete	9.66E+03	6.00E+00	5.80E+04			
	diesel	7.20E+01	1.40E+02			1.01E+04	
	consumab	2.40E+03	1.40E+02			3.36E+05	
	cement &						
	steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant							
Construction	grub/clear	7.25E+03	1.60E+01	1.16E+05			
	excavation	3.78E+05	4.00E+00	1.51E+06			
	backfill	2.67E+05	4.00E+00	1.07E+06			
	sand/grav	5.74E+04	1.00E+01	5.74E+05			
	concrete	1.07E+05	6.00E+00	6.45E+05			
	burial	1.88E+04	1.60E+01	3.01E+05			
	diesel	1.98E+03	1.40E+02			2.77E+05	
	consumab	7.00E+03	1.40E+02			9.80E+05	
	cement &						
	steel	2.22E+02	8.00E+02				1.78E+05
Operation	excavation	4.00E+05	4.00E+00	1.60E+06			
	backfill	1.95E+05	4.00E+00	7.79E+05			
	burial	6.49E+03	1.60E+01	1.04E+05			
	sand/grav	3.57E+04	1.00E+01	3.57E+05			
	concrete	6.66E+04	6.00E+00	4.00E+05			
	diesel	4.32E+02	1.40E+02			6.05E+04	
	kerosene	3.42E+03	1.40E+02			4.79E+05	
	glass form	1.69E+04	1.40E+02			2.37E+06	
	IX resins	3.00E+00	1.40E+02			4.20E+02	
	NH3	4.32E+02	8.00E+02			3.46E+05	
	HNO3	1.83E+02	8.00E+02			1.46E+05	
	NaOH	1.13E+03	8.00E+02			9.02E+05	
	cement,						
	steel, &						
	chemicals	3.54E+02	8.00E+02				2.83E+05
Closure							
Grout tank domes,	sand/grav	1.61E+03	1.00E+01	1.61E+04			
MUSTs, &	concrete	3.11E+03	6.00E+00	1.87E+04			
ancellary equip.	diesel	3.83E+02	1.40E+02			5.36E+04	
	cement	3.00E+00	8.00E+02				2.40E+03
Gravel fill tanks	gravel	6.21E+04	1.00E+01	6.21E+05			
Barrier	silt	4.64E+04	3.00E+01	1.39E+06			
	sand/grav	4.76E+04	1.00E+01	4.76E+05			
	basalt	7.84E+04	3.20E+01	2.51E+06			
	diesel	3.32E+03	1.40E+02			4.65E+05	
	asphalt	7.69E+03	1.40E+02			1.08E+06	
	fabric	2.00E+00	8.00E+02			1.60E+03	
Vit waste transport							
temporary storage	HLW	1.07E+02	8.00E+00				
storage	LAW	6.10E+02	4.00E+00				
				truck-on	rail-on	truck-off	rail-off
TOTAL km				1.26E+07		7.51E+06	5.07E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	7.51E+06	5.00E-02			3.76E+05		
	Rail	5.07E+05	5.00E-02			2.54E+04		
Suburban	Truck	7.51E+06	5.00E-02		1.26E+07	1.30E+07		
	Rail	5.07E+05	5.00E-02			2.54E+04		
Rural	Truck	7.51E+06	9.00E-01			6.76E+06		
	Rail	5.07E+05	9.00E-01			4.56E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		3.76E+05	2.54E+04	1.30E+07	2.54E+04	6.76E+06	4.56E+05
urban truck fat/km	7.50E-09	2.82E-03					
urban truck inj/km	3.70E-07	1.39E-01					
urban rail fat/km	1.70E-08		4.31E-04				
urban rail inj/km	3.30E-08		8.37E-04				
sub truck fat.km	1.30E-08			1.69E-01			
sub truck inj/km	3.80E-07			4.95E+00			
sub rail fat/km	1.70E-08				4.31E-04		
sub rail inj/km	3.30E-08				8.37E-04		
rural truck fat/km	5.30E-08					3.58E-01	
rural truck inj/km	8.00E-07					5.41E+00	
rural rail fat/km	1.70E-08						7.76E-03
rural rail inj/km	3.30E-08						1.51E-02
				truck fat =	5.30E-01		
				truck inj =	1.05E+01		
	TOTAL FATALITIES	5.39E-01		rail fat =	8.62E-03		
	TOTAL INJURIES	1.05E+01		rail inj =	1.67E-02		

EMPLOYEE VEHICLE

		person-yr	trip/yr	km/trip	car pool	total		
Retrieval								
	Const.	8.98E+03	2.60E+02	1.40E+02	7.41E-01	2.42E+08		
	Ops/D&D	3.11E+04	2.60E+02	1.40E+02	7.41E-01	8.39E+08		
Vitrification								
	Const.	3.33E+04	2.60E+02	1.40E+02	7.41E-01	8.97E+08		
	Ops/D&D	5.44E+04	2.60E+02	1.40E+02	7.41E-01	1.47E+09		
Closure		5.76E+02	2.60E+02	1.40E+02	7.41E-01	1.55E+07		
	total emp	1.28E+05					Total km	3.46E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	3.46E+09	8.98E-09	3.11E+01
injuries	3.46E+09	7.14E-07	2.47E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	5.39E-01	3.11E+01	3.16E+01
INJURIES	1.05E+01	2.47E+03	2.48E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	4.28E+04	=	4.17E+03			
	LWC =	2.45E-02	4.28E+04	=	1.05E+03			
	Fatality =	3.20E-05	4.28E+04	=	1.37E+00		const + ops	
							trc	6.06E+03
OPERATION ACCIDENTS							fatality	4.11E+00
		rate	person-yr					
	TRC =	2.20E-02	8.55E+04	=	1.88E+03			
	LWC =	1.10E-02	8.55E+04	=	9.41E+02			
	Fatality =	3.20E-05	8.55E+04	=	2.74E+00			
TOTALS				excluding employee traffic				
	INJUR	8.54E+03						
	FATAL	3.57E+01		fatal	4.11E+00			

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Safety: Nonradiological /Nontoxicological Occupational Accidents Including transportation for No Closure

ORIGINATOR Michael Harker DATE ~~02/12/96~~ 7-28-96

REVISION NO. 1 0

OBJECTIVE Show injuries and fatalities from construction operation, and transportation accidents. Replaces Old Calcs. for the TWRS EIS Rev. C. D

METHODOLOGY See attachments

ASSUMPTIONS See attachments

Occupational injury and fatality rates were taken from the Occupational Injuries Summary Report, January - Dec. 1993 DOE/EH/01570-H5. Truck and Rail Transport incidence rates are from Non-Radiological Impacts of transporting radioactive material. SAND81-1703, 1982. Employee Transportation incidence rates are from 1993 Washington State Highway Accident Report. Round Trip distance from Tri-Cities=1.40E+02 km from Portland/Seattle=8.00E+02 km. Carpool factor of 1.35/car from SIS EIS DOE/EIS-0212 1994.

(Continue on another sheet if necessary)

3-18-96
SIGNATURE/DATE

C Henderson 3·19·96
CHECKED/DATE

Doretta Chow 8/28/96.

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\NONRAD.TOX\CALCVR.SHT

		NO ACTION						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		grub/clear	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		burial	0.00E+00	0.00E+00	0.00E+00			
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
		steel	0.00E+00	0.00E+00				0.00E+00
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Remediate -Vit plant								
Construction		grub/clear	0.00E+00	0.00E+00	0.00E+00			
		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		burial	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	4.91E+03	1.60E+01	7.86E+04			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	1.16E+03	1.40E+02			1.63E+05	
		kerosene	0.00E+00	0.00E+00			0.00E+00	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	0.00E+00	0.00E+00			0.00E+00	
		HNO3	0.00E+00	0.00E+00			0.00E+00	
		NaOH	0.00E+00	0.00E+00			0.00E+00	
		steel	7.40E+01	1.40E+02			1.04E+04	
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					7.86E+04		1.73E+05	0.00E+00

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	1.73E+05	5.00E-02			8.65E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban	Truck	1.73E+05	5.00E-02		7.86E+04	8.73E+04		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural	Truck	1.73E+05	9.00E-01			1.56E+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
			8.65E+03	0.00E+00	8.73E+04	0.00E+00	1.56E+05	0.00E+00
urban truck fat/km		7.50E-09	6.49E-05					
urban truck inj/km		3.70E-07	3.20E-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			1.13E-03			
sub truck inj/km		3.80E-07			3.32E-02			
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					8.25E-03	
rural truck inj/km		8.00E-07					1.25E-01	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
					truck fat =	9.45E-03		
					truck inj =	1.61E-01		
	TOTAL FATALITIES		9.45E-03		rail fat =	0.00E+00		
	TOTAL INJURIES		1.61E-01		rail inj =	0.00E+00		

EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
Vitrification								
	Const.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Ops/D&D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	1.04E+05					Total km	2.81E+09

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				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		9.45E-03	2.52E+01	2.52E+01			
	INJURIES		1.61E-01	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		const + ops	
							trc	2.29E+03
OPERATION ACCIDENTS							fatality	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				excluding employee traffic				
	INJUR	4.29E+03						
	FATAL	2.85E+01		fatal	3.33E+00			

		LONG TERM MANAGEMENT						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
New tanks								
Construction		grub/clear	6.00E+03	1.60E+01	9.60E+04			
		excavation	4.42E+05	4.00E+00	1.77E+06			
		backfill	4.26E+05	4.00E+00	1.70E+06			
		sand/grav	3.07E+04	1.00E+01	3.07E+05			
		concrete	4.81E+04	6.00E+00	2.89E+05			
		burial	4.80E+03	1.60E+01	7.68E+04			
		diesel	7.87E+03	1.40E+02			1.10E+06	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement	9.63E+02	8.00E+02				7.70E+05
		steel	2.98E+02	8.00E+02				2.38E+05
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	4.91E+03	1.60E+01	7.86E+04			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	1.16E+03	1.40E+02			1.63E+05	
		kerosene	0.00E+00	0.00E+00			0.00E+00	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	0.00E+00	0.00E+00			0.00E+00	
		HNO3	0.00E+00	0.00E+00			0.00E+00	
		NaOH	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				
		steel	7.40E+01	1.40E+02			1.04E+04	
		chemicals	0.00E+00	0.00E+00				0.00E+00
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					4.35E+06		1.61E+06	1.04E+06

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	1.61E+06	5.00E-02			8.05E+04		
	Rail	1.04E+06	5.00E-02			5.18E+04		
Suburban	Truck	1.61E+06	5.00E-02		4.35E+06	4.43E+06		
	Rail	1.04E+06	5.00E-02			5.18E+04		
Rural	Truck	1.61E+06	9.00E-01			1.45E+06		
	Rail	1.04E+06	9.00E-01			9.33E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			8.05E+04	5.18E+04	4.43E+06	5.18E+04	1.45E+06	9.33E+05
urban truck fat/km		7.50E-09	6.04E-04					
urban truck inj/km		3.70E-07	2.98E-02					
urban rail fat/km		1.70E-08		8.81E-04				
urban rail inj/km		3.30E-08		1.71E-03				
sub truck fat.km		1.30E-08			5.76E-02			
sub truck inj/km		3.80E-07			1.68E+00			
sub rail fat/km		1.70E-08				8.81E-04		
sub rail inj/km		3.30E-08				1.71E-03		
rural truck fat/km		5.30E-08					7.68E-02	
rural truck inj/km		8.00E-07					1.16E+00	
rural rail fat/km		1.70E-08						1.59E-02
rural rail inj/km		3.30E-08						3.08E-02
					truck fat =	1.35E-01		
					truck inj =	2.87E+00		
	TOTAL FATALITIES		1.53E-01		rail fat =	1.76E-02		
	TOTAL INJURIES		2.91E+00		rail inj =	3.42E-02		

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		
Vitrification								
	Const.	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	Ops/D&D	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total emp	1.08E+05					Total km	2.91E+09

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

Cumulative fatalities/injuries from traffic impacts				
		transport	employee	TOTAL
	FATALITIES	1.53E-01	2.61E+01	2.63E+01
	INJURIES	2.91E+00	2.08E+03	2.08E+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		const + ops	
							trc	2.65E+03
OPERATION ACCIDENTS							fatality	3.45E+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				excluding employee traffic				
	INJUR	4.73E+03						
	FATAL	2.97E+01		fatal	3.45E+00			

			IN SITU FILL AND CAP					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Remediate -fill/cap								
Construction		grub/clear	2.25E+03	1.60E+01	3.60E+04			
		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		burial	2.40E+03	1.60E+01	3.84E+04			
		diesel	7.40E+01	1.40E+02			1.04E+04	
		consumab	1.20E+03	1.40E+02			1.68E+05	
		cement &						
		steel	0.00E+00	0.00E+00				0.00E+00
Operation - tank fill		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	4.91E+03	1.60E+01	7.86E+04			
		sand/grav	6.17E+04	1.00E+01	6.17E+05			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	3.22E+02	1.40E+02			4.51E+04	
		kerosene	0.00E+00	0.00E+00			0.00E+00	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	0.00E+00	0.00E+00			0.00E+00	
		HNO3	0.00E+00	0.00E+00			0.00E+00	
		NaOH	0.00E+00	0.00E+00			0.00E+00	
		cement,						
		steel, &						
		chemicals	0.00E+00	0.00E+00				0.00E+00
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					8.03E+05		2.24E+05	2.80E+04

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	2.24E+05	5.00E-02			1.12E+04		
	Rail	2.80E+04	5.00E-02			1.40E+03		
Suburban	Truck	2.24E+05	5.00E-02		8.03E+05	8.15E+05		
	Rail	2.80E+04	5.00E-02			1.40E+03		
Rural	Truck	2.24E+05	9.00E-01			2.01E+05		
	Rail	2.80E+04	9.00E-01			2.52E+04		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.12E+04	1.40E+03	8.15E+05	1.40E+03	2.01E+05	2.52E+04
urban truck fat/km		7.50E-09	8.39E-05					
urban truck inj/km		3.70E-07	4.14E-03					
urban rail fat/km		1.70E-08		2.38E-05				
urban rail inj/km		3.30E-08		4.62E-05				
sub truck fat.km		1.30E-08			1.06E-02			
sub truck inj/km		3.80E-07			3.10E-01			
sub rail fat/km		1.70E-08				2.38E-05		
sub rail inj/km		3.30E-08				4.62E-05		
rural truck fat/km		5.30E-08					1.07E-02	
rural truck inj/km		8.00E-07					1.61E-01	
rural rail fat/km		1.70E-08						4.28E-04
rural rail inj/km		3.30E-08						8.32E-04
					truck fat =	2.14E-02		
					truck inj =	4.75E-01		
	TOTAL FATALITIES		2.18E-02		rail fat =	4.76E-04		
	TOTAL INJURIES		4.76E-01		rail inj =	9.24E-04		

EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	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		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	2.57E+04					Total km	6.92E+08

Fatalities/Injuries resulting from Employee vehicle accidents				
	km	rate/km	TOTAL	
fatalities	6.92E+08	8.98E-09	6.22E+00	
injuries	6.92E+08	7.14E-07	4.94E+02	

Cumulative fatalities/injuries from traffic impacts				
	transport	employee	TOTAL	
FATALITIES	2.18E-02	6.22E+00	6.24E+00	
INJURIES	4.76E-01	4.94E+02	4.95E+02	

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.58E+02	=	2.52E+01			
	LWC =	2.45E-02	2.58E+02	=	6.32E+00			
	Fatality =	3.20E-05	2.58E+02	=	8.26E-03		const + ops	
							trc	5.84E+02
OPERATION ACCIDENTS							fatality	8.21E-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	1.08E+03						
	FATAL	7.06E+00		fatal	8.21E-01			

	IN SITU VITRIFICATION						
Truck and Rail Transport							
				Total Distance			
				onsite		offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314	sand/grav	3.25E+02	1.00E+01	3.25E+03			
	excavation	2.29E+03	4.00E+00	9.17E+03			
	backfill	2.75E+03	4.00E+00	1.10E+04			
	grub/clear	3.43E+02	1.60E+01	5.49E+03			
	concrete	6.42E+02	6.00E+00	3.85E+03			
	burial	1.30E+01	1.60E+01	2.08E+02			
	consumab	3.00E+00	1.40E+02			4.20E+02	
	cement	1.10E+01	8.00E+02				8.80E+03
	steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	concrete	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	consumab	0.00E+00	0.00E+00			0.00E+00	
	cement &						
	steel	0.00E+00	0.00E+00				0.00E+00
Remediate -Insitu vit.							
Construction	grub/clear	6.88E+03	1.60E+01	1.10E+05			
	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	1.14E+04	1.00E+01	1.14E+05			
	concrete	2.13E+04	6.00E+00	1.28E+05			
	burial	1.80E+04	1.60E+01	2.88E+05			
	diesel	1.85E+03	1.40E+02			2.59E+05	
	consumab	9.00E+03	1.40E+02			1.26E+06	
	cement &						
	steel	2.50E+02	8.00E+02				2.00E+05
Operation	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	burial	4.91E+03	1.60E+01	7.86E+04			
	sand/grav	2.38E+04	1.00E+01	2.38E+05			
	concrete	0.00E+00	6.00E+00	0.00E+00			
	diesel	3.22E+02	1.40E+02			4.51E+04	
	kerosene	0.00E+00	0.00E+00			0.00E+00	
	glass form	6.00E+00	8.00E+02				4.80E+03
	IX resins	0.00E+00	0.00E+00			0.00E+00	
	NH3	3.00E+02	1.40E+02			4.20E+04	
	HNO3	0.00E+00	0.00E+00			0.00E+00	
	NaOH	0.00E+00	0.00E+00			0.00E+00	
	cement,						
	steel, &						
	chemicals	0.00E+00	0.00E+00				0.00E+00
Closure							
Grout tank domes,	sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &	concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.	diesel	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks	gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier	silt	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	basalt	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	asphalt	0.00E+00	0.00E+00			0.00E+00	
	fabric	0.00E+00	0.00E+00			0.00E+00	
				truck-on	rail-on	truck-off	rail-off
TOTAL km				9.89E+05		1.61E+06	2.33E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	1.61E+06	5.00E-02			8.03E+04		
	Rail	2.33E+05	5.00E-02			1.16E+04		
Suburban	Truck	1.61E+06	5.00E-02		9.89E+05	1.07E+06		
	Rail	2.33E+05	5.00E-02			1.16E+04		
Rural	Truck	1.61E+06	9.00E-01			1.45E+06		
	Rail	2.33E+05	9.00E-01			2.10E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			8.03E+04	1.16E+04	1.07E+06	1.16E+04	1.45E+06	2.10E+05
urban truck fat/km		7.50E-09	6.02E-04					
urban truck inj/km		3.70E-07	2.97E-02					
urban rail fat/km		1.70E-08		1.98E-04				
urban rail inj/km		3.30E-08		3.84E-04				
sub truck fat.km		1.30E-08			1.39E-02			
sub truck inj/km		3.80E-07			4.06E-01			
sub rail fat/km		1.70E-08				1.98E-04		
sub rail inj/km		3.30E-08				3.84E-04		
rural truck fat/km		5.30E-08					7.66E-02	
rural truck inj/km		8.00E-07					1.16E+00	
rural rail fat/km		1.70E-08						3.56E-03
rural rail inj/km		3.30E-08						6.91E-03
					truck fat =	9.11E-02		
					truck inj =	1.59E+00		
	TOTAL FATALITIES		9.51E-02		rail fat =	3.96E-03	-	
	TOTAL INJURIES		1.60E+00		rail inj =	7.68E-03		

EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops/D&D	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		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	4.85E+04					Total km	1.31E+09

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.31E+09	8.98E-09	1.18E+01				
	injuries	1.31E+09	7.14E-07	9.34E+02				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		9.51E-02	1.18E+01	1.18E+01			
	INJURIES		1.60E+00	9.34E+02	9.36E+02			

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.22E+04	=	2.16E+03			
	LWC =	2.45E-02	2.22E+04	=	5.43E+02			
	Fatality =	3.20E-05	2.22E+04	=	7.09E-01		const + ops	
							trc	2.74E+03
OPERATION ACCIDENTS							fatality	1.55E+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	3.68E+03						
	FATAL	1.34E+01		fatal	1.55E+00			

	EX SITU INTERMEDIATE SEPARATIONS							
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavatio	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant								
Construction		grub/clear	5.50E+03	1.60E+01	8.80E+04			
		excavatio	2.78E+05	4.00E+00	1.11E+06			
		backfill	1.97E+05	4.00E+00	7.86E+05			
		sand/grav	4.22E+04	1.00E+01	4.22E+05			
		concrete	7.89E+04	6.00E+00	4.74E+05			
		burial	2.28E+04	1.60E+01	3.65E+05			
		diesel	1.45E+03	1.40E+02			2.03E+05	
		consumab	9.00E+03	1.40E+02			1.26E+06	
		cement &						
		steel	1.64E+02	8.00E+02				1.31E+05
Operation		excavatio	4.00E+05	4.00E+00	1.60E+06			
		backfill	1.95E+05	4.00E+00	7.79E+05			
		burial	6.49E+03	1.60E+01	1.04E+05			
		sand/grav	4.16E+04	1.00E+01	4.16E+05			
		concrete	7.79E+04	6.00E+00	4.67E+05			
		diesel	3.80E+02	1.40E+02			5.32E+04	
		kerosene	3.78E+03	1.40E+02			5.29E+05	
		glass form	1.71E+04	1.40E+02			2.40E+06	
		IX resins	3.00E+00	1.40E+02			4.20E+02	
		NH3	4.38E+02	8.00E+02			3.50E+05	
		HNO3	1.85E+02	8.00E+02			1.48E+05	
		NaOH	1.14E+03	8.00E+02			9.15E+05	
		cement,						
		steel, &						
		chemicals	3.79E+02	8.00E+02				3.03E+05
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					6.77E+06		6.21E+06	4.78E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	6.21E+06	5.00E-02			3.10E+05
	Rail	4.78E+05	5.00E-02			2.39E+04
Suburban	Truck	6.21E+06	5.00E-02		6.77E+06	7.08E+06
	Rail	4.78E+05	5.00E-02			2.39E+04
Rural	Truck	6.21E+06	9.00E-01			5.59E+06
	Rail	4.78E+05	9.00E-01			4.31E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		3.10E+05	2.39E+04	7.08E+06	2.39E+04	5.59E+06	4.31E+05
urban truck fat/km	7.50E-09	2.33E-03					
urban truck inj/km	3.70E-07	1.15E-01					
urban rail fat/km	1.70E-08		4.07E-04				
urban rail inj/km	3.30E-08		7.89E-04				
sub truck fat.km	1.30E-08			9.20E-02			
sub truck inj/km	3.80E-07			2.69E+00			
sub rail fat/km	1.70E-08				4.07E-04		
sub rail inj/km	3.30E-08				7.89E-04		
rural truck fat/km	5.30E-08					2.96E-01	
rural truck inj/km	8.00E-07					4.47E+00	
rural rail fat/km	1.70E-08						7.32E-03
rural rail inj/km	3.30E-08						1.42E-02
				truck fat =	3.91E-01		
				truck inj =	7.28E+00		
	TOTAL FATALITIES	3.99E-01		rail fat =	8.13E-03		
	TOTAL INJURIES	7.29E+00		rail inj =	1.58E-02		

EMPLOYEE VEHICLE

		person-yr	trip/yr	km/trip	car pool	total		
Retrieval								
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+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		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	8.53E+04					Total km	2.30E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	2.30E+09	8.98E-09	2.07E+01
injuries	2.30E+09	7.14E-07	1.64E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	3.99E-01	2.07E+01	2.11E+01
INJURIES	7.29E+00	1.64E+03	1.65E+03

CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	3.06E+04	=	2.98E+03				
	LWC =	2.45E-02	3.06E+04	=	7.49E+02				
	Fatality =	3.20E-05	3.06E+04	=	9.78E-01		const + ops		
							trc	4.18E+03	
OPERATION ACCIDENTS							fatality	2.73E+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	**5.83E+03**							
	FATAL	**2.38E+01**		**fatal**	**2.73E+00**				

	EX SITU NO SEPARATIONS - VITRIFICATION						
Truck and Rail Transport							
				Total Distance			
				onsite		offsite	
Activity	cargo	trips	rt distance	truck	rail	truck	rail
Retrieval							
Waste transport	tk waste	6.25E+02	2.00E+01	1.25E+04			
	diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314	sand/grav	3.25E+02	1.00E+01	3.25E+03			
	excavation	2.29E+03	4.00E+00	9.17E+03			
	backfill	2.75E+03	4.00E+00	1.10E+04			
	grub/clear	3.43E+02	1.60E+01	5.49E+03			
	concrete	6.42E+02	6.00E+00	3.85E+03			
	burial	1.30E+01	1.60E+01	2.08E+02			
	consumab	3.00E+00	1.40E+02			4.20E+02	
	cement	1.10E+01	8.00E+02				8.80E+03
	steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex	sand/grav	5.36E+03	1.00E+01	5.36E+04			
	concrete	9.66E+03	6.00E+00	5.80E+04			
	diesel	7.10E+01	1.40E+02			9.94E+03	
	consumab	2.40E+03	1.40E+02			3.36E+05	
	cement &						
	steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant							
Construction	grub/clear	4.25E+03	1.60E+01	6.80E+04			
	excavation	1.30E+05	4.00E+00	5.21E+05			
	backfill	9.38E+04	4.00E+00	3.75E+05			
	sand/grav	1.90E+04	1.00E+01	1.90E+05			
	concrete	3.55E+04	6.00E+00	2.13E+05			
	burial	1.69E+04	1.60E+01	2.70E+05			
	diesel	8.30E+02	1.40E+02			1.16E+05	
	consumab	6.00E+03	1.40E+02			8.40E+05	
	cement &						
	steel	8.20E+01	8.00E+02				6.56E+04
Operation	excavation	0.00E+00	0.00E+00	0.00E+00			
	backfill	0.00E+00	0.00E+00	0.00E+00			
	burial	6.35E+03	1.60E+01	1.02E+05			
	sand/grav	2.17E+05	1.00E+01	2.17E+06			
	concrete	4.06E+05	6.00E+00	2.44E+06			
	diesel	2.00E+01	1.40E+02			2.80E+03	
	kerosene	4.48E+03	1.40E+02			6.27E+05	
	glass form	1.31E+04	1.40E+02			1.83E+06	
	IX resins	0.00E+00	0.00E+00			0.00E+00	
	NH3	3.08E+02	8.00E+02			2.46E+05	
	HNO3	2.80E+01	8.00E+02			2.24E+04	
	NaOH	1.20E+01	8.00E+02			9.60E+03	
	cement,						
	steel, &						
	chemicals	6.92E+02	8.00E+02				5.54E+05
Closure							
Grout tank domes,	sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &	concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.	diesel	0.00E+00	0.00E+00			0.00E+00	
	cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks	gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier	silt	0.00E+00	0.00E+00	0.00E+00			
	sand/grav	0.00E+00	0.00E+00	0.00E+00			
	basalt	0.00E+00	0.00E+00	0.00E+00			
	diesel	0.00E+00	0.00E+00			0.00E+00	
	asphalt	0.00E+00	0.00E+00			0.00E+00	
	fabric	0.00E+00	0.00E+00			0.00E+00	
				truck-on	rail-on	truck-off	rail-off
TOTAL km				6.50E+06		4.05E+06	6.63E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	4.05E+06	5.00E-02			2.02E+05
	Rail	6.63E+05	5.00E-02			3.32E+04
Suburban	Truck	4.05E+06	5.00E-02		6.50E+06	6.71E+06
	Rail	6.63E+05	5.00E-02			3.32E+04
Rural	Truck	4.05E+06	9.00E-01			3.64E+06
	Rail	6.63E+05	9.00E-01			5.97E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		2.02E+05	3.32E+04	6.71E+06	3.32E+04	3.64E+06	5.97E+05
urban truck fat/km	7.50E-09	1.52E-03					
urban truck inj/km	3.70E-07	7.49E-02					
urban rail fat/km	1.70E-08		5.64E-04				
urban rail inj/km	3.30E-08		1.09E-03				
sub truck fat.km	1.30E-08			8.72E-02			
sub truck inj/km	3.80E-07			2.55E+00			
sub rail fat/km	1.70E-08				5.64E-04		
sub rail inj/km	3.30E-08				1.09E-03		
rural truck fat/km	5.30E-08					1.93E-01	
rural truck inj/km	8.00E-07					2.91E+00	
rural rail fat/km	1.70E-08						1.01E-02
rural rail inj/km	3.30E-08						1.97E-02
				truck fat =	2.82E-01		
				truck inj =	5.54E+00		
	TOTAL FATALITIES	2.93E-01		rail fat =	1.13E-02		
	TOTAL INJURIES	5.56E+00		rail inj =	2.19E-02		

EMPLOYEE VEHICLE

		person-yr	trip/yr	km/trip	car pool	total		
Retrieval								
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+08		
	Ops/D&D	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/D&D	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	6.68E+04					Total km	1.80E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	1.80E+09	8.98E-09	1.62E+01
injuries	1.80E+09	7.14E-07	1.29E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	2.93E-01	1.62E+01	1.65E+01
INJURIES	5.56E+00	1.29E+03	1.29E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.56E+04	=	2.49E+03			
	LWC =	2.45E-02	2.56E+04	=	6.26E+02			
	Fatality =	3.20E-05	2.56E+04	=	8.18E-01		const + ops	
							trc	3.40E+03
OPERATION ACCIDENTS							fatality	2.14E+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	4.69E+03						
	FATAL	1.86E+01		fatal	2.14E+00			

			EX SITU NO SEPARATIONS - CALCINATION					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Cal plant								
Construction		grub/clear	4.25E+03	1.60E+01	6.80E+04			
		excavation	1.30E+05	4.00E+00	5.21E+05			
		backfill	9.38E+04	4.00E+00	3.75E+05			
		sand/grav	1.82E+04	1.00E+01	1.82E+05			
		concrete	3.39E+04	6.00E+00	2.03E+05			
		burial	1.69E+04	1.60E+01	2.70E+05			
		diesel	8.30E+02	1.40E+02			1.16E+05	
		consumab	6.00E+03	1.40E+02			8.40E+05	
		cement &						
		steel	8.60E+01	8.00E+02				6.88E+04
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	6.35E+03	1.60E+01	1.02E+05			
		sand/grav	8.59E+04	1.00E+01	8.59E+05			
		concrete	1.60E+05	6.00E+00	9.63E+05			
		diesel	8.00E+00	1.40E+02			1.12E+03	
		kerosene	5.55E+02	1.40E+02			7.77E+04	
		glass form	0.00E+00	0.00E+00			0.00E+00	
		IX resins	0.00E+00	0.00E+00			0.00E+00	
		NH3	1.59E+03	8.00E+02			1.27E+06	
		HNO3	2.80E+01	8.00E+02			2.24E+04	
		NaOH	1.20E+01	8.00E+02			9.60E+03	
		cement,						
		steel, &						
		chemicals	2.57E+02	8.00E+02				2.06E+05
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					3.70E+06		2.69E+06	3.18E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	2.69E+06	5.00E-02			1.35E+05		
	Rail	3.18E+05	5.00E-02			1.59E+04		
Suburban	Truck	2.69E+06	5.00E-02		3.70E+06	3.83E+06		
	Rail	3.18E+05	5.00E-02			1.59E+04		
Rural	Truck	2.69E+06	9.00E-01			2.42E+06		
	Rail	3.18E+05	9.00E-01			2.87E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.35E+05	1.59E+04	3.83E+06	1.59E+04	2.42E+06	2.87E+05
urban truck fat/km		7.50E-09	1.01E-03					
urban truck inj/km		3.70E-07	4.98E-02					
urban rail fat/km		1.70E-08		2.71E-04				
urban rail inj/km		3.30E-08		5.25E-04				
sub truck fat.km		1.30E-08			4.98E-02			
sub truck inj/km		3.80E-07			1.46E+00			
sub rail fat/km		1.70E-08				2.71E-04		
sub rail inj/km		3.30E-08				5.25E-04		
rural truck fat/km		5.30E-08					1.28E-01	
rural truck inj/km		8.00E-07					1.94E+00	
rural rail fat/km		1.70E-08						4.87E-03
rural rail inj/km		3.30E-08						9.46E-03
					truck fat =	1.79E-01		
					truck inj =	3.44E+00		
	TOTAL FATALITIES		1.85E-01		rail fat =	5.41E-03		
	TOTAL INJURIES		3.45E+00		rail inj =	1.05E-02		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+08		
	Ops/D&D	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/D&D	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	6.68E+04					Total km	1.80E+09

Fatalities/Injuries resulting from Employee vehicle accidents					
		km	rate/km	TOTAL	
	fatalities	1.80E+09	8.98E-09	1.62E+01	
	injuries	1.80E+09	7.14E-07	1.29E+03	

Cumulative fatalities/injuries from traffic impacts				
		transport	employee	TOTAL
	FATALITIES	1.85E-01	1.62E+01	1.64E+01
	INJURIES	3.45E+00	1.29E+03	1.29E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.56E+04	=	2.49E+03			
	LWC =	2.45E-02	2.56E+04	=	6.26E+02			
	Fatality =	3.20E-05	2.56E+04	=	8.18E-01		const + ops	
							trc	3.40E+03
OPERATION ACCIDENTS							fatality	2.14E+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	**4.69E+03**						
	FATAL	**1.85E+01**		**fatal**	**2.14E+00**			

			EX SITU EXTENSIVE SEPARATIONS					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.10E+01	1.40E+02			9.94E+03	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant								
Construction		grub/clear	8.25E+03	1.60E+01	1.32E+05			
		excavation	2.95E+05	4.00E+00	1.18E+06			
		backfill	1.39E+05	4.00E+00	5.57E+05			
		sand/grav	3.86E+04	1.00E+01	3.86E+05			
		concrete	7.21E+04	6.00E+00	4.32E+05			
		burial	1.88E+04	1.60E+01	3.01E+05			
		diesel	1.98E+03	1.40E+02			2.77E+05	
		consumab	7.00E+03	1.40E+02			9.80E+05	
		cement &						
		steel	1.87E+02	8.00E+02				1.50E+05
Operation		excavation	4.00E+05	4.00E+00	1.60E+06			
		backfill	1.95E+05	4.00E+00	7.79E+05			
		burial	6.55E+03	1.60E+01	1.05E+05			
		sand/grav	3.41E+04	1.00E+01	3.41E+05			
		concrete	6.37E+04	6.00E+00	3.82E+05			
		diesel	3.81E+02	1.40E+02			5.33E+04	
		kerosene	9.89E+03	1.40E+02			1.38E+06	
		glass form	1.58E+04	1.40E+02			2.21E+06	
		IX resins	5.60E+01	1.40E+02			7.84E+03	
		NH3	4.07E+02	8.00E+02			3.26E+05	
		HNO3	2.05E+04	8.00E+02			1.64E+07	
		NaOH	6.60E+03	8.00E+02			5.28E+06	
		cement,						
		steel, &						
		chemicals	4.75E+02	8.00E+02				3.80E+05
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					6.35E+06		2.72E+07	5.74E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	2.72E+07	5.00E-02			1.36E+06		
	Rail	5.74E+05	5.00E-02			2.87E+04		
Suburban	Truck	2.72E+07	5.00E-02		6.35E+06	7.71E+06		
	Rail	5.74E+05	5.00E-02			2.87E+04		
Rural	Truck	2.72E+07	9.00E-01			2.45E+07		
	Rail	5.74E+05	9.00E-01			5.16E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.36E+06	2.87E+04	7.71E+06	2.87E+04	2.45E+07	5.16E+05
urban truck fat/km		7.50E-09	1.02E-02					
urban truck inj/km		3.70E-07	5.04E-01					
urban rail fat/km		1.70E-08		4.88E-04				
urban rail inj/km		3.30E-08		9.46E-04				
sub truck fat.km		1.30E-08			1.00E-01			
sub truck inj/km		3.80E-07			2.93E+00			
sub rail fat/km		1.70E-08				4.88E-04		
sub rail inj/km		3.30E-08				9.46E-04		
rural truck fat/km		5.30E-08					1.30E+00	
rural truck inj/km		8.00E-07					1.96E+01	
rural rail fat/km		1.70E-08						8.78E-03
rural rail inj/km		3.30E-08						1.70E-02
					truck fat =	1.41E+00		
					truck inj =	2.30E+01		
	TOTAL FATALITIES		1.42E+00		rail fat =	9.75E-03		
	TOTAL INJURIES		2.31E+01		rail inj =	1.89E-02		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.08E+04	2.60E+02	1.40E+02	7.41E-01	2.90E+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		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	8.09E+04					Total km	2.18E+09

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.18E+09	8.98E-09	1.96E+01				
	injuries	2.18E+09	7.14E-07	1.56E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.42E+00	1.96E+01	2.10E+01			
	INJURIES		2.31E+01	1.56E+03	1.58E+03			

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.66E+04	=	3.56E+03			
	LWC =	2.45E-02	3.66E+04	=	8.96E+02			
	Fatality =	3.20E-05	3.66E+04	=	1.17E+00		const + ops	
							trc	4.54E+03
OPERATION ACCIDENTS							fatality	2.59E+00
		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	6.12E+03						
	FATAL	2.36E+01		fatal	2.59E+00			

			EX SITU/IN SITU COMBINATION 1					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	2.00E+01	0.00E+00			
		diesel	0.00E+00	1.40E+02			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	2.59E+03	1.00E+01	2.59E+04			
		concrete	4.83E+03	6.00E+00	2.90E+04			
		diesel	4.30E+01	1.40E+02			6.02E+03	
		consumab	1.80E+03	1.40E+02			2.52E+05	
		cement &						
		steel	9.00E+00	8.00E+02				7.20E+03
Remediate -Vit plant								
Construction		grub/clear	5.25E+03	1.60E+01	8.40E+04			
		excavation	2.07E+05	4.00E+00	8.26E+05			
		backfill	9.83E+04	4.00E+00	3.93E+05			
		sand/grav	2.43E+04	1.00E+01	2.43E+05			
		concrete	4.54E+04	6.00E+00	2.72E+05			
		burial	1.47E+04	1.60E+01	2.36E+05			
		diesel	1.87E+03	1.40E+02			2.62E+05	
		consumab	5.60E+03	1.40E+02			7.84E+05	
		cement &						
		steel	8.70E+01	8.00E+02				6.96E+04
Operation		excavation	1.20E+05	4.00E+00	4.79E+05			
		backfill	8.22E+04	4.00E+00	3.29E+05			
		burial	6.56E+03	1.60E+01	1.05E+05			
		sand/grav	2.19E+04	1.00E+01	2.19E+05			
		concrete	4.09E+04	6.00E+00	2.46E+05			
		diesel	4.48E+02	1.40E+02			6.27E+04	
		kerosene	2.13E+03	1.40E+02			2.99E+05	
		glass form	1.16E+04	1.40E+02			1.62E+06	
		IX resins	2.00E+00	1.40E+02			2.80E+02	
		NH3	1.94E+02	8.00E+02			1.55E+05	
		HNO3	9.30E+01	8.00E+02			7.44E+04	
		NaOH	5.72E+02	8.00E+02			4.58E+05	
		cement,						
		steel, &						
		chemicals	2.26E+02	8.00E+02				1.81E+05
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					truck-on	rail-on	truck-off	rail-off
TOTAL km					3.52E+06		3.97E+06	2.86E+05

Distance traveled in population zones

		Offsite km	fraction		Onsite	TOTALS
Urban	Truck	3.97E+06	5.00E-02			1.99E+05
	Rail	2.86E+05	5.00E-02			1.43E+04
Suburban	Truck	3.97E+06	5.00E-02		3.52E+06	3.72E+06
	Rail	2.86E+05	5.00E-02			1.43E+04
Rural	Truck	3.97E+06	9.00E-01			3.58E+06
	Rail	2.86E+05	9.00E-01			2.57E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		1.99E+05	1.43E+04	3.72E+06	1.43E+04	3.58E+06	2.57E+05
urban truck fat/km	7.50E-09	1.49E-03					
urban truck inj/km	3.70E-07	7.35E-02					
urban rail fat/km	1.70E-08		2.43E-04				
urban rail inj/km	3.30E-08		4.71E-04				
sub truck fat.km	1.30E-08			4.84E-02			
sub truck inj/km	3.80E-07			1.41E+00			
sub rail fat/km	1.70E-08				2.43E-04		
sub rail inj/km	3.30E-08				4.71E-04		
rural truck fat/km	5.30E-08					1.90E-01	
rural truck inj/km	8.00E-07					2.86E+00	
rural rail fat/km	1.70E-08						4.37E-03
rural rail inj/km	3.30E-08						8.48E-03
				truck fat =	2.39E-01		
				truck inj =	4.35E+00		
	TOTAL FATALITIES	2.44E-01		rail fat =	4.86E-03		
	TOTAL INJURIES	4.36E+00		rail inj =	9.42E-03		

EMPLOYEE VEHICLE

Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	4.24E+03	2.60E+02	1.40E+02	7.41E-01	1.14E+08		
	Ops/D&D	1.63E+04	2.60E+02	1.40E+02	7.41E-01	4.38E+08		
Vitrification and fill and cap								
	Const.	1.60E+04	2.60E+02	1.40E+02	7.41E-01	4.32E+08		
	Ops/D&D	3.63E+04	2.60E+02	1.40E+02	7.41E-01	9.78E+08		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	7.27E+04					Total km	1.96E+09

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	1.96E+09	8.98E-09	1.76E+01
injuries	1.96E+09	7.14E-07	1.40E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	2.44E-01	1.76E+01	1.79E+01
INJURIES	4.36E+00	1.40E+03	1.41E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.02E+04	=	1.97E+03			
	LWC =	2.45E-02	2.02E+04	=	4.96E+02			
	Fatality =	3.20E-05	2.02E+04	=	6.48E-01		const + ops	
							trc	3.13E+03
OPERATION ACCIDENTS							fatality	2.33E+00
		rate	person-yr					
	TRC =	2.20E-02	5.25E+04	=	1.16E+03			
	LWC =	1.10E-02	5.25E+04	=	5.78E+02			
	Fatality =	3.20E-05	5.25E+04	=	1.68E+00			
TOTALS				excluding employee traffic				
	INJUR	4.53E+03						
	FATAL	2.02E+01		fatal	2.33E+00			

			EX SITU/IN SITU COMBINATION 2					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	1.82E+03	1.00E+01	1.82E+04			
		concrete	3.39E+03	6.00E+00	2.03E+04			
		diesel	3.10E+01	1.40E+02			4.34E+03	
		consumab	1.20E+03	1.40E+02			1.68E+05	
		cement &						
		steel	7.00E+00	8.00E+02				5.60E+03
Remediate -Vit plant								
Construction		grub/clear	3.70E+03	1.60E+01	5.92E+04			
		excavation	1.45E+05	4.00E+00	5.79E+05			
		backfill	6.88E+04	4.00E+00	2.75E+05			
		sand/grav	1.49E+04	1.00E+01	1.49E+05			
		concrete	2.78E+04	6.00E+00	1.67E+05			
		burial	1.04E+04	1.60E+01	1.67E+05			
		diesel	9.91E+02	1.40E+02			1.39E+05	
		consumab	4.00E+03	1.40E+02			5.60E+05	
		cement &						
		steel	5.80E+01	8.00E+02				4.64E+04
Operation		excavation	1.20E+05	4.00E+00	4.79E+05			
		backfill	8.22E+04	4.00E+00	3.29E+05			
		burial	6.49E+03	1.60E+01	1.04E+05			
		sand/grav	1.52E+04	1.00E+01	1.52E+05			
		concrete	2.83E+04	6.00E+00	1.70E+05			
		diesel	2.26E+02	1.40E+02			3.16E+04	
		kerosene	1.24E+03	1.40E+02			1.73E+05	
		glass form	6.76E+03	1.40E+02			9.46E+05	
		IX resins	1.00E+00	1.40E+02			1.40E+02	
		NH3	1.30E+02	8.00E+02			1.04E+05	
		HNO3	5.40E+01	8.00E+02			4.32E+04	
		NaOH	3.32E+02	8.00E+02			2.66E+05	
		cement,						
		steel, &						
		chemicals	1.21E+02	8.00E+02				9.68E+04
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
					tuck-on	rail-on	truck-off	rail-off
TOTAL km					2.70E+06		2.44E+06	1.77E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	2.44E+06	5.00E-02			1.22E+05		
	Rail	1.77E+05	5.00E-02			8.84E+03		
Suburban	Truck	2.44E+06	5.00E-02		2.70E+06	2.82E+06		
	Rail	1.77E+05	5.00E-02			8.84E+03		
Rural	Truck	2.44E+06	9.00E-01			2.19E+06		
	Rail	1.77E+05	9.00E-01			1.59E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.22E+05	8.84E+03	2.82E+06	8.84E+03	2.19E+06	1.59E+05
urban truck fat/km		7.50E-09	9.13E-04					
urban truck inj/km		3.70E-07	4.51E-02					
urban rail fat/km		1.70E-08		1.50E-04				
urban rail inj/km		3.30E-08		2.92E-04				
sub truck fat.km		1.30E-08			3.67E-02			
sub truck inj/km		3.80E-07			1.07E+00			
sub rail fat/km		1.70E-08				1.50E-04		
sub rail inj/km		3.30E-08				2.92E-04		
rural truck fat/km		5.30E-08					1.16E-01	
rural truck inj/km		8.00E-07					1.75E+00	
rural rail fat/km		1.70E-08						2.71E-03
rural rail inj/km		3.30E-08						5.25E-03
					truck fat =	1.54E-01		
					truck inj =	2.87E+00		
	TOTAL FATALITIES		1.57E-01		rail fat =	3.01E-03		
	TOTAL INJURIES		2.88E+00		rail inj =	5.83E-03		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.44E+03	2.60E+02	1.40E+02	7.41E-01	3.88E+07		
	Ops/D&D	9.16E+03	2.60E+02	1.40E+02	7.41E-01	2.47E+08		
Vitrification								
	Const.	1.60E+04	2.60E+02	1.40E+02	7.41E-01	4.32E+08		
	Ops/D&D	2.66E+04	2.60E+02	1.40E+02	7.41E-01	7.17E+08		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	5.32E+04					Total km	1.43E+09

Fatalities/Injuries resulting from Employee vehicle accidents				
		km	rate/km	TOTAL
	fatalities	1.43E+09	8.98E-09	1.29E+01
	injuries	1.43E+09	7.14E-07	1.02E+03

Cumulative fatalities/injuries from traffic impacts				
		transport	employee	TOTAL
	FATALITIES	1.57E-01	1.29E+01	1.30E+01
	INJURIES	2.88E+00	1.02E+03	1.03E+03

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.74E+04	=	1.70E+03			
	LWC =	2.45E-02	1.74E+04	=	4.27E+02			
	Fatality =	3.20E-05	1.74E+04	=	5.58E-01		const + ops	
							trc	2.49E+03
OPERATION ACCIDENTS							fatality	1.70E+00
		rate	person-yr					
	TRC =	2.20E-02	3.58E+04	=	7.87E+02			
	LWC =	1.10E-02	3.58E+04	=	3.93E+02			
	Fatality =	3.20E-05	3.58E+04	=	1.14E+00			
TOTALS				**excluding employee traffic**				
	INJUR	**3.51E+03**						
	FATAL	**1.47E+01**		**fatal**	**1.70E+00**			

		PHASE I IMPLEMENTATION						
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		concrete	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		consumab	0.00E+00	0.00E+00			0.00E+00	
		cement &	0.00E+00	0.00E+00				
		steel	0.00E+00	0.00E+00				0.00E+00
Remediate -Vit plant								
Construction		grub/clear	8.00E+02	1.60E+01	1.28E+04			
		excavation	4.50E+04	4.00E+00	1.80E+05			
		backfill	5.51E+03	4.00E+00	2.21E+04			
		sand/grav	2.09E+03	1.00E+01	2.09E+04			
		concrete	3.93E+03	6.00E+00	2.36E+04			
		burial	3.60E+03	1.60E+01	5.76E+04			
		diesel	1.30E+03	1.40E+02			1.81E+05	
		consumab	1.60E+03	1.40E+02			2.24E+05	
		cement &						
		steel	8.90E+01	8.00E+02				7.12E+04
Operation		excavation	0.00E+00	0.00E+00	0.00E+00			
		backfill	0.00E+00	0.00E+00	0.00E+00			
		burial	6.65E+02	1.60E+01	1.06E+04			
		sand/grav	5.32E+02	1.00E+01	5.32E+03			
		concrete	9.94E+02	6.00E+00	5.96E+03			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		kerosene	5.20E+01	1.40E+02			7.28E+03	
		glass form	4.11E+03	1.40E+02			5.75E+05	
		IX resins	1.00E+00	1.40E+02			1.40E+02	
		NH3	7.90E+01	8.00E+02			6.32E+04	
		HNO3	3.80E+01	8.00E+02			3.04E+04	
		NaOH	2.31E+02	8.00E+02			1.85E+05	
		cement,						
		steel, &						
		chemicals	4.80E+01	8.00E+02				3.84E+04
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
Vit waste transport								
temporary storage		HLW	1.07E+02	1.00E+01	1.07E+03			
storage		LAW	6.10E+03	2.00E+00	1.22E+04			
					truck-on	**rail-on**	**truck-off**	**rail-off**
TOTAL km					**3.85E+05**		**1.27E+06**	**1.38E+05**

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	1.27E+06	5.00E-02			6.33E+04		
	Rail	1.38E+05	5.00E-02			6.88E+03		
Suburban	Truck	1.27E+06	5.00E-02		3.85E+05	4.49E+05		
	Rail	1.38E+05	5.00E-02			6.88E+03		
Rural	Truck	1.27E+06	9.00E-01			1.14E+06		
	Rail	1.38E+05	9.00E-01			1.24E+05		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			6.33E+04	6.88E+03	4.49E+05	6.88E+03	1.14E+06	1.24E+05
urban truck fat/km		7.50E-09	4.75E-04					
urban truck inj/km		3.70E-07	2.34E-02					
urban rail fat/km		1.70E-08		1.17E-04				
urban rail inj/km		3.30E-08		2.27E-04				
sub truck fat.km		1.30E-08			5.83E-03			
sub truck inj/km		3.80E-07			1.70E-01			
sub rail fat/km		1.70E-08				1.17E-04		
sub rail inj/km		3.30E-08				2.27E-04		
rural truck fat/km		5.30E-08					6.04E-02	
rural truck inj/km		8.00E-07					9.12E-01	
rural rail fat/km		1.70E-08						2.11E-03
rural rail inj/km		3.30E-08						4.09E-03
					truck fat =	6.67E-02		
					truck inj =	1.11E+00		
	TOTAL FATALITIES		6.90E-02		rail fat =	2.34E-03		
	TOTAL INJURIES		1.11E+00		rail inj =	4.54E-03		
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		
	Const.	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	Ops/D&D	0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total emp	1.76E+04					Total km	4.76E+08
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		6.90E-02	4.27E+00	4.34E+00			
	INJURIES		1.11E+00	3.40E+02	3.41E+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		const + ops	
							trc	1.20E+03
OPERATION ACCIDENTS							fatality	5.64E-01
		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				excluding employee traffic				
	INJUR	1.54E+03						
	FATAL	4.90E+00		fatal	5.64E-01			

			TOTAL ALTERNATIVE					
Truck and Rail Transport								
					Total Distance			
					onsite		offsite	
Activity		cargo	trips	rt distance	truck	rail	truck	rail
Retrieval								
Waste transport		tk waste	6.25E+02	2.00E+01	1.25E+04			
		diesel	5.40E+01	1.40E+02			7.56E+03	
Construction-W314		sand/grav	3.25E+02	1.00E+01	3.25E+03			
		excavation	2.29E+03	4.00E+00	9.17E+03			
		backfill	2.75E+03	4.00E+00	1.10E+04			
		grub/clear	3.43E+02	1.60E+01	5.49E+03			
		concrete	6.42E+02	6.00E+00	3.85E+03			
		burial	1.30E+01	1.60E+01	2.08E+02			
		consumab	3.00E+00	1.40E+02			4.20E+02	
		cement	1.10E+01	8.00E+02				8.80E+03
		steel	2.40E+01	8.00E+02				1.92E+04
Construction-annex		sand/grav	5.18E+03	1.00E+01	5.18E+04			
		concrete	9.66E+03	6.00E+00	5.80E+04			
		diesel	7.20E+01	1.40E+02			1.01E+04	
		consumab	2.40E+03	1.40E+02			3.36E+05	
		cement &						
		steel	2.00E+01	8.00E+02				1.60E+04
Remediate -Vit plant								
Construction		grub/clear	7.25E+03	1.60E+01	1.16E+05			
		excavation	3.78E+05	4.00E+00	1.51E+06			
		backfill	2.67E+05	4.00E+00	1.07E+06			
		sand/grav	5.74E+04	1.00E+01	5.74E+05			
		concrete	1.07E+05	6.00E+00	6.45E+05			
		burial	1.88E+04	1.60E+01	3.01E+05			
		diesel	1.98E+03	1.40E+02			2.77E+05	
		consumab	7.00E+03	1.40E+02			9.80E+05	
		cement &						
		steel	2.22E+02	8.00E+02				1.78E+05
Operation		excavation	4.00E+05	4.00E+00	1.60E+06			
		backfill	1.95E+05	4.00E+00	7.79E+05			
		burial	6.49E+03	1.60E+01	1.04E+05			
		sand/grav	3.57E+04	1.00E+01	3.57E+05			
		concrete	6.66E+04	6.00E+00	4.00E+05			
		diesel	4.32E+02	1.40E+02			6.05E+04	
		kerosene	3.42E+03	1.40E+02			4.79E+05	
		glass form	1.69E+04	1.40E+02			2.37E+06	
		IX resins	3.00E+00	1.40E+02			4.20E+02	
		NH3	4.32E+02	8.00E+02			3.46E+05	
		HNO3	1.83E+02	8.00E+02			1.46E+05	
		NaOH	1.13E+03	8.00E+02			9.02E+05	
		cement,						
		steel, &						
		chemicals	3.54E+02	8.00E+02				2.83E+05
Closure								
Grout tank domes,		sand/grav	0.00E+00	0.00E+00	0.00E+00			
MUSTs, &		concrete	0.00E+00	0.00E+00	0.00E+00			
ancellary equip.		diesel	0.00E+00	0.00E+00			0.00E+00	
		cement	0.00E+00	0.00E+00				0.00E+00
Gravel fill tanks		gravel	0.00E+00	0.00E+00	0.00E+00			
Barrier		silt	0.00E+00	0.00E+00	0.00E+00			
		sand/grav	0.00E+00	0.00E+00	0.00E+00			
		basalt	0.00E+00	0.00E+00	0.00E+00			
		diesel	0.00E+00	0.00E+00			0.00E+00	
		asphalt	0.00E+00	0.00E+00			0.00E+00	
		fabric	0.00E+00	0.00E+00			0.00E+00	
Vit waste transport								
temporary storage		HLW	1.07E+02	8.00E+00				
storage		LAW	6.10E+02	4.00E+00				
					truck-on	rail-on	truck-off	rail-off
TOTAL km					7.61E+06		5.92E+06	5.05E+05

Distance traveled in population zones								
		Offsite km	fraction		Onsite	TOTALS		
Urban	Truck	5.92E+06	5.00E-02			2.96E+05		
	Rail	5.05E+05	5.00E-02			2.52E+04		
Suburban	Truck	5.92E+06	5.00E-02		7.61E+06	7.91E+06		
	Rail	5.05E+05	5.00E-02			2.52E+04		
Rural	Truck	5.92E+06	9.00E-01			5.32E+06		
	Rail	5.05E+05	9.00E-01			4.54E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			2.96E+05	2.52E+04	7.91E+06	2.52E+04	5.32E+06	4.54E+05
urban truck fat/km		7.50E-09	2.22E-03					
urban truck inj/km		3.70E-07	1.09E-01					
urban rail fat/km		1.70E-08		4.29E-04				
urban rail inj/km		3.30E-08		8.33E-04				
sub truck fat.km		1.30E-08			1.03E-01			
sub truck inj/km		3.80E-07			3.00E+00			
sub rail fat/km		1.70E-08				4.29E-04		
sub rail inj/km		3.30E-08				8.33E-04		
rural truck fat/km		5.30E-08					2.82E-01	
rural truck inj/km		8.00E-07					4.26E+00	
rural rail fat/km		1.70E-08						7.72E-03
rural rail inj/km		3.30E-08						1.50E-02
					truck fat =	3.87E-01		
					truck inj =	7.37E+00		
	TOTAL FATALITIES		3.96E-01		rail fat =	8.58E-03		
	TOTAL INJURIES		7.39E+00		rail inj =	1.67E-02		

EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	8.98E+03	2.60E+02	1.40E+02	7.41E-01	2.42E+08		
	Ops/D&D	3.11E+04	2.60E+02	1.40E+02	7.41E-01	8.39E+08		
Vitrification								
	Const.	3.33E+04	2.60E+02	1.40E+02	7.41E-01	8.97E+08		
	Ops/D&D	5.44E+04	2.60E+02	1.40E+02	7.41E-01	1.47E+09		
Closure		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	total emp	1.28E+05					Total km	3.45E+09

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	3.45E+09	8.98E-09	3.09E+01				
	injuries	3.45E+09	7.14E-07	2.46E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		3.96E-01	3.09E+01	3.13E+01			
	INJURIES		7.39E+00	2.46E+03	2.47E+03			

CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	4.22E+04	=	4.12E+03			
	LWC =	2.45E-02	4.22E+04	=	1.03E+03			
	Fatality =	3.20E-05	4.22E+04	=	1.35E+00		const + ops	
							trc	6.00E+03
OPERATION ACCIDENTS							fatality	4.09E+00
		rate	person-yr					
	TRC =	2.20E-02	8.55E+04	=	1.88E+03			
	LWC =	1.10E-02	8.55E+04	=	9.41E+02			
	Fatality =	3.20E-05	8.55E+04	=	2.74E+00			
TOTALS				excluding employee traffic				
	INJUR	8.47E+03						
	FATAL	3.54E+01		fatal	4.09E+00			

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering – Resources Summary Table B.11.0.3 and Transportation Input – TWRS FEIS Draft July 1996.

ORIGINATOR Ronald D. Weed DATE 7-30-96

REVISION NO. 0

OBJECTIVE Revise Resources data for TWRS and Generate common basis for Transportation data for appendix E Evaluation.

METHODOLOGY Contained within the various calculation segments.

ASSUMPTIONS Contained within the various calculation segments

(Continue on another sheet if necessary)

Cover Sheet – 1 Page
Table of Contents – 1 Pages (10)
Calculation – 393 Pages
Appendix A Data – 318 Pages

Ronald D Weed 7-30-96
SIGNATURE/DATE

J C Henderson 8/20/96
CHECKED/DATE

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resource Summary table B.11.0.3 and Transportation Tables SHEET NO. i of x

BY RDW CHKD. JOB NO. 01K47101

TABLE OF CONTENTS

ITEM NUMBER	ITEM NAME/DISCRIPTION	page NUMBER.
1.	Extensive Retrieval - Ex Situ Extensive separations	1
2.	Extensive Retrieval - Ex Situ No Separations, Vitri.	9.
3.	Extensive Retrieval - Intermediate Separations	14.
4.	Ex Situ / In Situ Combination alternative	20.
5.	Extensive Retrieval - Ex Situ No Separations, Calcination	24
6.	Phased Implementation - Phase I and 2.	29
7.	W-314 Tank farm upgrades	35
8.	Determination of grouting ancillary Equipment and void fill for 161 empty tanks.	38
	Determine Resource Summary and transportation for TWRS FEIS due July 31, 1996.	
1.	Ex Situ No Separations - vitrification	41
2.	Ex Situ Extensive separations	47
3.	Ex Situ Intermediate separations	55
4.	Ex Situ / In Situ Combination 1 (70/177)	65
5.	Ex Situ / In Situ Combination 2 (25/177)	74
6.	Phased Implementation alternative, Phase 1	82
7.	Phased Implementation alternative, Phase 2	87
8.	Calculate transportation numbers for materials	98
8.A	No action alternative	98.
8.B	Long-Term management alternative	99
8.C	In Situ fill and Cap alternative	100
8.D	In Situ vitrification alternative	102
8.E	W-314 upgrades	105
8.F	Ex Situ No Separations, vitrification	106
8.G.	Ex Situ No Separations, Calcination	112
8.H.	Ex Situ Extensive Separations	117
8.I.	Ex Situ Intermediate separations	125
8.J.	Ex Situ / In Situ Combination 1 (70 of 177 tanks)	132
8.K.	Ex Situ / In Situ Combination 2 (25 of 177 Tanks)	139
8.L.	Phased Implementation, Phase 1	147
8.M.	Phased Implementation, Phase 2	151
8.N.	Determine number of trips - Concrete trucks at Batch Plant	158

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resources Summary Table B.11.0.3 and Transportation Tables SHEET NO. ii of 4

BY RDW CHKD. _____ JOB NO. 01K47101

ITEM NUMBER	ITEM NAME/ DISCRIPTION	Page number
8.N.B.	Long Term management	158
8.N.C	In Situ fill and cap	158
8.N.D.	In Situ vitrification	158
8.N.E.	W-314 upgrades	158
8.N.F.	Ex Situ No Separations, vitrification	159
8.N.G.	Ex Situ No Separations, Calcination	159
8.N.H.	Ex Situ Extension Separations	160
8.N.I.	Ex Situ Intermediate Separations	161
8.N.J.	Ex Situ / In Situ Combination 1 (70 of 177)	162
8.N.K	Ex Situ / In Situ Combination 2 (25 of 177)	163
8.N.L	phased Implementation - phase I	163
8.N.M.	Phased Implementation - phase II	164
9.	Develop new Land use numbers for spread sheet and table B.11.0.4 (new number)	165
9.A	Ex Situ Intermediate Separations	165
9.B	Ex Situ No-Separations Calcination	165
9.C	Ex Situ No-Separations vitrification	165
9.D	Ex Situ Extension Separations	166
9.E	Ex Situ / In Situ Combination 1	166
9.F	phased Implementation - phase 1	166
9.G.	Ex Situ / In Situ combination 2	166
9.H.	Phased Implementation, phase 2	167
10.	Calculate the Borrow Site Silt requirements	168
10.A	Ex Situ No separations vitrification	168
10.B	Ex Situ No-Separations Calcination	168
10.C.	Ex Situ Extension Separations	168
10.D.	Ex Situ Intermediate Separations	169
10.E.	Ex Situ / In Situ Combination 1	169
10.F.	Ex Situ / In Situ Combination 2	169
10.G.	Phased Implementation, phase 1	170
10.H.	Phased Implementation, phase 2	170
10.	Determine the Quantity of basalt and number of trips.	170
10.A	Ex Situ No-Separations vitrification	170

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-86 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. iii OF 4

BY RDW CHKD. JOB NO. 01K4710/

ITEM NUMBER	ITEM NAME/DESCRIPTION	PAGE NUMBER
10.B.	Ex Situ No Separations Calcination	170
10.C	Ex Situ Extensive Separations	170
10.D	Ex Situ Intermediate Separations	171
10.E	Ex Situ / In Situ Combination 1.	171
10.F	Ex Situ / In Situ Combination 2	171
10.G	Ex Situ Phased Implementation, phase 2	171
11.	Determine the amount of Barrier asphalt required.	171
11.A	Ex Situ no Separations vitrification	172
11.B	Ex Situ no Separations Calcination	172
11.C	Ex Situ Extensive separations	172
11.D	Ex Situ Intermediate Separations	172
11.E	Ex Situ / In Situ Combination 1	172
11.F.	Ex Situ / In Situ Combination 2	173
11.G.	Phased Implementation, phase 2	173
12.	Determine the Sand and Gravel for construction and operation	173
12.A.	Ex Situ No Separations vitrification	173
12.B.	Ex Situ No Separations Calcination	173
12.C.	Ex Situ Extensive Separations	174
12.D.	Ex Situ Intermediate Separations	174
12.E.	Ex Situ / In Situ Combination 1	174
12.F.	Ex Situ / In Situ Combination 2	175
12.G.	Phased Implementation, phase 2	175
13.	Determine the Closure quantity of Sand and Gravel required	175
13.A	Ex Situ No Separations vitrification	175
13.B	Ex Situ No Separations Calcination	176
13.C	Ex Situ Extensive Separations	176
13.D	Ex Situ Intermediate Separations	177
13.E.	Ex Situ / In Situ Combination 1	177
13.F.	Ex Situ / In Situ Combination 2	178

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resources Summary table B.11.0.3 and Transportation table SHEET NO. 10 of 4

BY RDW CHKD. _____ JOB NO. 01K47101

ITEM NUMBER	ITEM NAME / DESCRIPTION	PAGE NUMBER
13. H.	Phased Implementation, phase 2	178
14.	Determine truck trips for gravel to fill empty tanks, etc in tank farms.	178
15.	Verify Hectares for tank farm barrier	179
16.	Determine transportation for Construction Grub and Clear, Construction Consumables, Barrier sheeting, and Trash to burial ground (Solid Waste).	179
16. A.	No action alternative	179
16. B.	Long-Term Management	180
16. C.	In Situ Fill and Cap	181
16. D.	In Situ Vitrification	182
16. E.	HL-314 upgrades	183
16. F.	Ex Situ No Separations Vitrification	183
16. G.	Ex Situ No Separations Calcination	185
16. H.	Ex Situ Extensive Separations	186
16. I	Ex Situ Intermediate Separations	187
16. J.	Ex Situ / In Situ Combination 1 (70 of 177)	188
16 K	Ex Situ / In Situ Combination 2 (25 of 177)	189
16 L.	Phased Implementation phase 1	190
16. M.	Phased Implementation phase 2	191
17.	Determine the Disturbed areas for the potential Borrow Sites: Pit 30, McGee Ranch, Vernita Quarry	192
17. A.	In Situ Fill and Cap	193
17. B.	Ex Situ No Separations vitrification	193
17. C.	Ex Situ No Separations Calcination	193
17. D.	Ex Situ Extensive Separations	194
17. E	Ex Situ Intermediate Separations	195
17. F.	Ex Situ / In Situ Combination 1 (70 tanks)	195
17. G.	Ex Situ / In Situ Combination 2 (25 tanks)	196
17. H.	Phased Implementation, Phase 1	197
17. I.	Phased Implementation, Phase 2	198

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-93 SUBJECT Resource Summary Table B.11.0.3 and Transportation Tables SHEET NO. 1 OF 1

BY Rodal CHKD. _____ JOB NO. 01K47101

ITEM NUMBER	ITEM NAME/ DESCRIPTION	PAGE NUMBER
TABLE I	Table B.11.0.3 — 0.62 m^3/1.5 blend HLW data for spread sheet showing concrete breakdown for gravel, sand, cement.	199
Table II	Table B.11.0.3 - 1.17 m^3/1.2 blend HLW data for 1st draft of TWRS-FEIS. Includes sand, gravel, cement breakdown for new spread sheet.	215
TABLE III	Tabulation of the number of trips (vehicles) required for the particular vehicles chosen for the item transported.	247
Table IV	Transportation summary for commodity required with size and type of conveyance, point of origin (or distance per trip) and number of trips	260
SKETCHES	plant layouts for two alternatives: (1) Ex Situ In Situ Combination 2; (2) phased implementation phase 2.	296
18.	Determination of Values for Table 5.16.1	302
18.A	Determine the sand, gravel, silt, and riprap resources for the alternatives	302
18.A.1	No action	302
18.A.2	Long term management	302
18.A.3	In Situ Fill and Cap	302
18.A.4	In Situ Vitrification	303
18.A.5	Ex Situ Intermediate Separations	303
18.A.6	Ex Situ No Separations Vitrification	303
18.A.7	Ex Situ No Separations Calcination	304
18.A.8	Ex Situ Extensive Separations	304
18.A.9	Ex Situ/ In Situ Combination 1	305
18.A.10	Ex Situ/ In Situ Combination 2	305

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resources Summary Table B.11.0.3 and Transportation Tables SHEET NO. vi of x

BY RDW CHKD. _____ JOB NO. 01K4701

ITEM NUMBER	ITEM NAME / DESCRIPTION	PAGE NUMBER
18.A.11	Phased Implementation, phase I	306
18.A.12	Phased Implementation, phase II	306
18.B.	Steel Metric Tons - Total Carbon Steel - Table II	306
18.C.	Stainless steel and alloy steel added - Table II Summation	307
18.D.	Concrete was added to the table	307
18.E.	Total Water usage was added from table II	307
18.F	Electric Power added from Table II	307
18 G	Gasoline column added from table II	307
18 H	Diesel column added from Table II	307
18 I	Kerosene Column data added from table II	307
18 J	Process chemicals data column from Table II	307
18 K	The Cost column taken from analysis data provided	307
19.	Determine data for Table B.6.2.1	307
19.A	Long term management	307
19.B	In Situ fill and cap	308
19 C	In Situ Vitrification	308
19 D	Ex Situ Intermediate separations	308
19 E	Ex Situ No Separations vitrification	308
19 F	Ex Situ No Separations Calcination	308
19 G	Ex Situ Extensive Separations	308
19 H	Ex Situ / In Situ Combination 1	308
19 I	Ex Situ / In Situ Combination 2	308
19 J	Phased Implementation, phase I	308
19 K	Phased Implementation, phase II	308
20	Determine data for Table B.6.2.2	308
20.A	Ex Situ all	308
20 B	Ex Situ / In Situ Combination 1	308
20 C	Ex Situ / In Situ Combination 2	309
20 D	Phased Implementation, phase 2	309
21.	Determine data for Table B.6.2.3	309
21 A	In Situ fill and cap, In Situ Vitrification, or Ex No Sep	309
21 B	Ex Situ, Intermediate, Extensive or phased implementation	309

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resources Summary Table B.11.0.3 and Transportation Tables SHEET NO. xii of x

BY RDW CHKD. _____ JOB NO. 01K4710 1

ITEM NUMBER	ITEM NAME / DESCRIPTION	PAGE NUMBER
21 C.	Ex Situ / In Situ Combination 1	309
21 D	Footnote added to Table B.6.2-1	309
21 E	Ex Situ / In Situ Combination 2	310
22	Develop numbers for Table 3.6.1	310
23	Develop numbers for Table 3.6.2	310
24	Develop numbers for Table 3.6.3	310
25	Determine data for Table 5.1.1	310
25 A	No action Tank waste alternative	310
25 B	Long-Term Management Tank waste alternative	311
25 C	In Situ fill and Cap Tank waste alternative	311
25 D	In Situ Vitrification Tank waste alternative	312
25 E	Ex Situ Intermediate Separations	312
25 F	Ex Situ no Separations Vitrification	313
25 G	Ex Situ no Separations Calcination	313
25 H.	Ex Situ Extensive Separations	314
25 I.	Ex Situ / In Situ Combination 1	314
25. J.	Ex Situ / In Situ Combination 2	315
25 K.	Phased Implementation, Phase 1	315
25 L.	Phased Implementation, Phase 2	316
26.	Determine data for Table 3.7.1	317
26 A	No action —Through— In Situ vitrification	317
26 B	Ex Situ Intermediate Separations	317
26 C	Ex Situ No Separations Vitrification	317
26 D	Ex Situ No Separations Calcination	317
26 E	Ex Situ Extensive Separations	318
26 F	Ex Situ / In Situ Combination 1	318
26 G	Ex Situ / In Situ Combination 2	318
26 H.	Phased Implementation, Phase 1 and 2	319
27	Determine revised values for sensitivity analysis using the Intermediate Separations Case	319
27 A	Intermediate Separations — LLW = 10 wt% Na_2O, HLW = 15 w/o waste oxides.	319

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resource Summary Table B.11.0.3 and Transportation Tables SHEET NO. viii of x

BY RDW CHKD. _____ JOB NO. 01K47101

ITEM NUMBER	ITEM NAME / DESCRIPTION	PAGE NUMBER
27 Q	Determine data for case Intermediate Separations HLW = 25 w/o Na_2O and HLW = 40 w/o waste oxides	327
TABLE V	Sensitivity Data Tabulation for the Ex Situ Intermediate Separations base case Comparison	332
28.	Develop new data for Table D-4-8-1 - Ex Situ/In Situ Combination 1 -- and new data and Table for Combination 2.	344
28. A.	Separation and Vitrification Emissions	344
28. B.	Retrieval Emissions	346
28 C.	Continuous operations	347
28. D.	Treatment (gravel fill) area	347
29.	Develop data changes for tables D.4. "n". 1, .2, .3, .4 etc as needed.	348
29. A	No action alternative	348
29. B	Long-term Management alternative	348
29 C	In Situ fill and cap	349
29 D	In Situ Vitrification	349
29 E	Ex Situ Intermediate separations	351
29 F	Ex Situ No Separations	352
29 G	Ex Situ Extension Separations	354
29 H	Ex Situ / In Situ Combination 1	355
29 I	Ex Situ / In Situ Combination 2	356
29 J	phased Implementation - phase 1, phase 2	356
29 K.	Capsule - No action	358
29. L.	Capsule - onsite Disposal	358
29 M	Capsule - overpack and Ship	359
29. N.	Capsule - Vitrify with tank waste	359
30.	Recalculate Resources for Ex Situ/In Situ Combination 1 due to a change in input data	359

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resources Summary table B.11.0.3 and Transportation tables SHEET NO. 14 of 4

BY RDW CHKD. _____ JOB NO. 01K47101

ITEM NUMBER	ITEM NAME/DESCRIPTION	page number
31.	Recalculate Resources for Ex Situ/In Situ Combination 2 due to a change in input data	367
32.	Generate new revised tables for appendix G.	375
32.A.	Table G.3.1.19	375
32.B.	Table G.3.1.20	375
32.C.	Table G.3.1.22	375
32.D.	table G.3.1.23	375
32.E.	Table G.3.1.24	376
32.F.	Table G.3.1.25	376
32.G.	Table G.3.1.26	376
32.H.	Table G.3.1.27	376
32.I.	Table G.3.1.28	376
32.J.	Table G.3.1.29	376
32.K.	Table G. --- Create one for Ex Situ/In Situ Combination 2	376
33.	Tabulation of Canister Size Number for HLW	377
34.	Mileage Change description and Reasons	377
35.	Generate Radiological Emissions for Table B.11.0.6 for Phase 1 and Phase 2	379
36.	Replacement portion for W-314 project rewrite	381
37.	Generate non Radiological emissions for table B.11.0.7 for Combination 2. alternative	382
38.	Data for Table B.11.0.8 - Transportation values appendix E tables.	383
39.	Determine Sand and gravel usage, Silt usage, and Rip Rap usage for the alternatives for Construction and operation, total sand and gravel, and total Borrow material.	384

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 7-30-96 SUBJECT Resource Summary table 8.11-0.3 and Transportation Tables SHEET NO. 4 of 4

BY RDA CHKD. JOB NO. OIK 47101

ITEM NUMBER	ITEM DESCRIPTION/ NAME	Page number
39 A	No-action	384
39 B	Long Term Management	384
39 C	In Situ Fill and Cap	384
39 D.	In Situ Vitrification	384
39 E.	Ex Situ Intermediate	385
39 F.	Ex Situ No Separations, Vitrification	385
39 G.	Ex Situ no Separations, Calcination	386
39 H.	Ex Situ Extension Separations	387
39 I	Ex Situ / In Situ Combination 1	387
39 J	Ex Situ / In Situ Combination 2	388
39 K	phased Implementation phase 1	388
39 L	Phased Implementation phase 2	389
40.	Verification check for Riprap quantity	389
41.	Dump Truck Sizing - 20 yd³ (Eff 16)	390
42	Vault size, Number of Canisters, and Phase I Interim Storage.	391
43.	Estimate HLW storage pad size for Interim storage requirement for the alternatives	392
APPENDIX	INPUT MATERIAL USED IN THE VARIOUS SECTIONS OF THESE CALCULATIONS FOR THE DRAFT TWRS FEIS OF JULY 1996	A-1 through A-318

FORM 91-005-1 (4/81)

Establish revision to the Resource Summary Spread sheet for the various alternatives considered. To make the information more useful expand some areas of the spreadsheet and remove duplication of entries. Establish an entry for the Sulfur cement considerations. Some changes will make the spread sheet more like Table B.11.0.3 and other changes will put a common basis in effect for the accident analyses for the Truck and rail Travel carrying the material to the site for Construction operations, and closure, as well as shipment of the waste product to an acceptable repository.

Calculation of the items for break down to include overlooked items for transportation are based on the overall values calculated for the Resource Summary Table B.11.0.3 for the April 1996 issue of the Draft EIS for the TRW project.

In this phase the numbers deal only with those items that will be transported to the job site for the particular alternative discussed.

1. Extensive Retrieval - Ex-Situ Extensive Separations alternative.

a. Gasoline (m^3)

1. For construction the values remain the same as given in the spread sheet.

2. For operations there will be gasoline requirements for moving the HLW canisters and shielding blocks to the storage pads. (Note this is considered Diesel usage rather than gasoline usage. The Gasoline usage results from the construction of LLW vaults.

3. For closure, the values in the spread sheet were assumed to be unchanged.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11.0.3 and Transportation Tables SHEET NO. 2 OF 393

BY RDW CHKD. JOB NO. 01K47101

1. a. Gasoline (m^3)

Construction

WR&T	330
Vitrification	9400

operation

vault Construction	54.6

Closure

Tank Stabilization	40.1
Barrier	350.0
anc. Equipment	1.2

b. Diesel (m^3)

1. For construction, the value of diesel consumption did not change.

2. For operations, the amount of diesel consumption increased for the vault construction and movement of LLW and HLW wastes into storage as required.

3. For closure, the diesel consumption remained as given as no changes were made to affect this operation.

Diesel (m^3)

Construction

WR&T	1000
Vitrification	28000

operation

WR&T	1200
Vitrification	22800

Closure

Tank Stabilization	63800
Barrier	60000
anc. Equipment	802

1. c. Propane (m^3)

1. For construction the use of propane remained constant as no change occurred in this area to affect the propane usage.

propane (m^3)
Construction
WR&T 1200

d. Kerosene (m^3)
1. Due to changes in the amount of material vitrified as both LLW and HLW upon application of blending factors and loading factors, the consumption of kerosene increased.
The combined ratio was calculated as 2.5
(2.5) (9.36E+04) = 2.34E+05 see previous
Calculation by RDW red dated 2-15-96, page 80/48.

Kerosene (m^3)
operations
vitrification 2.34E+05

e. Materials
Concrete (m^3)

1. The concrete requirements for construction of the facility were assumed to remain unchanged. The concrete has been broken down into its components to better determine the shipping point and mode of transportation to be used.

2. The concrete requirements for operation of the facility changed due to the requirement of LLW vaults, HLW shield casks, and increased HLW storage pad area.

3. The concrete requirements for closure were assumed to remain unchanged but were broken down into

1.e.3. the components of sand, gravel, and cement to better determine the point of origin and the mode of transportation to the site.

materials - Concrete (m^3)

Construction

WR+T

Sand = (59000)(0.63)(1.07) = 4.0E+04

gravel = (59000)(0.37)(1.07) = 2.46E+04

Cement (MT) = (59000)(1.1)(5)(1/22) = 1.48E+04

From WHC-SD-WM-DP-129, page 472 of Rev 0 (Jacobs No. 0635) the following information is extracted for use in these following calculations.

Sand is 0.63% of the concrete
Gravel is 0.37% of the Concrete
Sand and gravel wastage assumed at 7%
Gravel will be crushed rock from an onsite borrow pit.
Sand will be trucked from ~~the tri-cities~~ sand pit (Pit 30)
Portland Cement will be shipped by rail car.
a 5-sack mix was assumed (5.5 sks / cu yd.).

vitrification

Sand = (4.4E+05)(0.63)(1.07) = 2.97E+05

Gravel = (4.4E+05)(0.37)(1.07) = 1.74E+05

Cement (MT) = (4.4E+05)(1.1)(5)(1/22) = 1.1E+05

operation

LLVaults

Sand = (3.98E+05)(0.63)(1.07) = 2.68E+05

gravel = (3.98E+05)(0.37)(1.07) = 1.58E+05

cement (MT) = (3.98E+05)(1.1)(5)(1/22) = 9.95E+04

HLW Shield Casks

Sand = (1.8E+04)(0.63)(1.07) = 1.21E+04

gravel = (1.8E+04)(0.37)(1.07) = 7.13E+03

Cement (MT) = (1.8E+04)(1.1)(1/22)(5) = 4.5E+03

1. e. Closure

Tank Stabilization

Sand = (5300)(0.63)(1.07) = 3.6 E+03
Gravel = (5300)(0.37)(1.07) = 2.1 E+03
(MT) Cement = (5300)(1.1)(5)(1/22) = 1.33 E+03

Barrier

anc. Equip -
Sand = (13700)(0.63)(1.07) = 9.2 E+03
Gravel = (13700)(0.37)(1.07) = 5.4 E+03
Cement (MT) = (13700)(1.1)(5)(1/22) = 3.4 E+03

f. Carbon Steel (MT)

1. For construction, the usage of carbon steel remained unchanged.

2. For operations, the use of carbon steel changed because of the increased number of vaults, the steel containers for LLW and the HLW shielding cask steel, and extra storage pads.

3. For closure, the usage of carbon steel remained unchanged.

Carbon Steel (MT)

Construction

WR+T	10000
Vitrification	130000

Operation

LLW Vaults	4.6 E+04
HLW Containers	1.54 E+03
LLW Boxes	1.26 E+05

Closure

g. Stainless Steel (MT)

1. g. Stainless Steel (MT)

1. For Construction, the stainless steel usage remained unchanged.

2. For operations, the amount of material for the stainless steel commsites is included here.

3. For Closure, there was no usage of stainless steel considered.

Stainless Steel (MT)

Construction

WR&T	4000
Vitrification	17000

operations

SS Computers	1200

closure

h. Hastelloy/Inconel (MT)

1. Hastelloy/Inconel materials are used only in the initial construction of portions of the vitrification units and remain unchanged.

Hastelloy/Inconel (MT)

Construction

WR+T	
Vitrification	1.80E+03

operation

Closure

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resume Summary Table B.1.0.3 and Transportation Tables SHEET NO. 7 OF 393

BY RDW CHKD. _____ JOB NO. 01K47101

1. i. Flux (MT) - [Glass Formers] MT

These materials occur only in operation and vary accordingly with the glass loading factor and the blending factor application.

aluminia

Borax = [(5.75)/(35.5)](8.88E+05) = 1.44E+05 MT

Bulk frit

Calcium oxide = [(4.10)/(355)](8.88E+05) = 1.07E+04 MT

Ferric oxide = [(14)/(355000)](8.88E+05) = 1.07E+02 MT

Limestone

Lithium Oxide = [(2100)/(355000)](8.88E+05) = 5.2E+03 MT

Mag oxide = [(4.1)/(355)](8.88E+05) = 1.07E+04 MT

Silica = [(2.57)/(3.55)](8.88E+05) = 7.18E+05 MT

3. Process Chemicals (MT)

aluminum nitrate ~~(1.32E+06)(1.12E+02/8.86E+05)~~ = 1.12E+02 ~~171.6~~

* ammonia (1.32E+06)(9.24E+03/8.86E+05) = 9.24E+03 1.37E+05

antifoam

APM ~~(1.32E+06)(1.00E+01/8.86E+05)~~ = 1.00E+01 ~~14.78~~

CMPO ~~(1.32E+06)(5.0E+00/8.86E+05)~~ = 5.0E+00 ~~7.4~~

Crown Ether ~~(1.32E+06)(2.84E+02/8.86E+05)~~ = 2.84E+02 ~~4.22E+4~~

Decon Chem ~~(1.32E+06)(1.4E+04/8.86E+05)~~ = 1.4E+04 ~~2.09E+04~~

Floc ~~(1.32E+06)[(1.5E+02)/8.86E+05)]~~ = 1.5E+02 ~~221.4~~

Formic acid ~~(1.32E+06)(1.47E+03/8.86E+05)~~ = 1.47E+03 ~~2191.2~~

FSA ~~(1.32E+06)[(4.72E+03)/8.86E+05)~~ = 4.72E+03 ~~25.16~~

Glycolic acid ~~(1.32E+06)(7.7E+03/8.86E+05)~~ = 7.7E+03 ~~11470.8~~

N.F ~~(1.32E+06)(9.4E+02/8.86E+05)~~ = 9.4E+02 ~~1409~~

* HNO3, 50% ~~(1.32E+06)(4.65E+05/8.86E+05)~~ = 4.65E+05 ~~6.93E+05~~

Hydroxylamin ~~(1.32E+06)(9.5E+01/8.86E+05)~~ = 9.5E+01 ~~141.24~~

* NaOH, 50% ~~(1.32E+06)(1.5E+05/8.86E+05)~~ = 1.5E+05 ~~2.23E+05~~

Na 3 DTPA ~~(1.32E+06)(1.96E+02/8.86E+05)~~ = 1.96E+02 ~~291~~

HPH ~~(1.32E+06)(7.3E+02/8.86E+05)~~ = 7.3E+02 ~~1087~~

Oxalic acid ~~(1.32E+06)(1.2E+04/8.86E+05)~~ = 6.2E+04 ~~1.79E+04~~

** oxygen (See calc page 4 this calc) 7.68E+05 MT

Peroxide ~~(1.32E+06)(6.4E+03/8.86E+05)~~ = 6.4E+03 ~~4530~~

Potassium permanganate

Sodium bicarb ~~(1.32E+06)(1.25E+04/8.86E+05)~~ = 1.25E+04 ~~18.6E+04~~

Sodium carbonate ~~(1.32E+06)(1.8E+02/8.86E+05)~~ = 1.8E+02 ~~268~~

NOTE: It is assumed that the only Process Chemical to contribute is the oxygen because of the assumed use of kerosene in the mixture.

FORM 91-005-1 (4/81)

Sodium nitrate
Sodium oxalate ~~(1.32E+06)(2.09E+04/8.86E+05)~~ = ~~3.1E+04~~ 2.09E+04
TBP ~~(1.32E+06)(7.55E+02/8.86E+05)~~ = ~~1125~~ 7.55E+02
TSP
Zinc Nitrate ~~(1.32E+06)(4.7E+01/8.86E+05)~~ = ~~70~~ 4.7E+01

~~**~~ Oxygen is shown as supplied to the LLW and the HLW melters but no value has been included. Based on the oxygen for the No separations vitrification alternative and the kerosene ratio an estimate is made for the original alternative and is carried forward to the present alternative covered in Table B.11.0.3.

$$\text{Kerosene ratio} = \frac{\text{Extensive Separation}}{\text{No Separations}} = \frac{9.36E+04\ (m^3)}{5.64E+04\ (m^3)} = 1.66$$

$$O_2 \text{ usage Extensive Separations} = (\text{Oxygen no Sep})(\text{Kerosene Ratio})$$
$$= (1.85E+05)(1.66)$$
$$= 3.07E+05\ MT$$

Combined ratio of LLW and HLW = 2.5 (See previous Calculation by RDW and dated 2-15-96, page 7,8 of 46)

O_2 usage for revised extensive separations:
$= (2.5)(3.07E+05\ MT) = 7.68\ MT.\ (E+05)$

K. Bulk Sulfur Cement (MT)

This material has been considered for solidifying Glass cullet in the LLW process for the LLW Vault disposal operations – LSW vault disposal.

Sulfur	4.25E+05
Dicyclopentadiene (DCPD)	1.12E+04
Oligomer (DCP)	1.12E+04

1. I. IX Resin (m^3)

The Resins are used in the Separations portion and remain unchanged based on treating all the liquid waste from the tanks.

IX Resins (m^3)
operations 4.90 E+03 ~~2.80 E+02~~ RDW

2. Extensive Retrieval - Ex-Situ no separations vitrification alternative.

a. Gasoline
1. For Construction there was no change in the Gasoline consumption.
2. For operation, there was no change in the Gasoline consumption.
3. for Closure, there was no change in the Gasoline consumption.

Gasoline (m^3)
Construction
WR&T 3.30 E+02
vitrifi 4.80 E+03

operation

Closure
tank Stab 4.01 E+01
Barrier 2.60 E+02
onc Equip 1.20 E+00

b. Diesel (m^3)
1. For Construction there was no change in the Diesel Consumption.
2. For operation there was a change in the diesel consumption due to movement of additional Cannisters and cover shields.

2. b. 3. For closure there was no change in the diesel consumption.

Diesel (m^3)

Construction

WR&T	1.0 E+03
Vitrifi	1.09E+04

operation

WR&T	1.02 E+03
Vitrifi	1.3 E+04

Closure

Tank Slab	6.38 E+03
Barrier	4.50 E+04
onc. Equip.	8.02 E+02

c. Propane

The propane usage was not affected by any changes in the glass loading or the blending factor.

Propane (m^3)

Construction

WR&T	1200

d. Kerosene (m^3) usage.

Because of changes resulting from the application of blending and loading factors the kerosene usage increased.

Kerosene (m^3)

Operations

Vitrifi	1.06 E+05

e. Materials - Concrete (m^3)

1. For Construction, the vitrifi concrete usage increased due to the increased amount of storage pad needed under the new loading and blending requirements.

2. e. 2. The operational concrete requirements changed due to the increased number of shielding containers required.

3. The amount of concrete usage for closure remained unchanged.

Materials - Concrete (M^3)

Construction

WR&T

Sand = (59000)(0.63)(1.07) = 4.0E+04

Gravel (") (0.37) (") = 2.46E+04

Cement (MT) = (")(1.1)(5)(1/22) = 1.48E+04

~~Est~~

Vitrifi.

Sand = (3.73E+05)(0.63)(1.07) = 2.51E+05

Gravel = (") (0.37) (") = 1.48E+05

Cement (MT) = (")(1.1)(5)(1/22) = 9.33E+04

Operations

HLW Shield Cofs.

Sand (9.17E+06)(0.63)(1.07) = 6.18E+06

Gravel (9.17E+06)(0.37)(1.07) = 3.63E+06

Cement (MT) 9.17E+06)(1.1)(5)(1/22) = 2.3E+06

Closure

Tank Slab (See page 5 above Item 1.e. Closure.

Sand 3.6E+03

Gravel 2.1E+03

Cement (MT) 1.33E+03

Barrier

Anc. Equip

Sand See above (1.32E+04) = 9.2E+03

Gravel 5.4E+03

Cement (MT) 3.4E+03

2. f. Carbon Steel (MT)

1. The Carbon steel usage for construction increased due to the larger storage pad area required.

2. The operations use of Carbon Steel did increase by the increase in the number of HWPC's required.

3. The Closure usage of Carbon Steel did not change.

Carbon Steel (MT)

Construction

WR&T	~~5.9 E+04~~ RDW	1.00 E+04
Vitrifi		5.72 E+04

operations

HLW Casks = (125,600)(6,500 Kg/each) = 816.4 E+06 Kg.
= 8.164 E+05 Mg (MT)

= 8.164 E+05 + 1.46 E+05
= 9.62 E+05 MT.

Closure

g. Stainless Steel (MT)

1. Construction usage of SS did not change
2. operations usage changed due to increased number of Canisters.
3. No SS used in closure.

Stainless Steel (MT)

Construction

WR&T	4.00 E+03
Vitrifi	8.61 E+03

operations

SS Canister	4.4 E+05

Closure

2. h. Hastelloy / Inconel (MT)

Hastelloy/Inconel materials are used in construction of the initial vitrification system where needed. Operations and closure activities do not use these materials. Therefore there was no change in these quantities.

Hastelloy/Inconel (MT)

Construction

vitrifi- 1.51E+03

i. Flux (MT) [Glass formers (MT)]

These materials occur only in the vitrification operation and vary according to the glass loading factor and the blending factor applied.

alumina	(4.68E+05) (1.60E+04/2.50E+05) = 1.87E+04
Calcium oxide	(4.68E+05) (3.85E+04/2.50E+05) = 6.65E+04
Silica	(4.68E+05) (2.04E+05/2.50E+05) = 3.82E+05

j. Process chemicals (MT)

These materials occur only in the processing of the waste prior to its solidification in the containers for disposal.

Ammonia	6.98E+03	
Nitric acid, 50%	6.30E+02	
NaOH, 50%	2.66E+02	
Oxalic acid	3.20E+01	
Oxygen	3.46E+05	(1.85E+05)(1.87)
$KMnO_4$	1.70E+01	
TSP	1.90E+03	

Increases in the process chemicals was assumed to be limited to the increase in oxygen required by the increase in consumption of kerosene.

k. Sulfur Cement (MT)

2. R. In this alternative the Sulfur matrix material is not applicable since it is for LLW and here is only HLW.

l. Ion Exchange (m^3)

In this alternative for no Separations there is no use for Resins because there is only HLW waste and no LLW waste.

3. Ex Situ Intermediate Separations alternative with extensive Retrieval

a. Gasoline (m^3)

1. The consumption of Gasoline for construction was assumed as calculated.
2. The Gasoline consumption applied for operations was applied to the building of additional LLW Vaults.
3. The gasoline consumption for closure was assumed to remain unchanged.

Gasoline (m^3)

construction		
WR&T	3.30E+02	
vitrifi	7.30E+03	
operation		
vaultconst.	3.46E+01	See page 12 of previous calculation by K.D. Weed dated 2-15-96.
closure		
Tank Stab	4.01E+01	
Barrier	3.50E+02	
anc. Equip	1.20E+06	

3. b. Diesel (m^3)

1. The Diesel Consumption for construction was assumed to be unchanged.
2. The diesel consumption for operation was increased because of the increase in ~~wastes~~ constructed and the increase in total quantity of waste handled for storage.
3. The diesel Consumption for closure was assumed to be unchanged.

Diesel (m^3)

Construction	
WR&T	1.00 E+03
vitrifi	2.00 E+04
operation	
WR&T	1.02 E+03
vitrifi	4.51 E+03
Closure	
Tanks Stab	6.38 E+03
Barrier	5.90 E+04
anc Equip	8.02 E+02

c. Propane (m^3)

Propane consumption remained constant since there were no changes in construction in this area to affect the propane usage.

Propane (m^3)

Construction	
WR&T	1.2 E+03

d. Kerosene

Due to changes in the loading percentage and the application of blending factors the requirements for kerosene usage increase accordingly.

3. d. Kerosene (m^3)
operation
vitrifi 9.56 E+04

e. Materials – Concrete (m^3)
1. assumed the construction concrete requirements increased by the additional storage pad requirements.
2. assumed the operation concrete requirements increased by the additional vaults and by the additional shield casks required.
3. assumed the closure concrete requirements remained the same as originally estimated.

Materials Concrete (m^3)

Construction

WR&T

Sand	(5.9E+04)(0.63)(1.07)	= 4.0 E+04
gravel	(5.9E+04)(0.37)(1.07)	= 2.46E+04
Cement (MT)	(5.9E+04)(1.1)(5)(1/22)	= 1.48 E+04

vitrification

Sand	(4.89E+05)(0.63)(1.07)	= 3.3 E+05
Gravel	(4.89E+05)(0.37)(1.07)	= 1.94E+05
Cement (MT)	(4.89E+05)(1.1)(5)(1/22)	= 1.22E+05

operations

LLW vaults

Sand	(5.37E+05)(0.63)(1.07)	= 3.62E+05
gravel	(5.37E+05)(0.37)(1.07)	= 2.13E+05
cement (MT)	(5.37E+05)(1.1)(5)(1/22)	= 1.343E+05

HLW Containers Shield Casks $= \frac{(8350)(90.7\ mg)}{1.6\ mg/m^3} + 1.0E+04 = \cancel{4.67}\ 4.83\ E+05$

~~Ratio of 2.2 (1.0E+04) = 2.2E+04~~

3. e. HLW Container shielding Casks.

Sand	(4.83 E+05)(0.63)(1.07)	= 3.26 E+05
gravel	(4.83 E+05)0.37)(1.07)	= 1.91 E+05
Cement (MT)	(4.83 E+05)(1.1)(5)(1/22)	= 1.21 E+05

Closure
Tank Slab

Sand	(5.3 E+03)	= 3.6 E+03
gravel	(5.3 E+03)	= 2.1 E+03
Cement (MT)	(5.3 E+03)	= 1.33 E+03

f. Barrier

one Equip

Sand	(1.37 E+04)	= 9.2 E+03
gravel	(1.37 E+04)	= 5.4 E+03
Cement (MT)	(1.37 E+04)	= 3.4 E+03

f. Carbon Steel (MT)

1. Construction Carbon steel usage increases by the estimated HLW storage pad increased area.
2. The operations Carbon steel usage increases by the increased ~~bldg~~ vault construction, the increased HMPC's required, and the addition of the LLW steel boxes for storage of the waste glass in the LLW vaults.
3. The use of Carbon steel in closure remains unchanged.

Carbon Steel (MT)
Construction

WR&T	1.00 E+04	
Vitrifi	9.70 E+04 + 3.78 E+02	= 9.74 E+04

Operation

LLW vaults	4.1 E+04	
HLW Casks	5.4 E+04	= [(6.5)(8350)] − (230)
LLW boxes	1.26 E+05	

3. f. Closure

g. Stainless Steel (MT)
1. Stainless Steel usage in construction remains unchanged
2. Stainless Steel usage in operations increases because of the number of Canisters required.
3. Stainless steel usage in closure is not applicable.

Stainless Steel (MT)
Construction
WR+T 4.0 E+03
Vitrifi 1.5 E+04

operations
vitrifi 2.51 E+04 = (33400)(0.75 MT/Canister)

closure

h. Hastelloy / Inconel (MT)
The Hastelloy / Inconel materials are utilized only in portions of vitrification system where corrosion resistance at high temperature is required.

Hastelloy/Inconel (MT)
Construction
vitrifie 2.3 E+03
WR+T

operation

closure

i. Glass (MT) - [Glass Formers (MT)]
all of the materials in this category increase due to the increase in the waste glass product, both LLW and HLW, due to application of lower loading factors and stream blending factors.

3. i. Flux (MT)

alumina	(4.68E+05)	(1.30E+04/2.94E+05)	= 2.07E+04
Borax	(4.68E+05)	(1.80E+03/2.94E+05)	= 2.9E+03
Bulk frit	(4.68E+05)	(5.20E+01/2.94E+05	= 8.3E+01
Calcium oxide	(4.68E+05) ~~3.9E+04~~	(3.9E+04/2.94E+05)	= 6.21E+04
Ferric oxide			
Limestone			
Lithium oxide	(4.68E+05)	(5.0E+02/2.94E+05)	= 7.96E+02
Mag oxide			
Silica	(4.68E+05)	(2.4E+05/2.94E+05)	= 3.82E+05

j. Process Chemicals (MT)

Except for oxygen the process chemicals listed as used in this operation remain unchanged in quantity. The oxygen requirement increased because the amount of kerosene consumed increased.

oxygen 3.46E+05 MT

k. Bulk Sulfur Cement (MT)

operation
vitrific

Sulfur	2.21E+05
Dicyclopentadiene	5.78E+03
Oligomer	5.78E+03

l. IX Resins (m³)

The Resins used are unchanged in quantity.

IX Resin (m³)

operation
vitrifi 2.2E+02

4. Ex Situ / In Situ Combination alternative

a. Gasoline (m^3)

1. For Construction the Gasoline consumption was assumed to be unchanged.
2. For operations the gasoline consumption increased by the amount for new vault construction.
3. For Closure the gasoline consumption was assumed to be unchanged.

Gasoline (m^3)

Construction	
WR&T	1.98 E+02
Vitrifi	4.38 E+03
Fill+Cap	6.79 E+01
operation	
vitrifi	2.0 E+01
Closure	
Tank Stab	4.01 E+01
Barrier	2.96 E+02
onc Equip	1.20 E+00

b Diesel (m^3)

1. Diesel consumption for construction was assumed to be unchanged.
2. Diesel consumption for operation was changed because of the additional vault construction.
3. The diesel for closure was assumed to be unchanged.

Diesel (m^3)

Construction	
WR&T	6.0 E+02
Vitrifi	1.2 E+04
Fill and Cap	9.1 E+02
operation	

4. b

WR&T	5.1 E+02
Vitrifi	9.22 E+03
fill & Cap	3.66 E+03

Closure

Tank Slab	6.38 E+03
Barrier	5.06 E+04
anc Equip	8.02 E+02

c. propane (m^3)
No change to this item.

Propane (m^3)
Construction
WR&T 6.0E+02

d. Kerosene (m^3)
The Kerosene increased due to the increased amount of waste glass produced for the same volume of liquid waste treated.

Kerosene (m^3) 4.93E+04

e. Materials - Concrete (M^3)
1. The quantity of Concrete for construction increased by the additional storage pad area.
2. The operations Concrete are increased due to the HLW vaults and the HLW shielding Casks.
3. The closure usage of Concrete remained unchanged.

Materials - Concrete (M^3)
Construction
WR&T

Sand	(2.95 E+04)(0.63)(1.07)	= 1.99 E+04
gravel	(2.95E+04)(0.37)(1.07)	= 1.17 E+04
Cement (MT)	(2.95E+04)(1.1)(5)(1/22)	= 7.38 E+03

4. e Materials - Concrete (m^3)

Construction

vitrifi

sand	(2.444E+05)(0.03)(1.07)	= 1.65E+05
gravel	(2.444E+05)(0.37)(1.07)	= 9.68E+04
cement (MT)	(2.444E+05)(1.1)(5)(1/22)	= 6.11E+04

operation

LLW vaults

sand	(1.75E+05)(0.03)(1.07)	= 1.18E+05
gravel	(1.75E+05)(0.37)(1.07)	= 6.93E+04
cement (MT)	(1.75E+05)(1.1)(5)(1/22)	= 4.38E+04

HLW shield casks

sand	(1.93E+05)(0.03)(1.07)	= 1.3E+05
gravel	(1.93E+05)(0.37)(1.07)	= 7.64E+04
cement (MT)	(1.93E+05)(1.1)(5)(1/22)	= 4.83E+04

closure

Tank slab

sand	(5.3E+03)	= 3.6E+03
gravel	(5.3E+03)	= 2.1E+03
cement (MT)	(5.3E+03)	= 1.33E+03

Barrier

onc equip

sand	(1.37E+04)	= 9.2E+03
gravel	(1.37E+04)	= 5.4E+03
cement (MT)	(1.37E+04)	= 3.4E+03

f. Carbon Steel (MT)

1. The construction usage of carbon steel increased by the amount required for the additional storage pad area for HLW.
2. The operation carbon steel usage increased due to the added number of HMPC's, the additional vaults, and the HLW waste boxes required.

4. f. 3. There is no carbon steel used in closure of the area.

Carbon Steel (MT)
Construction
WR&T 5.0E+03
vitrifi 4.871E+04

operation
LLW vaults 2.05 E+04
HLW Containers 2.72 E+04 = (4175) (6.5 MT/AMPC)
LLW boxes 5.35 E+04 = (1.26E+05) (42/99)

Closure

g. Stainless Steel (MT)
1. Stainless steel for construction remains unchanged.
2. Stainless steel for the Canisters must be considered in operation.
3. Stainless steel is not used in closing the field.

Stainless Steel (MT)
Construction
WR&T 2.0E+03
vitrifi 7.5E+03

operation
vitrif.
Canisters 1.25E+04

h. Hastelloy/Inconel (MT)
This material used only in initial construction where needed.

Hastelloy/Inconel (MT)
Construction
vitrifi 1.15E+03

4. i. Flux (MT) – [Glass Formers (MT)]
These materials increased according to the increase in the amount of waste glass product formed.

Flux (MT)	(2.5 E+05)		
alumina	(2.5E+05)	(6.5 E+03/1.47E+05)	= 1.11E+04
Borax	(2.5E+05)	(9.0E+02/1.47E+05)	= 1.53E+03
Bulk frit	(2.5E+05)	(2.6E+01/1.47E+05)	= 4.42E+01
Calcium oxide	(2.5E+05)	(1.95E+04/1.47E+05)	= 3.32E+04
Lithium oxide	(2.5E+05)	(2.5E+02/1.47E+05)	= 4.25E+02
Silica	(2.5E+05)	(1.2E+05/1.47E+05)	= 2.04E+05

j. The process chemicals remain unchanged except for the increased oxygen to the melter due to the kerosene increase for the increased glass product formed.

Oxygen increase (MT) 1.63E+05 MT

5. Extensive Retrieval - Ex Situ No Separations Calcination alternative
a. Gasoline (m^3)
There was no change in this consumption for operation, Construction and Closure entries

Gasoline (m^3)

Construction	
WR+T	3.3E+02
Calcination	4.8E+03
Operation	
vault Const.	
Closure	
Tank Slab	4.01E+01
Barrier	2.60E+02
ana. Equip	1.20E+00

These values remain the same for the 0.62 m^3 Canisters and for the 10 m^3 canisters.

5. b. Diesel (m^3)

1. The diesel usage for construction does not change for either size container.
2. The operation usage of diesel does change because of the increased HMPCs and shielded cask to be handled for interim storage.
3. The Diesel usage for closure does not change with either size container.

Diesel (m^3)

Construction

WR&T	1.00E+03
Calcination	1.09E+04

operation

WR&T	1.02E+03
Calcination	1.66E+03

Closure

Tank Stub	6.38E+03
Primer	4.5E+04
and Equip	8.02E+02

c. propane (m^3)

The propane usage will not change and will be equivalent to that for no separations vitrification

propane (m^3)

Construction

WR&T	1.2E+03

d. Kerosene (m^3)

The Kerosene usage does not change with the size of Container used.

Kerosene (m^3)

operations

calcination	1.05E+04

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and Transportation Tables SHEET NO. 26 OF 393

BY RDW CHKD. _____ JOB NO. 01K47101

5 c Materials - Concrete (m^3)

Construction	($0.62 m^3$)	($10 m^3$)
WR+T	5.9E+04	5.9E+04
Calcination	2.29E+05	2.07E+05

WR+T	( ) (0.63) (1.07)		
Sand	~~(0.57)~~ (0.63)	= 3.98E+04	= 3.98E+04
gravel	(0.37)	= 2.34E+04	= 2.34E+04
Cement (MT)	(1.1)(5)(1/22)	= 1.48E+04	= 1.48E+04

Calcination	(2.29E+05)	(2.07E+05)
Sand	= 1.54E+05	1.4E+05
gravel	= 9.1E+04	8.2E+04
Cement (MT)	= 5.73E+04	5.18E+04

operation

LLW vault		
total		
sand		
gravel		
Cement (MT)		
HLW shield Casks	(1.93E+06)	(9.8E+05)
Sand (0.63)	1.3E+06	6.61E+05
gravel (0.37)	7.65E+05	3.88E+05
Cement (MT) (5.5/22)	4.83E+05	2.45E+05

Closure

Tank Slab	(5.3E+03)	(5.3E+03)
Sand	= 3.6E+03	= 3.6E+03
gravel	= 2.1E+03	= 2.1E+03
Cement (MT)	= 1.33E+03	= 1.33E+03

Barrier

onc Equip	(1.37E+04)	(1.37E+04)
Sand	= 9.2E+03	= 9.2E+03
gravel	= 5.4E+03	= 5.4E+03
Cement (MT)	= 3.4E+03	= 3.4E+03

FORM 91-005-1 (4/81)

5. f. Carbon Steel (mT)

1. The Construction steel usage increased by the amount needed for extra storage pads with the smaller Canister size.
2. The operation steel usage increased by the amount for the additional HMPCS needed.
3. There is no usage of steel in the closure operation.

Carbon Steel (mT)

Construction		
WR&T	1.00 E+04	1.00 E+04
Calcination	5.22 E+04	5.12 E+04
operation		
LLW vaults		
HLW Casks	1.87 E+05	7.04 E+04
LLW Casks		

$$1.77E+05 = (1.5)(27097) + (3)[(7.04 - 1.7)]$$

g. Stainless Steel (mT)

1. Stainless steel usage in construction does not change.
2. Stainless steel usage in operation changes in accordance with the quantity required for the canister.
3. Stainless steel is not used in the closure operation.

Stainless Steel (mT)

Construction		
WR&T	4.0 E+03	4.0 E+03
Calcination	8.61 E+03	8.61 E+03
operation		
SS Canisters	1.25 E+05	5.84 E+04

10 m^3 Canister = 5.67 mT each.

$$(10300)(5.67) = 5.84\ E+04$$

5. h. Hastelloy/Inconel (m³)

Hastelloy/Inconel Materials are used when needed for the process equipment and do not vary with the product increase or decrease.

Hastelloy/Inconel (m³)
Construction
Calcination/ 1.51 E+03 1.51 E+03

i. Flux (MT)
The Glassforming materials are not required in the calcination process.

j. Process Chemicals (MT)
The following process chemicals were estimated for the calcination process.

Sugar	3.3 E+04	from price Calculation by RDW and dated 9-29-95
ammonia	3.61 E+04	
Oxygen	2.34 E+05	
HNO_3	6.3 E+02	
NaOH	2.66 E+02	
$KMnO_4$	1.70 E+01	
oxalic acid	3.2 E+01	
TSP	1.9 E+03	

k. Sulfur Cement (MT)
Sulfur Cement is not required in this alternative.

l. Ion Exchange Resin (m³)

Ion Exchange Resin is not required in this alternative since there are no separations being performed.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and Transportation tables SHEET NO. 29 of 393

BY RDW CHKD. JOB NO. 01K47101

6. Phased Implementation alternative - phase I and phase 2.

a. 1 Construction gasoline usage remained unchanged.

2. Operations gasoline usage changes due to the increased number of storage vaults.

3. closure ~~gasoline~~ consumption remains unchanged.

Gasoline (m^3)	I	II
construction		
WR&T	2.2E+02 ~~22.82~~ = (650)(330/9400)	(1.12E+04) = 3.93E+02
Vitrifi.	6.28E+03 = (6500 − 220)	(11200 − 393) = 1.08E+04
operation		
vault Const.		7.55 E+01
Closure		
Dismantle.	3.3 E+02	
Tank Stab.		4.01 E+01
Barrier		3.50 E+02
anc. Equip.		1.2 E+00

b. Diesel (m^3)

1. The diesel consumption for construction remains unchanged.

2. The diesel consumption for operation increases by the number of casks handled and by the number of new vaults required.

3. the diesel consumption for closure remains unchanged.

Diesel (m^3)		
Construction		
WR&T	6.43+02 = (1.8E+04)(1/28)	(1/26)(1.3 ~~1.3~~ E+04) = 4.64E+02
Vitrifi.	1.74E+04 = (1.8E+04 − 643)	(1.3E+04 − 464) = 1.25E+04
operation		
WR&T		
Vitrifi	2.0E+02	1.403 E+04

New Cask + Shield handling = 6.0 E+03 = (4.9)(1.22E+03)

New vaults for SSW = (83)(96.7) = 8.03E+03

Σ = 1.463 E+04.

FORM 91-005-1 (4/81)

b. Closure

Tank Slab		6.38 E+03
Barrier		5.90 E+04
anc. Equip		8.02 E+02
Dismantle	1.8 E+04	

c Propane (m^3)

used only in the WR+T Construction area.

Propane (m^3)
Construction
WR+T 1.2 E+03

d. Kerosene (m^3)
Construction
vitrifi. 9.8 E+02 5.1 E+04

The Kerosene use will be increased due to the increased waste generated by the blending and loading factors.

e. Materials - Concrete (m^3)

1. Construction Concrete usage increased according to the HLW storage Pad increase.
2. The operations concrete increased according to the increased shield racks required and the new vaults for LLW needed.
3. The closure concrete requirement remained unchanged.

Materials - Concrete (m^3)
Construction
WR+T (5.9)/44 = 0.134

Total	3.22 E+03	3.89 E+03
Sand	2.17 E+03	2.62 E+03
Gravel	1.28 E+03	1.54 E+03
cement (MT)	8.05 E+02	9.73 E+02

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 31 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

C. e. material - Concrete (m^3)

Construction		
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
operations		
I Vaults		
total		3.57E+05 =(83)(4300) ~~1.54E+05~~
sand		~~1.37E+05~~ 2.41E+05
gravel		~~7.48E+04~~ 1.41E+05
cement (MT)		~~4.73E+04~~ 8.93E+04
Shield Casks		
total	4.4E+02	4.73E+05 ~~3.77E+05~~ =(8350)(90.7)/1.6
sand	2.97E+02	3.19E+05
gravel	1.74E+02	1.87E+05
cement (MT)	1.1E+02	1.18E+05
closure		
tank stab.		
total		5.3E+03
sand		9.6E+03
gravel		2.1E+03
Cement (MT)		1.33E+03
basin		
aux. Equip.		
total		1.32E+04
Sand		9.2E+03
gravel		5.4E+03
Cement (MT)		3.4E+03

FORM 91-005-1 (4/81)

6. f. Carbon Steel (mT)

1. Carbon steel for construction will increase according to the increased storage pad area required for HLW.
2. operation Carbon steel requirements will increase for the additional LLW vaults, the HLW steel casks needed and the LLW waste glass boxes needed.
3. Carbon steel is not used in the Closure application.

Carbon Steel (mT)

Construction		
WR&T	6.4E+03	4.5 E+03 ~~4.68E+03~~
vitrifi	7.66 E+04	5.44 E+04
operation		
LLW vaults		4.2 E+04
HLW ~~casks~~	2.9 E+02	5.43 E+04
LLW boxes	8.23E+03	1.06 E+05
Closure		

place 1 Boxes for LLW.

(20) (365) (10) = 73 000 mTons glass.

box = 2.6 m^3

glass = 2.63 mT/m^3

73000 / (2.63)(2.6) = 7300/17.8 = 4102

(4102)(2 pbs) = 8204

(8204)(0.144)(7) = 8.23 E+03 mTons

g. Stainless Steel (mT)

1. The stainless steel construction quantity should not change.
2. The operation quantity will change with the number of SS Canisters required.
3. Closure does not require any stainless steel.

6. g. Stainless Steel (MT)

construction

WR&T	2.86E+03	5.05E+03
vitrifi	1.22E+04	2.15E+04

operation

SS Canister		
0.62 m³	~~4.54E+01~~ * RDW	2.51E+04
*10m³ Can	4.54E+01 *	

WR&T = 2.86E+03 = (4/21)(1.5E+04)
WR&T = 5.05E+03 = (4/21)(2.65E+04)
vitrifi = 15000 − 2860 = 1.22E+04
vitrifi = 26500 − 5050 = 2.15E+04

10m³ Can = (8)(5.67) = 4.54E+01 MT can

h. Hastelloy/Inconel (MT)

Construction

vitrifi	9.6E+03	1.15E+04

i. Flux (MT) − (Glass Formers − MT)

total =	1.3E+05	4.76E+05
silica =	1.06E+05	3.64E+05

Based on ratio for intermediate gravity alternative

Silica = (1.3E+05)(2.90/2.94) = 1.061E+05

Silica = (4.76E+05)(3.82/3.0) = 3.64E+05

6. j. Process Chemicals (mT)

only the main chemicals will be estimated from the total value given.

ammonia = [(Intermediate value)/(Intermediate total)] (total for phase I or II)

Intermediate total = 5.15E+05
phase I total = 5.8E+04
phase II total = 4.75E+05

Intermediate value ammonia = 8.8E+03
HNO3 = 4.2E+03
NaOH = 2.64E+03
oxygen = 3.46E+05

Total	5.8E+04	4.75E+05 ~~8.12E+0~~
ammonia	9.9E+02	8.12E+03
HNO3	4.73E+02	3.9E+03
NaOH	2.97E+02	2.44E+03
oxygen	3.9E+04	3.2E+05

k. Bulk Sulfur cement.

The amount of sulfur cement will vary according to the increases or decreases associated with the application of blending factors and glass loading factors.

Bulk Sulfur cement.

Sulfur	1.45E+04	2.04E+05
Dicyclopentadiene (DCPD)	3.74E+02	5.28E+03
Oligomer (DCP)	3.74E+02	5.28E+03

6. l. Ion Exchange Resins (m^3)

The quantity of liquid waste treated does not vary, therefore the quantity of ion exchange resin used will not vary within each alternative.

Ion Exchange Resin (m^3)

operation 1.4E+01 1.4E+02

7. W-314 Tank Farm upgrades

Construction resources

a. Land permanently committed

all Calculations = Σ TPlant transfer line + PF Plant transfer line + 211 Sy piping + 241 Sy valve pit lines + A Farm Trunk Line + 241 AY/241 AZ piping + 204 AR piping + Misc. Diversion box and valve pit lines.

ha = Σ 0.43 + 0.25 + 0.66 + 0.00 + 0.58 + 0.66 + 0.02 + 0.00
= 2.6 ha

b. Land temporary Commitment

ha = Σ 0.85 + 0.49 + 0.10 + 0.10 + 1.15 + 0.10 + 0.04 + 0.10
ha = 2.93 ha

c. Water, Raw

Liters = 102,195 + 81 037 + 586,389 + 0 + 137,857 + 586,389 + 5004 + 0
= 1,498871 liters $1 m^3 = 10^3$ liters
= 1.5E+03 m^3

d. Concrete (m^3)

= 1550 + 763 + 210 + 0 + 1065 + 210 + 121 + 0

= 3919 m^3

7 d. Concrete

Sand 2462 m^3
Gravel 1552 m^3
Cement (MT) 980 MT

e Energy Electrical = NR.

f. Carbon Steel

Miscellaneous CS (kg) = 86 174 + 81199 = 167373 kg.

Carbon Steel pipe (m) = 2953 + 2261 + 2 184 + 0 + 3780 + ~~2184~~ 2184 + 141

= 13503 Meters

assumed 3 inch pipe std wall. encased in 6 inch pipe standard wall.

$Kg = (m)\left(\frac{Lbs}{ft}\right)\left(\frac{Kg}{Lbs}\right)\left(\frac{in}{cm}\right)\left(\frac{ft}{in}\right)\left(\frac{cm}{m}\right)$

for 3 inch pipe $= (13503)(7.58\ Lbs/ft)\left(\frac{Kg\ 1}{Lbs\ 2.2}\right)$

for 6 inch pipe $= (13503)\ 18.97\ Lbs/ft$

for 3 inch pipe $= \frac{(13503)(7.58)(100)}{(2.2)(2.54)(12)} = 152637.7\ Kg$

for 6 in pipe $= \frac{(13503)(18.97)(100)}{(2.2)(2.54)(12)} = 381996.97\ Kg$

Carbon Steel = 381996.97 + 152637.7 + 167367
= 702002 Kg. = 702 Mg = 702 MT

g. Electrical Conduit

Σ = 1082 + 459 + 866 + 0 + 3780 + 866 + 0 + 0
= 7053 meters.

assumed 3 inch CS galvanized Sch 40 for conduit.

7.g. weight of pipe 7.58 lbs/FT

$$\text{Kg of Conduit} = \frac{(7053)(7.58)(100)}{(2.2)(2.54)(12)} = 79727 \text{ Kg}$$

$$= 80 \text{ Mg} = 80 \text{ MT}$$

Carbon Steel Total = 702 + 80 = 782 MT.

h. stainless steel

Kg miscellaneous material = 76167 + 26665 + 0 + 1739 + 133809 + 0 + 0 + 16157

Kg SS = 259537 Kg = 260 Mg = 260 MT

SS piping (meters) = 3,157 + 2251 + 2184 + 0 + 3780 + 2184 + 137 + 0 = 13693

assumed 3 inch std. pipe wt = 7.58 lbs/FT

assumed 6 inch schedule 10 measurement pipe · wt = 9.29 lbs/FT

$$\text{3 inch pipe} = \frac{(13693)(7.58)(100)}{(2.2)(2.54)(12)} = 154785.45 \text{ Kg}$$

$$\text{6 inch pipe} = \frac{(13693)(9.29)(100)}{(2.2)(2.54)(12)} = 189704.67$$

Σ = 344490 Kg = 345 Mg = 345 MT

SS (MT) = Σ 345 + 260 = 605 MT

i Excavation m^3

Σ = 3030 + 1184 + 2293 + 0 + 1538 + 2293 + 146 + 0

= 10484 m^3

7. j. Backfill (m^3)

$\Sigma = 3384 + 778 + 2293 + 7935 + 2293 + 146 + 0$
$= 16829\ m^3$

k. Miscellaneous materials (m^3) Truck hauling of Construction materials
$\Sigma = 142 + 73 + 459 + 459 + 88$
$= 1221\ m^3$

8. Determination about grouting ancillary Equipment, Wastes etc.
used table 5-3A of WHC-SD-WM-EV-107 Rev 0; also used data page 3-10, and tables A1, A2, A3, A4, A5 and A6.

using data from table A.2.3.1 of DEIS and using a volume of 50,000 liters for each of the following tanks, a calculation of the volume for fill was made.

244-ER-311A	242-TA-R1
241-AX-151	242-T-135
216-TY-201	243-S-TK-1
216-BY-201	

Σ of MUST. Tank volumes = 2 783200 liters 10^3 liters = $1\ m^3$
Estimated volume = 2.783 E+03 m^3

from page 3-10 16 tanks at 208 m^3 each (Table A1) are to be grouted or filled with concrete

$\Sigma = (16)(208) = 3328\ m^3$

from data in tables A2, A3, A4, A5
241A piping and structural void volume = 1690.24 m^3
241T piping and structural void volume = 820.79 m^3
241TY piping and structural void volume = 445.71 m^3

$\Sigma = 2956.74\ m^3$

total C = 2.783 E+03 + 3.328 E+03 + 2.956 74 E+03
= 9.068 E+03 m^3

The ancillary Equipment for the DST2 was assumed to be
= 3.208 E+03 m^3 See note on Table 5-2C

total E = 1.23 E+04 m^3 This compares easily with

the value incorporated of 1.37 E+04 m^3 of Table 5-3A

In addition tank stabilization by gravel fill must be incorporated into the spreadsheet under closure.

Volume of tarps from Table A1 is calculated as

177 Tarps = 761 487 m^3 but 16 tarps (3328 m^3) are to be filled with Cement not gravel.

Therefore
161 Tarps = 761487 − 3328 = 758 159 m^3

= 7.58 E+05 m^3

It is assumed that concrete consistent with the other concrete calculations is used to fill this anc. Equip.

The grout mix proposed in (CEV-107 Rev 0) is not considered of sufficient strength for use in this application. Page 3-6 gives the following grout composition.

Kg/m^3	=	1660 sand	0.826
	=	180 fly ash	0.090
	=	150 water	0.074
	=	20 portland Cement	0.010
	Σ =	2010	1.000

also 0.45 Kg of an air entrainment additive is included in the grout mix.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11-0-3 and Transportation tables SHEET NO. 40 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

If Grout is used for the ancillary Equipment and the "must" tanks, the following quantities of materials are used (estimated):

anc. Equip + MUSTs (m^3) Grout.

Total 1.37 E+04 m^3

Sand 1.13 E+04 m^3

Flyash ~~1.23 E+02 m^3~~ 1.23E+03 m^3

H_2O ~~1.04 E+03 m^3~~ 1.04E+03 m^3

Cement 1.37E+02 m^3

Sand 1.879 E+07 Kg. = 1.879E+04 mT

Flyash 2.22 E+05 Kg → 2.22 E+02 MT

H_2O (not hauled)

Cement. 2.740 E+03 Kg. = 2.7 mT

FORM 91-005-1 (4/81)

Determination of Resource Summary for Tank Waste alternatives - Table B.11.0.3 and the Resource Summary spread sheet.

1. Ex Situ No separations alternative - Extensive Retrieval.

A. Land permanently committed (hectares)

Construction / operation

WR&T 5.43 hectares = 5.43E+04 m^2

vitrifi 13.57 hectares = 1.357E+05 m^2

Closure 8 hectares = 80000 m^2 8.0E+04 m^2

1 hectare = 2.4711 acres

1 hectare = 10,000 meters, square

WR&T Fraction

$\frac{4000}{14000} = 0.2857142$

Vitrifi fraction

$\frac{10000}{14000} = 0.7142857$

The value of land committed did not change. The same size plant is required for this operation using the blending factor of 1.2 and 20 wt % sodium oxide loading as was required for the 20 wt % sodium oxide loading and the 1.5 blending factor.

Total = = 27 hectares

Construction/operation = 19 hectares

Closure = 8 hectares

B. Land temporarily committed

Construction / operation

WR&T 7.388 ha = 7.4E+04 m^2

vitrifi 138.6 ha = 1.4E+06 m^2

Closure 20 ha = 2.0E+05 m^2

WR&T = $\frac{32000}{632000} = 0.0506$

Vitrifi = $\frac{600000}{632000} = 0.9494$

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 42 OF 393

BY MDW CHKD. JOB NO. 01K4710/

1.B. Construction/operations

WR&T = 3.4 = 3.4E+04 WR&T = 32000 / 632000 = 0.0506

Vitrifi = 64.6 = 6.46E+05 Vitrifi = 600000 / 632000 = 0.9494

Closure = 20 = 2.0E+05

Cannisters/HMPCs = 146 750 = 968550 m²

now = 29100 = 192060 m²

6.6 m²/HMPC Less storage area = 776490 m²

= 78 hectares

temporary Committed Land = 146 − 78

= 68 hectares

Total = = 88 ha

Construction/operation = 68 ha

Closure = 20 ha

C. Raw water usage for the new case using 20% Na_2O loading with 1.2 blending and 10 m³ cannisters.

New mass of glass = ~~5.36 MT~~ 5.36 E+05 MT.

previous Mass of glass = 6.71 E+05 MT.

Ratio for application = 5.36/6.71 = 0.8

Raw water usage is for cooling tower makeup for loss through, evaporation, bledoff, and drift and is based on the cooling tower duty.

Raw water = (0.8) (8.64 E+05 m³) = 6.91 E+05 m³

2. Sanitary water usage

Sanitary water = (0.8)(3.85 E+06) = 3.08 E+06 m³

FORM 91-005-1 (4/81)

1.E. total water usage

total Water usage = RW + SW

RW = 6.91 E+05 m^3

SW = (3.08 E+06 m^3) + (4.13 E+04) + (2.39 E+05 m^3)
SW = 3.36 E+06 m^3

total water usage = 3.36 E+06 + 6.91 E+05
= 4.05 E+06 m^3

F. operations requirement for Electrical Energy.

Electrical usage = (0.8)(8.77 E+03 Gwh.
= 7.02 E+03 Gwh.

G. Gasoline consumption

there is no operational component to be affected.

H. Diesel usage

Initial $10^3 m^3$ Commutes = 21400 total = 21400 x 3

Present $10^3 m^3$ Commutes = 29100 total = 29100 x 3

Ratio = 29100/21400 = 1.36

Diesel = (1.36)(1.02 E+03 m^3) = 1.39 E+03 m^3

I. Kerosene usage changes per the change in MTolglass produced

ratio = 5.36/1.71 = 0.8

Kerosene usage = (0.8)(1.06 E+05 m^3)
= 8.48 E+04 m^3

1. J. Concrete materials

Concrete for the increased storage requirement.

new casks 29100
old casks 21400 $\Delta = 7700$ units.

storage area = (7700) (6.6 m²) = 50820 m²
at 0.2m thick = 10164 m³

Concrete for Construction = 2.66 E+05 + 1.02 E+04
total = 2.76 E+05

Concrete for WR+T = 5.9 E+04 m³
sand = 4.0 E+04 m³
gravel = 2.46 E+04 m³
Cement = 1.48 E+04 MT

Concrete for Vitrifi = 2.97 E+05 m³
sand = 1.4 E+05 m³
gravel = 8.2 E+04 m³
Cement = 5.18 E+04 MT

Concrete for operation

HLW shield casks. operational Concrete = 2.04 E+06 m³

additional new casks = 7700 (90.7)(1/1.6) = 4.4 E+05 m³

total new value = 2.48 E+06 m³
sand = 1.67 m³ E+06
gravel = 9.82 m³ E+05
Cement = 6.2 E+05 MT

Concrete for closure remained the same
Concrete = 1.9 E+04 m³

Tank Slab = 5.3 E+03 m³
Sand = 3.6 E+03 m³
gravel = ~~3.6 E+03 m³~~ 2.1 E+03 m³
Cement = 1.33 E+03 MT

1.J. ancillary Equipment
total = 1.37 E+04 m^3

sand = 9.2 E+03 m^3
gravel = 5.4 E+03 m^3
Cement = 3.4 E+03 MT

H. Carbon Steel
Construction
WR+T = 1.00 E+04 MT

Vitrifi = 5.12 E+04 + Increase for storage pads.

Increased area for 5 pads = (7700)(6.6)
= 50 820 m^2
Approximate size = 226 m x 226 m
= 51076 m^2

assumed rebar diameter of 0.0125 meters
and a spacing of 0.2 meters
Rebar area = $\pi (0.0125)^2/4$ = 0.000123 m^2

Number of rebars = 226 m / 0.2 m = 1130
add 1 meter to rebar length for bending L = 227 m

ρ of steel = 7 mg/m^3
MT = (0.000123) m^2 x 227 m x 1130 x (2/~~4~~) x (7)
= 4.41 E+02 MT steel.

Vitrifi = 5.12 E+04 + 4.42 E+02
= 5.17 E+04 MT

Construction total = 6.17 E+04 MT

operation
HLW HMPCS Δ = (7700)(6.5 MT each) = 5.01 E+04 MT

total = 1.46 E+05 + 5.01 E+04
= 1.96 E+05 MT

Closure steel = Not Reported.

1. L. Stainless Steel
Construction
WR&T 4.00 E+03 MT
vitrifi 8.61 E+03 MT

operation
stainlessteel canisters = 29100 10 m³ size
10 m³ canister = 5.67 MT each

total = (29100) (5.67) = 1.65 E+05 MT.

M. Hastelloy / Inconel
These materials are used where needed in plant construction for vitrifi section.

Construction
vitrifi = 1.51 E+03 MT

N. Glass formers
These materials change according to the change in the mass of glass.
Glass formers required = 4.29 E+05 MT

alumina (1.87 E+04 / 46.72 E+04) = 0.0400
Calcium oxide (6.65 E+04 / 46.72 E+04) = 0.1423
Silica (38.2 E+04 / 46.72 E+04) = 0.8177

alumina = 1.72 E+04 MT

Calcium oxide = 6.11 E+04 MT

Silica = 3.51 E+05 MT

lbs/ft³ = 11.82

= (MT) (3.45)
= (3.51 E+05) (3.45)
= 1.211 E+06 yd³
use 1.07 for wastage = 1.296 E+06 yd³

Cu yd = (MT) (2000/MT) (2 lbs/ton) (ft³/66) (yd³/ft³)
= (MT) (1.1) (103) / (11.82) (27)

1 O. Process Chemicals

only the oxygen quantity changes and this material is produced on site by an air separation plant.

Oxygen = (1.85 E+05) (5.36/3.58) = 2.77 E+05 MT

process Chemicals = 2.87 E+05 MT.

P. Ion Exchange Resins.
No change as Resins are not used in this alternative

2. Ex Situ Extension Separations alternative - Extension Retrieval.
A. Land permanently committed will be calculated later.
B. Land temporarily committed will be calculated later.
C. Borrow pit disturbance will be calculated later.

D. Calculate water usage.

LAW new mass of glass vitrified = 6.43 E+05 MT
LAW number of vaults needed = 66
HLW new mass of glass vitrified = 1.755 MT (E+03)
HLW new number of Canisters 1.17 m^3 vol = 5700
HLW new number of HMPCS = 143
HLW new number of shield Casks = 143

HLW old number of Canisters = 1571
HMPC = 393
Shield Casks = 393
(Initial Core 250)

$\frac{143}{393} = 0.364$
$\frac{143}{250} = 0.572$

HLW old mass of glass = 2.561 E+03 MT

LAW old mass of glass = 8.04 E+05 MT
old number of vaults = 82

HLW = 1755/2561
= 0.685

LAW = new mass/old mass
= 6.43 E+05/8.04 E+05
= 0.8

overall = 644755/806561
= 0.8

2.0. The raw water usage applies the overall ratio to the calculated number to obtain the new value.

raw water = $(7.5E+07\ m^3)(0.8) = 6.0E+07\ m^3$

E. Sanitary water increase for the increased or decreased glass waste product.
Construction usage did not change.

Closure usage will change for additional vault Barriers.

operational usage will change for the additional vaults built and the additional tower makeup required.

operational usage of Sanitary water
$= (0.8)(8.03E+06) = 6.42E+06\ m^3$

Closure usage calculation:
Estimated area of Barrier = area of tanks + area of vaults
1. $= 2.464E+05 + 2.331E+04$
$= 2.6971E+05\ m^2$
2. $= 2.464E+05 + 3.663E+04$
$= 2.8303E+05$

Ratio = $2.8303/2.6971 = 1.05$

Closure Water usage = $(3.80E+04)(1.05) = 3.99 = 4.0E+04$
for Barriers

7. Calculate change in Electrical requirements.

$= (4.15E+04)(0.8) = 3.32E+04$ Gwh. operation for vitrification and Construction of new vaults for LLW

The construction and closure consumption did not change
The operations value changed.

2.G. Gasoline usage

The Gasoline usage to construct the facility did not change.

operation usage varied by the new vault Construction.

usage = (5.46 E+01) (0.8) = 4.4 E+01 m^3

Barrier at Closure = (3.5 E+02) (1.05) = 3.68E+02 m^3

H. Diesel Consumption.

1. Initial construction diesel consumption does not increase
2. operation diesel consumption increase by the quantity to add. 56 new vaults for LAW.
3. Closure diesel consumption increase by the additional barrier requirements.

Construction total = 2.9 E+04 m^3
WRT = 1.0E+03
Vitrifi = 2.8E+04

operation

New vaults = 56 Diesel to Construct each vault = 25530 gallons

amount = (56) (2.553 E+04) (3.788×10^{-3}) m^3
= 5.42 E+03 m^3

Handling boxes in vaults. (1263) (39) = 49257
(1263) (66) = 83358

$\frac{66}{39}$ = 1.692

amount = (1.02 E+03) (1.692) = 1.73 E+03 m^3

Σ = 5.42 E+03 + 1.73 E+03 = 7.15 E+03

Closure Diesel requirements increase for vault Barrier area

A. 39 vaults = (37)(15) = (555)(39) = 2.164 E+04

66 vaults = (66)(555) = 3.663 E+04 m^2

Tk farms = 2.464 E+03 m^2

Ratio = $\frac{283030}{268045}$ = 1.06

amount = (6.0 E+04) (1.06) = 6.36 E+04 m^3

2. H. Operation

total = 8.17 E+03
WR+T = 1.02 E+03
vitrifi = 7.15 E+03

Closure

Total = 7.08 E+04
tank slab. = 6.38 E+03
Barrier = 6.36 E+04
asrc-Cpiy = 8.02 E+02

I. Kerosene m^3

The Kerosene increases or decreases in relationship to the mass of glass produced.

Ratio of mass of glass produced = overall HLW + LLW mass ratio

overall ratio determined in 2 D above = 0.8

amount = (0.8)(2.34 E+05) = 1.872 E+05 m^3

J. Materials - Concrete (m^3)

1. Initial construction the concrete volume will not change.

2. The quantity of concrete required is proportional to the amount of glass produced and the new vaults required.

3. The quantity of concrete required under closure will not change.

Construction total = 5.0 E+05

sand (0.63)(1.07)
gravel (0.37)(1.07)
Cement (1.1)(5)(1/22)

2. J. Construction Concrete

WR+T = total = 5.9E+04 m^3
sand = 3.98E+04 m^3
gravel = 2.34 E+04 m^3
cement = 1.48 E+04 MT

vitrifi = total = 4.4 E+05 m^3
sand = 2.97E+05 m^3
gravel = 1.742E+05 m^3
Cement = 1.1 E+06 MT

operation concrete
LLW additional vaults = 56 @ 4300 m^3/vault.
quantity = (56) (4300) = 2.41E+05 m^3
total = 1.4 E+05 + 2.41E+05
total = 3.81 E+05 m^3

Sand = 2.57E+05 m^3
gravel = 1.51E+05 m^3
Cement MT = 9.53E+04 MT

HLW Shield Casks = (143) (90.7/1.6) = 8.11 E+03 m^3

Concrete amount = 8.11 E+03 m^3
Sand = 5.47E+03 m^3
gravel = 3.21E+03 m^3
Cement = 2.03E+03 MT

Concrete for Closure
Tank Slab
total = 5.30E+03 m^3
sand = 3.6E+03 m^3
gravel = 2.1E+03 m^3
cement = 1.33E+03 MT

2. J. Concrete
Closure
Barrier = NA

and Equip
total = 1.37 E+04
sand = 9.2 E+03
gravel = 5.4 E+03
cement = 3.4 E+03

total = 1.9 E+04 m^3

K. Carbon Steel consumption (MT)
1. Steel consumption for construction (initial) does not change.
Steel = total = 1.4 E+05 MT

WRAT = 1.0 E+04 MT
Vitrifi = 1.3 E+05 MT

2. Closure operation does not require carbon steel.

3. Use of carbon steel in operational functions varies with the additional LLW vaults and the HLW shield casks. also the steel boxes for the LLW waste and the HNPCs.

steel for vaults = (500 Mg) (56 vaults) = 2.8 E+04 MT
= 1.6 E+04 + 2.8 E+04 = 4.4 E+04
steel for vault boxes = (66) (1263) (0.144) (7) = 8.4 E+04 MT
Box steel volume = 0.144 m^3
weight = 7 Mg/m^3

steel for HNPCs @ 6.5 MTons each.
quantity = (6.5) (143) = 9.3 E+03 MT

2 L. Stainless Steel usage MT

1. Initial construction of process systems will not change and thus quantities remain the same.

Construction

total = 2.1 E+04
WR+T = 4.0 E+03
vitrifi = 1.70 E+04

2. Stainless usage in operation is required for the HLW canister used for the waste glass in the HLW vitrification system.

Number of Canisters = 570 with a volume of 1.17 m^3

The volume of SS in this canister is assumed equivalent to the 0.62 m^3 Canister but adjusted for the new length of 4.5 meters versus 3.0 meters.

~~volume~~ weight of SS = (0.75) (4.5/3) = 1.125 Mg

Quantity = (570) (1.125) = 6.41 E+02 MT

M. Hastelloy / Inconel MT

usage for operation and Closure actions are NA
usage for initial construction does not change

Construction

total = 1.8E+03
WR+T = NA
vitrifi = 1.8 E+03

N. Calculate the Glass formers required.

1. Calculate the materials for the HLW total = 1.31E+03 MT

2.N.

B_2O_3 fraction = 1.22/8.73 = 0.14 amount = 183.4 MT

SiO_2 fraction = 13.2/873 = 0.015 " = 19.8 MT

Na_2O fraction = 24/873 = 0.028 " = 36.7 MT

SiO_2 fraction = 7.13/8.73 = 0.817 " = 1070.3 MT

2. Calculate the materials for the SJW total = 5.22E+05 MT

Al_2O_3 fraction = 1.16/26.5 = 0.044 amount = 2.3 E+04 MT

CaO fraction = 3.84/26.5 = 0.145 amount = 7.57 E+04 MT

SiO_2 fraction = 2.15/2.65 = 0.811 amount = 4.24 E+05 MT

Glass formers.

SiO_2 = 4.24 E+05 + 1.070 E+03
= 4.25 E+05 MT

Total Glass Formers = 5.22 E+05 + 1.31 E+03
= 5.233 E+05 MT

O. Calculate the Process chemicals required.

1. The process chemicals are used for the extension separations and the tail gas treatment. Therefore, they do not change with the mass of glass produced. The oxygen requirement however changes with the kerosene used in the final melter.

The overall ratio is 0.8 The previous quantity of oxygen estimated was 4.63 metric tons (E+05)

present quantity = (4.63 E+05) (0.8)
= 3.704 E+05 MT

Σ of process chemicals = 1.06 E+05

Σ = 4.76 E+05

2. P. Calculate the sulfur cement requirements. for this case.

These components will vary with the mass of glass produced for LLW

Sulfur = (6.42/3.86) (1.7 E+05) = 2.83 E+05 MT

DCPD = (6.42/3.86) (4.46 E+03) = 7.42 E+03 MT
DCPD = (6.42/3.86) (4.46 E+03) = 7.42 E+03 MT

Q. Ion Exchange Resins.

These are used in the separations treatment area and the quantity of waste treated does not change.

Ion Resins = 4.9 E+03 m^3

R. Calculate Excavation

Construction excavation = 1.8 E+06 m^3

Construction Backfill = 8.5 E+05 m^3

Operation excavation = 56 vaults @ 43600 m^3 per vault.

(43600)(56) = 2.44 E+06 m^3

Operation Backfill = 56 vaults @ 21250 m^3/per vault.

(21250)(56) = 1.19 E+06 m^3

3. Ex Situ Intermediate Separations alternative - Extensive Retrieval

A. Land permanently committed will be calculated later.
B. Land temporarily committed will be calculated later.
C. Borrow Pit disturbance will be determined later.

D. Calculate raw water usage.

List the items for LLW and HLW to be used in this consideration.

3.D. for HLW Mass of ~~Glass~~ = 3.73 E+04 MT
Number of 1.17 m^3 Canisters = 12100
Number of HMPCs and Shield Casks = 3030 of each.

Old mass of Glass = 5.44 E+04 MT
Number of 0.62 m^3 Canisters = 33400
Number of HMPCs and shield Casks = 8350 original = 1705

for LLW Mass of glass 6.45 E+05 MT
Number of vaults 66

Mass of glass used previously = 9.68 E+05 MT
Number of vaults previously = 99 original vaults = 39

HLW ratio = 3.73/5.44 = 0.686

LLW Ratio = 6.45/9.68 = 0.666

overall ratio = 6.823/10.224 = 0.6674

Raw water usage for construction is NR/NA
Raw water usage for closure is NR/NA

Raw water for operation = (overall ratio) (existing value)
= (0.6674) ~~(1.72E+0~~ (1.82 E+07 m3)

= 1.22 E+07 m^3

E. Calculate Sanitary water usage.

Calculate Construction increase due to increased HLW storage pad = (6.6)(3030 - 1705) = ~~1749 m~~ 8.745 (0.2) = 1.749 E+03 m^3

Water in gallons/vault = 1.33 E+06 Concrete per vault = 4300 m^3
Concrete for pad = 1749 m^3

Water for Pad increase = (1.33 E+06)(3.785 E-3)(1749/4300)
= 2.05 E+03 m^3

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resume Summary table B.11.03. and Transportation tables SHEET NO. 57 of 393

BY RDW CHKD. JOB NO. 01K 47101

3. E. Construction water increase is tabulated value + addition

$\Sigma = 5.0E+05 + 2.05E+03$

Construction = Total = 5.02 E+05 m^3

WR&T = 9.4 E+03

vitrifi = 4.926 E+05

operation

WR&T = 2.0E+06

vitrifi = (1.1E+06)

additional water requirement for increased/decreased glass production.

(5.27E+06)(0.6674) = 3.52E+06 m^3

water requirements for new vaults required.

56 new vaults required at 1.33E+06 gallons/vault.

= (56)(1.33E+06)(3.785)(10^{-3})

= 2.82+E+05 m^3

operation water usage = 2.82E+05 m^3 + 3.52E+06 m^3

= 3.8 E+06 m^3

total = 2.0E+06 + 3.8E+06 m^3

= 5.8E+06 m^3

Sanitary water for closure varies for the additional barrier

= (1.05)(5.7 E+04 m^3)

= 6.0 E+04 m^3

7. Calculate total water

Total = 1.86 E+07 m^3

WR&T = 2.01 E+06 m^3

Vitrifi = 1.65 E+07 m^3

Closure = 6.33 E+04 m^3

FORM 91-005-1 (4/81)

3.D. Calculate the Gwh of electrical usage.

Construction

The WR&T usage does not change = 7.60E-01 Gwh.
The construction usage will change due to the increased storage pad requirements.

$(3030 - 1705)(6.6)(0.2) = 1.75E+03\ m^3$ Concrete
$= 8745\ m^2$ storage pad

Compared to total this increase is negligible in electrical usage.
vitrifi = 7.3E+01 Gwh.

Construction = total = 7.38E+01 Gwh. = 7.4E+01
WR&T = 7.6E-01
vitrifi = 7.3E+01

Closure usage = N/R

Operation = (1.55E+01)(0.6674) = 1.04E+04
WR&T = 6.0E-01

Construction vaults = 7.5 Gwh per vault + 56 vaults
= (7.5)(56) = 4.2E+2 Gwh.

Operation = 4.2E+02 + 1.04E+04
= 1.08E+04 Gwh

operation = total = 1.08E+04 Gwh.
WR&T = 6.0E-01
vitrifi = 1.08E+04

total = 1.09E+04 Gwh.
WR&T = 1.36E+00
vitrifi = 1.09E+04
Closure = NR

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation tables SHEET NO. 59 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

3.H. Calculate the gasoline usage.

Construction Gasoline

WR&T = 3.3E+02
Vitrifi = 7.3 E+03
total = 7.63 E+03 m^3

operation
Vitrifi = (240)(56)(3.785)(10⁻³) = 5.08704 E+01 m^3

operation
WR&T = 0
Vitrifi = 5.1 E+01 m^3
total = 5.1 E+01 m^3

Closure
Tank Slab = 4.01 E+01
one Grip = 1.2 E+00

Barrier = (1.06)(3.00 E+02) = 3.71 E+02 56 vaults.

total = 4.12 E+02 m^3

J. Calculate the Diesel consumption

Changes occur in: Number of Canisters
Number of HMPCs
Number of Shielcasks
Number of vaults
HLW storage pad
Barrier area due to vaults.
LLW waste boxes

Construction usage
WR&T = no-Change = 1.00 E+03 m^3

Vitrifi = [(3030) - (1705)](6.6)(0.2) = 1.749 E+03 m^3 Concrete

Vitrifi = 5.4 E+05 + 1.749 E+03 = 5.42 E+05 m^3 Concrete
ratio 5.42/5.4 = 1.004

FORM 91-005-1 (4/81)

3. J. Construction Diesel use

$= (2.0E+04)(1.004) = 2.01E+04\ m^3$

Construction = total $= 2.11E+04\ m^3$

WR&T $= 1.0E+03\ m^3$

vitrifi $= 2.01E+04\ m^3$

operations

WR&T no change $= 1.02E+03\ m^3$

vitrifi = handling of HLW Canisters, Hampers, Shielcasks and LLW waste boxes.

vitrifi wt $= (1.02E+03)(1.7) = 1.734E+03\ m^3$

Vault Construction 56 vaults @ 25530 gal/vault

$= (56)(25530)(3.785)(10^{-3}) = 5.41E+03\ m^3$

Operation = total $= 8.164E+03\ m^3$

WR&T $= 1.02E+03\ m^3$

vitrifi $= 7.144E+03\ m^3$

Closure diesel usage

tank stab no change $= 6.38E+03$

area Equip no change $= 8.02E+03$

Basin change $= (5.90E+04)\left(\frac{293030}{268045}\right) = 6.254E+04$

$= (1.06)$

Closure = total $= 7.7E+04\ m^3$

tank stab $= 6.38E+03\ m^3$

Basin $= 6.254E+04\ m^3$

area Equip $= 8.02E+03\ m^3$

K. Kerosene usage - varies with glass quantity produced.

previously calculated value $= 9.86E+04$

overall ratio $= 0.6674$

amount $= (9.86E+04)(0.6674) = 6.58E+04$

3. K. Calculate the concrete requirements

Concrete usage varies for: Increased storage pad.
: LLW vaults constructed
: Shield casks constructed.

Construction Concrete

WR&T = no change = 5.90E+04 m^3

Vitrifi = Vitrifi Constant + Increased pad volume.
= 4.8 E+05 + 1.749 E+03 m^3 (from above)
= 4.82 E+05 m^3

WR&T = 5.90 E+04 m^3
Sand = 3.48E+04
gravel = 2.34E+04
Cement = 1.48E+04 mT

Vitrifi = 4.82E+05
sand = 3.25E+05
gravel = 1.91E+05
Cement = 1.21E+05 mT

Operation needs for Concrete

LLW vaults = 56 @ 4300 m^3
= 2.41 E+05 m^3
for 66 = (66)(4300) = 2.84 E+05 m^3

total = 2.84 E+05 + 5% wastage
= 3.0 E+05 m^3
sand = 2.02 E+05 m^3
gravel = 1.19 E+05 m^3
cement = 7.5 E+04 MT

For 3030 shield casks @ 90.7 Mg at 1.6 mg/m^3
frontsity = (3030)(90.7)(1/1.6) = 1.72E+06 m^3
= 1.75 E+06 m^3

3 K. HLW total = 1.75 E+05 m^3
sand = 1.18 E+05 m^3
gravel = 6.93 E+04 m^3
cement = 4.4 E+04 MT

Closure requirements do not change for this option.

Closure = 1.9 E+04
Tank Stab = 5.3 E+03 and equip = 1.37 E+04
sand = 3.6 E+03 = 9.2 E+03
gravel = 2.1 E+03 = 5.4 E+03
cement = 1.33 E+03 = 3.4 E+03

L. Calculate the carbon steel requirements.

The requirements change according to: Storage pad increase
: HMPC increase
: LLW Waste boxes
: LLW vault increase

Storage Pad increase = 8745 m^3 ≅ 100 m x 88 m
use Rebar 101 meters long and 88 meters long & spacing 0.2 meters

= (0.000123)(101)(500)(7) + (0.000123)(89)(440)(7)

= 43.48 MT + 33.72 MT
= 7.72 E+01 MT = 77.2 MT

Steel for HMPC's at 6.5 MT each
= (3030)(6.5) = 1.97 E+04 MT

LLW Boxes = (66)(1263)(0.144)(7.0)
= 8.4 E+04 MT

LLW Vaults = 66 @ 500 MT each
= (66)(500) = 3.3 E+04 MT

3. L. C. Steel materials

total = 2.44E+05
WR&T = 1.0E+04
vitrifi = 2.34E+05
closure = N/R

Construction
total = 1.07E+05 MT
WR&T = 1.0E+04
vitrifi = 9.71E+04 9.7E+04 + 77.2

operation = vitrification
total = 1.37E+05
HLW vault = 3.3E+04 MT
HLW HM/C2 = 1.97E+04 MT
HLW Boxes = 8.4E+04 MT

Closure = NR

M. Stainless Steel requirements.
Construction requirements = no change
Closure NR

operation - Canisters for HLW 1.17 m^3

= (12100)(1.125) = 1.36E+04 MT

N. Hastelloy / Inconel
usage was not changed.

Construction - vitrifi = 2.30E+03 MT

O. Calculate the glass formers required for this process.

Calculate the materials for the LLW total = 5.39E+05

Al_2O_3 = (1.32E+04 / 2.81E+05) = (0.047) 5.39E+05 = 2.53E+04 MT
CAO = (3.87E+04 / 2.81E+05) = (0.138) 5.39E+05 = 7.44E+04 MT
SiO_2 = (2.29E+05 / 2.81E+05) = (0.815) 5.39E+05 = 4.39E+05 MT
Σ = 2.81E+05 ✓

3.O. Calculate materials for HLW Total = 2.38E+04

B_2O_3 = 1.75E+03 / 1.36E+04 = (0.1287) 2.38E+04 = 3.32E+03 MT
Li_2O = 5.00E+02 / 1.36E+04 = (0.0368) 2.38E+04 = 9.5E+02 MT
SiO_2 = 1.13E+04 / 1.36E+04 = (0.8309) 2.38E+04 = 2.14E+04 MT
Σ = 1.36E+04 X

SiO = 2.14E+04 + 4.39E+05 = 4.604E+05 MT

P. Calculate the process chemicals required for this process.
The oxygen requirement for the final furnace will change in accordance with the kerosene consumption.

O_2 = (3.25)(0.6674) = 2.17E+05 mtons.

Σ process chemical total = 5.42E+04
Σ = 2.71E+05

Q. Sulfur cement materials
ratio 0.668

Sulfur = (0.668)(3.21E+05) = 1.48E+05
DCPD = (0.668)(5.78E+03) = 3.86E+03
oligomer = (0.668)(5.78E+03) = 3.86E+03

R. Ion Exchange material is not changed.

IX Resin = 2.20E+02 m^3

S. Calculate Excavation for facility and vaults.
1. Initial construction Excavation = 1.7E+06 m^3
2. Construction in operation for 56 vaults
= (56)(43600) = 2.44E+06 m^3

3.T Calculate Backfill for facility and vaults.

1. Initial backfill in construction = 1.2E+06 m^3

2. Backfill in operation for 56 vaults.
= (56) (21250) = 1.19E+06 m^3

4. Ex Situ / In Situ Combination (70 of 177 Ha) - Intermediate operations

A. The permanently committed land will be calculated later

B. The temporarily committed land will be calculated later.

C. The Borrow Pit disturbed area will be developed later.

D. Calculate the raw water usage (m^3)
determine the LLW, HLW and overall ratios for the changes made in the mass of glass produced.

LLW new mass of glass = 3.95E+05 MT
LLW new number of vaults = 40

Previous mass of glass = 4.84E+05 MT
Previous number of vaults = 42

HLW new mass of glass = 1.85E+04 MT
new number of Canisters = 6010 @ 1.17 m^3 each.
new number of Shields + HMPCs = 1500 each.

HLW previous mass of glass = 2.72E+04 MT
previous number of Canisters = 16700 @ 0.62 m^3 each
previous number of shields + HMPCs = 4175 each.

LLW ratio = 3.95/4.84 = 0.8161
HLW ratio = 1.85/2.72 = 0.6802

Over-all ratio = 413500/511200 = 0.8089

4. D. The construction use of raw water does not change = 5.5 E+06 should be NR to be consistent.

The operations load for cooling tower makeup and other cooling loads changes according to the mass of glass produced as related to the process heat load.

Raw Water = (0.8089)(9.35 E+06)
= 7.56 E+06 m^3

Closure usage is NR.

E. Calculate the consumption of sanitary water. (m^3)
The uses of sanitary water changes: Extra HLW Pad area
Extra LLW vault area
Mass of glass production

1500 − 855

Extra area of Storage pad = (647)(6.6)(0.2) = 854 m^3
original Concrete = 2.75 E+05 m^3
new = 2.75854 E+05 m^3
Ratio = 2.75 / 2.76 = 1.004

Construction Sanitary water use
WR&T = 9.4 E+03
withdr = (4.19 E+05 − 9.4 E+03)(1.004)
= 409600
= (409600)(1.004) = 411238.4
= 4.1124 E+05 m^3
total = 411240 + 9400 = 4.21 E+05

operation Sanitary water
= (5.24 E+06)(0.8089) = 4.24 E+06

WR&T = 1.0 E+06
withdr = 3.24 E+06

New vaults = (20)(13253)(3.785)(10^{-3})
= 1.01 E+05 m^3

7.C. operation = total = 4.34E+06
WR+T = 1.0E+06
Utility = 3.34E+06 = (3.24E+06 + 1.01E+05)

closure

barrier ratio = $\frac{(40)(555)}{(20)(555)}$ = $\frac{22200}{11100}$

area ratio = $\frac{2.464E+05 + (40)}{2.464E+05 + (20)}$

= 268600/257500 = 1.043
= (4.56E+04)(1.043) = 4.76E+04

tank slab = 0

anc equip = 3.3E+03

7. Calculate the electrical requirements (kwh)

Electrical requirements changed in accordance with the mass of glass produced. Construction requirements remained ~~nearly~~ the same and closure requirements were NR

Construction = total = 3.7E+03
= WR+T = 1.46E+00
= utility = 3.7E+03

operations = (769)(0.8)(E+03) = 6.152E+03
WR+T = 3.0E-01
utility = 6.15E+03

8. Gasoline consumption (m3)
Construction consumption = total = 4.65E+03
WR+T = 2.0E+02
utility = 4.45E+03

operation = gasoline for new vault
= (30)(240)(3.785)(10⁻³) = 2.73E+01 m³

1. D. Closure usage

Tank Stabilization equals no change = 4.01E+01

and Equip equals no change. = 1.2E+00

Barrier increase due to increased number of vaults.

amount = (2.96E+02)(1.643) = 3.09E+02

total = 3.5E+02 m^3

H. Calculate Diesel usage for changes in glass mass produced. (m^3)

Construction change will be the storage pad size for HLW HMPCs.

Construction WRT = 600 m^3

Construction vit = (2.04E+04) + Increase for Pad

area for Storage pad = (1500)(6.6)

= 9900 m^2

old area = (853)(6.6) = 5630 m^2

Ratio = 9900/5630 = 1.76

Diesel usage = (~~2.04~~ 1.224 E+04)(1.76) = ~~3.59~~ 2.1542 m^3 E+04

Construction = WRT = 6.00 ~~E+01~~ E+02 m^3

~~= vit = 3.59 m3~~

= vit = ~~3.59~~ 2.1542 E+04 + 7.21 E+02

= vit = ~~3.5900~~ 2.1542 + 721 = ~~3.66~~ 2.2263 E+04 m^3

= total = ~~3.72~~ E+04

= 2.2863.4 = 2.29E+04 m^3

Construction 6-13-96 RDW

operation diesel usage

Diesel usage for 30 vaults @ 25,530 gallons each

usage = (30)(25530)(3.785)(10^-3) = Meters^3

= 2.9E+03 m^3

WRT = 6.0E+02 m^3 + 3660

= 4.27E+03

H. Closure usage determination.

Closure for Tank Slab does not change = 6.38E+03 m³
Closure for anc Equip does not change = 8.02E+02 m³

Closure for Barrier does change according to the additional vaults required.

Closure = (1.043)(5.06E+04)
= 5.28E+04 m³

Closure = tank slab = 6.38E+03
anc Equip = 8.02E+02
Barrier = 5.28E+04
total = 6.0E+04 m³

I. Kerosene usage (m³)

ratio = (413500/302400) = 1.37

= (1.37)(2.9E+04)
= 3.97E+04 m³

J. Determine Concrete requirements for alternative. (m³)

Concrete requirements change for: storage pad for HLW
storage vaults for LLW
shield casks for HMPCS

Construction WR+T does not change = 2.95E+04
vit = (2.4E+05) ~~(1.176)~~ + (4270)(0.2) = 2.4E+05 + 854
= ~~4.224E+05 m³~~ 240000 + 854 = 240854
= 2.41E+05
total = ~~4.224E+05~~ 2.41E+05 m³ + 2.95E+04
= ~~4.52~~ 2.71 E+05 m³

Corrects RDW 6-17-96

WR+T		vitrifi	
Sand	= 1.99E+04 m³	Sand	= ~~2.90~~ E+05 m³ 1.63
Gravel	= 1.17E+04 m³	Gravel	= ~~1.67~~ E+05 m³ 9.54
Cement	= 7.38E+03 MT	cement	= ~~1.06~~ E+04 MT 6.03

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 70393

BY RDW CHKD. _____ JOB NO. 01K47101

4. J. Concrete for operations

Concrete for vaults = (4300) ~~(30)~~ (30)
= 1.29 E+05 m^3

Concrete for Shield Casks = ~~3030~~ (1500) (80.7) (1/1.6) m^3
= 8.5 E+04 m^3

SLW vaults = 1.29 E+05 m^3
Sand = 5.7 E+04
gravel = 5.11 E+04
cement = 3.23 E+04 MT

HLW shield casks = 8.5 E+04 m^3
Sand = 5.73 E+04
gravel = 3.37 E+04
cement = 2.13 E+04 MT

total = 2.14 E+05

Concrete for closure does not change
Tank Slab = 5.3 E+03
Basin = NR
aux Equip = 1.37 E+04
total = 1.9 E+04 m^3

K. Determine Carbon Steel requirements (MT)

Carbon Steel requirements increase for: HLW Storage Pad rebar.
: HLW HMPCA.
: LLW vaults rebar
: SLW waste boxes

WR&T Construction does not change

WR&T = 5000 MT

vit = 4.85 E+04 + storage Pad rebar increase.

Increased area = 42.70

assumed Pad area increase = 67 x 67 m

FORM 01 005 1 (4/90)

4.K. Rebar = (0.000123)(68)(375)(7)(2) = 3.923 E+1 mT

Construction vitrified = 4.85 E+04 + 39.23
= 4.86 E+04 mT

total = 5.36 mT.

operation Carbon Steel usage

IJW vaults = (30)(500)
= 1.5 E+04 mT

HMPCs = (6.5)(1500)
= 9.75 E+03 mT

LLW waste boxes
= (40)(1263)(0.144)(7.0)
= 5.09 E+04 mT.

total = 7.57 E+04 mT

L. Determine the stainless steel usage. (mT)

Construction WR&T remains unchanged.
Construction vitrified remains unchanged.

WR&T = 2.0E+03
vitrified = 7.5E+03
total = 9.5E+03 mT.

~~Stainless Steel~~
Stainless Steel in operations
SS Connections 1.17 m^3 = 0.62 Connections × 34.5/3
= (0.75)(4.5/3)(6010)
= 6.76E+03 mT.

4. M. Hastelloy / Inconel (MT)
Hastelloy / Inconel usage in construction only.
did not change
vitrifie = 1.15E+03 MT

N. Calculate change in Glass former requirement (MT

SAW = 3.28 E+05 MT HFW = 1.23 E+04 MT

Al_2O_3	1.54E+04 MT	B_2O_3	1.51E+03
CaO	4.52 E+04	Li_2O	4.31E+02
SiO_2	2.67 E+05	SiO_2	9.72 E+03
Σ	32.76 E+04	Σ	1.1661 E+04

$Al_2O_3 = (1.54/32.76)(3.28) = 1.54\,E+04$ (0.047)

$CaO = (4.52/32.76)(3.28) = 4.53\,E+04$ (0.138)

$SiO_2 = (26.7/32.76)(3.28) = 2.67\,E+05$ (0.815)

$B_2O_3 = (1.51/11.661)(1.23) = 1.59\,E+03$ (0.1295)

$Li_2O = (4.31/11.661)(1.23) = 4.55\,E+02$

$SiO_2 = (9.72/11.661)(1.23) = 1.03\,E+04$ (0.037) (0.833333)

Al_2O_3 = 1.54 E+04 MT

B_2O_3 = 1.59 E+03 MT

CaO = 4.53 E+04 MT

Li_2O = 4.55E+02 MT

SiO_2 = 2.77 E+05 MT

total = 3.4E+05 MT

4.O. Determine Process chemicals change. (MT)

only chemical changing is Oxygen consumption for the Kerosene melter.

$$\text{Oxygen} = (3.97E+04/6.58E+04)(2.17E+05)$$
$$= (0.603)(2.17) = 1.31E+05$$
$$= 1.31E+05 \text{ MT}$$

The other process chemicals do not change because the volume of waste processed did not change. only the waste product mass changed.

Σ of process Chemicals $= 2.71E+04$ MT

$$PC + O_2 = 1.58E+05 \text{ MT}$$

P. Calculate Sulfur Cement requirements (MT)

$$\text{Sulfur} = (1.37)(6.5E+04) = 8.91E+04 \text{ MT}$$

$$\text{DCPD} = (1.37)(1.7E+03) = 2.33E+03 \text{ MT}$$

$$\text{Oligomer} = (1.37)(1.7E+03) = 2.33E+03 \text{ MT}$$

Q. Ion Exchange Resin (m^3)

No change $= 1.1E+02$

R. Excavation (m^3)

Construction will not be affected significantly
$= 1.26E+06 \text{ m}^3$

operation - Excavation for vaults
$= (30)(43600) = 1.31E+06 \text{ m}^3$

4.5. Backfill (m^3)
Construction not significantly affected
$= 6.0E+05\ m^3$

operations for vaults (30)
$(30)(2(250)) = 6.38E+05\ m^3$

5. Exhibit Insitu Combination Low (25 of 177 tanks) - Intermediate Deportations
A. The permanently committed land will be calculated later

B. The temporarily committed land will be calculated later.

C. The Borrow Pit disturbed area will be calculated later.

D. Calculate the raw water usage (m^3)
Determine the relationship of these items to those given in item 4.D. above.

	(25/177)	(70/177)
HLW Mass of glass produced	= 1.09E+04 MT	1.85E+04
Volume of glass "	= 4.16E+03 m^3	7.03E+03
Number of 1.17 m^3 Canisters	= 3550	6010
Number of HMPCs + Shield Casks	= 888 each	1500
LLW Mass of glass produced	= 2.29E+05 MT	3.95E+05 MT
Number of vaults	= 14	40
Volume of glass	= 1.25E+05 m^3	2.15E+05

HLW Mass ratio = 1.09/1.85 = 0.5892
HLW Volume ratio = 4.16/7.03 = 0.59175

LLW Mass ratio = 2.29/3.95 = 0.57975
LLW Volume Ratio = 1.25/2.15 = 0.5814

Overall ratio Mass = 2.389/4.135 = 0.58017
Volume = 1.2916/2.2203 = 0.58172

5.D.

Mass of liquid waste treated - ratio assumed to be same as ratio of of overall mass produced. as determined above

overall mass ratio = 0.58017

The raw water usage is directly proportional to the operation heat load.

operation vitrifi = (7.56 E+06 m^3)(0.58017)
= 4.39 E+06 m^3

Closure usage is NR
Construction usage assumed NA.

E. Determine Sanitary water usage (m^3)

Construction usage

for WR&T - water usage was determined as
= (9.4 E+03)(0.58017) = 5.45 E+03

for vitrifi - water usage was determined as
= (4.11 E+05)(0.70)
= 2.88 E+05

(0.70) was applied because cutting volume throughput by 50% does not cut facility size by 50%

total = 2.93 E+05 m^3

operation sanitary water use

WR&T is tank waste retrieval
= (0.58017)(1.0 E+06) = 5.8 E+05 m^3

vitrifi = (3.34 E+06)(0.58017) = 1.94 E+06 m^3

total operations = 2.52 E+06 m^3

5 E. For closure the sanitary water use for anc Equipment will remain unchanged.

anc Equip = 3.3 E+03 m^3

Tank Stab = HR

Barrier use will change by change in area of barriers constructed.

$$\text{Ratio area} = \frac{246400 + 24\text{ vaults}}{246400 + 40\text{ vaults}} = \frac{259720}{268600} = 0.9669 = 0.97$$

(13320) (22200)

usage = (0.97)(4.76 E+04) = 4.62 E+04 m^3

F. Total water usage (m^3) determined.

WR+T = 5.86 E+05
Vitrifi = 6.62 E+06
Closure = 4.95 E+04

total = 7.25 E+06 m^3

G. Determine the Electrical Energy usage (Gwh)

Construction applied 0.7 factor

WR&T = (1.46 E+00)(0.7) = 1.022 E+00
Vitrifi = (0.7)(3.7 E+03) = 2.59 E+03

total = 2.59 E+03

operation

WR+T = (3.0 E-01)(0.58017) = 1.74 E-01

Vitrifi = (6.15 E+03)(0.58017) = 3.57 E+03

total = 3.57 E+03

Closure usage was not reported. = NR.

5.H. Determine the gasoline consumption (m^3)

Construction WR+T = (2.0 E+02)(0.7) apply 0.7 to Construction
= 1.4 E+02 m^3

Vitrifi = (4.45 E+03)(0.7)
= 3.12 E+03 m^3

total = 3.26 E+03 m^3

operation - gasoline for I&W vaults.
= (24)(240)(10^{-3})(3.785) = 2.18 E+01 m^3

Closure Tank Stab no change = 4.01 E+01 m^3
and Equip no change = 1.2 E+00 m^3

Barrier change
= (~~3.5~~ 3.09 E+02)(0.8) = ~~3.4~~ 2.16 E+02 m^3
Comm RPW 6-13-96

total = ~~3.44~~ 2.57 E+02

I. Determine the Diesel consumption for the 25/137 case. (m^3)

Construction at 0.7
WR&T = (~~4.27 E+03~~ 6.00 E+02)(0.7) = ~~2.99 E+03~~ 4.2 E+02 m^3

Vitrifi = storage pad is negligible for Diesel usage

= (2.23 E+04)(0.7) = 1.56 E+04 m^3

total = 1.6 E+04

operation
Diesel usage for vaults = (14)(25530)(3.785)(10^{-3})
= 1.353 E+03 m^3

5 ~~B~~. wR&T = (4.27 E+03)(0.58017)
= 2.48 E+03 m^3

total = 3.83 E+03 m^3

closure
tank Stab = ~~6.0 E+04~~ = 6.38 E+03
Ove Equip = 8.02 E+02

Barrier = (5.28)(0.97) = 5.12 E+04 m^3

total = ~~7.2 E+~~ 5.84 E+04 m^3

J. Calculate Kerosene consumption

operation = (3.97 E+04 m^3)(0.58017)
= 2.3 E+04 m^3

K. Calculate the concrete requirements for this alternative.

Construction wR&T = (2.95 E+04)(0.7)
= 2.07 E+04 m^3
Sand = 1.4 E+04 m^3
gravel = 8.2 E+03 m^3
Cement (MT) = 5.2 E+03 MT

vibrifi = (2.41 E+05)(0.7)
= 1.69 E+05 m^3
Sand = 1.14 E+05 m^3
gravel = 6.7 E+04 m^3
Cement = 4.23 E+04 MT

operation
SSW vault
(24)(4300) = 1.03 E+05 m^3
Sand = 6.94 E+04 m^3
gravel = 4.08 E+04 m^3
Cement = 2.58 E+04 MT

5.K. operation HLW shield casks
$= (90.7/1.6)(888)$
$= 5.04E+04\ m^3$
Sand $= 3.4E+04\ m^3$
gravel $= 2.0E+04\ m^3$
Cement $= 1.26E+04$ MT

Concrete for closure does not change

Tank Slab $= 5.3E+03\ m^3$
Barrier = NA
one Equip $= 1.37E+04$
total $= 1.9E+04\ m^3$

tank Slab $= 5.3E+04$
Sand $= 3.6E+04\ m^3$
gravel $= 2.1E+04\ m^3$
Cement $= 1.33E+04$ MT

one Equip $= 1.37E+04$
Sand $= 9.2E+03\ m^3$
gravel $= 5.4E+03\ m^3$
Cement $= 3.4E+03$ MT

L. Determine the carbon steel requirements for the 25/177 option (MT)

Construction
WRT $= (0.7)(5E+03) = 3.5E+03$ MT
vitrifi $= (4.86E+04)(0.7) = 3.40E+04$ MT
total $= 3.75E+04$ MT

operation = HLW vaults $= (24)(500)$
$= 1.2E+04$ MT

= HMPCs $= (888)(6.5) = 5.772$
$= 5.77E+03$ MT

= LLW boxes $= (24)(1263)(0.144)(7.0)$
$= 3.06E+04$ MT

Closure = NA

5. M. Determine the stainless steel requirements for 25/177 Core (MT)

Construction WRPT = (0.7)(2.0 E+03) = 1.4 E+03

vitrified = (0.7)(7.5E+03 = 5.25 E+03

total = 6.65 E+03

operation

55 Canisters 1.17 m^3 = (0.75)($\frac{4.5}{3}$)(3550)
= 3.994 E+03 MT
= 4.0 E+03 MT

Closure = NA

N. Hastelloy/Inconel (MT)

Construction vitrified = (1.15 E+03)(0.7) = 8.05 E+2 MT

O. Determine the (flux) glass formers required (MT)

SSW = 1.91E+05 HLW = 7.25E+03

		FACTOR			FACTOR
Al_2O_3	8.98E+03	0.04695	B_2O_3	8.85E+02	0.12901
CaO	2.63E+04	0.1375	Li_2O	2.53 E+02	0.03688
SiO_2	1.56 E+05	0.81556	SiO_2	5.72 E+03	0.83382
Σ	1.9128E+05		Σ	6.86 E+03	

Al_2O_3 = 8.97E+03 B_2O_3 = 9.35 E+02
CaO = 2.63 E+04 Li_2O = 2.67 E+02
SiO_2 = 1.56 E+05 SiO_2 = ~~8.695 E+~~ 6.045E+03

SiO_2 = 1.62 E+05

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 8 of 393

BY RPW CHKD. _____ JOB NO. 01K4707101

5.P. Determine the process chemicals (MT)

Oxygen requirements are proportional to the kerosene

Requirements = (0.58017)(1.31E+05) = 7.6E+04 MT

other process chemicals change by factor ~~0.8~~ 0.58017 times the values for the 70/177 case

aluminum nitrate	= (0.58017)(56)	= 3.3E+01	
ammonia	= (")(4.4E+03)	= 2.55E+03	
CMPO	= (")(2.5)	= 1.45E+00	
Decon chemicals	= (")(2.65E+03)	= 1.54E+03	
floc	= (")(42.5)	= 2.47E+01	
FeSA	= (")(2.36E+03)	= 1.37E+03	
Glycolic acid	= (")(1.75E+03)	= 1.02E+03	
HNO_3, 50%	= (")(2.1E+03)	= 1.22E+03	
NaOH, 50%	= (")(1.3E+04)	= 7.54E+03	
NPH	= (")(3.52E+02)	= 2.04E+02	Σ PC + O_2
Sodium Nitrate	= (")(2.7E+01)	= 1.57E+01	= 9.17E+04
TBP	= (")(3.78E+02)	= 2.19E+02	
			Σ = 1.5738E+04

Q Determine the Sulfur cement requirements (MT)

operation

Sulfur	= 8.91E+04	(0.57975)	= 5.17E+04
Dicyclopentadiene	= 2.33E+03	(0.57975)	= 1.35E+03
Oligomer	= 2.33E+03	(0.57975)	= 1.35E+03

R. Determine the Ion Exchange Media (MT)

operation

total = (1.1E+02)(0.58017) = 6.38E+01 M^3

S. Determine the Excavation quantity (m^3)

Construction

= (0.7)(1.26E+06 m^3) + storage pad

= 8.82E+05 + (888)(66)(0.2)

= 8.83E+05 m^3

FORM 91-005-1 (4/81)

5.S. ~~operation~~ Operation - vault. 30500
= (30500)(24)
= 7.32 E+05

T. Determine the amount of Backfill (m^3)

Construction = (6.0 E+05)(0.7) = 4.2 E+05

operation = (24)(30900)
= 5.02 E+05

6. Phased Implementation alternative, phase I two 20 ton/day LLW demonstration plants and one 1 ton/day HLW facility

The Basic assumption made is that the product output for these facilities remain constant. Therefore due to the blending and loading factor applications the quantity of liquid input changed accordingly. It was assumed that the treatment chemicals retained the same initial quantities and that the original quantities of electricity, water, fuels and construction requirements did not change. assumed closure to be incorporated with Phase II consideration. Phase I has no WR&T component.

A. The permanently committed land area will be determined later.
B. The temporarily committed land area will be determined later.
C. The Borrow Pit disturbed area will be determined later.

D. Determine the rawwater usage. (m^3)
Raw water usage = 2.2 E+06 m^3

E. Determine the Sanitary water usage (m^3)
Construction
WR&T = 0
vitrification = 3.9 E+05

operation
WR&T = 0
vitrifi = 2.2 E+05

6, E. closure NA

F. Total water Consumption (m^3)

total = ~~6.1 E+05~~ 2.81E+06
WR&T = ~~NA~~ NA
vitrifi = ~~6.1 E+05~~ 2.81 E+06
closure = ~~NA~~ NA

G. Determine the Electrical Consumption (Kwh)

Construction WR&T = NA
vitrification = 5.0 E+01

operation
WR&T = NA
vitrifi = 1.6E+03

closure = NR.

H. Determine the Gasoline usage (m^3)

Construction WR&T = 0
vitrifi = 6.5E+03

operation
WR&T = 0
vitrifi = 0
storage vaults considered under Phase II operations

Closure = NA

I. Determine the Diesel usage (m^3)
Construction
WR&T = NA
vitrifi = 1.8 E+04

operation WR&T = NA
vitrifi = NA Closure = NA.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 84 OF 393

BY RDW CHKD. JOB NO. 01K 47101

6 J. Determine the Kerosene usage (m^3)

vitrifi = 9.8 E+02 m^3

Verified by $\frac{6.58E+04}{6.82303E+05} = 0.096438$

(0.096438)(10074) = 9.72E+02 m^3

K. Concrete Requirements (m^3)

Construction WR&T = NA

vitrifi = 2.4E+04 m^3

Sand = 1.62E+04

gravel = 9.5E+03

Cement = 6.0E+03 MT

Operation

WR&T = NA

Cooko = 427

vitrifi = HLW shields. $\frac{1314 \text{ MT}}{(2.63)(1.17)(4)} = 107$

= (107)(90.7/1.6) = 6.07E+03 m^3

Sand = 4.09E+03

gravel = 2.4E+03

Cement = 1.52E+03 MT

LIW vaults = NA

Closure = NA

L. Determine the Carbon Steel requirements (MT)

Construction WR&T = NA

vitrifi = 9.3E+04 MT.

Operation WR&T = NA

LIW vaults = NA

HLW mpcs = (107)(6.5) = 7.0E+02 MT

LIW boxes = (0.144)(20)(8760)/(4.2)(2.3)(0.7)

= 1.14E+03 MT

4757 m^3

1133 boxes

total = 1.84E+03

Closure = NA.

FORM 91-005-1 (4/81)

L. M. Determine quantity of Stainless steel (MT)

Construction WR+T = NA

Vitrifi = 1.5E+04

operation

WR+T = NA Cask = 427

Vitrifi = (427)(4.5/3)(0.75)

55 Canisters 1.17m³ = 4.8 E+02 MT

Closure = NA

N. Determine the Hastelloy/Inconel usage (MT)

Construction

Vitrifi = 2.6E+03

O. Determine the Glass Former (Flux) (MT) required.

	LLW = 1.165 E+05	fraction		HLW = 1.95 E+04	fraction.
Al_2O_3	1.32 E+04	0.03805	B_2O_3	1.75 E+03	0.12915
CaO	3.87 E+04	0.11156	Li_2O	5.0 E+02	0.0369
SiO_2	2.95 E+05	0.85039	SiO_2	1.13 E+04	0.83395
Σ	3.469 E+05		Σ	1.355 E+04	

split 1.3E+05 Al_2O_3 = 4.2 E+03 B_2O_3 = 2.52 E+03

$\left(\frac{1314}{8760}\right)(1.3E+05)$ CaO = 1.23 E+04 Li_2O = 7.2 E+02

SiO_2 = 9.4 E+04 SiO_2 = 1.63 E+04

= 1.95 E+04

1.3 − (1.95 − 1) = (1.3 − 0.195) = 1.105 E+05

ΣSiO_2 = (9.4 E+04) + (1.63 E+04)

= 1.103 E+05

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.03 and transportation table SHEET NO. 86 of 393

BY RDW CHKD. _____ JOB NO. 01K 47101

6 P. Calculate the process chemicals (MT)

Oxygen proportional to kerosene use

$$\left(\frac{9.8\,E+02}{6.58\,E+04}\right)(2.17\,E+05) = (0.0149)(2.17\,E+05)$$
$$= 3.23\,E+03$$

$$PCs = (5.8\,E+04) - (3.23\,E+03) = 54770\ MT\ \cancel{total} - O_2$$

		Fraction	Quantity
aluminum nitrate	~~(1.12E+02)~~ 112 / ~~30834~~ 54234	0.0021	115
ammonia	8800 / ~~30834~~ 54234	0.1623	8809
CMPD	5 / (")	0.000092	5
Dacon Chem	5300 / (")	0.0977	5351
Floc	85 / (")	0.00157	86
FeSA	47200 / (")	0.8703	4766.6
Glycolic acid	3500 / (")	0.06454	3535
HNO_3 (50%)	4200 / (")	0.07744	4242
NaOH (50%	26000 / (")	0.4794	2625.7
NPH	703 / (")	0.01296	709.8
Sodium Nitrate	54 / (")	0.000996	54.6
TBP	755 / (")	0.01392	762.4
	Σ = 9.6714 E+04		Σ = 9.77E+04

Σ Intermediate = ~~30834~~ 54234 MT

O_2 = 2.17E+05 MT

Intermediate Separation plant = 200 T/d

phase 1 plants = 40 T/d ; 40/200 = 20%

use above fractions calculated at 20%

$$\Sigma PC = 1.42\,E+04$$
$$\Sigma PC + O_2 = 1.64\,E+04$$

Q. Determine Sulfur amount (MT)

Sulfur = (1.48 E+05)(0.2) = 2.96 E+04

Dicyclopentadiene = (3.86 E+03)(0.2) = 7.72 E+02

Oligomer = (3.86 E+03)(0.2) = 7.72 E+02

FORM 01.005 (4/94)

6 R. determine Ion Exchange media. (m^3)

$$I\cancel{X} \text{ media} = (2.2E+02)(0.2) = 4.4E+01\ m^3$$

S. Calculate the Excavation required (m^3)

$$\text{Construction} = 1.6145E+05\ m^3 + 1.1391E+05\ m^3$$

$$= 2.754E+05\ m^3$$

operation = NA.

T. Calculate the Backfill requirement (m^3)

$$\text{Construction} = 2.045E+04 + 1.965E+04$$
$$= 4.01E+04\ m^3$$

NOTE S+T obtained from previous Calculation by RDWeed for Construction Resource ~~Table~~ Requirements Table.

7. Phased Implementation alternative - Phase II.
Consider two (2) full size LLW plants at 100 MTons per day each capacity.
Consider 1 HLW plant at 10 MTons per day.

This facility will be similar to the Intermediate separations facility with reduced through put to 50% operational entities are considered at roughly the 50% reduction. However, the facility sizing will generally have a 70% reduction factor applied where necessary. Some areas will be calculated directly. Closure operations will be ascribed to the phase II operation and incorporate those associated with phase I which were deferred.

A. The permanently committed land area will be calculated later.
B. The temporarily committed land area will be calculated later.

7 .c. The Borrow Pit Disturbed area will be calculated later.

D. Determine the raw water usage (m^3)
operation
raw water

Determine the mass ratios etc for this alternative.
Phase II HSW mass of Glass = 3.73E+04 MT
Number of Canisters = 12100 (1.17 m^3 Canis
Number of HMPCs = 3030
Number of Shield Casks = 3030

SAW mass of Glass = 6.45E+05 MT
Number of Vaults = 66

Intermediate separations
HSW mass of glass = 37303
= 3.73E+04 Versus 3.76E+04
LSW mass of glass = 6.45E+05 Versus 6.45E+05

HLW phase I = 131
LLW phase I = 876

Phase II plants will handle totals – the phase I prod

Phase II HSW mass of glass = 37303 – 1314 = 35989 MT
phase II LSW mass of glass = 645000 – 8760 = 636240 MT

Ratios of the Intermediate alternative

HSW = 35989/37303 = 0.9648
LSW = 636240/645000 = 0.9864

overall ratio = 672229/682303 = 0.9852

Raw water estimated usage = (1.22 E+07)(0.9852) = 1.2 E+07 m^3

Fraction from HLW as related to LLW = $\frac{35989}{636240}$ = 0.056

7. E. Calculate the sanitary water usage (m^3)

facility size for Intermediate separations

LLW 200 T/day = 90 m x 75 m — 40 m high including 20 m below grade.

= 6750 m^2 = 270000 m^3 Volume

HLW 20 T/day = 55 x 165 — 45 m high including -13 m.

= 9075 m^2 = 408375 m^3 volume

Proposed size of facility for Phase 2

1st LLW 100 T/day = (40)(120) = 4800 m^2 = 1920,000 m^3

2nd LLW 100 T/day = (40)(120) = 4800 m^2 = 1920,000 m^3

HLW 10 T/day = (40)(160) = 6400 m^2 = 288,000 m^3

The WR&T facility operation & construction is equally ascribed to LLW plants with no portion ascribed to the HLW unit.

Construction

WR+T = 9.4 E+03

vitrifi = (4.92 E+05)(0.7) + (4.92E+05)(0.7)

= (4.92E+05)(0.056565) = 2.783 E+04

= 4.92E+05 - 2.78E+04

= 464170

= (464170)(0.7)(2) + (27830)(0.7)

= 6.69 E+05 m^3

Sanitary water for operation

WR&T = 2.0 E+06

vitrification = ~~(3800000)(0.056565) = 214947~~

= ~~3800000 - 214947 = 3585053~~

= ~~(3585053)(0.7)(2) + (214947)(0.7)~~

= (3.8 E+06)(0.9852)

= 3.74 E+06

7 E Sanitary water for Closure
Barrier = 6.0 E+04
anc Equip = 3.3 E+03
Tank Stab = NR

7 F. Determine the Electrical Energy requirements (Gwh)
Construction - utility.

(7.3 E+01)(0.056563) = 4.13 E+00
73 - 4.13 = 68.87
= (68.87)(07)(2) + (4.13)(0.7)
= 96.42 + 2.89
= 99.3 Gwh.

99.3
0.76
total = 100.06

WR&T = 7.60 E-01

operation = WR&T = 6.0 E-01
utility = (1.08 E+04)(0.9852)
= 1.06 E+04

Closure = NA

G. Determine the Gasoline usage (m^3)
Construction WR&T = 3.3 E+02 m^3
utility = (7400)(0.056563) = 419
7400 - 419 = 6981
= (6981)(0.7)(2) + (419)(0.7)
= 9773 + 293
= 10066 = 1.01 E+04 m^3

operation = WR&T = NA
utility = Gasoline for new vaults
= (56)(240)(3.785)(10^{-3})
= 5.01 E+01 m^3

Closure tank Stab = 4.01 E+01
Barrier = 3.71 E+02
anc Equip = 1.2 E+00
Total = 4.12 E+02

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 91 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

7 H. Determine the Diesel Consumption Requirements (m^3)

Construction

$WR+T = 1.02E+03$

$vehicle = (2.01E+04)(0.056565) = 1137$

$20100 - 1137 = 18963$

$= (18963)(0.7)(2) + (1137)(0.7)$

$= 26548.2 + 795.9$

$= 27344.1 = 2.7E+04\ m^3$

$total = 2.84E+04\ m^3$

operation

$WR+T = 1.02E+03$

~~vehicle = (7.14E+03)(0.9852)~~

~~= 7.034328E+03~~ Quantities RDW 6-15-96

~~= 9.03E+03 m³~~

~~total = 8.05 m³~~

handling boxes, Hopper, Cache

$Diesel = 1.734E+03\ m^3$

$vaults = (66)(25530)(3.785)(10^{-3}) = 6.38E+03\ m^3$

$total = 8.12E+03\ m^3$

closure Tank stab = 6.38 E+03

one equip = 8.02 E+02

$Closure = 6.254E+04\ m^3$

$total = 6.47E+04\ m^3$

J. Determine Kerosene Usage (m^3)

$Kerosene = (6.58E+04)(0.9852) = 6.48266E+04$

$= 6.48E+04\ m^3$

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. 92 of 393

BY PDW CHKD. JOB NO. 01K47101

7 J. Calculate the concrete requirements for these facilities under this alternative.

Construction WR&T = 5.9 E+04 m^3

sand = 3.98 E+04

gravel = 2.34 E+04

Cement = 1.48 E+04 MT

vitrifi = 4.82E+05 (0.056565) = 2.73E+04

482000 - 27300 = 454700

= (454760)(0.7) = 318290 (27300)(0.7)

= (318290)x(2) = 636580 = 19110

636580 + 19110 = 655690

= 6.56E+05 m^3 ~~Sand~~

Size of facility

2 at 40x120x40 Volume of shell @ ½ meter thick.

1 at (40)160 x 45

40x40 x2 = 1600 m^3

40x120 x4 = 9600 m^3

= 11200 m^3

~~add~~ Σ = 22400 + 15400 = 22400 m^3 2 units

= 3.78E+04 m^3

other facilities for support will account for additional concrete as will interior walls and floors of facilities.

40 x160 x2 = 6400

40 x45 x2 = 1800

45x160 x2 = 7200

= 15400 m^3 1 unit.

this is indication that estimating procedure is reasonable.

vitrif = 6.56 E+05 m^3

Sand = 4.42 E+05 m^3

gravel = 2.6 E+05 m^3

Cement = 1.64 E+05 MT

Construction total = 7.15 E+05

Determine operations concrete requirements.

LFW vaults

shielding casks.

FORM 91-005-1 (4/81)

7.j. operation

HLW shield casks of 3030 @ 90.7 Mg and 1.6 Mg/m³

= 3030 − 107 from phase I

= (2923)(90.7/1.6) = 1.66E+05 m³

SSW vaults = 66 − 10 = 56 @ 5300 m³ each.

= (56)(5300) = 2.41E+05 m³

total operation = 4.07E+05 m³

SSW vaults = 2.41E+05
sand = 1.63E+05 m³
gravel = 9.54E+04 m³
Cement = 6.03E+04 MT

HLW shields = 1.66E+05
sand = 1.12E+05 m³
gravel = 6.57E+04 m³
Cement = 4.15E+04 MT

Closure requirements:

tank slab = 5.03E+03 m³
Sand = 3.6E+03 m³
gravel = 2.1E+03 m³
Cement = 1.33E+03 MT

Barrier = NA

Ave Equip = 1.37E+04
Sand = 9.2E+03
Gravel = 5.4E+03
Cement = 3.4E+03

Total = 1.9E+04 m³

K. Determine the quantity of Carbon Steel requirements in (MT)

construction

WR+T = 1.0E+04 MT

7. K Construction utilities = 9.71 E+04

= (9.71E+04)(0.056565)

= {(9.71E+04) − [(9.71E+04)(0.056565)]}(0.7)(2) + [(9.71E+04)(0.056565)(0.7)]

5493

= (91607)(0.7)(2) + (5493)(0.7)

= 128249.8 + 3845.1

= 132094.9 = 1.32E+05 MT

Const total = 1.42 MT E+05

operation Carbon steel requirements.

LL vaults

LL boxes

HLW HMPCs.

LL vaults = (56)(500) = 2.8E+04 MT

HLW HMPCs = (2923)(6.5) = 1.9E+04 MT

LLW boxes = (0.144)(7)(1.3)(boxes)

= (0.144)(7)(1.3)(83358 − ~~2096~~ 1133)

= (0.144)(7)(1.3)(8 ~~+372~~ 2225) @ 4.2 m³

= ~~1064988.82~~ 1077476.4

= 1.08 E+05 MT

Correction RDW 6-15-96

1.2×1.2×2.9 m

= 4.2 m³

= 1160 boxes per vault.

phase I = ~~433~~ boxes

1.2×1.2×1.8 m³

= 2.6 m³

Phase I = ~~8760~~ ÷ 4.2 ~~+2.6~~ 40.7

= ~~2096~~ 1133 boxes

or = 8760 ÷ 2.6 ~~+2.6~~ 40.7

= ~~3370~~ 1830 boxes

total = (1.08E+05) + (1.9E+04) + (2.8E+04)

= 1.55E+05

1160 boxes = 4872 m³

Δ = 428 m³

102 boxes

Closure steel = NA.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11-0.3 and Transportation tables SHEET NO. 95 of 393

BY RDW CHKD. JOB NO. 01K47101

7 L. Determine the stainless steel requirements (MT)

Construction w R&T = 4.0 E+03

Vitrifi = 1.5 E+04 = 15000 MT

(15000)(0.056565) = 849 MT

15000 - 849 = 14151

(14151)(0.7)(2) + (849)(0.7) = 19811.4 + 594.3

9905.7

= 20405.7

= 2.04 E+04 MT.

total = 2.44 MT E+04

operation 55 Consumables for HLW = 12100 - 427.

= 11673

= (11673)(1.125) = 13132

= 1.32 E+04 MT

Closure = N.A.

M. Determine the Hastelloy/Inconel requirements.

Hastelloy/Inconel = 2.3 E+03

= 2300 (2300)(0.056565)

2300 - 130 = 130

= 2170

(2170)(0.7)(2) + (130)(0.7)

= 3038 + 91

= 3129 = 3.13 E+03 MT

FORM 01.005.1 (JIR1)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11-0-3 and transportation table

BY RDW CHKD. _____

SHEET NO. 96 of 393

JOB NO. 01K 47101

7 N. Determine the Glass former requirements (MT)

Glass formers:

$LLW = (5.39)(0.9864) = 5.32E+05$

$HLW = (2.61E+04)(0.9648) = 2.52E+04$

$LLW = 5.32E+05$ MT

	factor
$Al_2O_3 = 1.32E+04$	0.047
$CaO = 3.87E+04$	0.138
$SiO_2 = 2.29E+05$	0.815
$\Sigma = 2.809E+05$	

$HLW = 2.52E+04$ MT

	factor
$B_2O_3 = 1.95E+03$	0.129
$Li_2O = 5.0E+02$	0.037
$SiO_2 = 1.13E+04$	0.834
$\Sigma = 1.355E+04$	

$Al_2O_3 = 2.5E+04$

$CaO = 7.34E+04$

$SiO_2 = 4.34E+05$

$B_2O_3 = 3.25E+03$

$Li_2O = 9.3E+02$

$SiO_2 = 2.1E+04$

$\Sigma SiO_2 = 4.55E+05$ MT

O. Determine the Process chemical Requirements (MT)

Oxygen requirements is proportional to the Intermediate Separations usage and directly related to Hexone usage.

$O_2 = (0.9852)(2.17E+05) = 2.14E+05$ MT.

other chemicals = (0.9852)(Value from Intermediate Separations

aluminum nitrate	= 1.1E+02
ammonia	= 8.67E+03
CMPO	= 4.93E+00
Decon Chemicals	= 5.22E+03
Flocs	= 8.4E+01
FeSA	= 4.65E+03
Glycolic acid	= 3.45E+03
HNO_3, 50%	= 4.14E+03
NaOH, 50%	= 2.56E+04
NPH	= 6.93E+02

FORM 91-005-1 (4/81)

7. O. Sodium nitrate = 5.3E+01
TAP = 7.44E+02

PC Σ = 5.34E+04

PC+O₂ Σ = 2.67E+05

P. Determine the Sulfur Cement materials (MT)

operation factor = 0.9864
Sulfur = (0.9864)(1.48E+05) = 1.46E+05
Dicyclopentadiene = (0.9864)(3.86E+03) = 3.81E+03
Oligomer = (0.9864)(3.86E+03) = 3.81E+03

Q. Determine the Ion Exchange media (m³)

operation = (0.9852)(2.2E+02) = 2.17E+02 m³

R. Determine the excavation (m³)

Construction = (1.7E+06)(0.056565) = 96160.5
(1700000) − 96160 = 1603840 (.7)
(1603840)(0.7) = 1122688 (2) 67312.35
= 2245376 +
= 2.31E+06 m³

operation = (56)(43600) = 2.44E+06 m³

S. Determine the backfill requirements (m³)

Construction = (1.2E+06)(0.056565) = 67878E+04
= 1200000 − 67878
= 1132122 47514.6
792485.4
1584970.8 +
= 1632485.4 = 1.63E+06 m³

operation = (56)(21250) = ~~1.44E+06~~ 1.19E+06

8. Calculate the transportation numbers for materials for construction and operation for tables in appendix E.

A. No action alternative.

~~Transportation assumptions~~

~~1. offsite tank truck ≈ 5000 gallons~~

~~2. Rail car ≈ 100 MT = 110 tons~~

Conversion factor

gallons = $(m^3)(264)$

Cubic yds = $(m^3)(1.31)$

Tons = (M tons)(1.1)

tons = $(m^3)(1.76)$

Transportation assumptions

Transportation point of origin : Seattle Portland

: Tri cities

: Yucca Mountain

: Borrow pit-30

: Borrow Site - McGee Ranch

: Borrow Site - Vernita Quarry

Mode of transportation

1. Rail car ≈ 100 ~~metric~~ tons ~~or 110 tons~~
2. Dump trucks on site ≈ 10 cu yds - effective 8 cu yds.
3. Dump trucks on site ≈ 20 cu yds - effective 16 cu yds.
4. offsite tank trucks ≈ 5000 gallons or 50,000 lbs max.
5. 20 Rail Cars equal 1 train.
6. 40-50 ft Semi and tractor ≈ 45,000 lbs of steel - effective cargo payload 30,000 lbs (≈ 13.6 M tons of steel).
7. Rail cars flat bed, gondola, Box car - effective load 65 tons.
8. Rail Cars Hopper Cars effective 100 tons.

1. Diesel operation = 2.2E+04 m^3 = 580.8 E+04 gallons

= 5808000

at 5000 gal/trip = 1162 trips. 100 yrs.

= 11.62 Trips/year. Tri cities truck.

Carbon Steel - 1.0E+03 MT = 1000 = 11000 tons

= 11 Tons/year

100 years. = 1 trip/year Tri cities truck

B. Long term Management.

1. Construction Gasoline = 8.6 E+04 ~~gallons~~ m³
= 2.27 E+07 gallons

100 yr period @ 5000 gallons = 4541 trips.

= 46 trips/yr. truck.

2. Construction Diesel = 6.3 E+04
= (63000)(264) = 16632000

at 5000 gal. = 3326.4 trips.
at 100 yrs = 33.3 trips/yr. 3327 − 1162
at 4 yrs = 832 trips/yr. = 2165 truck.

operation diesel = 2.2 E+04
= 22000 = 5808000
= 1161.6 trips
at 100 yrs at 5000 gal = 11.6 trips/yr.
at 4 yrs = 291 trips/yr truck.

3. Construction Concrete WR+T 3.5 E+05 m³ Concrete

Sand − 2.36 E+05 m³ = 309160 yd³ @
at 16 yd³ = 19323 Trips
gravel − 1.39 E+05 m³ = 182090
@ 16 yd³ = 11381 trips
Cement − 8.75 E+04 MT = 96250 tons.
@ 100 ton Hopper = 962.5 ~~trips from Cabot~~ Rail Cars

4. Carbon Steel − Construction − 1.3 E+04
= 13000 MT = 14300
@ 65 tons = 220 Cars, rail

Steel operation = (1000)(1.1) = 1100
@ 100 = 11 tons yr = 1 truck/year

5. Stainless Steel = 2.2 E+01 MT
= ~~120 X 264 = 58080~~ (220)(1.1) = 242 tons
@ 65 tons = 3.72 = 4 rail Cars.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and Transportation tables SHEET NO. 100 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. B. 6 Construction Excavation = 2.7 E+06 m^3
= 3537000 cu yds.
@ 8 yds^3 = 44,2125 trips.

Const = 2 yr periods.

7. Construction Backfill = 2.6 E+06 m^3
= 3406000 cu yds
@ 8 yds^3 = 42,5750 trips.

C. In Situ Fill and Cap

1. Construction Gasoline = 9.7 E+01 m^3
= 25608 gallons
@ 5000 gallons = 5.12 trips.

2. Closure Gasoline tank Stab = 4.01 E+01
= (40.1)(264)
= 10586.4
at 5000 gal = 2.12 trips

3. Closure one Equip = 1.2 E+02
= (12)(264)
= 316.8
@ 5000 gallons = 0.063 trips

4. Closure Basin Gasoline = 2.6 E+02
= (260)(264)
= 68640
@ 5000 gal = 13.73 trips.

5. Construction Diesel = 1.3.0E +03
= (1300)(264)
= 343200
@ 5000 gal = 68.64 trips

6. operation Diesel = 6.10 E+03
= (6100)(264)
= 1610400
@ 5000 gall = 322.08 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 10 of 393

BY RDA CHKD. JOB NO. 01K4710

8.c.7. Closure Diesel Tank Slab 6.38 E+03
= (6380)(264)
= 1684320
@ 5000 gal = 336.864 trips

8. Closure Diesel and equip = 8.02 E+02
= (802)(264)
= 211728
@ 5000 gals = 42.35 trips

9. Closure Diesel Basin = 4.5 E+04
= (45000)(264)
= 11880000
at 5000 gals = 2376 trips

10 Concrete closure tank slab Sand = 3.6 E+03 m³
= (3600)(1.31)
= 4716 yd³
at 16 yd³ = 294.75 trips

Gravel = 2.1 E+03
= (2100)(1.31)
= 2751
at 16 yds³ = 171.94

Cement = 1.33 E+03 MT
= (1330)(1.1)
= 1463
@ 100T Hopper Car = 14.63

11 Concrete closure and Equip Sand = 9.2 E+03
= (9200)(1.31)
= 12052
at 16 yd³ = 753.25 trips

Gravel = 5.4 E+03
= (5400)(1.31)
= 7074
@ 16 yd³ = 442.125

FORM 91-005-1 (4/81)

8. C. 11 Concrete Closure on Equip Cement 3.4E+03
= (3400) (1.1)
= 3740
@ 100T Hopper = 37.4 trip.

12 Borrow site Silt - McGee Ranch.
Closure - Barrier 3.77E+05 m³
= (3.77) (1.31)
= 4.9387 E+05 yd³
= 493870
@ 16 yd³ = 30867 trips

13 Closure tank fill 7.54 E+05 m³
= (754000) (1.31)
= 987740
@ 16 yd³ = 61734 trips

14. Barrier Sand gravel Closure 4.15 E+05
~~= 4.15~~
= (415000) (1.31)
= 543650
@ 16 yd³ = 33978

15. Basalt Closure Barrier 6.38E+05
= (638000) (1.31)
= 835780
at 16 yd³ = 52236

16 asphalt Closure Barrier = 6.25 E+05
= (625000) (1.31)
= 818250
@ 16 yd³ = 51172

D. In situ vitrification
1. Construction gasoline 1.5E+04 m³
= (15000) (264)
= 3960000
@ 5000 gal = 792 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.03 and transportation Tables SHEET NO. 103 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.D.2. Closure Gasoline Tank Stab. 4.01E01
= (40.1)(264)
= 10586.4
@ 5000gals = 2.12 trips

3. Closure Gasoline and Equip 1.2E+00
= (3.2)(264)
= 316.8
@ 5000 gals = 0.063 trips

4. Barrier Gasoline = 2.6E+02
= (260)(264)
= 68640
@ 5000gals = 13.73 trips.

5. Construction Diesel 2.0E+04
= (20000)(264)
= 5280000
@ 5000gals = 1056 trips

6. operation Diesel 6.1E+03
= (6100)(264)
= 1610400
@ 5000 gallons = 322.08 trips

7. Closure Diesel Tank Stab NA

8. ~~Closure~~ Diesel and Equip NA

9. Barrier Diesel 4.5E+04
= (45000)(264)
= 11880000
@ 5000 gals = 2376 trips

10 Construction Concrete - 2 strip Sand 8.76E+04
= (87600)(1.31)
= 114756
@ 16 yd³ = 7172.3 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table 8.11.0.3 and transportation tables. SHEET NO. 104 OF 393

BY RDW CHKD. _____ JOB NO. 01K4710

8.12.11. Construction Concrete - vitrified gravel 5.15E+04 m³
= (5.1500) (1.31
= 67465
@ 16 yd³ = 4216.6 trips

12. Construction Cementitious - vitrified cement 3.25E+04 mT
= (32500) (1.1)
= 35750
@ 100 Ton Hopper = 357.5 trips

13. Construction Carbon Steel 2.6E+05 mT
= (260000) (1.1)
= 286000
@ .65 Tons/car = 4400 trips

14 Glass former material - Limestone = 1.1E+04 mT
= (11000) (1.1)
= 12100
@ 100T/car = 121 trips

15. process chemicals ammonia 6.8E+03 mT
= (6800) (1.1)
= 7480
@ 100 Ton tankcar = 74.8 trips or @ 25 Ton tank. 299.2

16 Closure Barrier silt 3.77E+05 m³
= (377000) (1.31)
= 493870
@ 16 yd³ = 30867 trips

17. Closure Barrier sand & gravel 4.15E+005 m³
= (415000) (1.31)
= 543650
@ 16 yd³ = 33978 trips

18. Barrier Basalt = 6.38E+05
= (638000) (1.31)
= 835280
@ 16 yd³ = 52236 trips

FORM 91-005-1 (4/81)

8.D.19. Closure Barrier asphalt 6.25E+04
= (6.25000)(1.31)
= 81875.0
@16 yds³ = 511.72 Trips

E. W-314 upgrades

1. Construction concrete WR&T Sand 2.42E+03 m³
= (2420)(1.31)
= 3170.2
@16 yds³ = 198.14 Trips

2. Construction Concrete WR&T gravel 1.55E+03 m³
= (1.550)(1.31)
= 2.030.5
@16 yds³ = 127 Trips

3. Construction concrete WR&T Cement 9.8E+02 MT
= (980)(1.1)
= 1078
@100T hopper = 10.78 Trips

4. Construction Carbon steel WR&T 7.82E+02 MT
= (782)(1.1)
= 860.2
@65T/car = 13.24 Trips

5. Construction stainless steel WR&T 6.02E+02 MT
= (602)(1.1)
= 662.2
@65T/car = 10.19 Trips

6. Construction Excavation 1.4E+04 m³
= (14000)(1.31)
= 18340
@8yds³ = 2293

8.E.7. Construction Backfill 1.68E+04
= (16800)(1.31)
= 22008
@ 8yds³ = 2751 trips

3. Ex Situ No Separations alternative

1. Construction Gasoline WR&T 3.3E+02
= (330)(264)
= 87120
@ 5000gals = 17.4 trips

2. Construction Gasoline w/ thifi 4.8E+03
= (4800)(264)
= 1267200
@ 5000gals = 253.44 trips

3. Closure Gasoline tank slab 4.01E01
= (40.1)(264)
= 10586.4
@ 5000 gals = 2.12 trips

4. Closure Gasoline anc Equip 1.2E+00
= (1.2)(264)
= 316.8
@ 5000gals = 0.063 trips.

5 Closure gasoline Barrier 2.6E+02
= (260)(264)
= 68640
@ 5000gals = 13.73 trips

6. Construction Diesel WR&T 1.0E+03
= (1000)(264)
= 264000
@ 5000gals = 52.8 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary table B.11.0.3 and transportation tables SHEET NO. 107 of 393

BY R.D.W. CHKD. JOB NO. 01K47101

8. F.7. Construction Diesel vehicle 1.090E+04
= (10900)(264)
= 2877600
@5000gals = 575.52 trips

8. operation Diesel WR&T 1.02E+03
= (1020)(264)
= 269280
@5000gals = 53.86

9. operation Diesel vehicle 3.7E+02
= (370)(264)
= 97680
@5000gals = 19.54 trips.

10 Closure Diesel tank & tab 6.38E+03
= (6380)(264)
= 1684320
@5000gals. = 336.86 trips

11. Closure Diesel anc equip 8.02E+02
= (802)(264)
= 211728
at 5000gals = 42.35 trips

12. Closure Diesel Barrier 4.50E+04
= (45000)(264)
= 11880000
@5000gals = 2376 trips

13. operations Kerosene vehicle 8.48E+04
= (84800)(264)
= 22387200
at 5000 gallons = 4477.44 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B-11-013 and transportation table SHEET NO. 108 OF 393

BY RDW CHKD. JOB NO. 01K 47101

8.7.14. Construction Concrete WR+T sand 4.0E+04
= (40000)(1.31)
= 52400
at 16 yds³ = 3275 Trips

15 Construction Concrete WR+T gravel 2.46E+04 m³
= (24600)(1.31)
= 32226
at 16 yds³ = 2014.13 trips

16. Construction Concrete WR+T Cement 1.48E+04 MT
= (14800)(1.1)
= 16280
at 100 Ton Hopper = 162.8 Trips

17. Construction Concrete vitrifi sand 1.46E+05
= (146000)(1.31)
= 191260
@ 16 yds³ = 11954 Trips

18. Construction Concrete vitrifi gravel 8.59E+04
= (85900)(1.31)
= 112529
at 16 yds³ = 7033 Trips

19 Construction Concrete vitrifi Cement 5.4E+04 MT
= (54000)(1.1)
= 59400
@ 100 Ton Hopper = 594 Trips

20. operations Concrete vitrifi ~~HSW vaults~~ HSW shield Casks. sand 1.67E+06
= ~~1.67E+06~~ (1670000)(1.31)
= 2187700
at 16 yds³ = 136731.3 Trips

21 operations concrete vitrifi HSW shield Casks gravel 9.82E+05
= (982000)(1.31) = ~~1286420~~ 1286420
@ 16 yds³ = 80401.3 Trips

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. 109 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. S. 22 operations concrete v ultra HSW Shield Cooks Cement 6.2E05 MT
= (620000)(1.1)
= 682000
@ 100 Ton Hopper = 6820 trips

23. Closure Concrete tank Slab sand 3.6E+03
= (3600)(1.31)
= 4716
at 16 yd³ = 294.75 trips

24. Closure Concrete tank Slab gravel 2.1E+03
= (2100)(1.31)
= 2751
at 16 yds³ = 171.94 trips

25. Closure Concrete tank Slab cement 1.33E+03 MT
= (1330)(1.1)
= 1463
at 100 Ton Hopper = 14.63 trips

26. Closure Concrete aux Equip sand 9.2E+03
= (9200)(1.31)
= 12052
@ 16 y³ = 753.25 trips

27. Closure Concrete aux Equip gravel 5.4E+03
= (5400)(1.31)
= 7074
at 16 yds³ = 442.13 trips

28. Closure Concrete aux Equip cement 3.4E+03 MT
= (3400)(1.1)
= 3740
at 100 Ton Hopper = 37.4 trips

FORM 91-005-1 (4/81)

8. F.29. Construction Carbon steel WR&T 1.0 E+04
= (10000)(1.1)
= 11000
@ 65 Ton Car = 169.23 Trips

30. Construction Carbon steel Witrifi 5.17 E+04
= (51700)(1.1)
= 56870
@ 65 Ton Car = 874.92 Trips

31. operation Carbon Steel HMPES 1.96 E+05
= (196000)(1.1)
= 215600
@ 65 Ton Car = 3317 Trips

32. Construction Stainless steel WR&T 4.0 E+03
= (4000)(1.1)
= 4400
at 65 Ton Car = 67.69 ~~68~~ Trips = 68 trips

33. Construction Stainless Steel witrifi 8.61 E+03
= (8610)(1.1)
= 9471
@ 65 Ton Car = 146

34. operation Stainless Steel witrifi 55 Computers = 1.65 E+05
= (165000)(1.1)
= 181500
@ 65 Ton Car = 2792.3

35. Construction Hastelloy/Inconel witrifi 1.51 E+03
= (1510)(1.1)
= 1661
@ 65 Ton Car = 25.6 Trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 111 OF 393

BY RDW CHKD. _____ JOB NO. 01K47161

8. F.36. operations Glass forms. vitrify SiO_2 3.51 E+05 MT/2.2

$= (\cancel{351000})(1.31)(159540.45)$

$= \cancel{4592610}$ 20900 4.53

$\rho_{sand} = 2.2 g/cm^3$

@ 16 yd³ $= \cancel{28736013}$ Trips 13062.76

37 operations Glass formers vitrify other materials CaO 6.11 E+04 MT

$\Sigma = 7.83$ E+04 Al_2O_3 1.72 E+04

$= (78300)(1.1)$

$= 86130$ CaO = 671.1

at 100 Hopper = 861.3 Trips. Al_2O_3 = 189.2

36. operations process chemicals ammonia 6.98 E+03 MT

$= (6980)(1.1)$

$= 7678$

@ 25 ton truck = 307.12 Trips. or 100 ton tanker = 76.8 Trips

39. operations Process Chemicals HNO_3, 50% 6.30 E+02 MT

$= (630)(1.1)$

$= 693$

@ 25 ton tanker = 28 Trips

40 operations process Chemicals NaOH, 50% 2.66 E+02

$= (266)(1.1)$

$= 292.6$

@ 25 ton tanker = 11.7 Trips

41. operations process Chemicals other Chemicals 3.2 E+01

$= (1949)(1.1)$ 1.7 E+01

$= 2143.9$ 1.9 E+03

@ 65 ton car = 32.98 Trips $\Sigma = 1949$ MT

42. Construction Excavation 7.95 E+05

$= (795000)(1.31)$

$= 1041450$

@ 8 yd³ = 130181.25 Trips

FORM 91-005-1 (4/81)

8.2.43. Construction Backfill 5.73E+05
= (573000)(1.31)
= 750630
@8yd³ = 93829 Trips

G. Ex Situ Vr Separations Calcination alternative.

1. Construction Gasoline WR&T 3.3E+02
= (330)(264)
= 87120
@5000gal = 17.4 Trips

2. Construction Gasoline vehicle 4.8E+03
= (4800)(264)
= 1267200
@5000gals = 253.44 Trips

3. Closure Gasoline Tank Stat 4.01E+01
= (40.1)(264)
= 10586.4
@5000 gals = 2.12 Trips

4. Closure Gasoline anc Equip 1.2E+00
= (1.2)(264)
= 316.8
@5000 gal. = 0.063 Trips

5 Closure Gasoline Barrier 2.6E+02
= (260)(264)
= 68640
@5000 gals. = 13.73 Trips.

6. Construction Diesel WR&T 1.0E+03
= (1000)(264)
= 264000
@5000gals. = 52.8

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11.0.3 and Transportation Table SHEET NO. 113 OF 393

BY RDA CHKD. _____ JOB NO. 01K4710I

8. J. 7. Construction Diesel vehicle 1.09E+04
= (10900)(264)
= 2877600
@ 5000 gals. = 575.52 Trips

8. operation Diesel WR&T 1.02E+03
= (1020)(264)
= 269280
@ 5000 gals = 53.9 Trips

9. Closure Diesel Tank Stor 6.38E+03
= (6380)(264)
= 1684320
@ 5000 gals = 337 Trips

10. Closure Diesel Anc Equip 8.02E+02
= (802)(264)
= 211728
@ 5000 gals = 42.35 Trips

11 Closure Diesel Barrier 4.50E+04
= (45000)(264)
= 11880000
@ 5000 gals. = 2376 Trips

12 operations vehicle (Calcination) Kerosene 1.05E+04
= (10500)(264)
= 2772000
@ 5000 gals = 554.4 Trips

13. Construction Concrete WR&T sand. 3.98E+04
= (39800)(1.31)
= 52138
@ 16 yd³ = 3259 Trips

14 Construction Concrete WR&T gravel 2.34E+04
= (23400)(1.31)
= 30654
@ 16 yd³ = 1916 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 table SHEET NO. 114 of

BY RDO CHKD. _____ JOB NO. 01K 471

8. 2.15. Construction Concrete WR&T cement 1.48E+04
= (14800)(1.1)
= 16280
@ 100 Ton Hopper = 162.8 trips

16. Construction Concrete vibrifi Sand 1.4E+05
= (146000)(1.31)
= 183400
@ 16 yds³ = 11463 trips

17. Construction Concrete vibrifi gravel 8.2E+04
= (82000)(1.31)
= 107420
@ 16 yd³ = 6714 trips

18. Construction concrete vibrifi cement 5.18E+04
= (51800)(1.31)
= 67858
@ 100 ton Hopper = 678.58 trips

19. operation Concrete HSW shield Cooks sand 6.61E+05
= (661000)(1.31)
= 865910
@ 16 yds³ = 54119.38 trips

20. operation Concrete HSW shield Cooks gravel 3.88E+05
= (388000)(1.31)
= 508280
@ 16 yd³ = 31767.5 trips

21. operation concrete HSW shield Cooks Cement 2.45E+05
= (245000)(1.1)
= 269500
@ 100T Hopper = 2695 trips

22 Closure Concrete Tank Slab sand 3.6E+03
~~17~~ = ~~3.6E+0~~ (3600)(1.31)
= 4716
@ 16 yd³ = 294.75 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary tables 8.11.0.3 and transportation tables SHEET NO. 115 of 393

BY R.D.W. CHKD. _____ JOB NO. 01K4710/

8. 2.23 Closure concrete tanks Stab gravel 2.1E+03
= (2100)(1.31)
= 2751
@16 yd³ = 172 Trips

24 Closure concrete tanks stab cement 1.33E+03
= (1330)(1.1)
= 1463
@100T Hopper = 14.63 Trips

25. Closure concrete and Equip sand 9.2E+03
= (9200)(1.31)
= 12052
@ 16 yd³ = 753.25

26. Closure Concrete and Equip gravel 5.4E+03
= (5400)(1.31)
= 7074
@ 16 yd³ = 442.13 trips

27. Closure Concrete and Equip Cement 3.4E+03
= (3400)(1.1)
= 3740
@100T Hopper = 37.4 Trips

28. Construction carbon steel w R&T 1.0E+04
= (10000)(1.1)
= 11000
@65 ton Car = 169.23 Trips

29 Construction carbon Steel Equip 5.12E+04
= (51200)(1.1)
= 56320
@ 65 ton Car = 866.5 Trips

30 operation Carbon Steel lift HLW Hopper 7.04E+04
= (70400)(1.1)
= 77440
@65 ton Car = 1192 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. 116 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. D.31 Construction Stainless steel WR+T 4.0E+03
= (4000)(1.1)
= 4400
@ 65 Ton car = 67.7 Trips

32. Construction stainless steel vitrifi 8.61E+03
= (8610)(1.1)
= 9471
@ 65 Ton car = ~~592~~ 145.71 Trips

33. operation stainless steel vitrifi SS Connector 5.84E+04
= (58400)(1.1)
= 64240
@ 65 Ton car = 988.31 Trips

34. Construction Hastelloy/Inconel vitrifi 1.51E+03
= (1510)(1.1)
= 1661
@ 65 Ton car = 25.6 Trips

35. operation process chemicals ammonia 3.61E+04
= (36100)(1.1)
= 39710
@ 25T truck = 1588.4 Trip or 100T hopper = 397.1 Trip

36. operation process chemicals HNO_3, 50% 6.30E+02
= (630)(1.1)
= 693
@ 25T truck = 27.72 Trips

37 operation process chemicals NaOH, 50% 2.66E+02
= (266)(1.1)
= 292.6
@ 25T truck = 11.7

38. operation process chemicals sugar 2.3E+04
= (23000)(1.1)
= 25300
@ 100T hopper = 253 Trips or 25T hopper = 1012 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 table SHEET NO. 117 OF 393

BY RDW CHKD. _____ JOB NO. 01K 4710/

8. H. 39. Process chemicals operation other chemicals 3.2E+01

= (1949) (1.1) 1.7E+01

= 2143.9 1.9E+03

@ 65T car = 33 trips Σ = 1949

40. Construction Excavation 7.95E+05

= (795000) (1.31)

= ~~894500~~ 1041450

@ 8yd³ = 130181.3 trips

41. Construction Backfill 5.73E+05

= (573000) (1.31)

= 750630

@ 8yd³ = 93828.75 trips

8. H. Existing Extension Separations

1. Construction Gasoline WR+T 3.3E+02

= (330) (264)

= 87120

@ 5000 gal. = 17.42 trips

2. Construction Gasoline Vitrifi 9.4E+03

= (9400) (264)

= 2481600

@ 5000 gal = 496.32 trips

3. Operation gasoline vitrifi 4.4E+01

= (44) (264)

= 11616

@ 5000 gal = 2.32 trips

4. Closure gasoline tank slab 4.01E+01

= (40.1) (264)

= 10586.4

@ 5000 gal = 2.12 trips

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. 118 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. H. 5. Closure gasoline acc - Equip 1.2E+00
= (1.2) (264)
= 316.8
@ 5000 gallons = 0.063 trip

6. Closure Gasoline Barrier 3.68 E+02
= (368) (264)
= 97152
@ 5000 gals = 19.43 trip

7. Construction Diesel WR&T 1.0E+03
= (1000) (264)
= 264000
@ 5000 gals = 52.8 trip

8. Construction Diesel vitrifi 28E+04
= (28000) (264)
= 7392000
@ 5000 gals = 1478.4 trips

9. operation Diesel WR&T 1.02 E+03
= (1020) (264)
= 269280
@ 5000 gals = 53.86 trip

10. operation Diesel vitrifi 7.15 E+03
= (7150) (264)
= 1887600
@ 5000 gals. = 377.5 trip

11 Closure Diesel Tank Stab 6.38E+03
= (6380) (264)
= 1684320
@ 5000 gals. = 337 trips

12. Closure Diesel acc Equip 8.02 E+02
= (802) (264)
= 211728
@ 5000 gals = 42.35 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. 119 of 393

BY R.D.W. CHKD. _____ JOB NO. 01K 47101

8. N. 13. Closure Diesel Barrier 6.36 E+04
= (63600)(264)
= 16790400
@ 5000 gals. = 3358 trips

14. operations Kerosene vitrifi 1.872 E+05
= (187200)(264)
= 49420800
@ 5000 gals. = 9884.16 trips

15. Construction Concrete WR&T sand 3.98 E+04
= (39800)(1.31)
= 52138
@ 16 yds³ = 3258.63 trips

16. Construction Concrete WR&T gravel 2.34 E+04
= (23400)(1.31)
= 30654
@ 16 yds³ = 1916 trips

17. Construction concrete WR&T cement 1.48 E+04 MT
= (14800)(1.1)
= 16280
@ 100 Ton Hopper = 162.8 trips

18. Construction Concrete vitrifi sand 2.97 E+05
= (297000)(1.31)
= 389070
@ 16 yd³ = 24,317 trips

19. ~~operation~~ Construction Concrete vitrifi gravel 1.742 E+05
= (174200)(1.31)
= 228202
@ 16 yd³ = 14,262.63 trips

20. ~~operation~~ Construction Concrete vitrifi cement 1.1 E+05 MT
= (110000)(1.1)
= 121000
@ 100 Ton Hopper = 1210 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.16.0.3 and transportation tables SHEET NO. 120 of 393

BY RDW CHKD. _____ JOB NO. 01K 47101

8.2.21. operation concrete vitrifi. LLW vaults sand 2.57E+05
= (257000)(1.31)
= 336670
@ 16 yds³ = 21042 trips

22 operation Concrete vitrifi LLW vaults gravel 1.51E+05
= (151000)(1.31)
= 197810
@ 16 yd³ = 12363.13 trips

23 operation Concrete vitrifi LLW vaults Cement 9.53E+04 MT
= (95300)(1.1)
= 104830
@ 100 ton Hopper = 1048.3 trips

24. operation Concrete vitrifi HLW shields sand 5.47E+03
= (5470)(1.31)
= 7165.7
@ 16 yd³ = 448 trips

25. operation Concrete vitrifi HLW Shields gravel 3.21E+03
= (3210)(1.31)
= 4205.1
@ 16 yd³ = 263 trips

26. operation Concrete vitrifi HLW shields Cement 2.03E+03
= (2030)(1.1)
= 2233
@ 100 ton Hopper = 22.33 trips

27. Closure Concrete tank stab sand 3.6E+03
= (3600)(1.31)
= 4716
@ 16 yds³ = 295 trips

28. Closure concrete tank stab gravel 2.1E+03
= (2100)(1.31)
= 2751
@ 16 yds³ = 172 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. 121 of 393

BY RDW CHKD. JOB NO. 01K 47101

8.N.29 Closure Concrete Tank Stab cement 1.33E+03
= (1330) (1.1)
= 1463
@ 100 Ton Hopper = 14.63 trips

30 Closure Concrete and Equip dond 9.2E+03
= (9200) (1.31)
= 12052
@ 16 yd³ = 753.25 trips

31. Closure Concrete and Equip grout 5.4E+03
= (5400) (1.31)
= 7074
@ 16 yd³ = 442.13 trips

32 Closure Concrete and Equip cement 3.4E+03 MT
= (3400) (1.1)
= 3740
@ 100 Ton Hopper = 37.4 trips

33. Construction Carbon Steel WRFT 1.0E+04
= (10000) (1.1)
= 11000
@ 65 Ton Car = 169.23 trips

34. Construction Carbon Steel vitrifi 1.3E+05
= (130000) (1.1)
= 143000
@ 65 Ton Car = 2200 trips

35. operation Carbon Steel vitrifi JSW Vaults 4.4E+04
= (44000) (1.1)
= 48400
@ 65 Ton Car = 744.62 trips

36. operation Carbon Steel vitrifi HLW HMPCs 9.3E+03
= (9300) (1.1)
= 10230
@ 65 Ton Car = 157.38 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. 122 of 393

BY RDW. CHKD. _____ JOB NO. 01K4701

8. H. 37 operation carbon steel vitrifi SSW waste hopper 1.09E+05

= (109000) (1.1)

= 119900

@ 65 Ton Car = 1844.62 trips

38 Construction stainless steel WRT 4.0 E+03

= (4000) (1.1)

= 4400

@ 65 Ton Car = 67.69 trips

39 construction stainless steel vitrifi 1.7 E+04

= (17000) (1.1)

= 18700

@ 65 Ton Car = 287.69 trips

40 operation stainless steel vitrifi 6.41E+02

= (641) (1.1)

= 705.1

@ 65 Ton Car = 10.85 trips

41. Construction Hastelloy/Inconel vitrifi 1.8 E+03

= (1800) (1.1)

= 1980

@ 65 Ton Car = 30.46 trips

42. operation Glass formers vitrifi Silica (SiO_2) 4.25 E+05

= (425000) (1/3.2) (1.31)

= 253068.2

@ 16 yd³ = 15816.76 = 15817 trips

43. operation Glass formers vitrifi CaO 7.57 E+04

= (75700) ~~(1.31) (1/3.3)~~ (1.1)

= ~~300506~~ 83270

@ 100 t hopper = 832.7

44. operation Glass formers vitrifi other Met. Al_2O_3 2.3E+04

= (240) (1.1) B_2O_3 2.88 E+02

= 264 Li_2O 2.0E+01

@ 100 t hopper = 2.64 trips Na_2O 3.7E+01

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation table SHEET NO. 123 of 383

BY RDW CHKD. _____ JOB NO. 01K47101

8. H. 44 operation Glass formers other materials

= (1.83) (1.1) 1.83E+02 B2O3

= 201.3

@ 100T hopper = 2.01 trips

= (20) (1.1) Li2O 2.0E+01

= 22

@ 100T hopper = 0.22 trips

= (37)(1.1) Na2O 3.7E+01

= 40.7

@ 100T hopper = 0.41 trips

= (23000) (1.1) Al2O3 2.3E+04

= 25300

@ 100T hopper = 253 trips

glass formers total = SiO2 = 15817 trips.

other mat = CaO 833 + Al2O3 253 + 2 + 1 + 1 = 1090 = Σ trips

45. ~~Operation~~ Process chemicals ammonia = 9.24E+03

= (9240)(1.1)

= 10164

@ 25 ~~Ton~~ Truck = 406.56 trips

46. operation process chemicals HNO3, 50% 4.65 E+05

= (465000) (1.1)

= 511500

@ 25 Ton truck = 20460 trips @ 100T tank car = 5115 trips

(EST 4 trucks/day)

47. operation process chemicals NaOH, 50% 1.5 E+05

= (150000)(1.1)

= 165000

@ 25 Ton truck = 6600 trips 100T tank car = 1650 trips

48. operation process chemicals other chemicals 72438 mT

= (72438) (1.1)

= 79681.8

@ 65 Ton car = 1225.87 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-95 SUBJECT Resources Summary table B.11-0.3 And TRANSPORTATION TABLES SHEET NO. 124 OF 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.11.49. Process Chemical Sulfur Cement Sulfur 2.83E+05
= (283000)(1.1)
= 311300
@ 100T truck car = 3113 Trips

50. Process Chemicals Sulfur Cement Dicyclopentadiene 7.42E+03
= (7420)(1.1)
= 8162
@ 100T truck car = 81.62 Trips

51. process Chemicals Sulfur Cement Oligomer 7.42E+03
= (7420)(1.1)
= 8162
@ 65T on car = 125.57 Trips.

52. Ion Exchange media process material 4.90E+03 m³
= (4900)(1.31)
= 6419
@ 16 yd³ = 401.2 Trips
NOTE Irregular
Box 8x12x50 = 4800 ft³ = 178 yds³ @ 65% = 116 yds³
= 55.34 Trip
= 56 Trips.

53. Construction Excavation 1.8 E+06 m³
= (1800000)(1.31)
= 2358000
@ 8 yd³ = 294750 Trips

54. operation Excavation 2.44 E+06 m³
= (2440000)(1.31)
= 3196400
@ 8 yd³ = 399550 Trips

55. Construction Backfill 8.5E+05
= (850000)(1.31)
= 1113500
@ 8 yd³ = 139188 Trips

FORM 91-005-1 (4/81)

8 H.56. operation backfill 1.19E+06
= (1190000)(1.30)
= 1558900
@ 8 yd3 = 194863 trip

2 Ex Situ Intermediate Separations - SSW and HSW

1. Construction Gasoline WR&T 3.3 E+02
= (330)(264)
= 87120
@ 5000 gals. = 17.42 trips

2. Construction Gasoline vitrifi 7.3 E+03
= (7300)(264)
= 1927200
@ 5000 gals. = 385.44 trips

3. operation Gasoline vitrifi 5.1E+01
= (51)(264)
= 13464
@ 5000 gals. = 2.69 trips

4. Closure Gasoline tank stat 4.01E+01
= (40.1)(264)
= 10586.4
@ 5000 gals = 2.12 trips

5. Closure Gasoline anc Equip 1.2E+00
= (1.2)(264)
= 316.8
@ 5000 gals = 0.063 trips

6. Closure Gasoline Barren 3.71 E+02
= (371)(264)
= 97944
@ 5000 gals. = 19.59 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and Transportation Tables SHEET NO. 126 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8 d. 7. Construction Diesel WR+T 1.0E+03
= (1000)(264)
= 264000
@ 5000 gals = 52.8 trips

8. Construction Diesel vitrifi 2.01E+04
= (20100)(264)
= 5306400
@ 5000 gals = 1061.28 trips

9. operation diesel WR+T 1.02E+03
= (1020)(264)
= 269280
@ 5000 gals. = 53.86 trips

10. operation Diesel vitrifi 7.14E+03
= (7140)(264)
= 1884960
@ 5000 gals. = 376.992 trips

11. Closure Diesel Tank Stab 6.4E+03
= (6400)(264)
= 1689600
@ 5000 gals = 337.92 trips

12. Closure diesel arc Equip 8.02E+02
= (802)(264)
= 211728
@ 5000 gals = 42.35 trips

13. Closure diesel Barrier 6.3E+04
= (63000)(264)
= 16632000
@ 5000 gals. = 3326.4 trips

14. operation Kerosene vitrifi 6.58E+04
= (65800)(264)
= 17371200
@ 5000 gals = 3474.24 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. 127 of 393

BY RDW CHKD. JOB NO. 01K47101

8.d.15. Construction concrete WRT sand 3.98E+04
= (3.9800)(1.31)
= 5.2138
@16 yd³ = 3258.63 trips

16. Construction Concrete WRT gravel 2.34E+04
= (23400)(1.31)
= 30654
@16 yd³ = 1915.88 trips

17 Construction Concrete WRT cement 1.48E+04 MT
= (14800)(~~1.31~~)(1.1)
= 16280
at 100 Ton Hopper ~~@16 yd³~~ = 162.8 trips

18. Construction Concrete vitrified sand 3.25E+05
= (325000)(1.31)
= 425750
@16 yd³ = 26609.38 trips

19. Construction Concrete vitrified gravel 1.91E+05
= (191000)(1.31)
= 250210
@16 yd³ = 15638.13 trips

20 Construction Concrete vitrified cement 1.21E+05 MT
= (121000)(1.1)
= 133100
@100 Ton Hopper = 1331 trips

21. operation concrete vitrified LLW vaults sand 2.02E+05
= (202000)(1.31)
= 264620
@ 16 yd³ = 16538.75 trips

22 operation Concrete vitrified LLW vaults gravel 1.19E+05
= (119000)(1.31)
= 155890
@16 yd³ = 9743.13 trips

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. 128 of 393

BY RDW CHKD. JOB NO. 01K47101

8. I.23. operation concrete vitrifi HLW & aux cement 7.5E+04 kg

= (75000)(1.1)

= 98250

@100 Ton Hopper = 982.5 Trips

24. operation concrete vitrifi HLW shield Casks sand 1.18E+05

= (18000)(1.31)

= 154580

@16 yds³ = 9661.25 trips

25. operation concrete vitrifi HLW Shield Casks gravel 6.93E+04

= (69300)(1.31)

= 90783

@16 yds³ = 5674 trips

26. operation Concrete vitrifi HLW Shield Casks cement 44E+04 kg

= (44000)(1.1)

= 48400

@ 100 Ton Hopper = 484 trips

27. Closure Concrete Tank Slab sand 3.6E+03

= (3600)(1.31)

= 4716

@16 yds³ = 294.75 trips

28. Closure Concrete Tank Slab gravel 2.1E+03

= (2100)(1.31)

= 2751

@16 yds³ = 171.94 trips

29. Closure Concrete Tank Slab cement 1.33E+03 kg

= (1330)(1.1)

= 1463

at 100 Ton Hopper = 14.63 trips

30. Closure concrete aux Equip sand 9.2E+03

= (9200)(1.31)

= 12052

@16 yds³ = 753.25 trips

FORM 91-005-1 (4/81)

31. Closure Concrete and Equip gravel 5.4 E+03
= (5400)(1.31)
= 7074
@16 yds³ = 442.13 trips

32. Closure Concrete and Equip. cement 3.4E+03 MT
= (3400)(1.1)
= 3740
@100 Ton Hopper = 37.4 trips

33. Construction Carbon Steel WR&T 1.0 E+04
= (10000)(1.1)
= 11000
@65 ton Car = 169.23 trips

34. Construction Carbon Steel vitrifi 9.71 E+04
= (97100)(1.1)
= 106810
@65 ton Car = 1643.23 trips

35. operation carbon Steel vitrifi f&W vaults 3.3E+04
= (33000)(1.1)
= 36300
@65 Ton Car = 558.46 trips

36. operation Carbon Steel vitrifi HMPCs 1.97E+04
= (19700)(1.1)
= 21670
@65 ton Car = 333.39 trips

37. operation Carbon Steel vitrifi f.L.W work boxes 1.09E+05
= (109000)(1.1)
= 119900
@65 Ton Car = 1844.62 trips

38 Construction stainless Steel WR&T 4.0E+03
= (4000)(1.1)
= 4400
@65 Ton Car = 67.69 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resources Summary Table B.11.0.3 and Transportation Tables SHEET NO. 130 of 393

BY RDW CHKD. JOB NO. 01K47101

8.J.39. Construction stainless steel vitrifi 1.5E+04
= (15000)(1.1)
= 16500
@ 65 Ton Car = 253.85 trips

40 operations stainless steel vitrifi ss canister 1.36E+04
= (13600)(1.1)
= 14960
@ 65 Ton car = 230.15 trips

41. Construction Hastelloy/Inconel vitrifi 2.3E+03
= (2300)(1.1)
= 2530
@ 65 Ton Car = 38.92 trips

42 operation Glass former SiO_2 4.6E+05 MT
= (460000)(1.31)/2.2
= 602600/2.2 = 273909.09
@ 16 yds³ = ~~37662.5 trip~~ 17119.32 trips

43. operation Glass former other materials
= (25300)(1.1) Al_2O_3 2.53E+04
= 27830 ~~BO 3~~
@ 100 Ton Hopper = 278.3 trips
= (3320)(1.1) BO 3.32E+03
= 3652
@ 100 Ton Hopper = 36.52 trips
= (74400)(1.1) CaO 7.44E+04
= 81840
@ 100 Ton Hopper = 819.4 trips
= (950)(1.1) Li_2O 9.5E+02
= 1045
@ 100 Ton Hopper = 10.45 trips

Σ of trips = 279 + 37 + 819 + 11
@ 100 Ton Hoppers = 1146 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 table SHEET NO. 131 OF 393

BY RDW CHKD. JOB NO. OIK 47101

8. J. 44. operation process chemicals vitrifi ammonia 8.8 E+03
= (8800)(1.1)
= 10940.6
@ 25 ton tank = 437.62 trips.

45 operation process chemicals vitrifi HNO_3, 50% 4.2E+03
= (4200)(1.1)
= 4620
25 Ton tank = 184.8 trips

46. operation process chemical vitrifi NaOH, 50% 2.6E+04
= (26000)(1.1)
= 28600
@ 25 Ton truck = 1144 trips

47. operation process chemical vitrifi other chemicals 15234
= (15234)(1.1)
= 16757.4
@ 65 ton car = 257.81 trips

48 operation process chemicals sulfur cement sulfur 1.48 E+05
= (148000)(1.1)
= 162800
@ 100 ton tanker = 1628 trips

49. operation process chemicals sulfur cement Dicyclopentadiene 3.86E+03
= (3860)(1.1)
= 4246
@ 100 ton tanker = 42.46 trips

50. operation process chemical sulfur cement Oligomer 3.86E+03
= (3860)(1.1)
= 4246
@ 65 ton car = 65.32 trips

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. 132 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. A.57 ~~Process~~ operation process material in exchange resin 2.2E+02 m^3

= (220) (1.31)

= 288.2

@ 116 yds^3 = 2.48 trips

52 Construction Excavation 1.7E+06 m^3

= (1700000) (1.31)

= 2227000

@ 8 yds^3 = 278375 trip

53 operation Excavation @ 2.44E+06

= (2440000) (1.31

= 3196400

@ 8 yds^3 = 399550 trips

54 Construction Backfill 1.2E+06

= (1200000) (1.31

= 1572000

@ 8 yds^3 = 196500 trips

55. operation Backfill 1.19E+06

= (1190000) (1.31)

= 1558900

@ 8 yds^3 = 194862.5 trips

J. Ex Situ In Situ Combination 70 tanks of 177 total tanks

1. Construction Gasoline WRT 2.0E+02

= (200) (264)

= 52800

@ 5000 gals. = 10.56 trips

2. Construction Gasoline vitrify 4.45E+03

= (4450) (264)

= 1174800

@ 5000 gals. = 234.96 trips

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. 133 OF 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. J.3. operation Gasoline vehicle 2.73 E+01
= (27.3)(264)
= 7207.2
@ 5000 gals. = 1.44 trips

4. Closure Gasoline Tank Stab 4.01 E+01
= (40.1)(264)
= 10586.4
@ 5000 gals = 2.12 trips

5. closure Gasoline and Equip 1.2 E+00
= (1.2)(264)
= 316.8
@ 5000 gals = 0.063 trips

6. Closure gasoline Barrier 3.09 E+02
= (309)(264)
= 81576
@ 5000 gals = 16.32 trips

7. Construction diesel WR&T 6.0 E+02 ~~2.24 E+04~~
= ~~(22400)(264)~~(600)(264)
= 158400
@ 5000 gals. = 31.68 trips

8. Construction Diesel vehicle 2.23 E+04
= (22300)(264)
= 5887200
@ 5000 gals = 1177.44 trips

9 operation diesel WR&T 4.27 E+03
= (4270)(264)
= 1127280
@ 5000 gals = 225.46 trips

10 operation Diesel vehicle 2.9 E+03
= (2900)(264)
= 765600
@ 5000 gals. = 153.12 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. 134 of 393

BY RDW CHKD. JOB NO. 01K47101

8.J.11. Closure Diesel Tank Stab 6.38E+03
= (6380)(264)
= 1684320
@ 5000 gals = 336.86 trips

12 Closure diesel arc Equip 8.02E+02
= (802)(264)
= 211728
@ 5000 gals = 42.35 trips

13 Closure Diesel barrier 5.28E+04
= (52800)(264)
= 13939200
@ 5000 gals = 2787.84 trips

14. operation Kerosene Vitrifi 3.97E+04
= (3.9700)(264)
= 10480800
@ 5000 gals = 2096.16 trips

15 Construction concrete WR&T Sand 1.99E+04 m³
= (19900)(1.31)
= 26069
@16 yds³ = 1629.3 trips

16. Construction concrete WR&T gravel 1.17E+04 m³
= (11700)(1.31)
= 15327
@16 yds³ = 957.94 trips

17. Construction Concrete WR&T Cement 7.38E+03 MT
= (7380)(1.1)
= 8118
@100 ton hopper = 81.18 trips

18 Construction concrete vitrifi Sand 1.63E05 m³
= (163000)(1.31)
= 213530
@16 yds³ = 13345.63 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 Table SHEET NO. 135 of 393

BY RDW CHKD. JOB NO. 01K47101

8. J. 19. Construction concrete vitrifi gravel 9.54E+04
= (95400)(1.31)
= 124974
@ 16 yds³ = 7810.88 trips

20. Construction Concrete vitrifi cement 6.03E+04 MT
= (60300)(1.1)
= 66330
@ 100 Ton Hopper = 663.3 trips

21. operation concrete vitrifi LLW vaults sand 8.7E+04
= (87000)(1.31)
= 113970
@ 16 yds³ = 7123.13 trips

22 operation Concrete vitrifi LLW vaults gravel 5.11E+04
= (51100)(1.31)
= 66941
@ 16 yds³ = 4183.813 trips

23. operation concrete vitrifi LLW vaults cement 3.23E+04 MT
= (32300)(1.1)
= 35530
@ 100 Ton Hopper = 355.3 trips

24. operation concrete vitrifi HLW Shield Casks sand 5.73E+04
= (57300)(1.31)
= 75063
@ 16 yds³ = 4691.44 trips

25. operation Concrete vitrifi HLW Shield Casks gravel 3.37E+04
= (33700)(1.31)
= ~~75063~~ 44147
@ 16 yds³ = ~~4691.44 trips~~ 2759.19 trips

26 operation concrete vitrifi HLW shield Casks cement 2.13E+04 MT
= (21300)(1.1)
= 23430
@ 100 Ton Hopper = 234.3 trips

FORM 91-0051 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables. SHEET NO. 136 393

BY RDW CHKD. JOB NO. 01K47101

8. J.27. Closure Concrete Tank Slab sand 3.6E+03
= (3600)(1.31)
= 4716
@ 16 yds³ = 294.75 trips

28 closure concrete ~~tank~~ Slab gravel 2.1E+03
= (2100)(1.31)
= 2751
@ 16 yds³ = 171.93 trips

29 Closure Concrete Tank Slab cement 1.33E+03
= (1330)(1.1)
= 1463
@ 100 Ton Hopper = 14.63 trips

30. Closure concrete one Equip sand 9.2E+03
= (9200)(1.31)
= 12052
@ 16 yds³ = 753.25 trips

31. Closure Concrete one Equip gravel 5.4E+03
= (5400)(1.31)
= 7074
@ 16 yds³ = 442.13 trips

32. Closure Concrete one Equip cement 3.4E+03 mT
= (3400)(1.1)
= 3740
@ 100 ton Hopper = 37.4 trips

33. Construction Carbon Steel w R&T 5.0E+03
= (5000)(1.1)
= 5500
@ 65 ton Car = 55 trips

34 Construction Carbon Steel w shipt 4.86E+04
= (48600)(1.1)
= 53460
@ 65 ton Car = 822.46 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. 137 of 393

BY RDW CHKD. JOB NO. 01K 47101

35. operation carbon steel vitrifi LSW vault 1.5E+04
= (15000)(1.1)
= 16500
@ 65 Ton Car = 253.85 trips

36. operation Carbon Steel vitrifi HSW HMPC+ 9.75E+03
= (9750)(1.1)
= 10725
@ 65 Ton Car = 165 trips

37 operation carbon steel vitrifi LSW boxes 6.62E+04
= (66200)(1.1)
= 72820
@ 65 ton Car = 1120.31 trips

38 Construction stainless steel WRT 2.0E+03
= (2000)(1.1)
= 2200
@ 65 Ton Car = 33.85 trips

39. Construction Stainless Steel vitrifi 7.5E+03
= (7500)(1.1)
= 8250
@ 65 Ton Car = 126.92 trips

40. operation stainless steel vitrifi SS Canister 6.76E+03
= (6760)(1.1)
= 7436
@ 65 Ton car = 114.4 trips

41. Construction Hastelloy/Inconel vitrifi 1.15E+03
= (1150)(1.1)
= 1265
@ 65 Ton Car = 19.46 trips

42 operation Glass Formers silica SiO_2 2.77E+05 MT
= (2.77)(4.2)(1.31)
= 164940.9
@ 16 yds^3 = 10308.81 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table 8.11.0.3 and Transportation Tables SHEET NO. 138 of 393

BY RDW CHKD. _____ JOB NO. 01K47161

8. J.43. operation Glass formers other materials

= (15400)(1.1) Al_2O_3 1.54E+04

= 16940

@ 100 Ton Hopper = 169.4 Trips

= (1590)(1.1) Borax 1.59E+03

= 1749

@ 100 Ton Hopper = 17.49 Trips

= (45360)(1.1) CaO 4.53E+04

= 49830

@ 100 Ton Hopper = 498.3 Trips

= (455)(1.1) Li_2O. 455 E+02

= 500.5

@ 100 Ton Hopper = 5.005 Trips

Σ = 5 + 499 + 184170 = 692 Trips

44. operations process chemicals ammonia 4.4E+03 mt

= (4400)(1.1)

= 4840

25 Ton tank = 193.6 Trips

45. operation process chemicals HNO_3 2.1E+03

= (2100)(1.1)

= 2310

@ 25 Ton tank = 92.4 Trips

46. operation process chemicals NaOH, 50% 1.3E+04

= (13000)(1.1)

= 14360

@ 25 Ton tank = 572 Trips

47. operation process chemicals other chemicals 7618

= (7618)(1.)

= 8379.8

@ 65 Ton Car = 128.92 Trips

48. operation process chemical sulfur cement binder 8.91E+04

= (89100)(1.1)

= 98010

100 Ton tank car ~~100 Hopper~~ = 980.1 Trips

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. 139 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.J.49. operation Sulfur cement Dicyclopentadiene 2.33E+03
=(2330)(1.1)
=2563
@ 100 Ton tankcar = 25.63 trips

50. operation sulfur cement oligomer 2.33E+03
=(2330)(1.1)
=2563
@ 65 Ton car = 39.43 trips

51. operation Ion Exchange media 1.1E+02 m³
=(110)(1.31)
=144.1
truck @ 116 yds³ = 1.24 trips

52 Construction Excavation 1.26E+06 m³
=(1260000)(1.31)
= ~~1336000~~ 1650600
@ 8 yds³ = ~~173250~~ trips 206325

51 operation Excavation 1.31E+06
=(1310000)(1.31)
=1716100
@ 8 yds³ = 214512.5 trips

52 Construction Backfill 6.0E+05
=(600000)(~~1.1~~)(1.31)
=786000
@ 8 yds³ = 98250 trips

53. operation Backfill 6.38E+05
=(638000)(~~1.1~~)(1.31)
=835780
@ 8 yds³ = 104472.5 trips

8.K. Ex Situ Insitu Combination Low. 25 tanks of 177 tanks

FORM 91-0051 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B-11.0.3 and Transportation table SHEET NO. 1400P 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.K.1. Construction Gasoline WR&T 1.4E+02
= (140)(264)
= 36960
@ 5000 gals = 7.39 Trips

2. Construction Gasoline vitrifi 3.12E+03
= (3120)(264)
= 823680
@ 5000 gals = 164.74 Trips

3. operation Gasoline vitrifi 2.18E+01
= (21.8)(264)
= 5755.2
@ 5000 gals = 1.15 Trips

4. Closure Gasoline tank Slab 4.01E+01
= (40.1)(264)
= 10586.4
@ 5000 gals = 2.12 Trips

5. Closure Gasoline Anc Equip 1.2E+00
= (1.2)(264)
= 316.8
@ 5000 gals = 0.063 Trip

6. Closure Gasoline Barrier 2.16E+02
= (216)(264)
= 57024
@ 5000 gals = 11.41 Trip

7. Construction Diesel WR&T 4.2E+02
= (420)(264)
= 110880
@ 5000 gals = 22.18 Trip

8. Construction Diesel vitrifi 1.56E+04
= (15600)(264)
= 4118400
@ 5000 gals = 823.68 Trip

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table 8.11.0.3 and transportation tables SHEET NO. 1410P 393

BY RDW CHKD. _____ JOB NO. 01K4710

8K. 9. operation Diesel WR&T 2.48E+03
= (2480) (264)
= 654720
@ 5000 gals = 130.944 trips

10 operation Diesel vehicle 1.35E+03
= (1350) (264)
= 356400
@ 5000 gals = 71.28 trips

11. Closure Diesel tank stat 6.38E+03
= (6380) (264)
= 1684320
@ 5000 gals = 336.86 trips

12. Closure Diesel anc Equip 8.02E+02
= (802) (264)
= 211728
@ 5000 gals = 42.35 trips

13. Closure Diesel Barrier 5.12E+04
= (51200) (264)
= 13516800
@ 5000 gals = 2703.36 trips

14. operation Kerosene vehicle 2.3E+04
= (23000) (264)
= 6072000
@ 5000 gals = 1214.4 trips

15. Construction concrete WR&T sand 1.4E+04
= (14000) (1.31)
= 18340
16 yds³ = 1146.25 trips

16. Construction Concrete WR&T gravel 8.2E03
= (8200) (1.31)
= 10742
@ 16 yds³ = 671.38 trips

FORM 91-005-1 (4/81)

8.K.17. Construction concrete WRT cement 5.2E+03
= (5200)(1.1)
= 5720
@ 100 Ton Hopper = 57.2 trips

18. Construction Concrete vitrifi sand 1.14E+05
= (114000)(1.31)
= 149340
@ 16 yds³ = 9333.75 trips

19. Construction concrete vitrifi gravel 6.7E+04
= (67000)(1.31)
= 87770
@ 16 yds³ = 5485.63 trips

20 Construction Concrete vitrifi cement 4.23E+04 MT
= (42300)(1.1)
= 46530
@ 100 Ton Hopper = 465.3 trips

21. operation concrete vitrifi HLW vault sand 6.94E+04
= (69400)(1.31)
= 90914
@ 16 yds³ = ~~5684~~ 5682.13 trips

22. operation concrete vitrifi HLW Vault gravel 4.08E+04
= (40800)(1.31)
= 53448
@ 16 yds³ = 3340.5 trips

23 operation concrete vitrifi HLW vault cement 2.58E+04 MT
= (25800)(1.1)
= 28380
@ 100 Ton Hopper = 283.8 trips

24 operation concrete vitrifi HLW Shield Casks Sand 3.4E+04
= (34000)(1.31)
= 44540
@ 16 yds³ = 2783.75 trips

8. K.25. operation concrete within HPW Shield Cach gravel 2.0E+04
= (20000)(1.31)
= 26200
@ 16 yds³ = 1637.5 trips

26 operation Concrete within HPW shield Cache ~~Cement~~ 1.26E+04 MT
= (12600)(1.1)
= ~~21200~~ 13860
@100 ton Hopper = 138.6 trips

27. Closure Concrete tank Slab sand 3.6E+03
= (3600)(1.31)
= 4716
@ 16 yds³ = 294.75 trips

28 Closure Concrete tank Slab gravel 2.1E+03
= (2100)(1.31)
= 2751
@ 16 yds³ = 172 trips

29. Closure Concrete tank Slab cement 1.33E+03
= (1330)(1.1)
= 1463
@ 100 Ton Hopper = 14.63 trips

30. Closure Concrete and Equip sand 9.2E+03
= (9200)(1.31)
= 12052
@ 16 yds³ = 753.25 trips

31 Closure Concrete and Equip gravel 5.4E+03
= (5400)(1.31)
= 7074
@ 16 yds³ = 442.13 trips

32 Closure concrete and Equip cement 3.4E+03 MT
= (3400)(1.1)
= 3740
@100 ton Hopper = 37.4 trips

8.K.33. Construction carbon steel WR&T 3.5E+03
= (3.500)(1.1)
= 3850
@ 65 ton car = 59.23 trips

34. Construction carbon steel vitrifi 3.4E+04
= (34000)(1.1)
= 37400
@ 65 ton car = 575.39 trips

35. operation carbon steel vitrifi LLW vaults 1.2E+04
= (12000)(1.1)
= 13200
@ 65 ton car = 203.1 trips

36 operation carbon steel vitrifi HLW Hopper 5.77E+03
= (5770)(1.1)
= 6347
@ 65 ton car = 97.65 trips

37. operation carbon steel vitrifi LLW waste boxes 3.98E+04
= (39800)(1.1)
= 43786.6
@ 65 ton car = 673.64 trips

38. Construction stainless steel WR&T 1.4E+03
= (1400)(1.1)
= 1540
@ 65 ton car = 23.69 trips

39. Construction stainless steel vitrifi 5.25E+03
= (5250)(1.1)
= 5775
@ 65 ton car = 88.85 trips

40 operation stainless steel vitrifi SS Canister 4.0E+03
= (4000)(1.1)
= 4400
@ 65 ton car = 67.69 trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.03 and transportation tables SHEET NO. 145 of 383

BY RDW CHKD. _____ JOB NO. 01K 47101

8.K.41 operations Hastelloy/Inconel vitrifi 8.05E+02
= (805)(1.1)
= 885.5
@ 65 ton Con = 13.62 trips

42. operations Glass Formers Silica SiO_2 1.62E+05 MT
= (162000)(1.31)(1/3.2)
= 96463.635
@ 16 yds³ = 6028.98 trips

43. operation Glass Formers other materials
= (8.970)(1.1) Al_2O_3 8.97E+03
= 9867
@ 100 ton Hopper = 98.67 trips
= (935)(1.1) Borax 9.35E+02
= 1028.5
@ 100 ton Hopper = 10.29 trips
= (26300)(1.1) CaO 2.63E+04
= 28930
@ 100 ton Hopper = 289.3 trips
= (267)(1.1) Li_2O 2.67E+02
= 293.7
@ 100 ton Hopper = 2.94 trips
Σ = 99 + 11 + 290 + 3 = 403 trips

44. operation process chemicals vitrifi ammonia 2.55E+03
= (2550)(1.1)
= 3248.3
@ 25 Ton tank = 129.93 trips

45. operation process chemicals vitrifi HNO_3 59% 1.22E+03
= (1220)(1.1)
= 1342
@ 25 Ton tank = 53.68 trips

46. operation process chemicals vitrifi NAOH 50% 7.54E+03
= (7540)(1.1)
= 8294
@ 25 Ton Tank = 331.76 trips

FORM 91-005-1 (4/81)

8.K.47. operation process chemicals vitrifi other chemicals 4427.85

= (4427.85)(1.1)

= 4870.635

@65 Ton Car = 74.93 Trips

48 operation sulfur cement sulfur 5.17E+04

= (51700)(1.1)

= 56870

@ 100 Ton tanker = 568.7 Trips

49. operation sulfur cement Dicyclopentadiene 1.35E+03

= (1350)(1.1)

= 1485

@ 100 Ton tanker = 14.85 Trips

50 operation sulfur cement oligomer 1.35E+03

= (1350)(1.1)

= 1485

@ 65 Ton Car = 22.85 Trips

51 operation Ion exchange resin vitrifi 6.38E+01 m^3

= (63.8)(1.31)

= 83.578

@ 116 yds^3 = 0.72 Trips

52 Construction Excavation 8.83E+05

= (883000)(1.31)

= 1156730

@ 8 yds^3 = 144591.25 Trips

53. operation Excavation 7.32E+05

= (732000)(1.31)

= 958920

@ 8 yds^3 = 119865 Trips

54. Construction Backfill 4.2E+05

= (420000)(1.31)

= 550200

@ 8 yds^3 = 68775 Trips

8.K.55. operation Backfill 5.02 E+05
= (502000)(1.31)
= 657620
@ 8 yds³ = 82202.5 trips

8. Phased Implementation, Phase I 2-20ton/day LLW + 1-1ton PER day HLW.

1. Construction gasoline vehicle 6.5E+03
= ~~6.5E~~ (6500)(264)
= 1716000
@ 5000 gals = 343.2 trips

2. Construction diesel vehicle 1.8E+04
= (18000)(264)
= 4752000
@ 5000 gals. = 950.4 trips

3. operation Kerosene vehicle 9.8E+02
= (980)(264)
= 258720
@ 5000 gals = 51.744 trips

4. Construction Concrete vehicle sand 1.62E+04
= (16200)(1.31)
= 21222
@ 16 yds³ = 1326.38 trips

5. Construction concrete vehicle gravel 9.3E+03
= (9300)(1.31)
= 12183
@ 16 yds³ = 761.44 trips

6. Construction Concrete vehicle cement 6.0E+03
= (6000)(1.1)
= 6600
@ 100 ton Hopper = 66 trips

8. I.7. operation concrete H&W shield Cashs sand 4.09 E+03
=(~~1.12000~~)(1.31)(4090)
= 5 357.9
@ 16 yd³ = 334.87 trips

8 operation concrete H&W Shield Cashs gravel 2.4E+03
=(2400)(1.31)
= 3144
@ 16 yds³ = 196.5 trips

9. operation Concrete H&W Shields vitrifi cement 1.52E+03 mT
=(1.520)(1.1)
= 1672
@ 100 ton Hopper = 16.72 trips

10. Construction Carbon Steel vitrifi 8.3E+04
=(83000)(1.1)
= 91300
@ 65 ton car = 1404.62 trips

11. operation Carbon steel vitrifi H&W HMPC 2 7.0E+02
=(700)(1.1)
= 770
@ 65 ton car = 11.85 trips

12. operation Carbon Steel vitrifi LL Boxes 2 .73E+03
=(2730)(1.1)
= 3003
@ 65 ton car = 46.2 trips

13. Construction Stainless steel vitrifi 1.5E+04
= (15000)(1.1)
= 16500
@ 65 ton car = 253.85 trips

14. operation stainless steel vitrifi SS Connecting 4.8E+02
= (480)(1.1)
= 528
@ 65 ton car = 8.12 trips

8.L.15. Construction Hastelloy/Inconel vitrifi 2.6 E+03
= (2600)(1.1)
= 2860
@ 65 Ton Car = 44 trips

16. operation Glass formers vitrifi Silica(SiO_2) 1.103E+05
= (110300)(1.31) ÷ (2.2)
= 65678.636
@ 16 yds³ = 4104.92 trips

17. Glass formers operation vitrifi other materials
= (4200)(1.1) Al_2O_3 4.2E+03
= 4620
@ 100 Ton Hopper = 46.2 trips
= (252)(1.1) Boron 252E+02
= 277.2
@ 100 Ton Hopper = 2.77 trips
= (12300)(1.1) CaO 1.23E+04
= 13530
@ 100 Ton Hopper = 135.3 trips
= (720)(1.1) Li_2O 7.2E+02
= 792
@ 100 Ton Hopper = 7.92 trips
Σ trips = 47 + 273 + 136 + 8 = 464

18. operation process chemicals vitrifi ammonia 1.78E+03
= (1780)(1.1)
= 1958
25 Ton truck = 78.32 trips

19 operation process chemicals vitrifi HNO_3, 50% 848E+02
= (848)(1.1)
= 932.8
25 Ton Truck = 37.31 trips

20 operations process chemicals vitrifi NaOH, 50% 5.25+03
= (5250)(1.1)
= 5775
25 Ton Truck = 231 trips

8.2.21. operations Process chemicals vitripi Oxygen 2.23E+03
= (2230)(1.1)
= 2453
@ 25 Ton Tank = 98.12 Trips
material may be trucked + not generated on site.

22. operation Process chemicals vitripi other chemicals 3076.5 MT
= (3076.5)(1.)
= 3384.15
@ 65 Ton Car = 52.1 Trips

23. operation sulfur cement vitripi sulfur 2.96E+04
= (29600)(1.1)
= 32560
@ 100 Ton tanker = 325.6 trips

24 operation sulfur cement vitripi Dicyclopentadiene 7.72E+02
= (772)(1.1)
= 849.2
@ 100 Ton tanker = 8.49 trips

25 operation Sulfur Cement vitripi oligomer 7.72E+02
= (7.72)(1.1)
= ~~(772)(1.1)~~ 849.2
@ 65 Ton Car = 13.1 trips

26. operation Ion Exchange Resin vitripi (4.4E+01) m^3
= (44)(1.1)
= 48.4
@ 116 m^3 = 0.42 trips

27. Construction Excavation 2.75E+05 m^3
= (275000)(1.31)
= 360250
@ 8 yds^3 = 45031.25 Trips

28 Construction Backfill 4.01E+04
= (40100)(1.31)
= 44110
@ 8 yds^3 = 5513.75 trips

8. M. Phased Implementation, Phase II: (2) 100 Ton/day LLW plants using intermediate separation processing; (1) 10 Ton/day HLW plant

1. Construction Gasoline WR&T 3.3E+02
= (330)(264)
= 87120
@ 5000 gals = 17.4 Trips

2. Construction Gasoline ~~WR&T~~ vitrifi 1.01E+04
= (10100)(264)
= 2666400
@ 5000 gals = 533.28 Trips

3. operation Gasoline vitrifi 5.01E+01
= (50.1)(264)
= 13226.4
@ 5000 gals. = 2.65 Trips

4. Closure Gasoline Tank Stab 4.01E+01
= (40.1)(264)
= 10586.4
@ 5000 gals. = 2.12 Trips

5. Closure Gasoline one Equip 1.2E+00
= (1.2)(264)
= 316.8
@ 5000 gals = 0.063 Trip

6. Closure Gasoline Basin 3.71E+02
= (371)(264)
= 97944
@ 5000 gals = 19.59 Trips

7. Construction Diesel WR&T 1.02E+03
= (1020)(264)
= 269280
@ 5000 gals = 53.86 Trips

8. Construction Diesel vitrifi 2.73E+04
= (27300)(264)
= 7207200
@ 5000 gals = 1441.44 Trips

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 152 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.M.9. operation Diesel WR&T 1.02 E+03
= (1020)(264)
= 269280
@ 5000 gals. = 53.86 trips

10. operation Diesel vehicle 8.12 E+03
= (8120)(264)
= 2143680
@ 5000 gals = 428.72 trips

11. Closure Diesel tank slab 6.38 E+03
= (6380)(264)
= 1684320
@ 5000 gals = 336.86 trips

12. Closure Diesel anc Equip 8.02 E+02
= (802)(264)
= 211728
@ 5000 gals = 42.35 trips

13. Closure Diesel barrier 6.254 E+04
= (62540)(264)
= 16510560
@ 5000 gals = 3302.11 trips

14. operation Kerosene vehicle 6.48 E+04
= (64800)(264)
= 17107200
@ 5000 gals = 3421.44 trips

15. Construction concrete WR&T sand 3.98 E+04
= (39800)(1.31)
= 52138
@ 16 yds^3 = 3258.63 trips

16. Construction Concrete WR&T gravel 2.34 E+04
= (23400)(1.31)
= 30654
@ 16 yds^3 = 1915.88 trips

FORM 91-0051 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary Table B.11.0.3 and transportation table SHEET NO. 153 OF 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.M.17. Construction concrete WRT cement 1.48E+04
=(14800)(1.1)
= 16280
@100 Ton hopper = 162.8 Trips

18. Construction concrete vitrifi sand 4.42E+05
=(442000)(1.31)
= 579020
@16 yds³ = 36188.75 Trips

19. Construction concrete vitrifi gravel 2.6E+05
=(260000)(1.31)
= 340600
@16 yds³ = 21287.5 Trips

20. Construction concrete vitrifi cement 1.64E+05
=(164000)(1.1)
= 180400
@100 Ton Hopper = 1804 trips

21. operations concrete vitrifi LLW Vaults sand 1.63E+05
=(163000)(1.31)
= 213530
@16 yds³. = 13345.63 Trips

22 operations Concrete vitrifi LLW Vaults gravel 9.54E+04
=(95400)(1.31)
= 124974
@16 yds³ = 7810.88 Trips

23. operations Concrete vitrifi LLW vaults Cement 6.03E+04 MT
=(60300)(1.1)
= 66330
@100 Ton Hopper = 663.3 trips

24. operation Concrete vitrifi HLW Shield Cask sand 1.12E+05
=(112000)(1.31)
= 146720
@16 yds³ = 9170 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. 154 of 393

BY RDW CHKD. _____ JOB NO. 01K47161

8.11.25. operation concrete within H&W Shield costs gravel 6.57E+04
=(65700)(1.31)
= 86067
@ 16 yds³ = 5379.19 Trips

26. operation concrete within H&W Shield Costs Cement 4.95E+04 MT
=(45500)(1.1)
= 45650
@100T hopper = 456.5 trips

27. Closure Concrete tank Slab Sand 3.6E+03
=(3600)(1.31)
= 4716
@16 yds³ = 294.75 trips

28. Closure concrete tank slab gravel 2.1E+03
=(2100)(1.31)
= 2751
@ 16 yds³ = 172 trips

29. Closure Concrete tank Slab cement 1.33E+03
=(1330)(1.1)
= 1463
@100 Ton Hopper = 14.63 trips

30. Closure Concrete and Equip sand 9.2E+03
=(9200)(1.31)
= 12052
@ 16 yds³ = 753.25 Trips

31. Closure Concrete and Equip gravel 5.4E+03
=(5400)(1.31)
= 7074
@ 16 yds³ = 442.13 trips

32. Closure Concrete and Equip cement 3.4E+03
=(3400)(1.1)
= 3740
@ 100 Ton Hopper = 37.4 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. 155 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8.M.33. Construction carbon steel WR&T 1.0E+04
= (10000)(1.1)
= 11000
@ 65 Ton car = 169.23 trips

34. Construction Carbon steel v ship 1.32E+05
= (132000)(1.1)
= 145200
@ 65 Ton car = 2233.85 trips

35. operation carbon steel L&W vaults 2.8E+04
= (28000)(1.1)
= 30800
@ 65 Ton car = 473.85 trips

36. operation carbon steel H&W HMPCs 1.9E+04
= (19000)(1.1)
= 20900
@ 65 Ton car = 321.54 trips

37. operation carbon steel L&W barge 1.08E+05
= (108000)(1.1)
= 118800
@ 65 Ton car = 1827.69 trips

38. Construction stainless steel ~~v ship~~ WR&T 4.0E+03
= (4000)(1.1)
= 4400
@ 65 Ton car = 67.69 trips

39. Construction stainless steel v ship 2.04E+04
= (20400)(1.1)
= 22440
@ 65 Ton car = 345.23 trips

40. operation stainless steel v ship SS cans 1.32E+04
= (13200)(1.1)
= 14520
@ 65 Ton car = 223.39 trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resume Summary table B.11-0.3 and transportation tables SHEET NO. 156 of 393

BY RDW CHKD. _____ JOB NO. 01K 47101

8.M.41. Construction Hastelloy/Inconel vitrifi 3.13E+03
= (3130)(1.1)
= 3443
@ 65 Ton Car = 52.97

42. operation Glass Former vitrifi SiO_2 Silica 4.55E+05 MT
= (455000)(1.31) ÷ (0.2)
= ~~500500~~ 270931.81
@ 16 yds³ = ~~31081.25~~ 16933.2 Bf trips

43. operation Glass Former vitrifi other materials
= (25000)(1.1) Al_2O_3 2.5E+04
= 27500
@ 100 Ton Hopper = 275 trips
= (3250)(1.1) Borax 3.25E+03
= 3575
@ 100 Ton Hopper = 35.75 trips
= (73400)(1.1) CaO 7.34E+04
= 80740
@ 100 Ton Hopper = 807.4 trips
= (920)(1.1) Li_2O 9.3E+02
= 1012
@ 100 Ton Hopper = 10.12 trips
Σ of trips = 275 + 36 + 808 + 11 = 1130 Trips

44. operation process chemicals vitrifi ammonia 8.70E+03
= (8670)(1.1)
= 10780
@ 25 Ton tank = 431.2 trips

45. operation process chemicals vitrifi HNO_3, 50% 4.14E+03
= (4140)(1.1)
= 4554
@ 25 Ton tank = 182.2 trips

46. operation process chemicals vitrifi NaOH, 50% 2.56E+04
= (25600)(1.1)
= 28160
@ 25 Ton tank = 1126.4 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. 157 of 393

BY RDW CHKD. _____ JOB NO. 01K4710/

8.11.47. operation process chemicals vitrifie other chemicals 15009 MT
= (15609)(1.1)
= 16509.9
@ 65 Ton Car = 254 trips

48 operation sulfur cement vitrifie sulfur 1.46E+05
= (146000)(1.1)
= 166600
@100 Ton tanker = 1606 trips

49. operation sulfur cement vitrifie dicyclopentadiene 3.81E+03
= (3810)(1.1)
= 4191
@100 Ton tanker = 41.91 trips

50. operation sulfur cement vitrifie oligomer 3.81E+03
= (3.810)(1.1)
= 4191
@65 Ton Car = 64.48 trips

51 operation Ion Exchange resin vitrifie 2.17E+02 m³
= (217)(1.31)
= 284.27
@ 116 yds³ = 2.451 trips

52 Construction Excavation 2.31E+06 m³
= (2310000)(1.31)
= 3026100
@ 8 yds³ = 378262.5 trips

53. ~~Construction~~ operation excavation 2.44E+06
= (2440000)(1.31)
= 3196400
@ 8 yds³ = 399550 trips

54. Construction Backfill 1.63E+06
= (1630000)(1.31)
= 2135300
@ 8 yds³ = 266912.5 trips

FORM 91-005-1 (4/81)

9. M.SS. operation backfill ~~1.0E+~~ 1.19E+06
= (190000) (1.31)
= 1558900
@ 8 yds³ = 194862.5 trips

N. Determine number trips for the concrete trucks from the batch plant to the building site.

B. Long Term management.
1. Construction Concrete WR+T 3.5E+05 m³
= (350000)(1.31)
= 385000
@ 8 yds³ = 48125 trips

C. In Situ Fill and Cap
1. Closure Concrete tank slab 5.3E+03
= (5300)(1.31)
= 6943
@ 8 yds³ = 867.88 trips

2. Closure Concrete one equip 1.37E+04
= (13700)(1.31)
= 17947
@ 8 yds³ = 2243.38 trips

D. In Situ vitrification
1. Construction concrete vitrifi 1.3E+05
= (130000)(1.31)
= 170300
@ 8 yds³ = 21287.5 trips

E. W-314 upgrades
1. Construction Concrete WR&T 3.92E+03
= (3920)(1.31)
= 5135.2
@ 8 yds³ = 641.9 trips.

JACOBS ENGINEERING GROUP INC.

DATE 6-30-96 SUBJECT Resource Summary table B.11.0.3 and transportation tables SHEET NO. 159 of 393

BY RDW CHKD. _____ JOB NO. 01K47101

8. N. J. Ex Situ, No Separations, Extensive Retrieval, vitrification

1. Construction Concrete WR&T 5.9E+04
= (59000)(1.31)
= 77290
@ 8 yds³ = 9661.25 trips

2. Construction concrete vitrifi 2.17E+05
= (217000)(1.31)
= 284270
@ 8 yds³ = 35533.75 trips

3. operation Concrete vitrifi HSW Shield Cells 2.48E+06
= (2480000)(1.31)
= 3248800
@ 8 yds³ = 406100 trips

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

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

B. Ex Situ, No Separations, Extensive Retrieval, Calcination.

1. Construction Concrete WR&T 5.9E+04
= (59000)(1.31)
= 77290
@ 8 yds³ = 9661.25 trips

2. Construction Concrete Calcina 2.07E+05
= (207000)(1.31)
= 271170
@ 8 yds³ = 33896.25 trips

FORM 91.005-1 (4/81)