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SECTION 3 OF _____

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3.3 HANFORD BARRIER

3.3.1 Barrier Design Basis

The need for a long-term, robust surface barrier design was identified first in the *Hanford Waste Management Plan* (DOE-RL 1987) and in the *Final Environmental Impact Statement for the Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes* (DOE 1987). The Hanford Site Permanent Isolation Barrier Development Program was organized soon after these documents were published.

The Hanford Barrier is the product of extensive research and engineering by the Hanford Barrier Development Team. Since 1987, numerous design concepts have been explored and evaluated in developing the current design.

In summary, performance objectives of the barrier system include the following:

- Function in a semi-arid to sub-humid climate
- Limit the amount of water migration through the waste to near zero amounts
- Be maintenance free
- Minimize the likelihood of intrusion by plants, animals, or people
- Limit the amount of noxious gases released to the air to less than those requiring a state emissions permit
- Minimize erosion
- Meet or exceed RCRA cover performance requirements
- Isolate wastes for a minimum of one thousand years
- Be acceptable to regulators and the public.

These performance objectives have been documented in *Performance Isolation Surface Barrier: Functional Performance* (Wing 1993).

3.3.2 The Hanford Barrier

The Hanford Barrier was originally envisioned to provide long-term isolation for radiological waste sites such as tank waste residuals containing HLW, grout vaults containing high-activity LLW, and sites with transuranic contamination. As a result of evaluating barrier

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needs for the Environmental Restoration Program, the Hanford Barrier has also been identified as the appropriate barrier option for greater than Class C LLW and related mixed wastes.

The Hanford Barrier would be composed of 10 layers with a combined thickness of 4.5 m (14.8 ft); these layers are described in detail from the top of the barrier down. The Hanford Barrier would be placed over the top of the stabilized tanks and ancillary equipment and over the LLW vaults described in the No Separations and Tri-Party Agreement alternatives. However, barrier construction over the LLW vaults would not begin until 5 years after the construction of the vaults is completed. This would allow for the completion of a 5-year monitoring period of any leachate from the leachate collection system under the vaults. More detailed information on the design basis and specifications for the Hanford Barrier can be found in *Prototype Hanford Surface Barrier: Design Basis Document* (Myers and Duranceau 1994).

Each layer of the proposed Hanford Barrier has a specific purpose. The top vegetative cover, which would be planted in the fall,would have a very important role in water retention and removal. Five species of perennial grasses would be planted across the barrier top. Seeding would include disking the soil, applying granular fertilizer, and seeding with a perennial grass mixture. To assist the establishment of cover grass, the site would be mulched with straw that would be crimped into the soil to minimize wind erosion until cover vegetation developed.

The top barrier layer would consist of topsoil with a pea-gravel admixture; the second layer would be topsoil without pea-gravel. The first layer would be 1 m (3.3 ft) of sandy silt to silt loam soil with a 15 percent (weight) admixture of pea gravel. It would be placed loosely with a bulk density of 1.46 grams per cubic centimeter (g/cm^3) or 91 to 92 pounds per cubic foot (lb/ft^3). The second layer would have the same type of topsoil; however, the bulk density would be approximately 1.38 g/cm^3 (86 lb/ft^3). These two layers would manage water by storing precipitation and providing a media for the growth of cover vegetation as well as allowing water to be removed by evaporation and transpiration by the cover plants. The proposed topsoil barrier would be obtained from the McGee Ranch area of the Hanford Site.

The third layer would be a geotextile, used primarily to separate topsoil layers from the sand filtration layer. After construction was completed, this geotextile would no longer have a specific function; therefore, its long-term durability is not an issue. The geotextile would be trucked in from the vendor.

The fourth layer would be a sand filter, and the fifth layer would be a gravel filter. The purpose of these two layers would be to prevent migration and accumulation of fine-textured topsoil in the basalt layer. A capillary barrier, which occurs when a layer of fine-textured soil overlays a layer of coarser-textured soil (e.g., sand, gravel, or rock), would be created at the interface between the geotextile and the fourth layer (sand filter). Surface tension effects within the pore space of fine-textured soil would exerts a negative pressure on the

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contained soil moisture. For moisture to drain out of fine-textured soil, suction pressure would have to be overcome by the development of gravitational pressure (hydraulic head) within the layer. In effect, some portion of the full thickness of this fine-soil layer would have to become completely saturated before drainage could occur. The sand filter would be 0.15 m (0.5 ft) deep, and the gravel filter would be 0.30 m (1 ft) deep. Both layers would be obtained from a local borrow site on the 200 Area Plateau.

The sixth layer would be constructed of coarse basalt (0.05 m < size of shot rock < 0.25 m). The basalt layer would control biointrusion from plant roots, burrowing animals, and people. The basalt would act as an impediment to exploratory drilling. A subsurface layer consisting of loose fractured rock would pose a particularly adverse drilling condition for the following reasons: circulation could not be maintained, cuttings could not be adequately removed from the hole, the drill bit could not receive adequate lubrication, and firm contact could not be maintained between the bit and the rock. All these would contribute to high bit wear and minimal advance of the drill hole. This layer also would prevent moisture retention because large void spaces would enable water to drain into the seventh layer.

The seventh layer would be for lateral drainage. It would consist of screened aggregate material having a diameter of 0.001 m or greater; this would give a hydraulic conductivity of at least 1 centimeter per second (cm/sec). This layer is part of contingency planning; any water draining to the seventh layer would be collected and/or diverted to the edge of the cover because of the 2 percent slope. This layer would be approximately 4 m (13 ft) below final grade to protect against frost penetration.

The eighth layer would consist of asphalt that would serve as a low-permeability barrier and as a secondary biointrusion barrier. The asphalt would be a durable asphaltic concrete mixture consisting of double-tar asphalt with added sand as a binder material. This layer would be 0.15 m (0.5 ft) thick with a hydraulic conductivity of around 10^{-8} cm/sec. Natural analog studies estimate that this asphalt could remain functional for a period of 5,000 years or more as long as the asphalt remained covered and protected from ultraviolet radiation and freeze and thaw activity. To provide additional protection against leakage, the asphaltic concrete would be coated with a sprayed asphaltic coating material which would be puncture-resistant, flexible, and easy to apply. The asphaltic coating material would have a permeability value of about 10^{-11} cm/sec.

The ninth layer would be an asphalt base course that would provide a stable base for construction of the asphalt layer.

Finally, the tenth layer would contain grading fill that would establish a smooth, planar base surface for construction of the barrier layers. The sites covered by the Hanford Barrier would be contoured and graded for a uniform slope of 2 percent.

Figure 3-8 is a pictorial representation of the Hanford Barrier. Backup information regarding the specifications for each layer are in Appendix A. The barriers would cap

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groups of tanks, not individual tanks. The tank array size (tank edge-to-edge dimensions) and the corresponding barrier sizes are tabulated in Appendix A. Each barrier would include 9 m of additional coverage on each side of the barrier.

The Hanford Barrier would meet specifications for use over the SSTs, DSTs, and MUSTs that have been stabilized in situ and over LLW containing solidified or vitrified LLW.

3.3.3 Barrier Cost Estimate

3.3.3.1 Cost Estimate Categories. The cost estimate for the engineering design of the Hanford Barrier was subdivided into three categories: definitive design; construction management, engineering, and inspection; and sealed double-ring infiltrometer tests for the asphaltic concrete layer. Historical data provides the basis for the first and second categories. Actual projects were compared, and a weighted average of project costs was computed to arrive at the cost estimates presented (see Tables 5-8 through 5-10 for cost breakdowns).

The first category, definitive design, includes the following: plan and section drawings, specifications, quality control plans for construction, materials testing, performance and stability calculations, and procurement documents. Definitive design is estimated to cost 10 percent of construction costs.

The second category, construction management, engineering, and inspection, includes the following: bid evaluations, control and review of vendor submittals, engineering support during construction, design change control, inspection planning, constructibility reviews, and production of as-built drawings. It also includes quality control overview and most sampling and testing (not including the SDRI test). Construction management, engineering and inspection is estimated to cost 10 percent of construction costs.

The third category, includes the sealed double-ring infiltrometer tests performed on the asphaltic concrete layer of the barrier. These tests, which are required by the Environmental Protection Agency, would give a direct measurement of the hydraulic conductivity of the layer and would help in determining whether the asphaltic concrete layer was properly placed. Costs include labor, equipment, per diem and travel expenses related to construction, installation, and monitoring of the test, and disassembly of the testing apparatus. Equipment costs are limited to the expendable portion of the testing apparatus. Costs for this task are estimated at $65,000 per barrier.

3.3.3.2 Cost Components. The cost components involved in the construction of the Hanford Barrier includes the following: site grading, compaction, and placement of grading fill; and placement of the asphalt base course, the asphaltic concrete layer, the gravel drainage layer, the coarse, fractured basalt layer and side slopes, the gravel and sand filter

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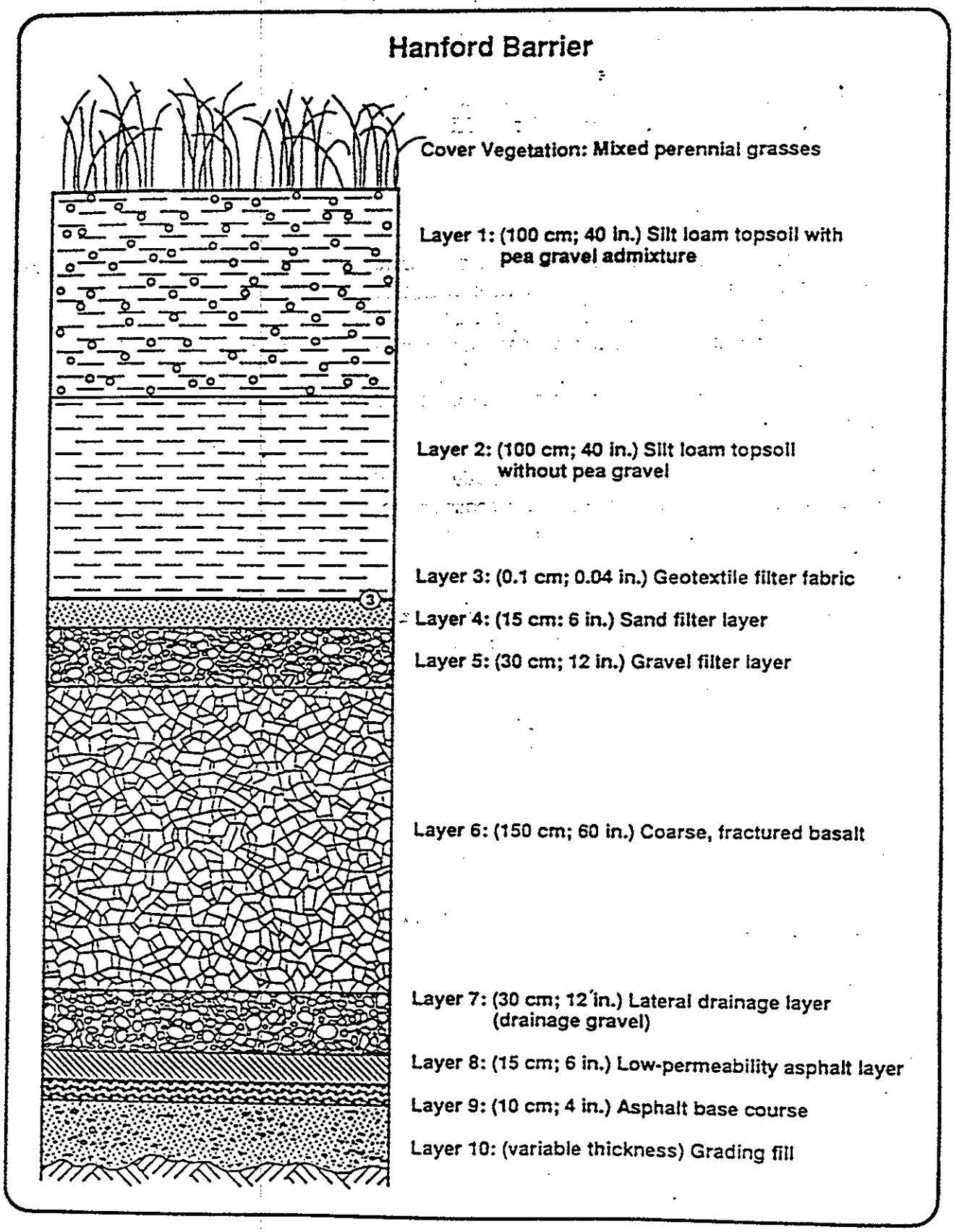
Figure 3-8. Hanford Barrier.



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layers, the lower silt layer, the upper silt layer with the pea gravel admixture, and the road base aggregate on the perimeter access road of each barrier site. These cost components are outlined below.

Site grading, compaction, and placement of grading fill are calculated using the following assumptions: the area would be devoid of vegetation so that no clearing and grubbing would be necessary, the existing site surface would be slightly irregular and slopes at approximately 1.5 percent to the north, and surface grading would be done exclusively with fill. The cost is based on a site surface measuring approximately 126 m (415 ft) in an east-west direction by 162 m (530 ft) in a north-south direction. The material used would be obtained from Pit 30, located between 200 West Area and 200 East Area and opposite the 609A fire station. Moisture conditioning (addition and control) would be performed at Pit 30 prior to transportation to the construction site. The one-way haul will be approximately 6.4 km (4 mi). Grading fill and existing site soils would be densified by making several passes over the site with a vibratory compactor to create a suitable sub-base for barrier construction.

Placement of the asphalt base course would include hauling and placing material provided by a local commercial supplier. A track dozer would spread and grade the material; a vibratory compactor would densify the base course material as it was placed. The base course material would be constructed on a 2 percent slope.

Placement of asphaltic concrete would be performed by a qualified contractor. The asphaltic concrete would consist of a double-tar asphaltic concrete mix with a spray-applied top coat of a proprietary liquid styrene-butadiene asphaltic material. The asphalt layer would be 0.15 m (0.5 ft) thick with a 2 percent slope.

Placement of the gravel drainage layer would begin by obtaining the material from Pit 30. Construction of this layer would require hauling and placing the gravel. A motor grader would spread and grade the material; a vibratory compactor would be used also.

Placement of the coarse, fractured basalt layer and side slopes would include constructing slide slopes at a 2 horizontal to 1 vertical. A 4.6 m- (15 ft-) wide perimeter access road bed would service vehicles at the crown. The maximum thickness of basalt would be beneath the access road; the coarse basalt layer would be a uniform 1.5 m (5 ft) thick. At the margin, the basalt layer would taper up to the crown on a slope of 3 horizontal to 1 vertical. The basalt would be taken from an existing quarry east of State Highway 24 on the east end of Umtanum Ridge, overlooking the Vernita Bridge. The one-way haul would be approximately 27 km (17 mi). The material density is assumed to be 0.75 m^3 per m^3 of volume with a specific gravity of 2.70 (corresponding to 126.4 lb/ft^3). Tables 5-5 and 5-6 provide additional information about the types of transportation used and load amount required for each barrier component.

Placement of the gravel and sand filter layers would prevent entry and accumulation of fines in the lateral drainage area. Filter gravel would be taken from Pit 30 and screened to specification at the pit. Construction of the gravel filter layer would require hauling and

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placing the gravel, which has a material density of 0.70 m^3 solids per m^3 of volume and a specific gravity of 2.70 (corresponding to 118 lb/ft^3). Filter sand also would be taken from Pit 30. This material would be another size fraction product from the same separation process that would provide the gravel filter material. Construction of the sand filter layer would require hauling and placing the material, which has a material density of 0.70 m^3 solids per m^3 volume and a specific gravity of 2.65 (corresponding to 116 lb/ft^3). A motor grader and a vibratory compactor would be required to support construction of this layer. When completed, the two filter layers would slope down at 2 percent over the central part of the cover area and up at 3:1 around the perimeter.

A non-woven, needle-punched, polypropylene geotextile would be placed over the top of the sand filter layer as a construction aid.

The lower silt layer would be obtained from the McGee Ranch site, a 27 km (17 mi) one-way haul on existing roads. A map of these roads is included in BHI-0005 (Duranceau 1995). Construction would require hauling and placing this material. Quantities were based upon the following dry unit weights: bank unit weight of 1,390 kg/m^3 (86.5 lb/ft^3), loose unit weight loaded on haul trucks of 1,160 kg/m^3 (72.1 lb/ft^3) assuming a 20 percent swell, and placement to a unit weight of 1,390 kg/m^3 (86.5 lb/ft^3). A motor grader or a small dozer would be used to spread the material. Minimal compaction of this layer would be required. Because wheel or track loads of placement equipment would provide sufficient compaction, no additional compaction equipment would be required.

The upper silt layer would be obtained from the McGee Ranch site. The material would be transported to an admix plant, located at Pit 30. Pea gravel would be mixed mechanically with silt to produce a product that would be 85 percent silt and 15 percent pea gravel (by weight). The dry unit weight of the McGee Ranch silt is 1,390 kg/m^3 (86.5 lb/ft^3); the loose unit weight of the silt would be 1,160 kg/m^3 (72.1 lb/ft^3) assuming a 20 percent swell; and the placement bank unit weight would be 1,440 kg/m^3 (90 lb/ft^3). A motor grader or a small dozer would be used to spread this layer. No additional compaction equipment would be required.

The road base aggregate for the perimeter road would be < 0.038 m (< 0.125 ft) in diameter. It would be provided by a local commercial supplier. Construction would require hauling and placing this aggregate, which has a material density of 0.75 m^3 solids per m^3 of volume and a specific gravity of 2.70 (corresponding to 126 lb/ft^3). A motor grader and a vibratory compactor would be used to spread, grade, and compact this material.

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4.0 MONITORING AND MAINTENANCE

Monitoring and maintenance would include the following activities:

- Planting and maintaining the vegetative cover
- Cover performance monitoring, including moisture monitoring and surface elevation monitoring (for soil loss and subsidence measures)
- Inspection of covered sites for regulatory compliance purposes.

Groundwater sampling and monitoring in accordance with RCRA are not included because these costs are defrayed by other Hanford Site programs.

Cover vegetation would consist of a mixture of native perennial grass species. After disking and seeding, the site would be mulched with two tons per acre of straw, which in turn, would be crimped into the soil to resist wind erosion. Equipment would include a farm tractor with disk, seeder, mulcher, and crimper implements. Seeding and mulching would require approximately 5 staff days per hectare (2 staff days/acre), approximately $990 per hectare ($400 per acre) for equipment usage, and $5,900 per hectare ($2,400 per acre) for materials. All materials would be purchased locally. Barrier sites may need to be reseeded at intervals during the postclosure period to replace vegetation destroyed by range fires. Costs and personnel requirements include reseeding once every ten years.

Cover moisture monitoring is expected to require about 7 staff days of labor per covered site per year. Plane surveys to assess elevation control and associated analytical labor are estimated to require about 30 staff days per covered site per year. Approximately 8 additional staff days per site would be required for the following: periodic inspections of the overall physical condition of the cover, monitoring the health of cover vegetation, obtaining physical evidence of erosion or deposition of topsoil, and monitoring other physical changes (e.g., the accumulation of debris) that would require non-routine maintenance. An allowance of $800 per month was made for monitoring materials and supplies.

According to the breakdown of direct manpower requirements described above, monitoring and maintenance would require a crew of four, one supervisor, and one clerk/secretary. Monitoring and maintenance activities will continue for 100 years, the maximum span of institutional control.

Costs were identified for the following monitoring and maintenance equipment items:

- One 100-HP farm tractor with disk, rotovator/packer, and seed drill at $91,000 (estimate from R.W. Ohrt, E-062-93, ICF Kaiser Hanford);
- Three pickup trucks at $20,000 each.

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These items would be replaced every five years for 100 years, the maximum span of institutional control. The item costs reflect 1994 dollars and do not include overhead costs.

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Table 5-3A. Comparison of Alternatives by Tank Stabilization Construction Resource Requirements (Units as Indicated).

Construction Resource	In Situ Disposal[1]	Tank Stabilization by Grout	Tank Stabilization by Gravel	Ancillary Equipment Stabilization
Land (ha) surface committed[2]				
Temporarily	n/a			
Permanently	n/a			
Water (m^3) [3]	n/a	113,000	n/a	3,300
Source of water				
Energy				
Electrical (GWh) [4]	n/a	n/a	n/a	n/a
Propane (m^3)	n/a	n/a	n/a	n/a
Diesel fuel (m^3) [5]	n/a	27,900	6,380	802
Gasoline (m^3) [6]	n/a	40.1	40.1	1.2
Materials				
Concrete fill (m^3)	n/a	760,000	5,300	13,700
Steel (t)	n/a	0	n/a	0
Asphalt (m^3)	n/a	0	n/a	0
Excavation (m^3) [7]	n/a	0	n/a	0
Soil (m^3) [8]	n/a	0	n/a	0
Riprap (m^3) [9]	n/a	0	n/a	0
Gravel/concrete fill (m^3) [10]	n/a	0	754,000	0
Waste debris	n/a	30	30	
Waste water	n/a	0	0	
Sewage	n/a	0	0	

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Table 5-3A. Comparison of Alternatives by Tank Stabilization Construction Resource Requirements (Units as Indicated).

Notes:

ha = hectares
n/a = not applicable
m^3 = cubic meters
GWh = gigawatt hour
t = metric ton

[1]All in situ disposal construction resources are documented in the in situ disposal data package and have not been addressed again in this table.

[2]Land: Permanently committed land is the sum of the barrier areas. The amount of temporarily committed land is used for equipment and materials laydown yards, and was estimated by W. A. Skelly from best engineering judgement. Both of these areas have been expressed in Table 5-3B (Barrier Construction Resource Requirements), and are not repeated here.

[3]Water: The maximum water requirement was assumed to be 50 gallons/yd^2 for barrier construction. The water requirement per barrier is the product of this maximum and the barrier acreage.

[4]Additional major power lines are not required for any of the options.

[5]Diesel fuel: See Appendix A for fuel consumption per day for specified equipment items. This number does not include fuel to run the generator that powers the high efficiency particulate air filter, or fuel to deliver gravel to the site. It only includes the fuel to run one 480 volt, 30 amp generator for the gravel slinger.

[6]Gasoline: Assume 3 light-duty trucks will be used for each barrier; each truck runs 80 miles per day and has an efficiency of 14 miles per gallon. See Tables 5-11 and 5-12 for estimates of barrier schedules; the length of each job was used to calculate the total fuel consumption per barrier.

[7]Excavation: Assumed excavation excludes the removal of material from borrow sites.

[8]Soil: Assumed that soil consists of the upper and lower silt layers of the barrier (layers 1 and 2).

[9]Riprap: Assumed that riprap refers to the basalt layer of the barrier.

[10]Gravel/sand: Assumed this figure is a compilation of all screened aggregate products from Pit 30, including the asphalt base course, the drainage media, and the gravel and sand filter layers of the barrier, as well as the road base.

For additional backup information, see Appendix A, Tables A1-A8.

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

Construction Resource	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Land (ha) surface committed[1]					
Temporarily	20	24	24	20	24
Permanently	17	25	64	17	25
Water (m^3) [2]	38,000	57,000	145,000	38,000	57,000
Source of water					
Energy					
Electrical (GWh) [3]	n/a	n/a	n/a	n/a	n/a
Propane (m^3)	n/a	n/a	n/a	n/a	n/a
Diesel fuel (m^3) [4]	45,000	60,000	142,000	45,000	59,000
Gasoline (m^3) [5]	260	350	830	260	350
Materials					
Concrete (m^3)	0	0	0	0	0
Steel (t)	0	0	0	0	0
Asphalt (m^3)	62,500	81,600	164,000	62,500	80,700
Excavation (m^3) [6]	0	0	0	0	0
Soil (m^3) [7]	377,000	535,000	1,320,000	377,000	526,000
Riprap (m^3) [8]	638,000	809,000	1,480,000	638,000	801,000
Gravel/sand (m^3) [9]	415,000	615,000	2,250,000	415,000	598,000
Waste debris	0	0	0	0	0
Waste water	0	0	0	0	0
Sewage	0	0	0	0	0

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

Notes:

ha = hectares
m^3 = cubic meters
n/a = not applicable
GWh = gigawatt hour
t = metric ton

[1]Land: Permanently committed land is the sum of the barrier areas. The amount of temporarily committed land is used for equipment and materials laydown yards and was estimated by W.A. Skelly.

[2]Water: The maximum water requirement was assumed to be 50 gallons per square yard for barrier construction. The water requirement per barrier is the product of this maximum and the barrier acreage.

[3]Additional major power lines are not required for any of the options.

[4]Diesel fuel: See Appendix A for fuel consumption per day for specified equipment items.

[5]Gasoline: Assume 3 light-duty trucks will be used for each barrier; each truck runs 80 miles per day and has an efficiency of 14 miles per gallon. See Tables 5-11 and 5-12 for estimates of barrier schedules. The length of each job was used to calculate the total fuel consumption per barrier.

[6]Excavation: Excludes excavation of material at borrow sites.

[7]Soil: Assumed that soil consists of the upper and lower silt layers of the barrier (layers 1 and 2).

[8]Riprap: Assumed that riprap refers to the basalt layer of the barrier (layer 6).

[9]Gravel/sand: Assumed this figure is a compilation of all screened aggregate products from Pit 30, including the asphalt base course, the drainage media, and the gravel and sand filter layers of the barrier, as well as the road base.

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

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Table 5-4. Comparison of Alternatives by Non-radiological Barrier Construction Emissions (Units as Indicated).

Construction Emission Pollutant	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Particulates (kg)	156,000	209,000	486,000	156,000	206,000
SO_x (as SO_2) (kg)	276,000	369,000	859,000	276,000	364,000
CO (kg)	1,110,000	1.480,000	3,430,000	1,110,000	1,460,000
Hydrocarbons (exhaust & fugitive) (kg)	119,000	159,000	369,000	119,000	157,000
NO_x (as NO_2) (kg)	2,540,000	3,400,000	7,920,000	2,540,000	3,360,000
Aldehydes (as HCHO) (kg)	68,000	91,100	212,000	68,000	89,800
Organic acids (kg)	n/a	n/a	n/a	n/a	n/a
Thermal releases (J)	930,000,000	621,000,000	185,000,000	930,000,000	638,000,000
Fugitive dust (t)	3,095	4,114	9,079	3,095	4,090

Note:

kg = kilograms
n/a = not applicable
J. = joules
t = metric ton

See Appendix A (Dozer Grading Emissions, Paved Road Traffic Particulate Emissions, Unpaved Road Traffic Particulate Emissions, Fugitive Dust Emissions for Material Transfer, and Clearing and Grubbing Emissions) for construction emission calculations. These emissions come from the equipment used to excavate the material, to fill the tanks, and to build the barrier, as seen on page A-27.

For additional backup information, see Appendix A, Figures A2, A3, and A4; and Tables A8, A9, and A10.

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Table 5-5. Comparison of Alternatives by Transportation of Earthen Borrow Barrier Construction Material (Units as Indicated).[1]

Item	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Borrow source location (state)[2]	3 km NW of site	3 km NW of site	3 km NW of site	3 km NW of site	3 km NW of site
Route location state mileage	Rt 3 to Rt 4 (7 km)	Rt 3 to Rt 4 (7 km)	Rt 3 to Rt 4 (7 km)	Rt 3 to Rt 4 (7 km)	Rt 3 to Rt 4 (7 km)
Road type gravel or asphalt	6 km paved; 1 km level gravel	6 km paved; 1 km level gravel	6 km paved; 1 km level gravel	6 km paved; 1 km level gravel	6 km paved; 1 km level gravel
Total number of trips (average/peak)					
Truck[3]	53,700	79,800	293,000	53,700	77,600
Train	0	0	0	0	0
Barge	0	0	0	0	0
New road construction (km)					
Load volumes (m^3)	7.6	7.6	7.6	7.6	7.6

Notes:

km = kilometer

[1]Borrow materials include grading fill, base course, drainage gravel, and filter material.

[2]The borrow source location is Pit 30 between 200 West and 200 East. The mileage is round-trip.

[3]The truck loads were determined by adding the amounts of excavation and gravel/sand materials and dividing this subtotal by the load volumes. These numbers were generated in Appendix A, Paved Road Traffic Particulate Emissions.

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

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Table 5-6. Comparison of Alternatives by Transportation of Other Barrier Construction Material (Units as Indicated).[1]

Item	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Borrow source location (state)	Seattle, WA	Seattle, WA	Seattle, WA	Seattle, WA	Seattle, WA
Route location state mileage[2]	240	240	240	240	240
Road type gravel or asphalt	asphalt	asphalt	asphalt	asphalt	asphalt
Total number of trips					
Truck[3]	2 (geotextile)	2 (geotextile)	2 (geotextile)	2 (geotextile)	2 (geotextile)
Train[4]	495 cars (asphalt)	646 cars (asphalt)	1,300 cars asphalt)	495 cars (asphalt)	639 cars (asphalt)
Barge	0	0	0	0	0

Note:

[1]Other barrier construction material includes the asphaltic concrete and coating and the geotextile fabric used as a construction aid.

[2]The mileage is one-way.

[3]Two truck trips assumes that each truck can carry one-half of the geotextile needed in rolls approximately 78.7 centimeters in diameter (31 inches in diameter). Each roll, an average of 4.6 meters wide and 229 meters long, will weigh on average 248 kilogram per roll. If a truck can haul 36,300 kilograms per load, a truck can carry about 146 rolls/trip.

[4]The number of train trips assumes that asphalt has a density of 721 kilograms per cubic meter, and that each railcar can carry 91,000 kilograms of asphalt.

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

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Table 5-7. Comparison of Alternatives by Monitoring and Maintenance Personnel Requirements (Staff Hours Per Year).

Operating Personnel	In Situ Disposal	Extensive Pretreatment Option A	Extensive Pretreatment Option B	No Separations	Tri-Party Agreement Preferred Alternative
Non-exempt					
Radiation worker	10,500	11,000	11,000	10,500	11,000
Nonradiation worker	0	0	0	0	0
Exempt					
Radiation worker	0	0	0	0	0
Nonradiation worker	0	0	0	0	0
Total staff hours per year	10,500	11,000	11,000	10,500	11,000

Notes:

For each alternative, this estimate includes one supervisor, 3 or 4 workers, and one clerk/secretary.

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

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Figure A1. Typical Tank Configuration (3 sheets).
(Backup to Tables 5-2A and 5-2B).

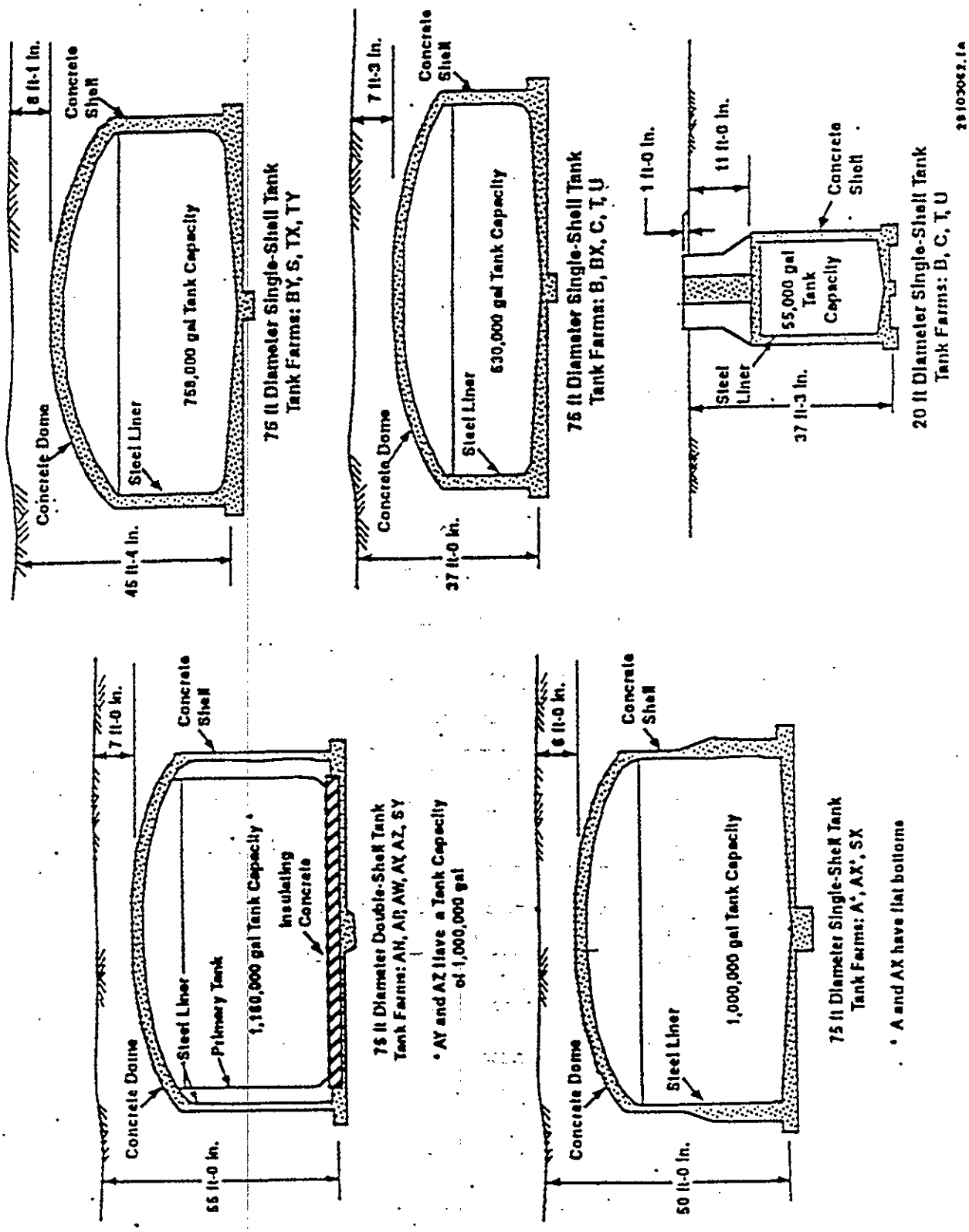

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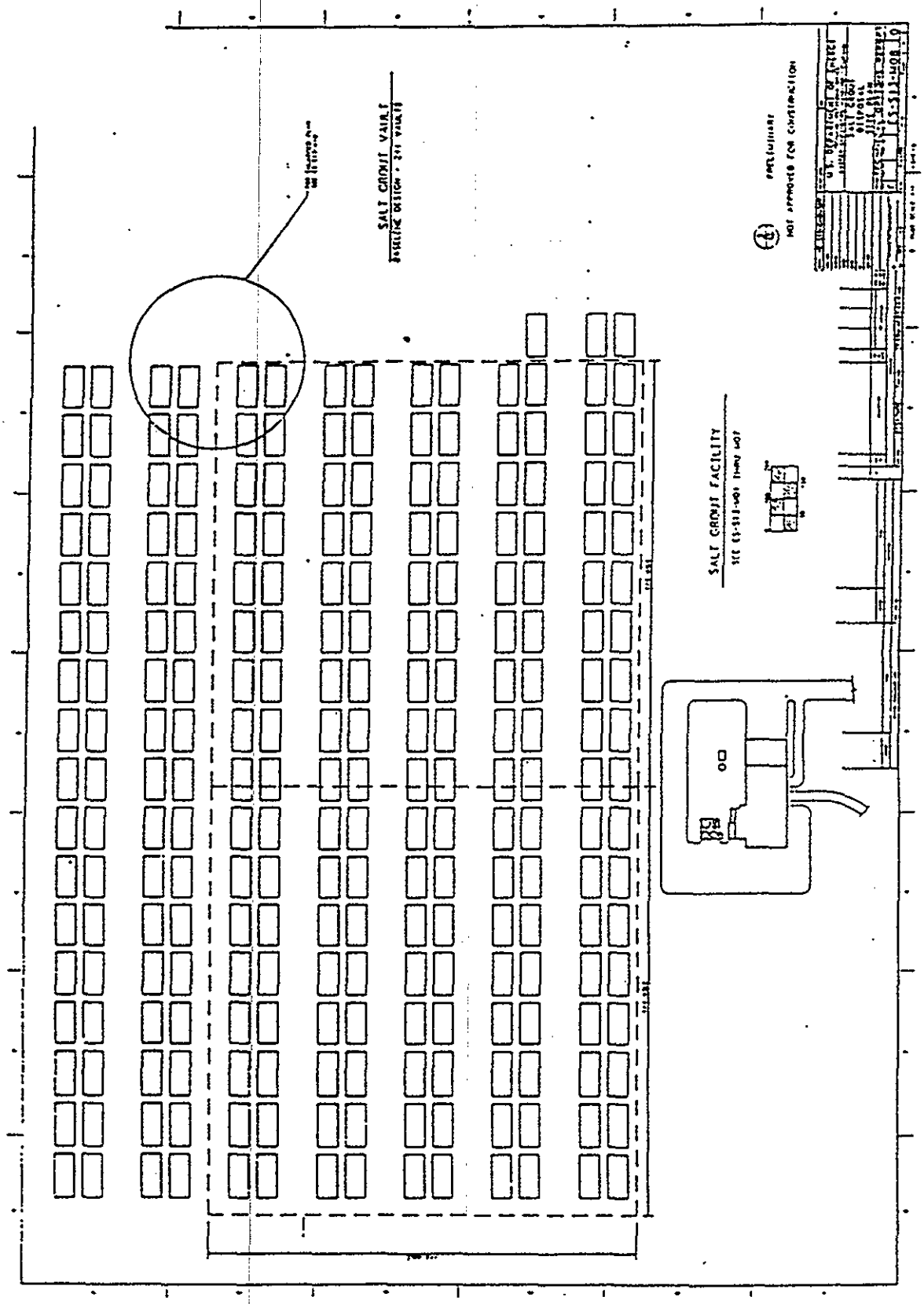
Figure A2. Extensive Separations Pretreatment: Low-Level Waste Grout Vault Configuration (Backup to Tables 5-1, 5-2D, 5-3B and 5-4 through 5-13).



Sheet A-18C
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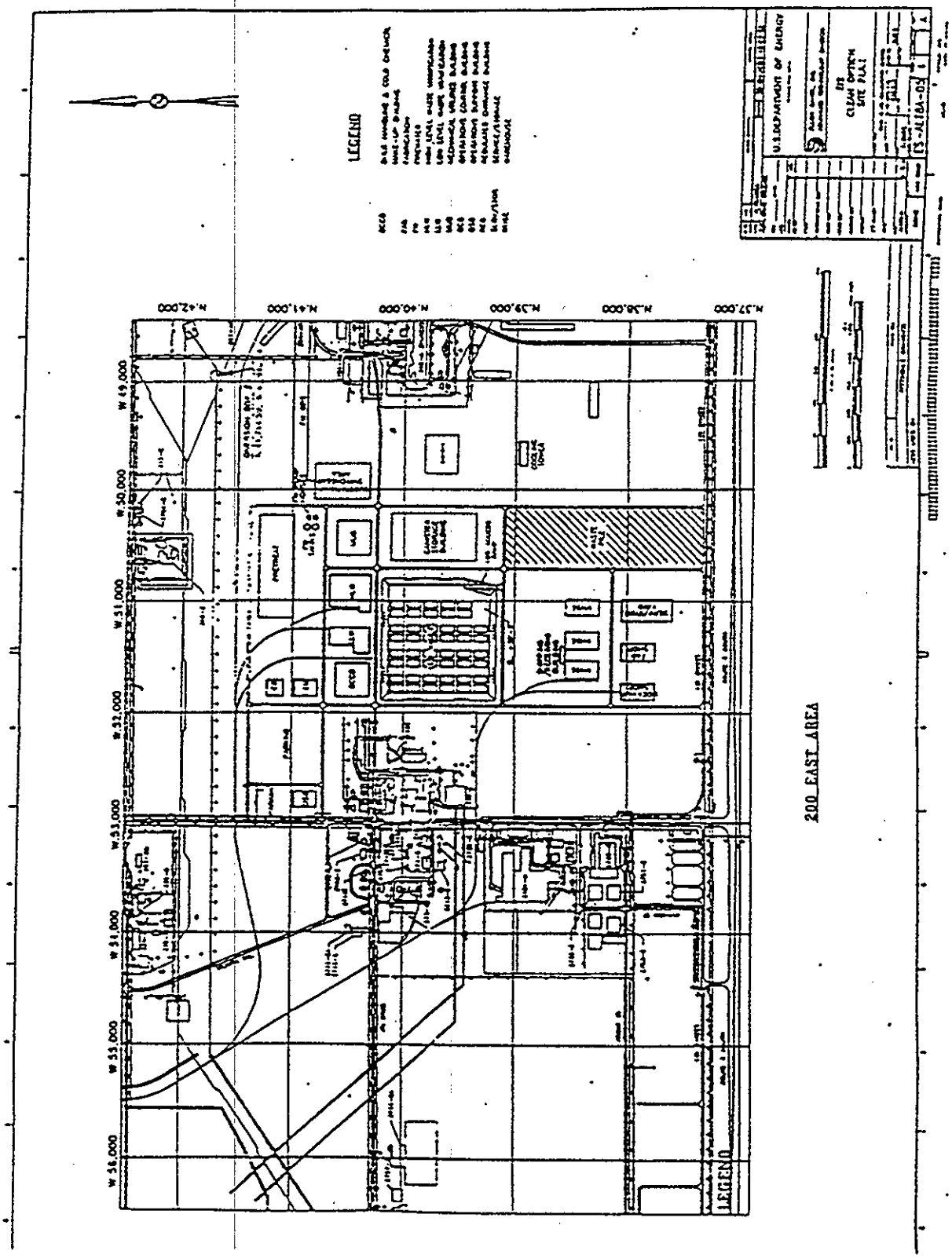
Figure A3. Extensive Separations Pretreatment: Low-Level Waste Glass Vault Configuration (Backup to Table 5-1, 5-2D, 5-3B and 5-4 through 5-13).



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Sheet A-188
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Table A7. Summary of Estimated Single-Shell Tank RCRA PPU Void Volumes (Backup to Tables 5-2C, 5-8, 5-9, 5-11 and 5-12).

TANK FARM	PIPING/RISER VOID VOLUME (cu m)	PITS, BOXES, ETC VOID VOLUMES (cu m)	TOTAL VOID VOLUME (cu m)	SCHEDULE (days)
241-A*	239.9	1450.4	1690.3	2.79
241-AX	158.3	957.3	1115.6	1.84
241-B	137.4	683.4	820.8	1.36
241-BX	109.9	546.7	656.6	1.09
241-BY	109.9	546.7	656.6	1.09
241-C	137.4	683.4	820.8	1.36
241-S	109.9	546.7	656.6	1.09
241-SX	137.4	683.4	820.8	1.36
241-T*	137.4	683.4	820.8	1.36
241-TX	192.3	956.8	1149.1	1.90
241-TY*	48.5	397.2	445.7	0.74
241-U	137.4	683.4	820.8	1.36
TOTAL:	1655.5	8819.1	10474.6	17.31

NOTE:

(1) Tank farms which are followed by an asterisk indicate that these void volumes were directly calculated from the preceding tables. All other void volumes were obtained from a scaling factor based on the other tanks' similarities to tanks A and T.

(2) The schedule is derived from the schedule for stabilizing the tanks with grout: the total m^3 of grout volume was divided by the total time for grouting to find a scaling factor. This scaling factor is (761,467 cu m)/(1259.04 days) = 605 cu m/day. All PPU void volumes were divided by this scaling factor to arrive at a preliminary schedule. 10% was added as a contingency factor to the DSTs, in order to compensate for differences in ancillary equipment that may be present.

(3) This schedule assumes 5-day workweeks of 8-hour days.

Sheet A-189
RDW 7-30-96

Table A8. Comparison of Alternatives by Unit Process: Barrier Construction Personnel Requirements (7 sheets). (Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

SST 241-A

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	7500	893	128	765	305	207	1.45	7.97	115.03
base course 02	1600	38	5	32	~~305~~	69	1.45	0.34	3.84
asphalt 03	2500	70	14	56	102		1.45	1.45	10.36
top coating		232	58	174			1.45	7.2	22.03
drainage layer 04	5400	113	16	97			1.45	1.01	13.38
basalt 05	34300	11079	1584	9495			1.45	98.92	1142.51
filter layers 06	4400	273	39	234			1.45	2.44	32.19
lower silt 07	8000	2208	316	1892			1.45	19.71	185.71
upper silt 08	8900	2305	330	1975			1.45	20.58	193.88
road base 09	300	7	1	6			1.45	0.06	0.38
TOTAL	~~72900~~ 65,100	17217	2491	14726	102	69		159.6827	1719.31

SST 241-AX

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	5200	619	88	530	209	207	0.99	5.53	79.75
base course 02	1300	31	4	26			0.99	0.27	3.12
asphalt 03	1900	48	10	38			0.99	0.99	7.07
top coating		158	40	119			0.99	5.0	15.05
drainage layer 04	4200	88	13	76			0.99	0.79	10.41
basalt 05	27000	8721	1247	7474			0.99	77.87	899.35
filter layers 06	3100	192	27	165			0.99	1.72	22.68
lower silt 07	5500	1518	217	1301			0.99	13.55	127.67
upper silt 08	6200	1606	230	1376			0.99	14.34	135.06
road base 09	300	7	1	6			0.99	0.06	0.38
TOTAL		12988	1877	11111				120.0639	1300.55

SST 241-B

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	19800	2356	337	2019	405	378	3.51	21.04	303.68
base course 02	3100	73	10	63			3.51	0.65	7.44
asphalt 03	4700	168	34	135			3.51	3.51	25.08
top coating		562	140	421			3.51	17.6	53.35
drainage layer 04	10000	210	30	180			3.51	1.88	24.78
basalt 05	61200	19768	2827	16941			3.51	176.50	2038.53
filter layers 06	9800	608	87	521			3.51	5.43	71.69
lower silt 07	19300	5327	762	4565			3.51	47.56	448.02
upper silt 08	20600	5335	763	4572			3.51	47.64	448.75
road base 09	500	12	2	10			3.51	0.11	0.63
TOTAL		34419	4992	29427				321.8525	3421.96

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Table A8. Comparison of Alternatives by Unit Process: Barrier Construction Personnel Requirements (7 sheets). (Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

SST 241 BY

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	15600	1856	265	1591	411	305	2.88	16.58	239.26
base course 02	2700	64	9	55			2.88	0.57	6.48
asphalt 03	4000	138	28	111			2.88	2.88	20.58
top coating		461	115	346			2.80	14.4	43.78
drainage layer 04	8600	181	26	155			2.88	1.61	21.31
basalt 05	53600	17313	2476	14837			2.88	154.58	1785.38
filter layers 06	8200	508	73	436			2.88	4.54	59.99
lower silt 07	15800	4361	624	3737			2.88	38.94	366.77
upper silt 08	17000	4403	630	3773			2.88	39.31	370.32
road base 09	400	10	1	8			2.88	0.09	0.51
TOTAL		29294	4246	25048				273.4882	2914.38

SST 241-BX

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	15400	1833	262	1571	405	305	2.84	16.36	236.19
base course 02	2700	64	9	55			2.84	0.57	6.48
asphalt 03	4000	136	27	109			2.84	2.84	20.29
top coating		454	114	341			2.84	14.2	43.17
drainage layer 04	8500	179	26	153			2.84	1.59	21.06
basalt 05	53000	17119	2448	14671			2.84	152.85	1765.40
filter layers 06	8000	496	71	425			2.84	4.43	58.52
lower silt 07	15600	4306	616	3690			2.84	38.44	362.13
upper silt 08	16800	4351	622	3729			2.84	38.85	365.97
road base 09	400	10	1	8			2.84	0.09	0.51
TOTAL		28947	4196	24751				270.2205	2879.72

SST 241-C

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	20400	2428	347	2080	411	382	3.60	21.68	312.88
base course 02	3200	76	11	65			3.60	0.67	7.68
asphalt 03	4800	173	35	138			3.60	3.60	25.72
top coating		576	144	432			3.60	18.0	54.72
drainage layer 04	10200	214	31	184			3.60	1.91	25.27
basalt 05	62300	20123	2878	17245			3.60	179.67	2075.17
filter layers 06	10000	620	89	531			3.60	5.54	73.15
lower silt 07	19800	5465	781	4683			3.60	48.79	459.63
upper silt 08	21100	5465	781	4683			3.60	48.79	459.64
road base 09	500	12	2	10			3.60	0.11	0.63
TOTAL		35151	5098	30053				328.76	3494.51

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RGW 7-30-95

Table A8. Comparison of Alternatives by Unit Process:
Barrier Construction Personnel Requirements (7 sheets).
(Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

SST 241-S

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	15900	1892	271	1622	411	309	2.92	16.89	243.86
base course 02	2700	64	9	55			2.92	0.57	6.48
asphalt 03	4100	140	28	112			2.92	2.92	20.86
top coating		467	117	350			2.92	14.6	44.38
drainage layer 04	8700	183	26	157			2.92	1.63	21.56
basalt 05	54000	17442	2494	14948			2.92	155.73	1798.71
filter layers 06	8200	508	73	436			2.92	4.54	59.99
lower silt 07	16000	4416	631	3785			2.92	39.43	371.42
upper silt 08	17200	4455	637	3818			2.92	39.78	374.68
road base 09	500	12	2	10			2.92	0.11	0.63
TOTAL		29579.1	4288	25291				276.1961	2942.57

SST 241-T

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	19800	2356	337	2019	405	378	3.51	21.04	303.68
base course 02	3100	73	10	63			3.51	0.65	7.44
asphalt 03	4700	168	34	135			3.51	3.51	25.08
top coating		562	140	421			3.51	17.6	53.35
drainage layer 04	10000	210	30	180			3.51	1.88	24.78
basalt 05	61200	19768	2827	16941			3.51	176.50	2038.53
filter layers 06	9800	608	87	521			3.51	5.43	71.69
lower silt 07	19300	5327	762	4565			3.51	47.56	448.02
upper silt 08	20600	5335	763	4572			3.51	47.64	448.75
road base 09	500	12	2	10			3.51	0.11	0.63
TOTAL		34418.8	4992	29427				321.8525	3421.96

SST 241-SX

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	20000	2380	340	2040	513	309	3.64	21.25	306.74
base course 02	3200	76	11	65			3.64	0.67	7.68
asphalt 03	4900	175	35	140			3.64	3.64	26.01
top coating		582	146	437			3.64	18.2	55.33
drainage layer 04	10400	218	31	187			3.64	1.95	25.77
basalt 05	63700	20575	2942	17633			3.64	183.71	2121.81
filter layers 06	10200	632	90	542			3.64	5.65	74.62
lower silt 07	20000	5520	789	4731			3.64	49.29	464.27
upper silt 08	21300	5517	789	4728			3.64	49.26	463.99
road base 09	500	12	2	10			3.64	0.11	0.63
TOTAL		35687.2	5176	30512				333.7161	3546.86

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Table A8. Comparison of Alternatives by Unit Process:
Barrier Construction Personnel Requirements (7 sheets).
(Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

SST 241-TY

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	7600	904	129	775	309	207	1.47	8.08	116.56
base course 02	1700	40	6	34			1.47	0.36	4.08
asphalt 03	2500	71	14	56			1.47	1.47	10.50
top coating		235	59	176			1.47	7.4	22.34
drainage layer 04	5400	113	16	97			1.47	1.01	13.38
basalt 05	34600	11176	1598	9578			1.47	99.78	1152.50
filter layers 06	4400	273	39	234			1.47	2.44	32.19
lower silt 07	8200	2263	324	1940			1.47	20.21	190.35
upper silt 08	9000	2331	333	1998			1.47	20.81	196.05
road base 09	300	7	1	6			1.47	0.06	0.38
TOTAL		17413.7	2519	14894				161.5693	1738.35

SST 241-TX

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	28600	3403	487	2917	513	411	4.84	30.39	438.64
base course 02	4000	94	13	81			4.84	0.84	9.60
asphalt 03	6100	232	46	186			4.84	4.84	34.58
top coating		774	194	581			4.84	24.2	73.57
drainage layer 04	12800	269	38	230			4.84	2.40	31.72
basalt 05	77300	24968	3570	21397			4.84	222.93	2574.81
filter layers 06	13200	818	117	701			4.84	7.31	96.56
lower silt 07	26500	7314	1046	6268			4.84	65.30	615.16
upper silt 08	28000	7252	1037	6215			4.84	64.75	609.95
road base 09	600	14	2	12			4.84	0.13	0.76
TOTAL		45140	6551	38589				423.0873	4485.36

SST 241-U

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	19200	2285	327	1958	405	368	3.42	20.40	294.47
base course 02	3100	73	10	63			3.42	0.65	7.44
asphalt 03	4600	164	33	131			3.42	3.42	24.44
top coating		547	137	410			3.42	17.1	51.98
drainage layer 04	9800	206	29	176			3.42	1.84	24.28
basalt 05	60113	19416	2777	16640			3.42	173.36	2002.33
filter layers 06	9600	595	85	510			3.42	5.31	70.23
lower silt 07	18800	5189	742	4447			3.42	46.33	436.42
upper silt 08	20100	5206	744	4461			3.42	46.48	437.85
road base 09	500	12	2	10			3.42	0.11	0.63
TOTAL		33694	4886	28807				315.0036	3350.08

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Table A8. Comparison of Alternatives by Unit Process: Barrier Construction Personnel Requirements (7 sheets). (Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

DST AN

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	12500	1488	213	1275	319	319	2.34	13.28	191.71
base course 02	2300	54	8	47			2.34	0.48	5.52
asphalt 03	3400	112	22	90			2.34	2.34	16.72
top coating		374	94	281			2.34	11.7	35.57
drainage layer 04	7400	155	22	133			2.34	1.39	18.34
basalt 05	46200	14923	2134	12789			2.34	133.24	1538.89
filter layers 06	6700	415	59	356			2.34	3.71	49.01
lower silt 07	12900	3560	509	3051			2.34	31.79	299.46
upper silt 08	13900	3600	515	3085			2.34	32.14	302.79
road base 09	400	10	1	8			2.34	0.09	0.51
TOTAL		24692	3577	21115				230.1586	2458.52

DST AP

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	10700	1273	182	1091	426	212	2.07	11.37	164.11
base course 02	2200	52	7	44			2.07	0.46	5.28
asphalt 03	3200	99	20	79			2.07	2.07	14.79
top coating		331	83	248			2.07	10.4	31.46
drainage layer 04	7000	147	21	126			2.07	1.31	17.34
basalt 05	44100	14244	2037	12207			2.07	127.18	1468.94
filter layers 06	6100	378	54	324			2.07	3.38	44.62
lower silt 07	11500	3174	454	2720			2.07	28.34	266.96
upper silt 08	12500	3238	463	2775			2.07	28.91	272.30
road base 09	400	10	1	8			2.07	0.09	0.51
TOTAL		22946	3322	19624				213.4541	2286.32

DST AW

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	8000	952	136	816	319	212	1.55	8.50	122.70
base course 02	1700	40	6	34			1.55	0.36	4.08
asphalt 03	2600	74	15	60			1.55	1.55	11.07
top coating		248	62	186			1.55	7.8	23.56
drainage layer 04	5600	118	17	101			1.55	1.05	13.88
basalt 05	35800	11563	1654	9910			1.55	103.24	1192.48
filter layers 06	4600	285	41	244			1.55	2.55	33.65
lower silt 07	8600	2374	339	2034			1.55	21.19	199.64
upper silt 08	9500	2461	352	2109			1.55	21.97	206.95
road base 09	300	7	1	6			1.55	0.06	0.38
TOTAL		18122	2622	15500				168.2252	1808.38

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Table A8. Comparison of Alternatives by Unit Process:
Barrier Construction Personnel Requirements (7 sheets).
(Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

DST AY

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	2900	345	49	296	212	105	0.51	3.08	44.48
base course 02	900	21	3	18			0.51	0.19	2.16
asphalt 03	1300	24	5	20			0.51	0.51	3.64
top coating		82	20	61			0.51	2.6	7.75
drainage layer 04	2900	61	9	52			0.51	0.54	7.19
basalt 05	19300	6234	891	5342			0.51	55.66	642.87
filter layers 06	1800	112	16	96			0.51	1.00	13.17
lower silt 07	2900	800	114	686			0.51	7.15	67.32
upper silt 08	3400	881	126	755			0.51	7.86	74.06
road base 09	200	5	1	4			0.51	0.04	0.25
TOTAL		8565	1235	7330				78.58268	862.90

DST AZ

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	2900	345	49	296	212	105	0.51	3.08	44.48
base course 02	900	21	3	18			0.51	0.19	2.16
asphalt 03	1300	24	5	20			0.51	0.51	3.64
top coating		82	20	61			0.51	2.6	7.75
drainage layer 04	2900	61	9	52			0.51	0.54	7.19
basalt 05	19300	6234	891	5342			0.51	55.66	642.87
filter layers 06	1800	112	16	96			0.51	1.00	13.17
lower silt 07	2900	800	114	686			0.51	7.15	67.32
upper silt 08	3400	881	126	755			0.51	7.86	74.06
road base 09	200	5	1	4			0.51	0.04	0.25
TOTAL		8565	1235	7330				78.58268	862.90

DST SY

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	5400	643	92	551	212	212	1.03	5.74	82.82
base course 02	1300	31	4	26			1.03	0.27	3.12
asphalt 03	1900	49	10	40			1.03	1.03	7.36
top coating		165	41	124			1.03	5.2	15.66
drainage layer 04	4300	90	13	77			1.03	0.81	10.65
basalt 05	27600	8915	1275	7640			1.03	79.60	919.34
filter layers 06	3200	198	28	170			1.03	1.77	23.41
lower silt 07	5800	1601	229	1372			1.03	14.29	134.64
upper silt 08	6500	1684	241	1443			1.03	15.03	141.59
road base 09	300	7	1	6			1.03	0.06	0.38
TOTAL		13383	1934	11448				123.7539	1338.97

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Table A8. Comparison of Alternatives by Unit Process: Barrier Construction Personnel Requirements (7 sheets). (Backup to Tables 5-1, 5-2D, 5-3A and B, and 5-4 through 5-13).

EPT OPTION B

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	1835800	218460	31240	187220	2761	1800	114.09	1950.54	28156.01
base course 02	67800	1600	229	1371			114.09	14.29	162.79
asphalt 03	101700	5476	1095	4381			114.09	114.09	815.17
top coating		18254	4564	13691			114.09	570.5	1734.17
drainage layer 04	206300	4332	620	3713			114.09	38.68	511.17
basalt 05	1096700	354234	50655	303579			114.09	3162.80	36530.39
filter layers 06	283400	17571	2513	15058			114.09	156.88	2073.20
lower silt 07	615800	169961	24304	145656			114.09	1517.51	14294.92
upper silt 08	623300	161435	23085	138350			114.09	1441.38	13577.81
road base 09	2600	62	9	53			114.09	0.56	3.30
TOTAL		951386	138314	813073				8967.177	97858.94

TPA PREFERRED ALT

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	143800	17112	2447	14665	1030	747	17.66	152.79	2205.49
base course 02	12100	286	41	245			17.66	2.55	29.05
asphalt 03	18200	848	170	678			17.66	17.66	126.18
top coating		2826	706	2119			17.66	88.3	268.43
drainage layer 04	37500	788	113	675			17.66	7.03	92.92
basalt 05	213100	68831	9843	58988			17.66	614.57	7098.23
filter layers 06	45600	2827	404	2423			17.66	25.24	333.58
lower silt 07	95900	26468	3785	22683			17.66	236.33	2226.18
upper silt 08	98800	25589	3659	21930			17.66	228.48	2152.23
road base 09	1000	24	3	21			17.66	0.21	1.27
TOTAL		145599	21171	124427				1373.151	14533.57

EPT OPTION A

BARRIER LAYER	VOLUME (cu yd)	TOTAL STFHR	CONSTR STFHR	SUPVSR STFHR	LENGTH (ft)	WIDTH (ft)	ACRES	DAYS	FUEL (cu m)
site grading 01	159300	18957	2711	16246	930	880	18.79	169.26	2443.21
base course 02	12800	302	43	259	310 yd	293 yd.	18.79	2.70	30.73
asphalt 03	19100	902	180	722			18.79	18.79	134.25
top coating		3006	752	2255			18.79	94.0	285.61
drainage layer 04	39500	830	119	711			18.79	7.41	97.87
basalt 05	223400	72158	10319	61840			18.79	644.27	7441.31
filter layers 06	48400	3001	429	2572			18.79	26.79	354.07
lower silt 07	101900	28124	4022	24103			18.79	251.11	2365.46
upper silt 08	104900	27169	3885	23284			18.79	242.58	2285.12
road base 09	1100	26	4	23			18.79	0.24	1.40
TOTAL		154476	22463	132012				1457.09	15439.04

550,000 yd³ for barrier

NOTE: All barrier length and width measurements include a 9 meter overhang on each side of the tank farm.

STFHR means Staff Hours, and is based on a 5 day workweek, and a 250 day work year.

associated with SST operations. Pipelines would include lines between tanks and process facilities, air and steam supply lines, raw water lines, and drains.

- During tank farm closure, ancillary equipment items and MUSTs would be stabilized in place with an appropriate grout material. The physical immobilization of contaminants provided by grout could be augmented by using sequestering agents, such as zeolites, that would be capable of chemical bonding with contaminants. If ancillary equipment was plugged at one or more points, several access ports would have to be installed to ensure complete grout filling.
- For purposes of assessing the environmental impacts associated with dispositioning of ancillary equipment and MUSTs as part of closure, it was assumed that the entire void volume within the ancillary equipment would be filled with grout and that no ancillary equipment or Inactive MUSTs would be excavated, packaged, or disposed of as LAW or mixed waste (WHC 1995i).
- Surface barriers (Hanford Barriers) would be placed over SSTs and DSTs for all alternatives except the No Action alternative. Barriers would also be placed over the LAW vaults described in the Ex Situ Intermediate Separations, Ex Situ No Separations, and Ex Situ Extensive Separations alternatives.

B.6.0 THE HANFORD BARRIER

This section describes the Hanford Barrier, which is included in all alternatives that include closure activities as a representative surface barrier (cap) for closure as a landfill.

The Hanford Barrier would be a horizontal, abovegrade engineered soil structure whose function would be to isolate the waste site from the environment by preventing or reducing the likelihood of wind erosion, water infiltration, and plant, animal, and human intrusion. It would be composed of 10 layers, with a combined thickness of 4.5 m (14.8 ft), and placed over the top of the stabilized tanks and the LAW disposal sites. Each Hanford Barrier would extend an additional 9 m (30 ft) beyond the perimeter of the area to be protected. Performance objectives of the Hanford Barrier system would include the following:

- Function in a semi-arid to sub-humid climate;
- Limit the amount of water migration through the waste to near zero amounts;
- Be maintenance free;
- Minimize the likelihood of intrusion by plants, animals, or people;
- Limit the amount of gases released;
- Minimize erosion;
- Meet or exceed RCRA cover performance requirements;
- Isolate waste for a minimum of 1,000 years; and
- Be acceptable to regulators and the public.

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B.6.1 DESCRIPTION OF THE BARRIER LAYERS

The layers of the barrier are described from the top down. The Hanford Barrier design is provided in Figure B.6.1.1.

Top Vegetative Cover

The top vegetative cover would be for water retention and removal. Five species of perennial grasses would be planted across the barrier top. Seeding would include disking the soil, applying granular fertilizer, and seeding with a perennial grass mixture. To help establish cover grass, the site would be mulched with straw, which would be crimped into the soil to minimize wind erosion until the vegetation cover is developed.

Top (First and Second) Barrier Layers

The first barrier layer would consist of topsoil with a pea-gravel mixture; the second layer would consist of topsoil without pea-gravel. The first layer would be 1 m (3.3 ft) of sandy silt to silt loam soil with a 15 percent by weight admixture of pea-gravel. This layer would be placed loosely with a bulk density of 1.46 grams/cm^3 (18.7 lb/ft^3). The second layer would have the same type of topsoil, however, the bulk density would be approximately 1.38 grams/cm^3 (86 lb/ft^3). These two layers would manage water by storing precipitation, providing a media for the growth of cover vegetation, and allowing evaporation and transpiration by the cover plants. The proposed topsoil would be obtained from the McGee Ranch quarry site of the Hanford Site.

Third Barrier Layer

The third layer would be a geotextile, used primarily to separate topsoil layers from the sand filtration layer. After construction is completed, this geotextile would no longer have a specific function and therefore its long-term durability is not an issue.

Fourth and Fifth Barrier Layers

The fourth layer would be a sand filter, and the fifth layer would be a gravel filter. The purpose of these two layers would be to prevent migration and accumulation of fine-textured topsoil in the basalt layer. A capillary barrier, which occurs when a layer of fine-textured soil overlays a layer of coarser-textured soil (e.g., sand, gravel, or rock), would be created at the interface between the geotextile and the fourth layer (sand filter). Surface tension effects within the pore space of fine-textured soil would exert a negative pressure on the contained soil moisture. For moisture to drain out of fine-textured soil, surface tension would have to be overcome by developing gravitational pressure (hydraulic head) within the layer. In effect, some portion of the full thickness of this fine-soil layer will have to become completely saturated before drainage could occur. The sand filter would be 0.15 m (0.5 ft) deep, and the gravel filter would be 0.3 m (1 ft) deep. Both layers would be obtained from the Pit 30 borrow site on the 200 Area Plateau.

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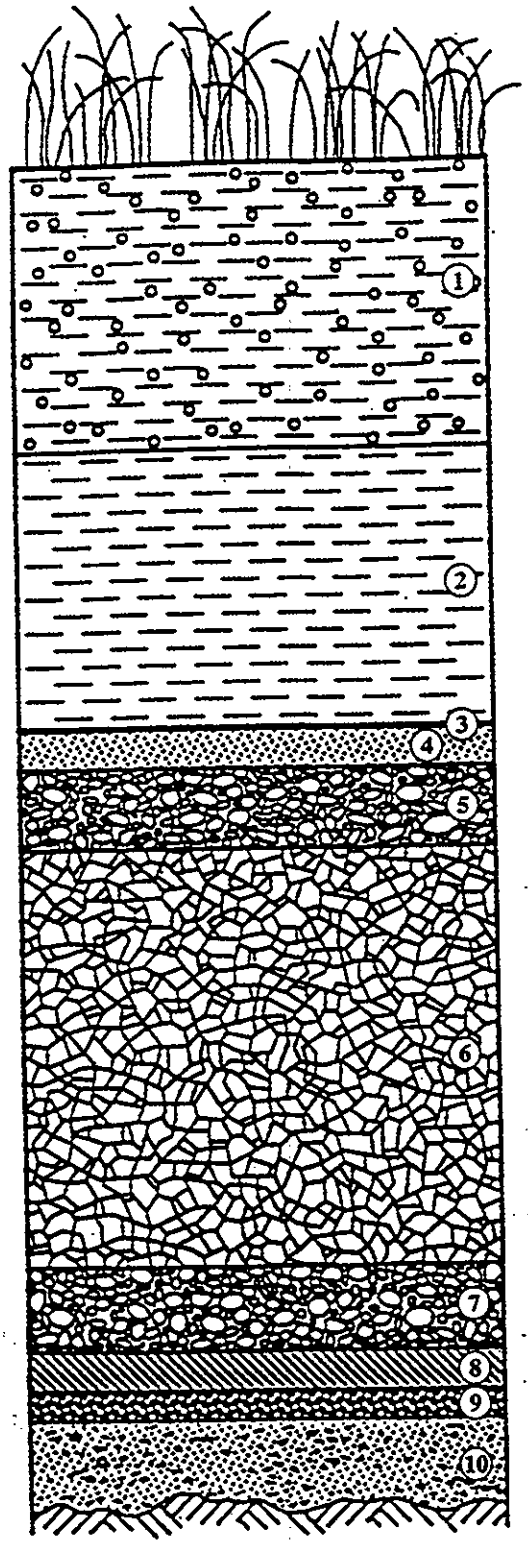
Figure B.6.1.1 Hanford Barrier



Cover Vegetation: Mixed perennial grasses

Layer 1: (100 cm; 40 in.) Silt loam topsoil with pea gravel admixture

Layer 2: (100 cm; 40 in.) Silt loam topsoil without pea gravel

Layer 3: (0.1 cm; 0.04 in.) Geotextile filter fabric

Layer 4: (15 cm; 6 in.) Sand filter layer

Layer 5: (30 cm; 12 in.) Gravel filter layer

Layer 6: (150 cm; 60 in.) Coarse, fractured basalt

Layer 7: (30 cm; 12 in.) Lateral drainage layer (drainage gravel)

Layer 8: (15 cm; 6 in.) Low-permeability asphalt layer

Layer 9: (10 cm; 4 in.) Asphalt base course

Layer 10: (variable thickness) Grading fill

SOURCE: WHC 1995i

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Sixth Barrier Layer

The sixth layer would be constructed of coarse basalt smaller than 25 by 5 cm (10 by 2 in.). The basalt layer would control biointrusion from plant roots, burrowing animals, and humans. The basalt would impede exploratory drilling. A subsurface layer consisting of loose fractured rock would pose a particularly adverse drilling condition for the following reasons:

- Circulation could not be maintained;
- Cuttings could not be adequately removed from the hole;
- The drill bit could not receive adequate lubrication; and
- Firm contact could not be maintained between the bit and the rock.

All of these factors would contribute to high bit wear and minimum advance of the drill hole. In addition, the layer would prevent moisture retention because large void spaces will enable water to drain into the seventh layer.

Seventh Barrier Layer

The seventh layer would be for lateral drainage. It would consist of screened material having a diameter of 1 mm (0.04 in.) or greater, which would give a hydraulic conductivity of at least 1 cm/sec (0.4 in./sec). This layer is part of contingency planning; any water draining to the seventh layer would be collected and/or diverted to the edge of the cover because of the 2 percent slope. This layer would be approximately 4 m (13 ft) below final grade to protect against frost penetration.

Eighth Barrier Layer

The eighth layer would consists of asphalt that would serve as a low-permeability barrier and as a secondary biointrusion barrier. The asphalt would be a durable asphaltic concrete mixture consisting of double-tar asphalt with added sand as a binder material. This layer would be 0.15 m (0.5 ft) thick with a hydraulic conductivity of approximately 1.0E-8 cm/sec. Natural analog studies estimate that this asphalt could remain functional for a period of 5,000 years or more as long as the asphalt remains covered and protected from ultraviolet radiation and freeze and thaw activity. To provide additional protection against leakage, the asphaltic concrete would be coated with a sprayed asphaltic coating material, which would be puncture-resistant, flexible, and easy to apply. The asphaltic coating material would have a permeability value of about 1.0E-11 cm/sec.

Ninth Barrier Layer

The ninth layer would be an asphalt base course that would provide a stable base for constructing the asphalt layer.

Tenth Barrier Layer

The tenth layer would contain grading fill that would establish a smooth, planar base surface for constructing the barrier layers. The sites covered by the Hanford Barrier would be contoured and graded for a uniform slope of 2 percent.

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Locations to be Covered

The following locations would be covered with a Hanford Barrier:

- Tank Farm A (SST 6 tanks): 0.86 ha (2.13 ac);
- Tank Farm AN (DST 7 tanks): 1.30 ha (3.21 ac);
- Tank Farm AP (DST 8 tanks): 1.17 ha (2.89 ac);
- Tank Farm AW (DST 6 tanks): 0.91 ha (2.26 ac);
- Tank Farm AX (SST 4 tanks): 0.63 ha (1.55 ac);
- Tank Farm AY (DST 2 tanks): 0.37 ha (0.92 ac);
- Tank Farm AZ (DST 2 tanks): 0.37 ha (0.92 ac);
- Tank Farm B (SST 16 tanks): 1.85 ha (4.57 ac);
- Tank Farm BX (SST 12 tanks): 1.54 ha (3.80 ac);
- Tank Farm BY (SST 12 tanks): 1.55 ha (3.84 ac);
- Tank Farm C (SST 16 tanks): 1.89 ha (4.68 ac);
- Tank Farm S (SST 12 tanks): 1.57 ha (3.89 ac);
- Tank Farm SX (SST 15 tanks): 1.91 ha (4.72 ac);
- Tank Farm SY (DST 3 tanks): 0.65 ha (1.61 ac);
- Tank Farm T (SST 16 tanks): 1.85 ha (4.57 ac);
- Tank Farm TX (SST 18 tanks): 2.46 ha (6.09 ac);
- Tank Farm TY (SST 6 tanks): 0.87 ha (2.16 ac);
- Tank Farm U (SST 16 tanks): 1.89 ha (4.67 ac); and
- LAW Disposal Vault.

2.6971 E+05 m²
1.39 (42) vaults 2.~~331~~ 165 E+04 m²
(60) vaults 3.663 E+04 m²
2.8303 E+05 m²
37×15 = 555 m²/vault
24.64 ha = 2.46400 m² E+05

B.6.2 SUMMARY OF BORROW SITES AND BORROW MATERIALS

There are three sites assumed in the engineering data packages for borrow materials. These are Pit 30, which supplies sand and aggregate; the Vernita Quarry, which supplies riprap; and McGee Ranch, which supplies silt. These areas are also potential borrow sites. A decision on exactly which borrow site would be used and to what extent they would be used would be made through the Hanford Site Land Use Plan (DOE 1993e). For purposes of analysis the following borrow sites were assumed. The following is a brief description of the location and estimated distance of each of the borrow sites.

Pit 30

Pit 30 is an existing and established borrow pit, located approximately centrally with respect to the 200 Areas. The estimated haul distance is 10 km (6 mi) round-trip.

Vernita Quarry

Vernita Quarry is located east of State Route 24 near the Vernita Bridge. It was probably originally used to support highway construction. Distance estimates (one-way) are 12 km (7 mi) from the 200 West Area and 19.0 km (12 mi) to the 200 East Area.

22.64 x10⁴ m²
22.64 ha.

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McGee Ranch

McGee Ranch is located west of State Route 24 and north of Route 11A. Distance estimates (one-way) are 11 km (6.5 mi) to the 200 West Area and 18 km (11 mi) to the 200 East Area.

These sites have been evaluated previously (BHI 1995) with respect to site proximity, availability of borrow material, transportation, safety, and land reclamation. This preliminary analysis indicated that all sites were suitable sources of borrow material. Figure B.6.2.1 shows the location of the proposed borrow sites.

Borrow Material Quantities

The estimated quantities of borrow materials taken from the various engineering data packages are shown on the following three tables. Table B.6.2.1 shows borrow materials used during construction and operation for the alternatives. Table B.6.2.2 shows borrow materials that are estimated for backfilling the empty tanks for all of the ex situ alternatives. Table B.6.2.3 shows the data for borrow materials used in the construction of the Hanford Barriers, which will be placed over the tanks and vaults. In this table, each group of alternatives uses the same quantity of borrow materials.

B.7.0 SITING OF FACILITIES

This section describes the preliminary siting study that was performed to develop a representative site for impact assessment purposes.

The site optimization process would be implemented to ensure that new facilities are located at a site that meets facility requirements and minimizes the impacts associated with construction and operations. The site optimization process would involve identifying and evaluating sites based on selection criteria that incorporates stakeholder values.

The site optimization process for the TWRS sites is an ongoing program whose function is to identify a site that best meets the selection criteria. The in situ alternatives would be sited at the existing tank farms and would require site selection for support facilities. For the ex situ alternatives, the area proposed for potential sites has been restricted to that which is in and around the 200 East Area. The 200 Areas have been heavily used for fuel reprocessing and waste management and disposal activities. The 200 East Area location was selected for the following reasons:

- Based on the TWRS Facility Configuration Study (Boomer et al. 1994) and the TWRS Process Flowsheet (Orme 1994), pretreating tank waste (if done in an existing tank) would be done by the in-tank sludge washing process in the 200 East A Farm Tank Complex. Tank waste from the 200 West Area would be retrieved to the SY Tank Farm and transferred cross-site to the AW Tank Farm where in-tank sludge washing would be performed. Waste in the 200 East Area would be retrieved to the AN Tank Farm where it would be washed and separated into HLW and LAW streams. The LAW streams would be pumped to the AP Tank Farm and then to the pretreatment

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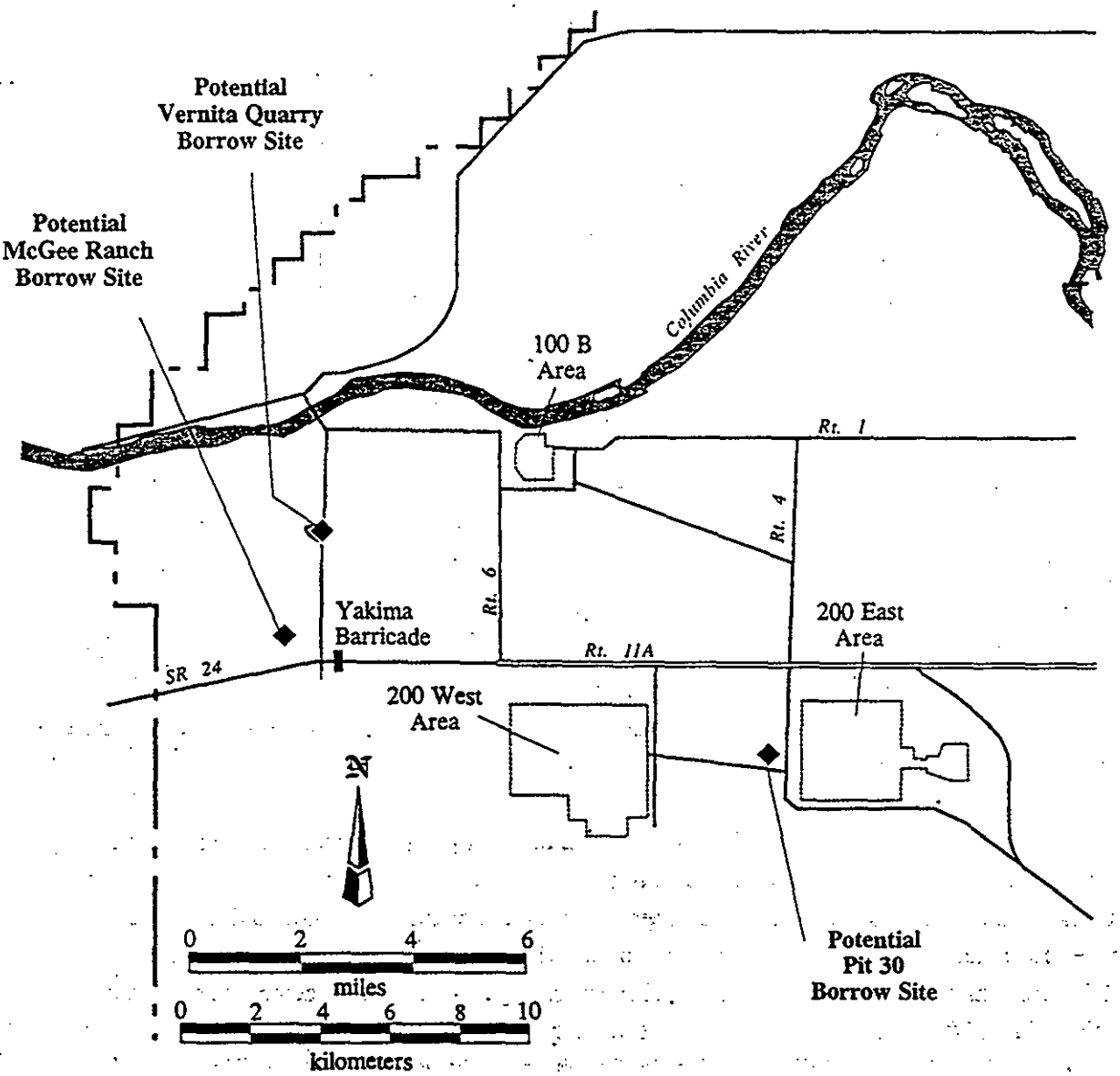
Figure B.6.2.1 Candidate Borrow Sites for TWRS



NOTE: Borrow sites not drawn to scale

LEGEND

◆ Potential Borrow Site

Hanford Site Boundary

SOURCE: Adapted from DOE 1993e

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HTA FDEIS

APPENDIX E

Quarry Sites, Borrow Pits, Haul Roads, Railroads, Barrier Description

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APPENDIX E

QUARRY SITES, BORROW PITS, HAUL ROADS, RAILROADS, BARRIER DESCRIPTION

Two borrow pits and one quarry site have been identified as potential sources of construction materials for isolation barriers related to the *Hanford Remedial Action Environmental Impact Statement*. These are the McGee Ranch, Pit 30, and Gable Butte. The McGee Ranch would serve as a source of fine material, Pit 30 would provide coarser aggregates, and Gable Butte would provide basalt riprap. Tentative haul routes have also been identified. These routes generally follow existing roads and would not require new or extensive construction. Based on information received from Westinghouse Hanford Company (WHC 1994), construction materials would be hauled from the quarry and borrow site with conventional 10-ton truck-trailer combinations. Large scale mining trucks (50 tons) are not planned for this portion of the action.

To provide conservative estimates of impacts and costs related to the placement of barriers, it was determined that the Hanford Barrier would be used for all sites. This is done strictly for purposes of conservative analysis. The discussion of the Hanford Barrier provided in this appendix deals with the concepts behind the Hanford Barrier. Details regarding volumes and costs of barriers may be found in Appendix H, Cost and Physical Impact Assessment.

E.1 QUARRY SITES AND ROADS

The following sites are presented for the purpose of discussion and speculation only. This discussion does not represent an analysis of all of the available sites. It is understood that there are important intangibles and other considerations attached to some of these sites. A complete analysis of each potential site and consultations with state, federal, and tribal interests would be required prior to the final selection(s).

E.1.1 McGee Ranch

The McGee Ranch has been selected as a possible borrow site for fine-grained soils to be used to construct permanent isolation barriers for closure of waste sites at the Hanford Site. Fine-grained soils may be used as topsoil for the barrier (Figure E-1).

The McGee Ranch is located near the west boundary of the Hanford Site, north of State Highway 24, west of State Highway 240 and south of the Columbia River. The site encompasses 873 ha (2,182 ac) and has approximately 36.1 million m^3 (47.3 million yd^3) of proven reserves (Lindberg 1994; Skelly 1992).

The Hanford Cultural Resources Laboratory has conducted an archaeological survey of the McGee Ranch (PNL 1992) and has determined that there are historic and prehistoric cultural

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resources associated with this site. Prior to initiating activities at the McGee Ranch, requests for determination of eligibility, findings of effect and adverse effect, and plans for mitigating adverse impacts of the proposed action would need to be prepared and submitted to the appropriate federal, state, and tribal interests.

A brief survey for sensitive species was conducted in 1991 (WHC 1991). No threatened or endangered species were encountered. Other species of concern potentially associated with the site include the loggerhead shrike (*Lanius ludovcianus*) and Swainson's hawk (*Buteo swainsoni*). Assuming total use of the site, operation of the McGee Ranch borrow pit would eradicate 652 ha (1,629 ac) of shrub-steppe. Prior to initiating the development of the site, it would be necessary to consult with the state and the U.S. Fish and Wildlife Service (FWS) regarding sensitive species.

No wetlands are associated with the McGee Ranch. At one time however there was a small seep associated with an uncapped well on the site. This seep provided some value to wildlife but the well has since been capped and the seep dried up.

Use of the McGee Ranch as a borrow site would result in an extensive below grade excavation, altering the undulating terrain in the area. The local vista would be altered from relatively level grasslands. Excavation would also generate fugitive dust as the result of excavating, loading, and hauling fill materials. Dust could temporarily obscure local views of the area and reduce visibility. Potential mitigation measures could include using water and crusting agents to control dust and tarping or otherwise covering all loads.

E.1.2 Pit 30

Pit 30 is an existing borrow site immediately adjacent to the west side of the 200-East Area. This is a disturbed site associated with pre-Hanford farming activity. The proposed action would potentially impact 172 ha (426 ac), including the existing 49-ha (120-ac) pit. Although a formal calculation of total reserves is not available, it is estimated that the site could produce approximately 15.3 million m^3 (20 million yd^3) of material. Pit 30 would provide aggregate to be used as graded filter material in the Hanford Barrier (Figure E-1) and other graded barriers initiating an expansion of the existing pit. Full use of the site would eradicate approximately 138 ha (345 ac) of shrub-steppe. Cultural resource and sensitive species surveys have not been conducted for Pit 30 and would be required prior to excavation. Preliminary information received from the FWS and the state of Washington indicate that there are no sensitive species associated with this site. Prior to initiating activity, it would be necessary to complete these surveys and consult with the state of Washington and the FWS. If necessary, mitigation plans would need to be developed to address potential adverse impacts. Visual impacts would be reduced since it is an existing site and enlargement of the pit wold not appreciably alter the existing landscape. Excavation activities would generate fugitive dust that could temporarily obscure local vistas. Potential mitigation could include using water and crusting agents to control dust and tarping or otherwise covering all loads.

E.1.3 Gable Butte

The Gable Butte site consists of 135 ha (333 ac) of basalt outcrop immediately west of "Gable Butte proper." The material to be excavated is above ground and hauling from a pit would not be required. Reclamation of the site would be relatively simple and inexpensive since

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there would be no pit to fill or otherwise reclaim. The terrain would be leveled/contoured and revegetated when the quarry is exhausted. Sufficient space exists for support facilities (crushers, shakers, stockpiles). The Gable Butte site is located closer to potential barrier sites than any other candidate site, significantly reducing transportation costs. There is also an existing railroad to the 200 Areas from Gable Butte. Dust generated by quarry operations would minimally impact traffic since the roads in the vicinity are not heavily used.

The selection of a basalt quarry site was based on a need for approximately 169,000 m^3 (220,000 yd^3) for the Columbia River, 9.4 million m^3 (12.3 million yd^3) for Reactors on the River, 34.5 million m^3 (45.2 million yd^3) of basalt riprap for barriers on the Central Plateau, and 4.3 million m^3 (5.7 million yd^3) for All Other Areas (see Appendix H, Table H-14). These requirements are based on the assumption that a capping alternative using a Hanford Barrier would be implemented at each of the four geographic areas. The Environmental Restoration Disposal Facility (ERDF) would require an estimated additional 2.3 million m^3 (3 million yd^3) of basalt riprap[1]. Other requirements for basalt include road construction for reactor block transport, improvements on State Highway 240, and other road work. The total basalt requirement is roughly 50 million m^3 (65 million yd^3). Although a formal calculation of total reserves at the Gable Butte site is not available, it is estimated that the site could produce sufficient basalt to satisfy this requirement. Gable Butte was selected as the preferred basalt quarry site based on engineering criteria described in the *Site Evaluation Report for Candidate Basalt Quarry Sites*. Six other sites were evaluated but were not selected since they did not fit engineering criteria as well as Gable Butte.[1]

The Gable Butte site was selected entirely on the basis of engineering criteria. All principals acknowledge that there are significant cultural resource issues associated with this site. Gable Butte and Gable Mountain have been nominated for inclusion in the *National Register of Historic Places* as an Archaeological District. Numerous sites and artifacts (isolates) are associated with Gable Butte. It is also considered a traditional cultural property. In this case "cultural property" may mean a location identified with traditional beliefs and cultural history of a Native American group. It is also a site where practitioners of a Native American religion have gone, and still go when possible, to conduct traditional ceremonies and other rituals.

Based on maps provided by the FWS and the state of Washington, there are no wetlands or sensitive species associated with the Gable Butte site. Removal of basalt would require the use of explosives. Blasting would create a sharp report accompanied by a dust cloud. One isolated blast may have minimal impact on wildlife in the vicinity of the project. Repeated explosions may cause a variety of reactions. Some wildlife may desert the area and continue to avoid it for the duration of operations. Other wildlife may accommodate the disturbance and continue to live in the vicinity of the quarry site. To avoid potential adverse impacts on endangered or other sensitive species in the project vicinity, it may be necessary to limit blasting on a seasonal basis. Actual need for such restrictions can best be determined after wildlife surveys have been conducted. Sensitive species and wetlands surveys would be required before using this site. In addition, approval would be required from the State Historic Preservation Office and the Hanford Site Historic Preservation Office.

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[1] *Site Evaluation Report for Candidate Basalt Quarry Sites*, Draft - Not Approved For Public Release, WHC, Richland, Washington.

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Gable Mountain is a prominent visual feature of the Hanford Site. Excavation would permanently alter this topographic feature and would be visible for long distances. Visual impacts would be greatest at this site. Excavation activities at Gable Butte, including blasting, would generate fugitive dust, temporarily reducing visibility and obscuring local vistas. Dust generation could be partially mitigated by using water to control dust and tarping or otherwise covering all loads. It may be impossible to control dust generated by blasting but this would likely be of short-term consequence.

E.2 HAUL ROADS

The proposed quarry and borrow sites would be served by existing roads and railroads. The majority of these roads are paved and would support conventional 10-ton trucks but would require reinforcement for continuous heavy truck use. Existing railroads appear to be in good repair and can be readily placed in service.[2] No permanent changes to topography or viewscape would occur. Some dust might be generated by the movement trucks over haul roads, but this impact is not expected to be significant. Potential mitigation could include using water and crusting agents to control dust or tarping or otherwise covering loads.

E.2.1 McGee Ranch Haul Roads

Trucks would exit the McGee Ranch borrow site by turning right onto southbound State Highway 24. This allows the trucks to move with the flow of traffic and not cross traffic. At the intersection with Route 11A (Yakima Barricade), the trucks would turn left on Route 11A, across traffic, and proceed west to Route 4 North. At the intersection with Route 4 North, the trucks would turn right and proceed south to local roads serving the 200-East and 200-West areas and ERDF.

Safety problems associated with this route include merging heavily loaded, slow moving trucks into highway traffic on State Highway 24, crossing lanes of oncoming traffic when turning west on Route 11A, and crossing lanes of oncoming traffic when returning to Route 11A and when entering the McGee Ranch. Flaggers, merge lanes, and traffic control devices may improve safety along heavily travelled roads. A transportation study, underway as of this writing, may determine alternate haul routes for transporting material from the McGee Ranch.

E.2.2 Pit 30 Haul Roads

Pit 30 is located in close proximity to the 200 Areas and ERDF. Trucks would be able to access all areas with minimal impact on traffic.

E.2.3 Gable Butte Haul Roads and Railroads

Trucks leaving the proposed Gable Butte quarry would proceed south on an existing road to Route 11A. At 11A trucks would turn left, proceeding east to Route 4 North. At Route 4 North, the trucks would turn right and proceed south into the proposed service area.

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[2] Personal communication with David Duranceau, WHC, Environmental Technology and Assessment, Richland, Washington.

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- 1 Water Truck Operator
- 1 Grade Checker
- 1 Foreman
- 1 Supervisor
- 1 Oiler
- 1 Quality Control Technician.

for a total of 12 workers per crew. Placement of the asphalt is also assumed to require a crew of 12 workers. Material transport labor estimates are based on the number of trucks per day discussed below and a construction duration of 1,000 working days. The estimated labor associated with each barrier, provided in Table 9-5, ranges from 21,000 worker-days for the low-infiltration barrier to 84,000 worker-days for the Hanford Barrier. Assuming that the construction period is 4 years (1,000 working days), multiple crews will be needed and construction of the barriers will result in between 21 and 84 jobs over a 4-year period.

Material Usage. Thicknesses for each component in the barriers are discussed in Section 8.5. The assumptions for the area estimates are provided above in the cost discussion. Estimated quantities of materials used for each barrier, summarized in Table 9-6, are based on the following assumptions:

- The silt quantities include silt layers and 85% of the silt and gravel admix
- The gravel quantities include gravel filter material, drainage gravel, drainage rock, the asphalt base course, and 15% of the silt and gravel admix.

The silt will likely be obtained from the McGee Ranch site. The Hanford Barrier requires twice as much silt as the modified Hanford barrier and four times as much silt as the low-infiltration soil barrier. Furthermore, only the Hanford Barrier uses crushed basalt, which will likely be obtained from a quarry to be developed somewhere on the Hanford Site.

The sand, gravel, and general fill will likely be obtained from native soil excavated for the ERDF trench. Therefore, they will have no impact on cultural and ecological resources at borrow sources. If materials excavated for the ERDF are not suitable, these granular materials will likely be obtained from gravel pits located between the 200 East and 200 West Areas. The vegetation seed, geotextiles, and asphalt materials will likely be obtained from off-Hanford Site suppliers.

Impacted Areas at the Borrow Sources. Assuming the silt and basalt usage estimates provided in Table 9-6, areas impacted at McGee Ranch and at the basalt borrow source can be estimated. The estimated areas provided below assume that the excavation depths will average 5 m (16 ft) at McGee Ranch and 10 m (33 ft) at the basalt borrow source.

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Impacted Areas at the Borrow Sources			
	Low-Infiltration Soil Barrier (km^2)	Modified Hanford Barrier (km^2)	Hanford Barrier (km^2)
McGee Ranch	0.14	0.26	0.54
Basalt Borrow Source	0	0	0.22
Note: 1 km^2 = 250 acres = 0.4 mi^2			

Traffic Loads. Materials included in the barriers that must be imported from off the ERDF site are vegetation (seed), silt, geotextile filter, crushed basalt, asphalt coating, and asphalt. Volumes of seed and asphalt coating are much less that the other materials and will not be evaluated in terms of traffic load. The assumed daily quantity of material transported per truck is provided for each material. The daily traffic loads are calculated assuming that the barriers are built over a period of 1,000 working days (approximately 4 years). The results are summarized below:

Traffic Associated with Barrier Construction (Trucks per day)				
	Daily Quantity Per Truck	Low-Infiltration Soil Barrier	Modified Hanford Barrier	Hanford Barrier
Silt	150 m^3	5	9	18
Geotextile Filter	20,000 m^2	0	0	<1
Crushed Basalt	150 m^3	0	0	15
Asphalt	100 m^3	0	2	2
Total		5	11	35

Fate and Transport Parameters. The only barrier-specific parameter used in the simulations presented in Appendix A is the infiltration rate. Based on the HELP modeling results presented in Appendix B, the infiltration rates through the three barriers are similar for current climatic conditions and are very close to zero. Results are also presented in Appendix B for a hypothetical wetter climate that uses Spokane climatic data. Infiltration increases for all three barriers under these wetter conditions. Under wet conditions, the infiltration rate for the low permeability soil barrier is approximately 15 times greater than for the modified Hanford and Hanford Barriers (which are virtually identical). The infiltration rates assumed for the simulations in Appendix A are summarized below:

Barrier Infiltration Rates (cm/yr)			
	Low-Infiltration Soil Barrier	Modified Hanford Barrier	Hanford Barrier
Current Climate	0.01	0.01	0.01
Wet Climate	5	0.4	0.4
Notes: 1 cm = 0.39 in.			

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Implementability. Implementability scores are summarized in Table 9-12. This alternative has a total of 19 layers in the barrier and liner, giving it a low technical implementability score.

Cost. As summarized on Table 9-13, the total net present value for this alternative is $920 million. This is the most expensive alternative.

9.6 COMPARATIVE ANALYSIS

A summary of the alternative rankings for each of the criteria is provided in Table 9-14. The following conclusions may be drawn from the summary ranking and other information provided in the detailed evaluations:

- Groundwater protection is primarily a function of the surface barrier. All three barriers provide equivalent groundwater protection under current climate conditions. Under hypothetical wetter climate conditions, however, alternatives with the Hanford Barrier and modified Hanford barrier provide better groundwater protection than alternatives with the low-infiltration soil barrier.

- The Hanford Barrier is more reliable than the modified Hanford barrier, which is itself more reliable than the low-infiltration soil barrier.

- Given the fate and transport assumptions used in this analysis, alternatives with no liner provide similar groundwater protection as alternatives with a liner. Furthermore, the single liner is virtually equivalent in effectiveness to the double liner.

- The most important advantage of alternatives with a liner is that they provide a means to determine the validity of assumptions regarding leachate generation and leachate quality. If these assumptions prove to be non-conservative, it would be possible to initiate corrective action.

- Alternatives with the Hanford Barrier provide the best long-term effectiveness but at the expense of greater impacts on the environment and higher costs.

- Worker risk is dominated by operations, which is the same for all the alternatives. Consequently, the expected number of worker fatalities ranges from 0.52 to 0.60 over the life of the facility, and is not a useful differentiator between the alternatives.

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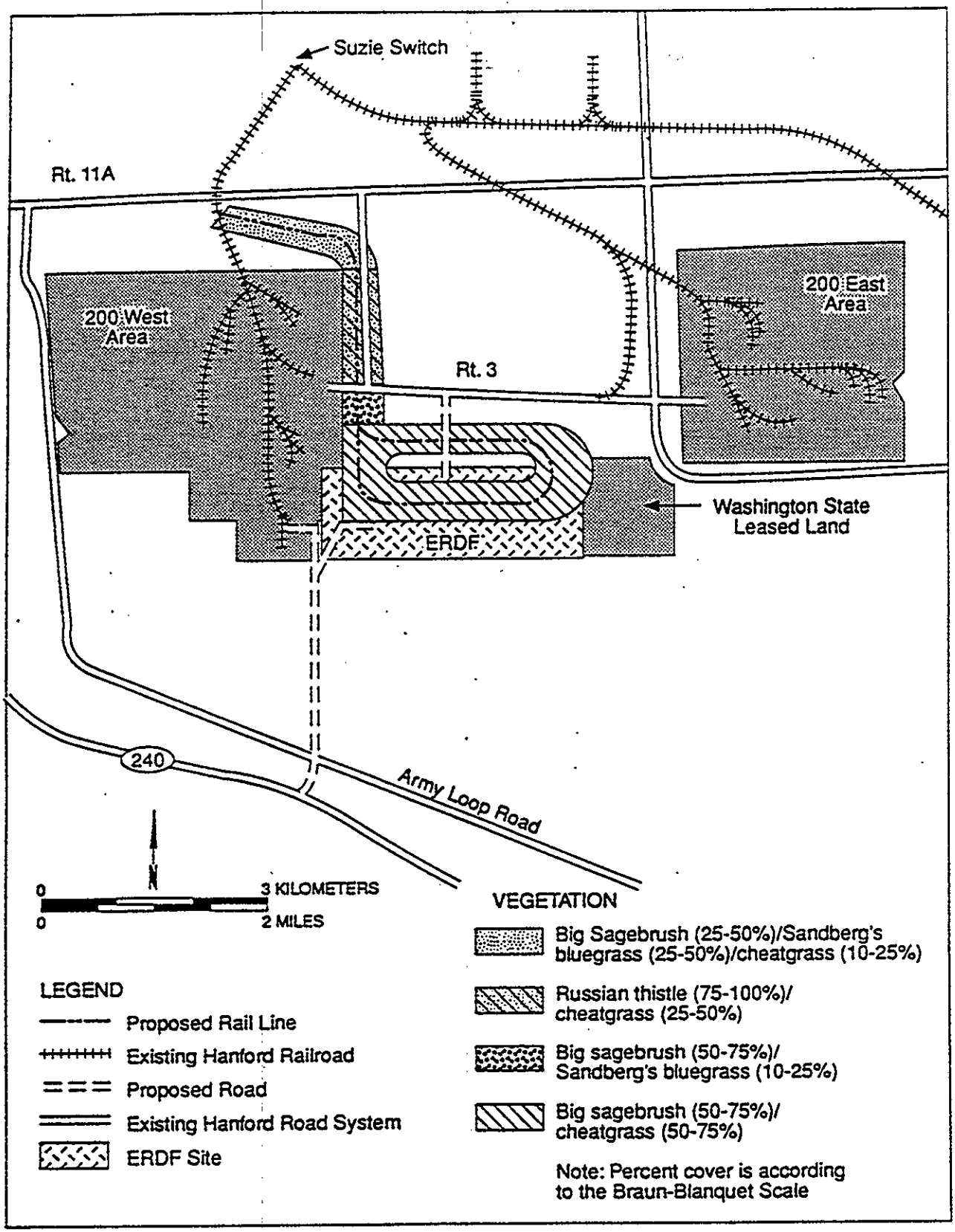

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Figure 9-1. Location of Proposed Rail Lines and Roads.

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Table 9-1. Summary of Remedial Action Components for ERDF Alternatives. RDW 7-30-96

Alternative Number	No Liner	Single Liner	Double Liner	Low Infiltration Soil Cover	Modified Hanford Barrier	Hanford Barrier
1						
2	X			X		
3	X				X	
4	X					X
5		X		X		
6		X			X	
7		X				X
8			X	X		
9			X		X	
10			X			X

Note: "X" indicates the technology is included in the alternative.
Blank spaces indicate the technology is not part of the alternative.

ALTERNATIVE NAMES

1. No Action Alternative
2. No Liner with a Low Infiltration Soil Cover
3. No Liner with a RCRA Compliant Barrier
4. No Liner with a Hanford Barrier
5. Single Composite Liner with Low Infiltration Soil Cover
6. Single Composite Liner with a RCRA Compliant Barrier
7. Single Composite Liner with a Hanford Barrier
8. Double Composite Liner with a Low Infiltration Soil Cover
9. Double Composite Liner with a RCRA Compliant Barrier
10. Double Composite Liner with a Hanford Barrier

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Table 9-2. Raw Liner Construction Costs.

	Single Liner	Double Liner
Bottom Liner (864,000 m^2)		
Unit Cost (per m^2)	$31.56	$70.54
Total Cost for Bottom	$27 million	$61 million
Sideslope Liner (417,000 m^2)		
Unit Cost (per m^2)	$28.72	$63.79
Total Cost for Sideslope	$12 million	$27 million
Total Liner Cost	$39 million	$88 million
Note: Unit costs for liners are based on information provided in Section 8.6.		

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Table 9-3. Labor Requirements for Construction of the Liners.

Layer	Crew Size	Material Placement Rate (per day)	Single Liner		Double Liner	
			Material Quantity	Labor (days)	Material Quantity	Labor (days)
Operations Layer (m^3)	11	2,000	1.20E+06	6,600	1.20E+06	6,600
Geotextile Separator (m^2)	24	7,500	8.60E+05	2,752	8.60E+05	2,752
Drainage Gravel (m^3)	9	750	2.60E+05	3,120	5.20E+05	6,240
Drainage Geocomposite (m^2)	24	5,000	4.20E+05	2,016	8.30E+05	3,984
Geotextile Cushion (m^2)	24	7,500	8.60E+05	2,752	2.60E+06	8,320
HDPE (m^2)	24	2,500	1.30E+06	12,480	2.60E+06	24,960
Bentonite Admix (m^3)	18	1,500	3.90E+05	4,680	1.20E+06	14,400
Subgrade (m^2)	4	5,000	1.30E+06	1,040	1.30E+06	1,040
Material Transport				5,000		11,000
Total				40,440		79,296

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Table 9-4. Total Material Requirements for the Trench Liners.

	Single Liner		Double Liner	
	Thickness (m)	Quantity (million)	Thickness (m)	Quantity (million)
General Fill (Bottom and Sideslope)	0.9	1.2 m^3	0.9	1.2 m^3
Geotextile Separator (Bottom only)	(area)	0.86 m^2	(area)	0.86 m^2
Gravel (Bottom only)	0.3	0.26 m^3	0.3x2	0.52 m^3
Geotextile Cushion (Bottom only)	(area)	0.86 m^2	(area)x3	2.6 m^2
Drainage Geocomposite (Sideslope only)	(area)	0.42 m^2	(area)x2	0.83 m^2
HDPE Geomembrane (Bottom and Sideslope)	(area)	1.3 m^2	(area)x2	2.6 m^2
Sand (Bottom and Sideslope)	0.24	0.31 m^3	0.72	0.92 m^3
Bentonite (Bottom and Sideslope)	0.06	0.08 m^3	0.18	0.23 m^3

Notes:
(area) - Two-dimensional material that is considered to have a thickness of zero.
Assumes areas of 864,000 m^2 for the bottom liner and 417,000 m^2 for the sideslope liner.
1 m = 3.28 ft

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Table 9-5. Labor Requirements for Construction of the Barriers. RDW 7-30-96

Layer	Material Placement Rate[a] (per day)	Low-Infiltration Soil Barrier		Modified Hanford Barrier		Hanford Barrier	
		Material Quantity	Labor (days)	Material Quantity	Labor (days)	Material Quantity	Labor (days)
Silt Admix (m^3)	3,000	8.16E+05	3,264	6.80E+05	2,720	1.47E+06	5,880
Silt (m^3)	1,500			6.80E+05	5,440	1.47E+06	11,760
General Fill (m^3)	5,000	5.44E+06	13,056	4.08E+06	9,792		
Geofilter (m^2)	7,500					1.46E+06	2,336
Sand Filter (m^3)	1,500			2.04E+05	1,632	2.20E+05	1,760
Gravel Filter (m^3)	1,500			2.04E+05	1,632	4.41E+05	3,528
Crushed Basalt (m^3)	1,500					2.21E+06	17,640
Drainage Gravel (m^3)	1,500			2.04E+05	1,632	4.41E+05	3,528
Asphalt (m^3)	2,000			2.04E+05	1,224	2.20E+05	1,320
Base Course (m^3)	1,500			1.36E+05	1,088	1.47E+05	1,176
Material Transport			5,000		11,000		35,000
Total			21,320		36,160		83,928

[a]Assumes a crew size of 12 workers.

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Table 9-6. Material Requirements for the Barriers.

	Low Infiltration Soil Barrier		Modified Hanford Barrier		Hanford Barrier	
	Thickness (m)	Quantity (million)	Thickness (m)	Quantity (million)	Thickness (m)	Quantity (million)
Vegetation	(area)	1.36 m^2	(area)	1.36 m^2	(area)	1.47 m^2
Silt	0.5	0.68 m^3	0.93	1.3 m^3	1.85	2.7 m^3
Sand	0	0	0.15	0.20 m^3	0.15	0.22 m^3
Gravel	0.1	0.14 m^3	0.47	0.64 m^3	0.85	1.2 m^3
General Fill	4.0	5.4 m^3	3.0	4.1 m^3	0	0
Geotextile Filter	0	0	0	0	(area)	1.47 m^2
Crushed Basalt	0	0	0	0	1.5	2.2 m^3
Asphalt Coating	0	0	(area)	1.36 m^2	(area)	1.47 m^2
Asphalt Concrete	0	0	0.15	0.20 m^3	0.15	0.22 m^3
Asphalt Base Course	0	0	0.10	0.10 m^3	0.10	0.10 m^3

Notes:
(area) - Two-dimensional material that is considered to have a thickness of zero.
Assumes areas of 1.36 million m^2 for the low permeability soil barrier and modified Hanford barrier and 1.47 million m^2 for the Hanford Barrier.
1 m = 3.28 ft

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TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Alternative Schedules For FEIS

ORIGINATOR Colin Henderson DATE 6/25/96

REVISION NO. 0

OBJECTIVE Modify the alternative schedules in the DEIS to move Construction start dates from 1997 to 1998 or 1999 as appropriate, modify operating durations to agree with processing requirements.

METHODOLOGY Using facility sizing data from waste loading Calculations adjust the alternative schedules.

ASSUMPTIONS Construction For Treatment facilities for all exsitu alternatives except Phase D Implementation will start No Sooner than 1999. Construction for Retrieval & Transfer would Start no sooner than 1998. Phase I Construction would start in 1998.

(Continue on another sheet if necessary)

Col Henderson
SIGNATURE/DATE

CHECKED/DATE

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\CALCVR.SHT

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NO ACTION SCHEDULE							**FEIS SCHEDULE**		
			DEIS CHAPTER 3 SCHEDULE			Duration			Duration
Continued Operations			1997-2097			100 yrs	1997-2097		100 yrs
LONG-TERM MANAGEMENT SCHEDULE									
Continued Operations									
Construction									
Waste Retrieval			2033-2037	2083-2087		4 yrs each	2033-2037	2083-2087	4 yrs ea.
New Tanks			2033-2037	2083-2087		4 yrs each	2033-2037	2083-2087	4 yrs ea.
Operations			2037-2042	2087-2092		5 yrs each	2037-2042	2087-2092	5 yrs ea
D&D			2042-2047	2092-2097	42-49,92-99 for WR&T	5 yrs	2042-2047	2092-2097	5 yrs
Monitoring & Maintenance			1997-2097			100 yrs	1997-2097		100 yrs
IN SITU FILL AND CAP SCHEDULE									
Continued Operations			1997-2009			12 yrs	1997-2009		12 yrs
Research and Development			N/A				N/A		
Construction			2003-2005			2 yrs	2003-2005		2 yrs
Operation			2000-2009			9 yrs	2000-2009		9 yrs
D&D			2009-2012			3 yrs	2009-2012		3 yrs
Monitoring and Maintenance			2009-2029			20 yrs	2009-2029		20yrs
Closure			2012-2029			17 yrs	2012-2029		17 yrs
Post Closure Monitoring			2029-2129			100 yrs	2029-2129		100 yrs
IN SITU VITRIFICATION SCHEDULE									
			DEIS CHAPTER 3 SCHEDULE				FEIS		
Continued Operations			1997-2013			16 yrs	1997-2013		16 yrs
Research and Development			1997-2002			5 yrs	1997-2002		5 yrs
Construction			1998-2016			18 yrs	1999-2016		17 yrs
Operation			2005-2016			11 yrs	2005-2016		11 yrs
DST evaporation			2000-2005			5 yrs	2000-2005		5 yrs
ISV start up			2005-2008			3 yrs	2005-2008		3 yrs
ISV operation			2008-2013			5 yrs	2008-2013		5 yrs
D&D			2013-2016			3 yrs	2013-2016		3 yrs
Monitoring and Maintenance			2016-2033			17 yrs	2016-2033		17 yrs
Closure			2016-2033			17 yrs	2016-2033		17 yrs
Post Closure Monitoring			2033-2133			100 yrs	2033-2133		100 yrs
EX SITU INTERMEDIATE SEPARATIONS SCHEDULE									
			DEIS CHAPTER 3 SCHEDULE						
Continued Operations							1997-2022		25 yrs
Research and Development			1995-2018			23 yrs	1997-2018		21 yrs
Construction									
Waste Retrieval and Transfer			1998-2017			19 yrs	1998-2017		19 yrs
Waste Treatment			1997-2007			10 yrs	1999-2009		10 yrs
HLW							2003-2009		6 yrs
LAW							1999-2004		5 yrs
Operation									
Waste Retrieval			2001-2024			23 yrs	2001-2022		21 yrs
Treatment			2004-2024			20 yrs			
Pretreatment							2004-2022		18 yrs
LLW Vitrification			2004-2024			20 yrs	2005-2022		17 yrs
HLW Vitrification			2011-2024			13 yrs	2011-2022		11 yrs
LLW Disposal							2005-2022		17 yrs
HLW Transportation and Disposal			2019-2029			10 yrs	2022-2040		18 yrs
D&D									
Waste Retrieval facilities			2013-2026			13 yrs	2013-2025		12 yrs
Treatment Facilities			2024-2033			9 yrs	2022-2031		9 yrs
Monitoring and Maintenance									
HLW	(assess impacts for 50 yr period)		2024-2029			5 yrs	2022-2040		18 yrs
LLW Disposal									
Closure			2010-2034			24 yrs	2010-2034		24 yrs
Post Closure Monitoring			2034-2134			100 yrs	2034-2134		100 yrs
EX SITU NO SEPARATIONS (VITRIFICATION AND CALCINATION)									
			PDEIS CHAPTER 3 SCHEDULE						

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Continued Operations							1997-2020		23 yrs
Research and Development			1995-2005			10 yrs	1997-2007		10 yrs
Construction									
Waste Retrieval and Transfer			1998-2017			19 yrs	1998-2017		19 yrs
Waste Treatment			1997-2002			5 yrs	1999-2005		6 yrs
Operation									
Waste Retrieval			2001-2019			18 yrs	2003-2020		17 yrs
HLW Vitrification			2004-2019			15 yrs	2006-2020		14 yrs
HLW Transportation and Disposal			2017-2037			20 yrs	2020-2040		20 yrs
D&D									
Waste Retrieval facilities			2013-2021			8 yrs	2015-2023		8 yrs
Treatment Facilities			2019-2024			5 yrs	2020-2025		5 yrs
Monitoring and Maintenance									
HLW	(assess impacts for 50 yrs)		2019-2037			18 yrs	2020-2040		20 yrs
Closure			2010-2024			14 yrs	2011-2025		14 yrs
Post Closure Monitoring			2024-2124			100 yrs	2025-2125		100 yrs
EX SITU EXTENSIVE SEPARATIONS SCHEDULE									
			DEIS CHAPTER 3 SCHEDULE						
Continued Operations							1997-2023		26 yrs
Research and Development			1995-2018			23 yrs	1997-2018		21 yrs
Construction									
Waste Retrieval and Transfer			1998-2017			19 yrs	1998-2016		18 yrs
Waste Treatment			1997-2006			9 yrs	1999-2011		12 yrs
HLW							2001-2006		6 yrs
LAW							1999-2004		5 yrs
Operation									
Waste Retrieval			2001-2024			23 yrs	2003-2023		20 yrs
Treatment			2004-2024			20 yrs	2004-2023		19 yrs
Pretreatment							2004-2023		19 yrs
LLW Vitrification							2006-2023		17 yrs
HLW Vitrification							2013-2023		10 yrs
LLW Disposal							2006-2023		17 yrs
HLW Transportation and Disposal			2020-2029			9 yrs	2022-2025		3 yrs
D&D									
Waste Retrieval facilities			2012-2025			13 yrs	2014-2024		10 yrs
Treatment Facilities			2024-2029			5 yrs	2023-2028		5 yrs
Monitoring and Maintenance									
HLW			2024-2029			5 yrs	2023-2025		2 yrs
LLW Disposal									
Closure			2010-2030			20 yrs	2012-2032		20 yrs
Post Closure Monitoring			2030-2130			100 yrs	2032-2132		100 yrs
EX SITU/IN SITU COMBINATION 2									
Continued Operations							1997-2022		25 yrs
Research and Development							1997-2018		21 yrs
Construction									
Waste Retrieval and Transfer							1998-2016		18 yrs
Waste Treatment							1999-2008		9 yrs
HLW							2002-2008		6 yrs
LAW							1999-2004		5 yrs
Fill & Cap							2003-2005		2 yrs
Operation									
Waste Retrieval							2002-2022		20 yrs
Treatment							2004-2022		18 yrs
Pretreatment							2004-2022		18 yrs
LLW Vitrification							2005-2022		17 yrs
HLW Vitrification							2009-2022		13 yrs
LLW Disposal									
HLW Transportation and Disposal							2022-2040		18 yrs
Fill and Cap Operations							2000-2009		9 yrs
D&D									
Waste Retrieval facilities							2013-2024		11 yrs
Treatment Facilities							2022-2031		9 yrs
Fill and Cap Equipment							2022-2025		3 yrs
Monitoring and Maintenance									

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	HLW							2022-2040		18 yrs
Closure								2010-2032		22 yrs
Post Closure Monitoring								2032-2132		100 yrs
EX SITU/IN SITU COMBINATION 1										
				DEIS CHAPTER 3 SCHEDULE						
Continued Operations								1997-2023		26 yrs
Research and Development				1995-2018			23 yrs	1997-2018		21 yrs
Construction										
	Waste Retrieval and Transfer			1998-2017			19 yrs	1998-2016		18 yrs
	Waste Treatment			1997-2007			10 yrs	1999-2009		10 yrs
	HLW							2003-2009		6 yrs
	LAW							1999-2005		6 yrs
	Fill & Cap			2003-2005			2 yrs	2003-2005		2 yrs
Operation										
	Waste Retrieval			2001-2024			23 yrs	2002-2022		20 yrs
	Treatment			2004-2024			20 yrs	2005-2023		18 yrs
	Pretreatment							2005-2023		18 yrs
	LLW Vitrification							2006-2023		17 yrs
	HLW Vitrification							2010-2023		13 yrs
	LLW Disposal							2006-2023		17 yrs
	HLW Transportation and Disposal			2019-2029			10 yrs	2022-2040		18 yrs
	Fill and Cap Operations			2005-2018			13 yrs	2000-2009		9 yrs
D&D				2019-2028			9 yrs			
	Waste Retrieval facilities			2012-2026			14 yrs	2013-2024		11 yrs
	Treatment Facilities			2024-2033			9 yrs	2023-2032		9 yrs
	Fill and Cap Equipment			2018-2021			3 yrs	2022-2025		3 yrs
Monitoring and Maintenance										
	HLW			2024-2029			5 yrs	2023-2040		17 yrs
Closure				2010-2034			24 yrs	2011-2035		24 yrs
Post Closure Monitoring				2034-2134			100 yrs	2035-2135		100 yrs
PHASED IMPLEMENTATION SCHEDULE				Phase 1		Phase 2		Phase 1	Phase 2	
				DEIS CHAPTER 3 SCHEDULE						
Continued Operations								1997-2028		31 yrs
Research and Development										
Construction										
	Phase 1			1997-2002			5 yrs	1998-2002		4 yrs
	Retrieval					2004-2020	16 yrs		2004-2020	16 yrs
	Phase 2					2005-2012	7 yrs		2006-2012	6 yrs
	HLW								2007-2012	5 yrs
	LAW								2006-2011	5 yrs
Operation										
	Phase 1			2002-2012			10 yrs			
	LAW Treatment Plants							2002-2012		10 yrs
	HLW Treatment Plant							2002-2008		6 yrs
	Phase 2									
	Waste Retrieval					2007-2028	21 yrs		2008-2028	20 yrs
	Treatment					2011-2028	17 yrs			
	HLW								2012-2028	16 yrs
	LAW								2011-2024	14 yrs
D&D						2015-2031	16 yrs		2015-2031	16 yrs
Monitoring and Maintenance										
	HLW								2028-2040	12 yrs
HLW Transportation									2022-2040	18 yrs
Closure						2016-2040	24 yrs		2016-2040	24 yrs
Post Closure M&M						2040-2140	100 yrs		2040-2140	100 yrs
	CAPSULES NO ACTION			DEIS CHAPTER 3 SCHEDULE						
Continued Operation				1997-2007			10yrs	1997-2007		10 yrs
Research and Development										
Construction										
Operation										
D&D										

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Monitoring and Maintenance									
CAPSULES ONSITE DISPOSAL									
			DEIS CHAPTER 3 SCHEDULE						
Continued Operation			1997-2028			31 yrs	1997-2028		31 yrs
Research and Development									
Construction			2002-2009			7 yrs	2002-2009		7 yrs
Operation			2010-2029			19 yrs	2010-2029		19 yrs
D&D									
Monitoring and Maintenance			2029-2129			100 yrs	2029-2129		100 yrs
CAPSULES OVERPACK AND SHIP									
			DEIS CHAPTER 3 SCHEDULE						
Continued Operation			1997-2028			31 yrs	1997-2028		31 yrs
Research and Development									
Construction			2002-2009			7 yrs	2002-2009		7 yrs
Operation			2010-2028			18 yrs	2010-2028		18 yrs
HLW Transportation and Disposal			2028-2029			1 yrs	2028-2029		1 yr
D&D									
Monitoring and Maintenance			2010-2029			19 yrs	2010-2029		19 yr
CAPSULES VITRIFY WITH TANK WASTES									
			DEIS CHAPTER 3 SCHEDULE						
Continued Operation			1997-2023			26 yrs	1997-2023		26 yrs
Research and Development									
Construction			2002-2007			5 yrs	2007-2012		5 yrs
Operation			2005-2023			18 yrs	2012-2028		16 yrs
D&D			2024-2029			5 yrs	2028-2033		5 yrs
Monitoring and Maintenance			2023-2029			6 yrs	2028-2040		12 yrs
HLW Transporation to Repository							2022-2040		18 yrs

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Table 6-4. Operating Resource Requirements (Units As Indicated).

Operating Resource	No Separations
Materials[5] (Continued)	
Antifoam solution	0
Ammonia (Mg)	6.98E3
Oxygen (Mg)	1.85E5
Bulk sulfur cement	
Sulfur (Mg)	0
Dicyclopentadiene (Mg)	0
Oligomer (Mg)	0
Ion exchange media (m^3)	0
Concrete (Mg)	2.04E6[9]
Steel (Mg)	1.46E5[10]

Notes:

GWh = gigawatt hours
m^2 = square meters
m^3 = cubic meters
Mg = megagrams
yr = year

[1]Area committed is the radioactively contaminated vitrification facility (i.e., approximately 100m x 100m).

[2]Raw water is used is for cooling tower makeup. The makeup for loss through evaporation, bleedoff, and drift is based on a cooling tower duty of 605 gigawatt hours per year (GWh/yr).

[3]Sanitary water use includes potable water, process water, demineralized water, utility station water and water for HVAC air humidification. For users and quantities, potable water use assumes 20 gallons per day per person with an additional 10 percent contingency. The total onsite population is 708 for no separation case. Process water use is based upon cold chemicals makeup and decontamination and equipment flushing requirements. Demineralized water use is based upon makeup requirements for the electric steam generators, melter cooling water system, process cooling water system, and process chilled water system. Sanitary water use for utility stations assumes continuous flow at 0.00379 cubic meters per minute (1 gallon per minute) for each Tank Waste Remediation System treatment facility.

[4]The electrical load includes the following:

Process 180 GWh/yr	Process electric heaters, electric steam generators, compressors, blowers, agitators and pumps.

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Table 6-4. Operating Resource Requirements (Units As Indicated).

Notes (Continued):

HVAC 113 GWh/yr	Heating, ventilation, and air conditioning for the process and ancillary buildings.
Mechanical 7 GWh/yr	Operation of cranes, master-slave manipulators and other miscellaneous mechanical equipment. Average requirement is assumed to be 27 percent of the maximum requirement.
Electrical 35 GWh/yr	Lighting, uninterrupted power supply and miscellaneous electrical equipment requirement.

[5]Generally, material requirements are based on the Westinghouse Hanford Company material balances and the facility design capacities. The exceptions the decontamination chemicals (nitric acid, sodium hydroxide, potassium permanganate, oxalic acid, and trisodium phosphate) requirements.

[6]The nitric acid requirement for decontamination for each facility is based upon the estimated needs for a high-level waste facility (Hanford Waste Vitrification Plant (HWVP). For the No Separations Alternative, 45 m^3/yr of 50 percent nitric acid is assumed for decontamination during normal hot operations.

[7]The sodium hydroxide requirement for decontamination for each facility is based upon the estimated needs for a high-level waste facility (HWVP). For the No Separations Alternative, 19 m^3/yr of 50 percent sodium hydroxide is assumed for decontamination during normal hot operations.

[8]Potassium permanganate, oxalic acid, and trisodium phosphate are used in the decontamination facilities for decontamination only during normal hot operations. The requirement for each Tank Waste Remediation System treatment facilities is based upon the estimated needs for a high-level waste facility (HWVP).

[9]22,481 concrete high-level waste shielding casks x 90.7 Mg each equals 2,039,000 Mg.

[10]22,481 high-level waste multi-purpose container stainless steel unshielded canister x 6,500 kg each equals 146,126 Mg of steel.

For additional backup information, see Appendix B.

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Table 6-15. Decommissioning of Non-Contaminated Treatment/Storage Facilities[1] (Metric Kilotons).

Item	No Separations[2]
Steel Quantity Disposition	 52.2[3] Inplace entombment
Concrete Quantity Disposition	 150/2,000[4] Inplace entombment/regulated landfill
Soil Quantity Disposition	 0
Debris Quantity Disposition	 27.4[5] Regulated landfill

Notes:

[1]Decommissioning of radioactivity contaminated facilities in the 200E Area is by entombment. Reference 5.0 Wagoner "Hanford Mission Plan" DOE/RL-93-102, September 23, 1994.

[2]Assumptions for data:

The plant has operated without accident.

Spills have been properly cleaned up and decontaminated.

The cell liner has not been breached during plant operation.

In the Vitrification Building(s), related dedicated facilities and the receipt/sample facilities, the following is contaminated: 5 percent of the concrete, 5 percent of the carbon steel, 85 percent of the stainless steel and 100 percent of hastelloy/incon is contaminated.

In the centralized facilities, there is no concrete and no steel contamination.

There is no soil contamination.

Debris = 5 percent of contaminated/non-contaminated concrete plus steel quantities.

One m^3 of concrete = 732 kilograms or .75 kilotons.

All installed quantities of concrete and steel are taken from the construction quantity backup table.

[3]Includes non-contaminated structural steel, equipment and pipe.

[4]Includes non-contaminated bldg/structural concrete (496.1 kilotons) plus 22,481 high-level waste concrete interim storage shielding casks (2039.0 kilotons).

[5]Miscellaneous debris is calculated as an allowance of 5 percent of steel and concrete (excluding steel and concrete interim shielding casks).

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Table 6-16. Decommissioning of Contaminated Treatment/Storage Facilities (metric kilotons)[1].

Item	No Separations[2]
Steel Quantity Disposition	 9.1 low-level waste burial grounds
Concrete Quantity Disposition	 22.5 low-level waste burial grounds
Soil Quantity Disposition	 0
Debris Quantity Disposition	 1.6 low-level waste burial grounds

Notes:

[1]Decommissioning of radioactivity contaminated facilities in the 200E Area is by entombment. Reference 5.0 Wagoner "Hanford Mission Plan" DOE/RL-93-102, September 23, 1994.

[2]Assumptions for data:

The plant has operated without accident.

Spills have been properly cleaned up and decontaminated.

The cell liner has not been breached during plant operation.

In the Vitrification Building(s), related dedicated facilities and the receipt/sample facilities, the following is contaminated: 5 percent of the concrete, 5 percent of the carbon steel, 85 percent of the stainless steel and 100 percent of hastelloy/incon is contaminated.

In the centralized facilities, there is no concrete and no steel contamination.

There is no soil contamination.

Debris = 5 percent of contaminated/non-contaminated concrete plus steel quantities.

One m^3 of concrete = 732 kilograms or .75 kilotons.

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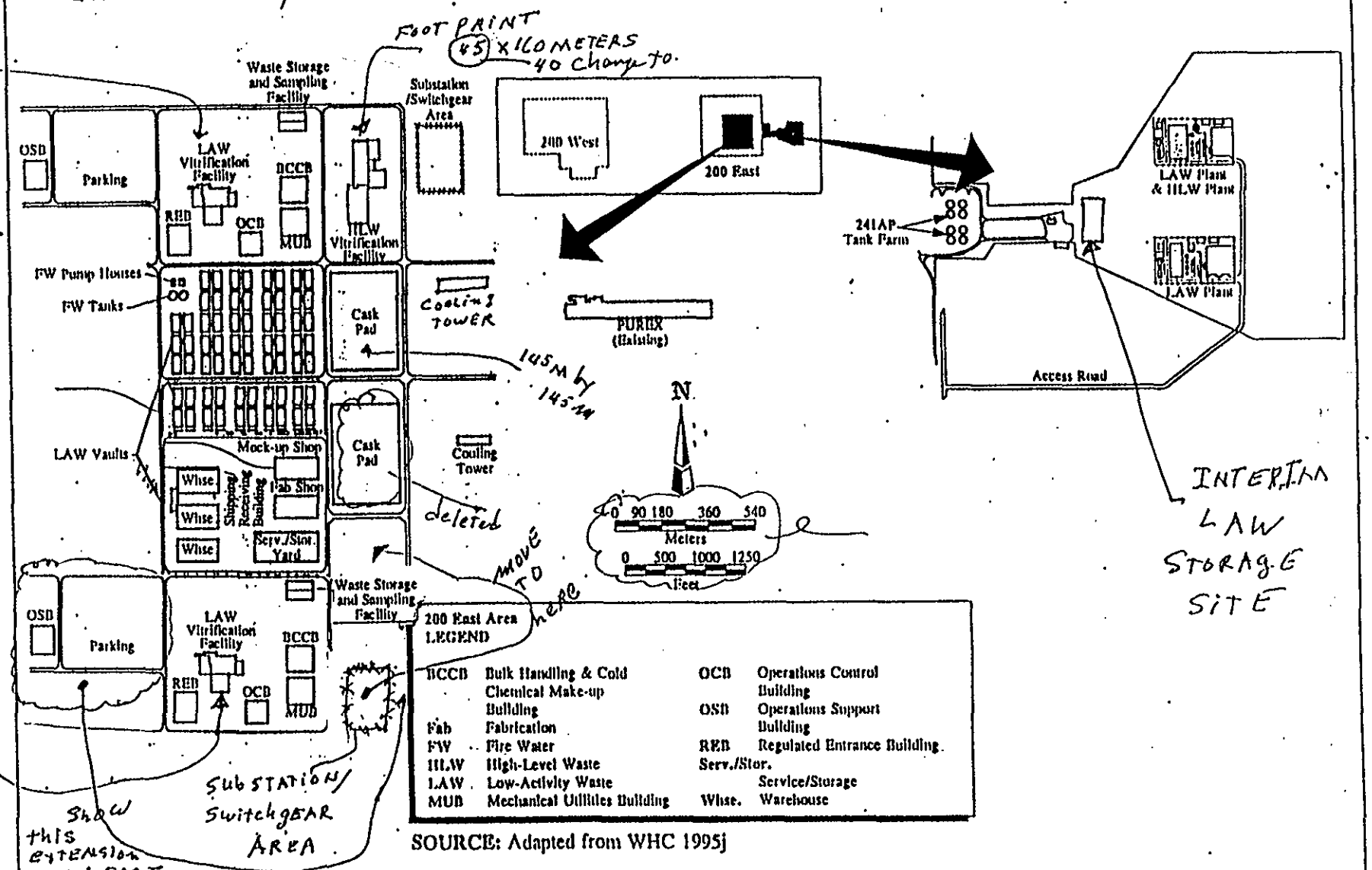
FOOT PRINT
40 METERS X 120 METERS
EACH LAW facility

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



200 East Area LEGEND

BCCB	Bulk Handling & Cold Chemical Make-up Building	OCB	Operations Control Building
Fab	Fabrication	OSB	Operations Support Building
FW	Fire Water	REB	Regulated Entrance Building
HLW	High-Level Waste	Serv./Stor.	Service/Storage
LAW	Low-Activity Waste	Whse.	Warehouse
MUB	Mechanical Utilities Building		

SOURCE: Adapted from WHC 1995j

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The crushed aggregate would be obtained from Pit 30 and delivered to four stockpiles in tank farm areas. Each stockpile would serve the following tank farms:

200E	241-T, 241-TX, and 241-TY 241-S, 241-SX, 241-U, and 241-SY
200W	241-A, 241-AX, 241-AW, 241-AP, 241-AY, and 241-AZ 241-B, 241-BX, 241-BY, 241-C, and 241-AN

Each stockpile would be served by a loader equipped with tires for loading a conveyor network. The network would serve one tank at a time. Because the time to fill a tank a tank is no more than a few operating days, the conveyor runs would be assembled from mobile sections to be repositioned by a crane, as required. After Pit 30 is finished being used for borrow material, it will be filled in until the land is returned to its original contours.

Gravel would be distributed in the tank with a slinger, a mechanism that is suspended in the tank, typically from the center riser. The slinger would capture gravel on a fast-moving horizontal belt, then throw it as it slowly rotated. The belt speed, belt angle, gravel feed rate, and rotational speed would be the primary controlling parameters. A hopper, mounted directly above the slinger, would be fed from the conveyor system and, in turn, would feed the slinger through a quick-acting isolation valve. The valve would not be used to control feed flow to the slinger but would be to isolate the slinger from the ambient environment if tank differential pressure was threatened.

Feed to the hopper would work with the isolation valve. An enclosure, placed around the slinger/hopper assembly, would serve as a confinement buffer not a confinement zone. Conditions could require more than one slinger in a tank. Installed hardware, which could not be removed, might require more than one slinger. The availability of existing risers versus the difficulty of installing new risers also could drive the decision to use more than one slinger. These somewhat smaller slingers could operate like the larger, center-mounted unit. For the purposes of this report, it is assumed that all tanks would use a larger, center-mounted unit. Sacrificial material vibrators could be strategically placed within the tanks to assure maximum fill in critical areas.

3.1.2.2 Special Gravel-Fill Requirements. The heating, ventilating and air conditioning system used must provide sufficient capacity and controls to assure that process operations could not upset the tank pressure differential. Gravel filling would generate a considerable volume of airborne particulates that would have to be separated and removed from the exhaust stream. A series of cyclone separators would be used to remove the particulate from the exhaust before passing through a dual-stage testable HEPA-filter system. Used HEPA filters may be disposed of inside the tanks in order to avoid separate waste disposal costs. There may be other costs associated with such in situ disposal, but they have not been calculated.

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The success of the filling operation would depend on demonstrating and verifying that required fill distribution and uniformity was achieved. The fill monitoring system would be able to visualize interior tank operations, and a vision system would be able provide imaging through airborne dust. Fill surface elevation measurement and mapping in real time would be available to document the progress of the operation and to verify results. Density and compaction measurement also would be used to verify fill integrity.

3.1.2.3 Engineering Cost for Gravel-Fill Stabilization. The tank waste retrieval process would leave 1 percent waste in the SSTs. The smaller tanks (16 each holding 208 m^3 [55,000 gal]) would be stabilized by grouting rather than gravel fill because they are too small to contain the gravel dispersing mechanism. For this reason, the void volume of the remaining SSTs and DSTs is about 751,000 m^3. This volume of gravel would be removed from Pit 30. The gravel would be transported by end-dump trucks capable of hauling 6 m^3 (10 yd^3) of gravel per trip. Therefore 125,000 trips would be necessary for filling the SSTs and DSTs.

3.2 ANCILLARY EQUIPMENT STABILIZATION

3.2.1 Disposition of Ancillary Equipment

For all alternatives considered in the TWRS EIS except the no disposal action alternative, closure would apply to SSTs, DSTs and the ancillary equipment associated with both groups of tanks. Ancillary equipment would include the following: diversion boxes, catch tanks, valve and pump pits, process pits, diverter stations, receiver vaults, condensate tanks, risers, transfer piping and piping encasements associated with single-shell tank operations. Pipelines would include the following: lines between tanks and to process facilities, air and steam supply lines, raw water lines, and drains. See Figures 3-3 through 3-7 for representative sketches of miscellaneous underground storage tanks.

During closure of tank farms, ancillary equipment items would be stabilized in place (i.e., disposed of). In situ stabilization would consist of filling all voids with an appropriate grout material (a chemical grout or cement grout product). The physical immobilization of contaminants provided by the grout could be augmented by the use of sequestering agents, such as zeolites, that would be capable of chemical bonding with contaminants. If ancillary equipment was plugged at one or more points, several access ports would have to be installed to ensure complete grout filling.

For purposes of assessing the environmental consequences associated with dispositioning of ancillary equipment as part of closure, it is assumed that the entire void volume within the ancillary equipment would be filled with grout (analogous to the grout fill alternative for tanks) and that no ancillary equipment would be excavated, packaged, or disposed of as LLW or mixed waste.

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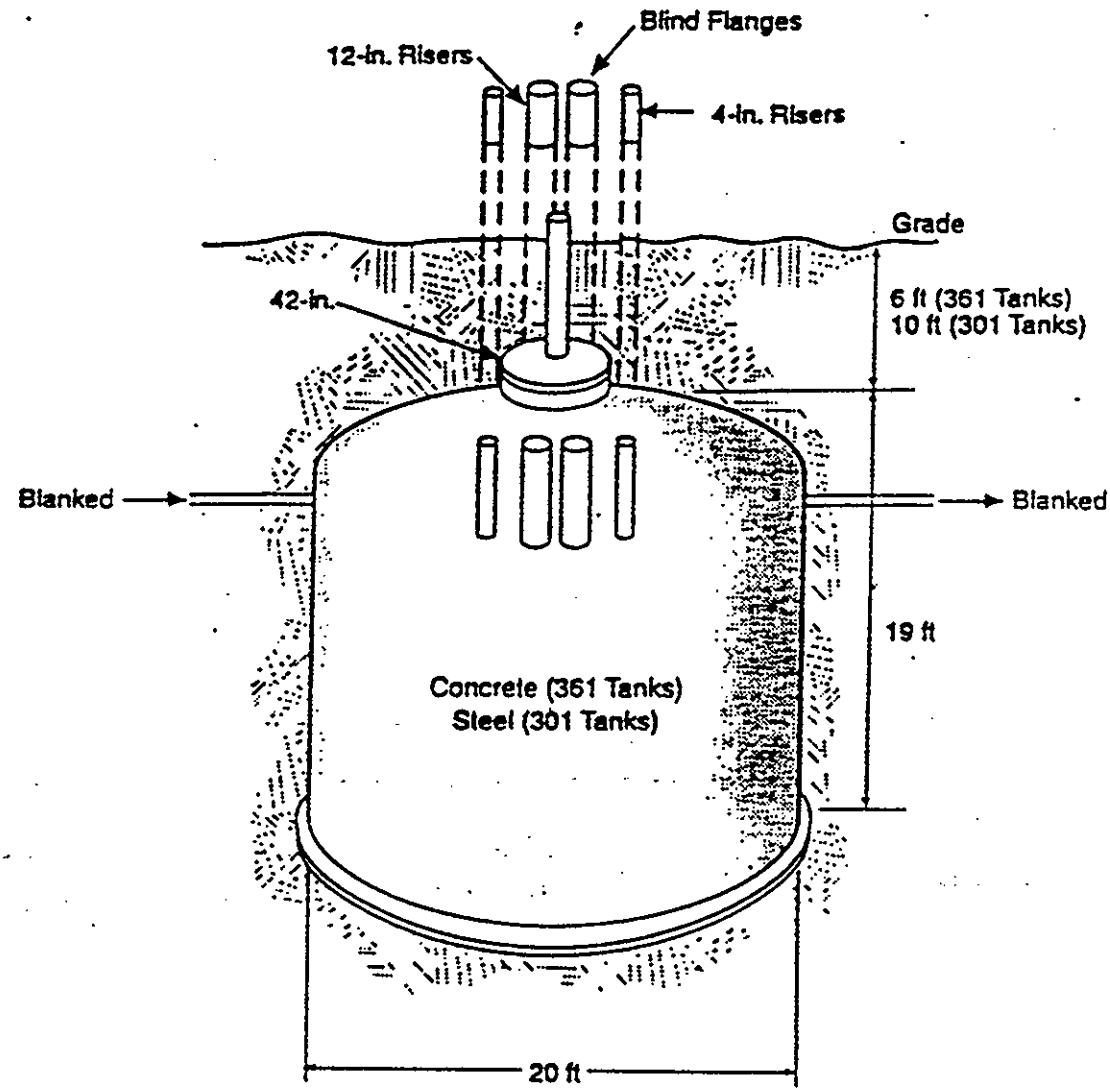
Figure 3-3. 301 Series Catch Tanks and Settling Tanks 241-B-361, 241-T-361 and 241-U-361.



Note: 4-in. central riser is not present in 301 series catch tanks

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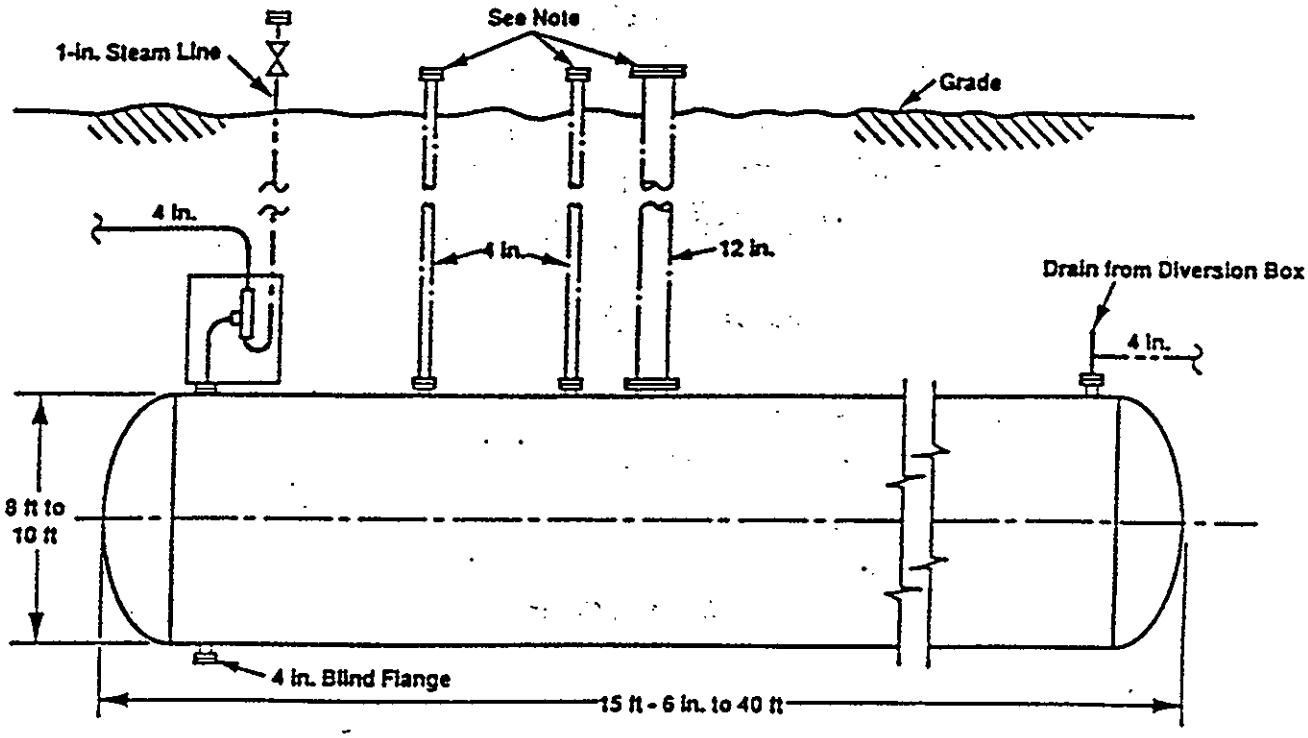
Figure 3-4. 302 Series Catch Tank.



Elevation

Scale: None

Capacity Range: 7,800 - 17,680 gallons
Note: All risers sealed with gaskets.
4-in. risers for thermocouples.
12-in. risers for dip tube liquid level measurement.

Source: Neilsen (1992)

39203001.1

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Figure 3-5. 244-BXR Vault and Tanks.

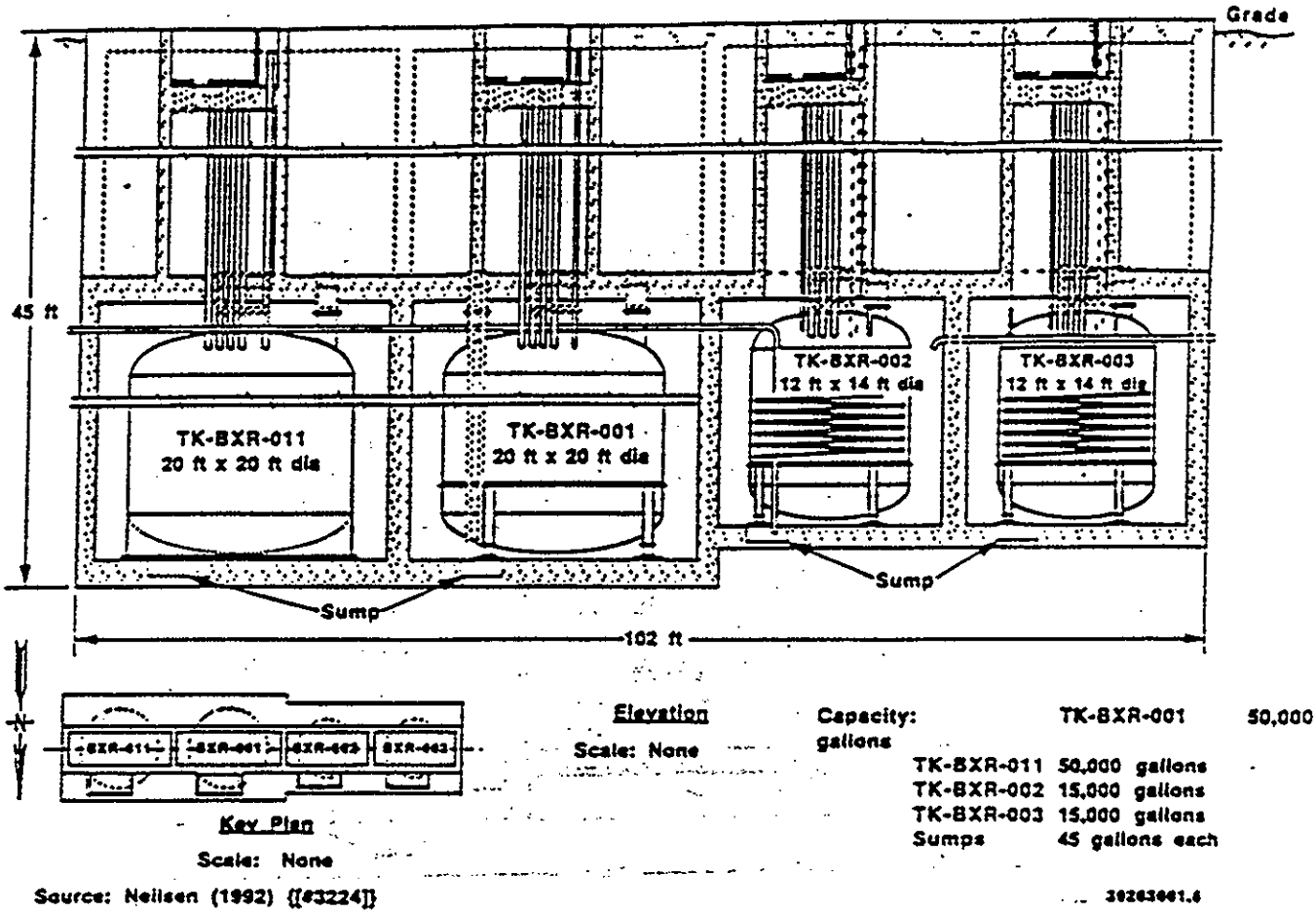

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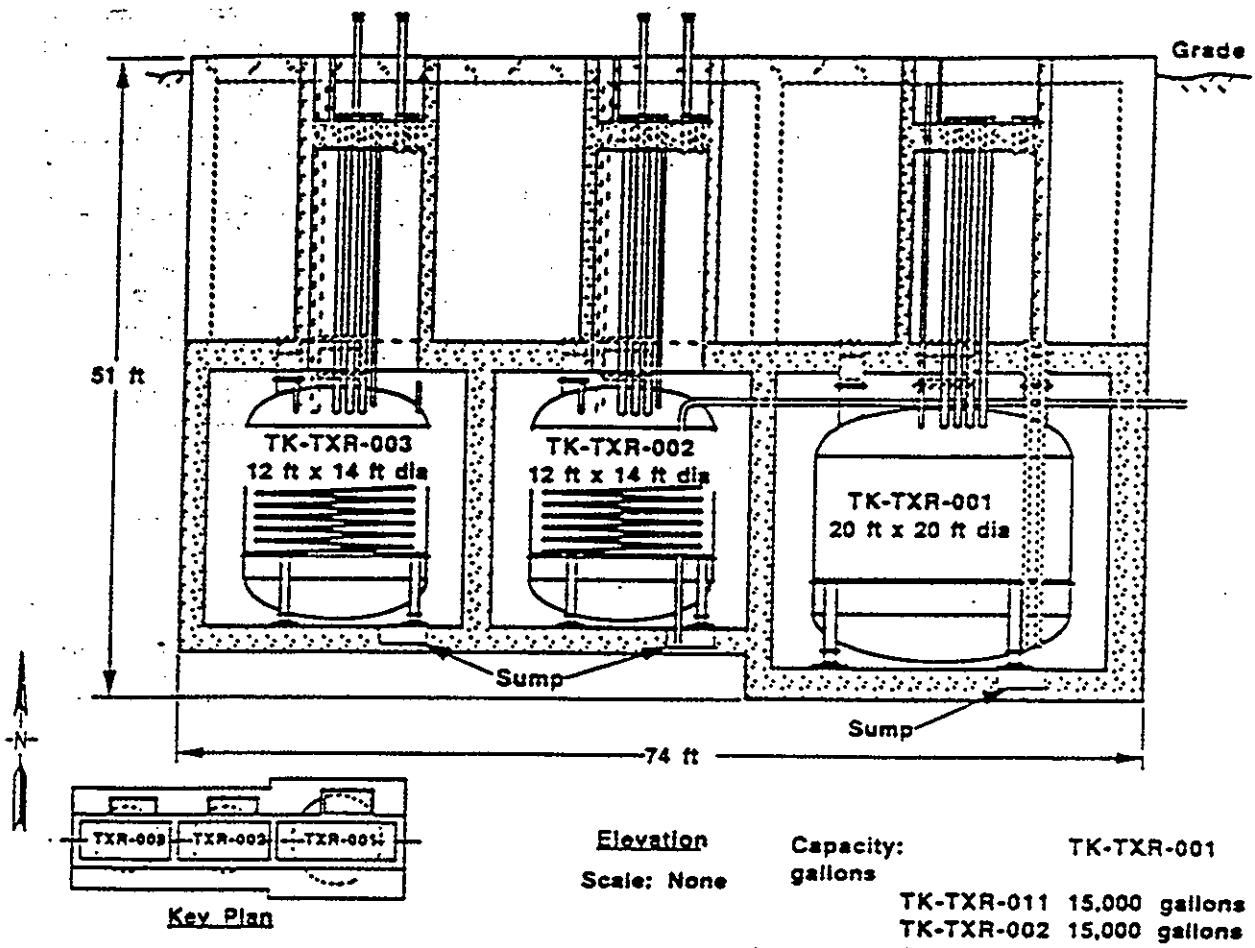
Figure 3-6. 244-TXR Vault and Tanks.



Key Plan

Scale: None

Elevation

Scale: None

Capacity: gallons

TK-TXR-001	50,000	
TK-TXR-011	15,000	gallons
TK-TXR-002	15,000	gallons
Sumps	45	gallons each

Source: Neilsen (1992) {[#3224]}

39203001.7

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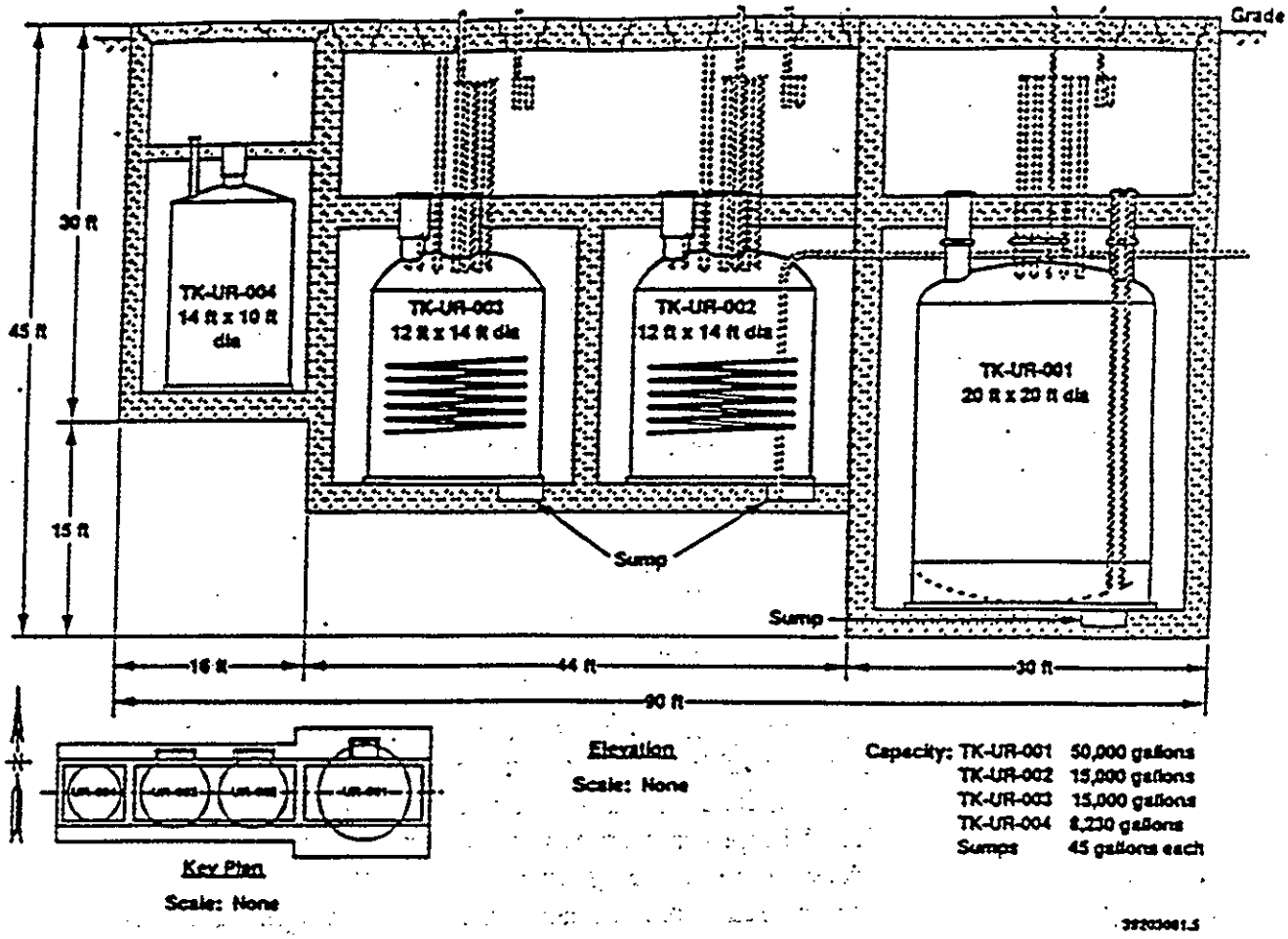
Figure 3-7. 244-UR Vault and Tanks.



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3.2.2 Description of Ancillary Equipment

Ancillary equipment components are defined in the Tri-Party Agreement as *Resource Conservation and Recovery Act* (RCRA) of 1976 (RCRA 1976) past practice units. Appendix A, Table A3 provides a list of the ancillary equipment associated with SSTs (see Appendix C, the Tri-Party Agreement). In 1993, the Tri-Party Agreement signatories agreed that past practice units within tank farms boundaries (fenceline boundaries) would be closed in accordance with the *Washington Administrative Code* (WAC 173-303-610). This decision was based on the intent to establish a consistent closure approach for SSTs and associated RCRA past practice units (i.e., contiguous ancillary equipment and spill sites) to eliminate redundancies in effort, time, and expense.

RCRA past practice units associated with SSTs include piping and control elements for routing waste to a specific tank or from one tank to another. Although the specific arrangement and connections would vary in detail between the various tank farms, all tank farms would be laid out in the same basic arrangement, where one main diversion box would serve several secondary diversion boxes or valve pits which, in turn, would serve three to nine tanks.

Piping consists primarily of welded-joint schedule 40 or 80 carbon steel (a limited amount of schedule 10 was used in the earlier installations). It varied in diameter from 8 to 15 cm (3 to 6 in.). Piping is buried or is within reinforced concrete encasements underground. A limited amount of double-wall pipe (a pipe within a pipe) also was installed. All pipes received one coat of red lead paint during installation. Underground pipe also received two coats of bitumastic paint and was double-wrapped with tar paper. Many pipe runs are equipped with pressure test connections. As many as 10 percent of the pipe runs, particularly the older schedule 10 pipes, are known or suspected to have leaks. Cathodic protection has been incorporated in some piping systems during the past 10 years; the adequacy of existing cathodic protection has not been verified. Some pipelines have been abandoned in place because of plugging.

The pipe encasement system consists of a monolithic reinforced concrete trough and removable reinforced concrete cover. Encasement wall thicknesses are typically 20 to 25 cm (8 to 10 in.), and cavities are minimally-sized to accommodate the installation of piping with the cover removed. Depth of soil cover over the encasements averages 1.8 to 2.4 m (6 to 8 ft). The encasement runs are sloped at about 1 percent to provide catchment of waste leaks or seepage of surface water runoff, and low points drain to a catch tank or pump or sluice pits. With a slope of only 1 percent, it is likely that shallow ponds occur in some sections of encasement. Swab risers at the low points of the encasement are provided to facilitate contamination monitoring.

Diversion boxes are mainly two-or three-chambered underground vaults. Inlet and outlet chambers provide isolated routing space for the intricate maze of inlet and outlet pipes. Waste flow diversion takes place in the central chamber by jumpers and associated valving. Jumpers, flexible or rigid pipes from 0.02-0.1 m (1 -4 in.) in diameter, are connected to the

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inlet and outlet pipes at the central chamber bulkheads by dry disconnect couplings. Jumper connections are routinely reconfigured to meet specific waste routing requirements. The central chamber perimeter is equipped with interior spray nozzles to provide a remotely activated surface decontamination wash mechanism. Diversion boxes are reinforced concrete with 0.6 m (2 ft) thick walls and 0.6 (2 ft) thick removable covers at grade level. A gantry crane is deployed over the central chamber to facilitate cover removal and equipment handling. The interiors of the diversion boxes were treated with Americoat, a chemical resistant paint, during construction. In some tank farms, valve boxes were installed instead of diversion boxes, but essential design features and functions are the same.

Liquid waste from underground piping is routed to an individual tank through one or more reinforced concrete pits above the tank, except for some very old tanks with side entry connections. Within these pump and sluice pits, dry disconnect jumpers are used for piping connections to pumps, valves, standpipes, etc. Interior spray nozzles provide decontamination washing of the pits. Drainage is directly into the waste tanks.

Several buried catch tanks provide collection points for liquids draining from diversion boxes and some encasements. The tanks, which are cylindrical in shape and constructed of steel, are accessible for sampling and pumping by standpipes.

Risers are vertical pipes connecting to tank domes. They vary in diameter from 2.5 cm to 107 cm (1-42 in.). Individual single-shell tanks may have as few as 6, or as many as 38 risers. Risers provide access for certain types of tank equipment including instrumentation and pumps. Some of the risers may be modified or removed by waste retrieval operations.

In two tank farms, French drains and septic tanks have been installed to collect and disperse surface water runoff from impervious paving and pads.

3.2.3 Development of Engineering Support Data

Void volumes within the past practice units are the combined volumes of tank farm piping, risers, and pits and encasements. The estimates of ancillary void volumes for the 12 SST tank farms are based on detailed analyses of three tank complexes: 241-A, 241-T, and 241-TY. Volume estimates for other farms are based on similarity to 241-A or 241-T. Void volume data for ancillary equipment are summarized in Appendix A, Figures A9-A13 (Boomer et al. 1993).

Void volumes for ancillary equipment associated with DSTs have been estimated based on similarity to the 241-A tank complexarm. Voids were estimated based on a factor of 28/6 times the 241-A tank complex volume. There are 28 DSTs, six of which are located in the 241-A tank complex. The result of this estimation is a void piping volume of approximately 1,120 m^3 (296,000 gal) and a void structure volume of approximately 6,770 m^3 (1.8 million gal) (Boomer et al. 1993).

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3.3 HANFORD BARRIER

3.3.1 Barrier Design Basis

The need for a long-term, robust surface barrier design was identified first in the *Hanford Waste Management Plan* (DOE-RL 1987) and in the *Final Environmental Impact Statement for the Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes* (DOE 1987). The Hanford Site Permanent Isolation Barrier Development Program was organized soon after these documents were published.

The Hanford Barrier is the product of extensive research and engineering by the Hanford Barrier Development Team. Since 1987, numerous design concepts have been explored and evaluated in developing the current design.

In summary, performance objectives of the barrier system include the following:

- Function in a semi-arid to sub-humid climate
- Limit the amount of water migration through the waste to near zero amounts
- Be maintenance free
- Minimize the likelihood of intrusion by plants, animals, or people
- Limit the amount of noxious gases released to the air to less than those requiring a state emissions permit
- Minimize erosion
- Meet or exceed RCRA cover performance requirements
- Isolate wastes for a minimum of one thousand years
- Be acceptable to regulators and the public.

These performance objectives have been documented in *Performance Isolation Surface Barrier: Functional Performance* (Wing 1993).

3.3.2 The Hanford Barrier

The Hanford Barrier was originally envisioned to provide long-term isolation for radiological waste sites such as tank waste residuals containing HLW, grout vaults containing high-activity LLW, and sites with transuranic contamination. As a result of evaluating barrier

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Figure A1. Typical Tank Configuration (3 sheets).
(Backup to Tables 5-2A and 5-2B).

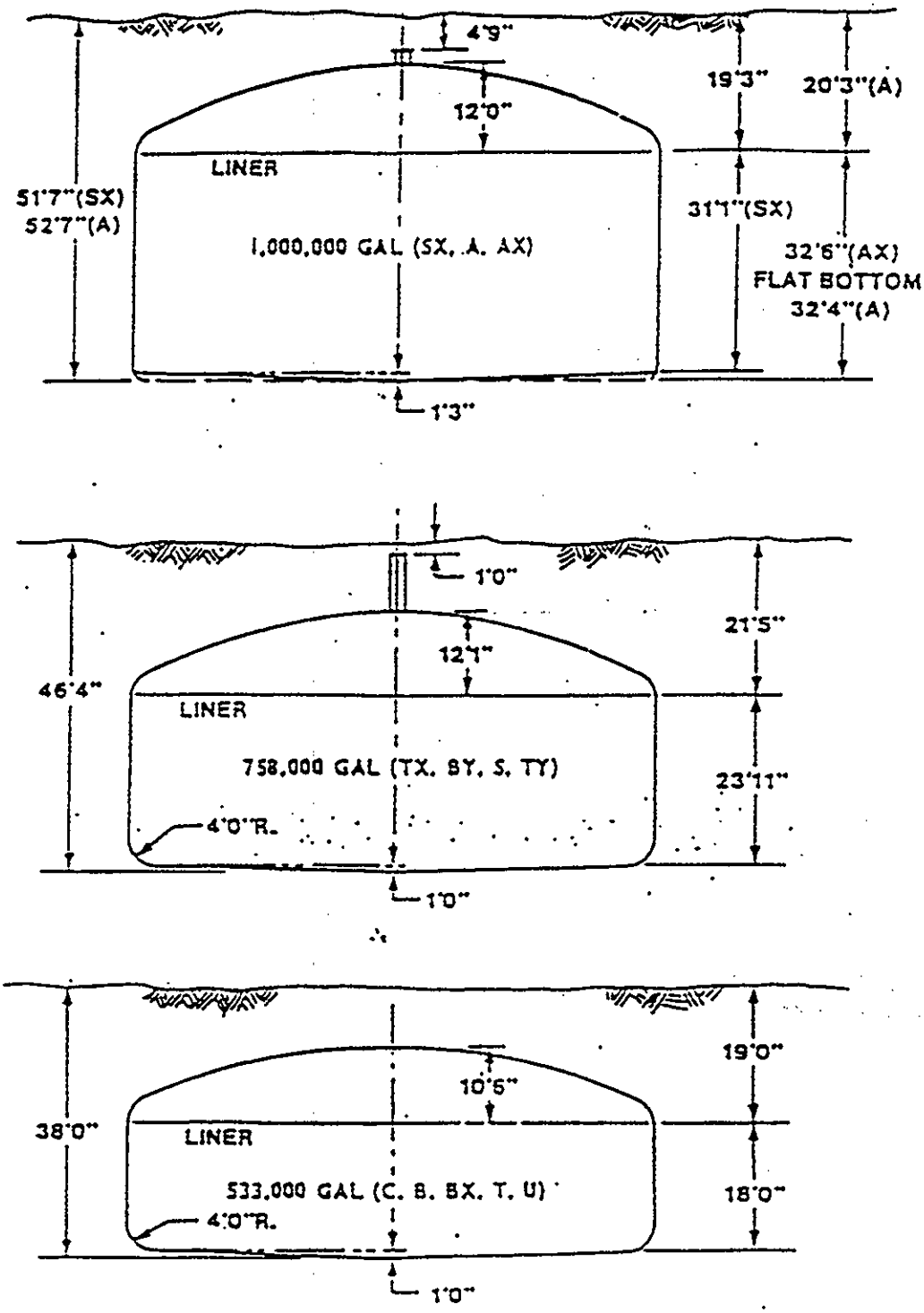

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Figure A1. Typical Tank Configuration (3 sheets).
(Backup to Tables 5-2A and 5-2B).

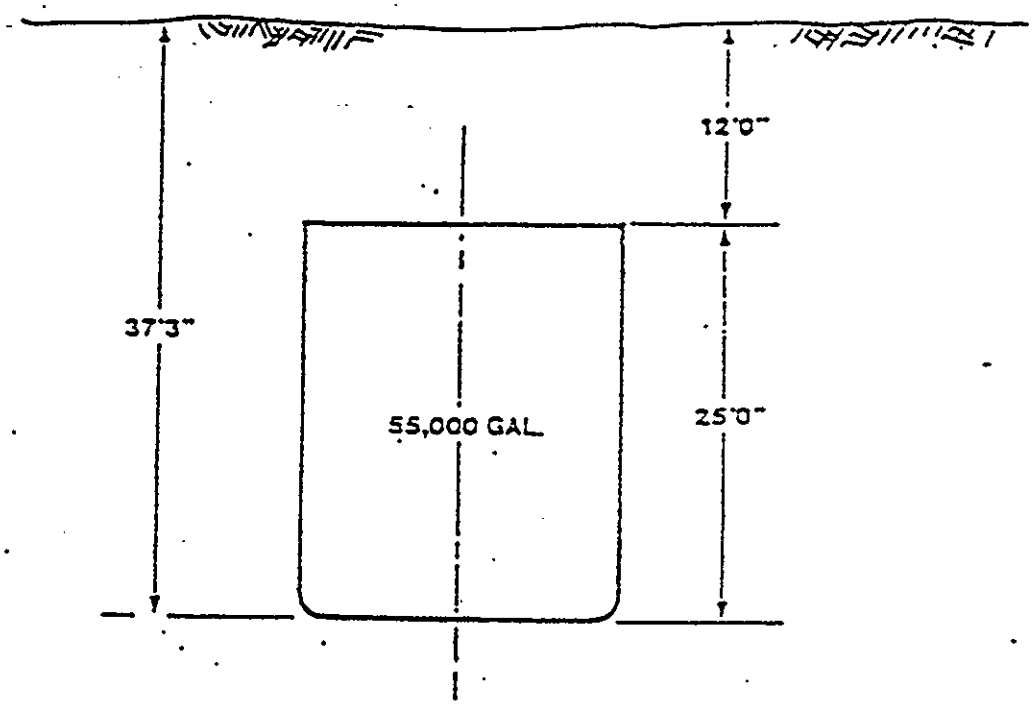

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Figure A1. Typical Tank Configuration (3 sheets).
(Backup to Tables 5-2A and 5-2B).

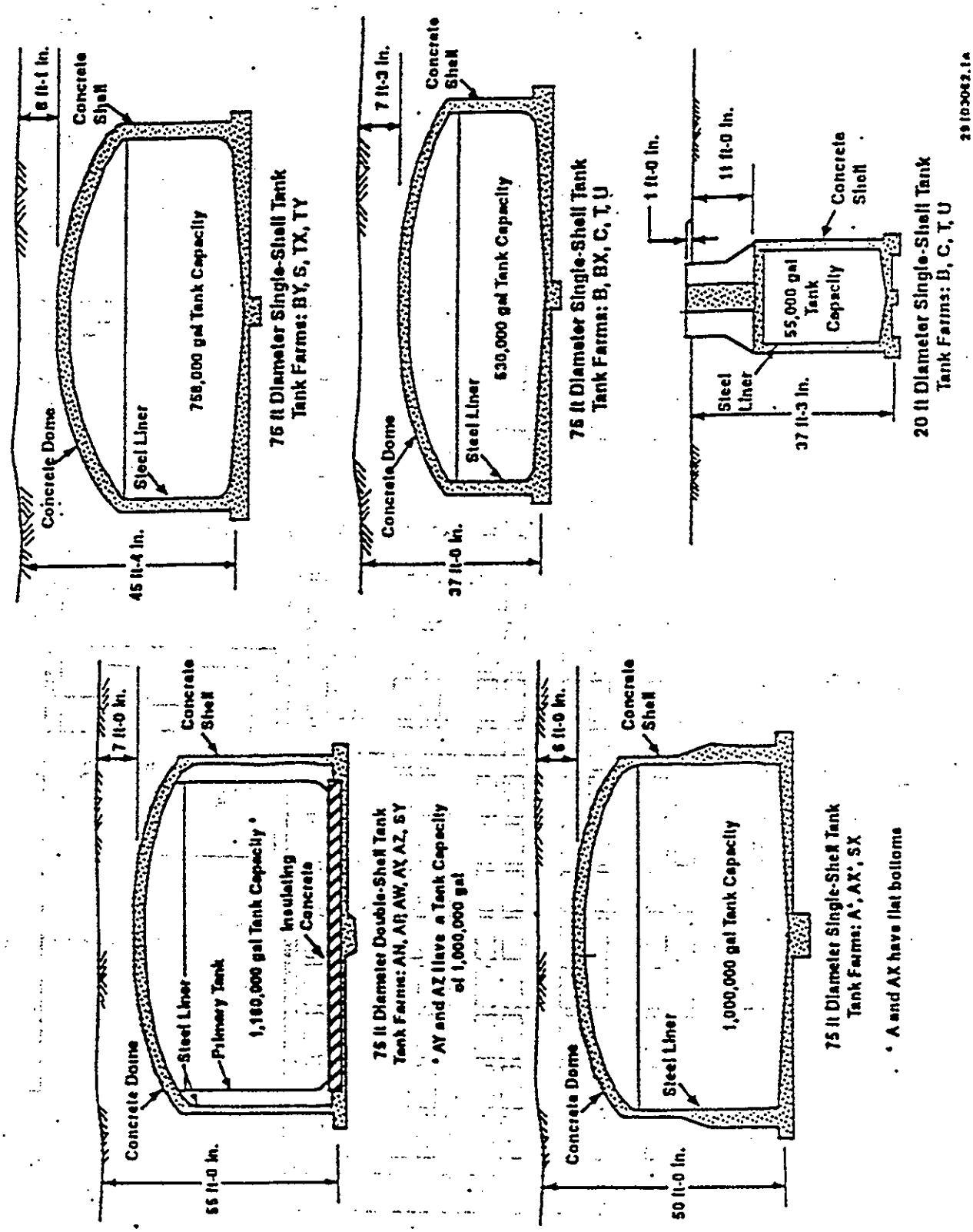

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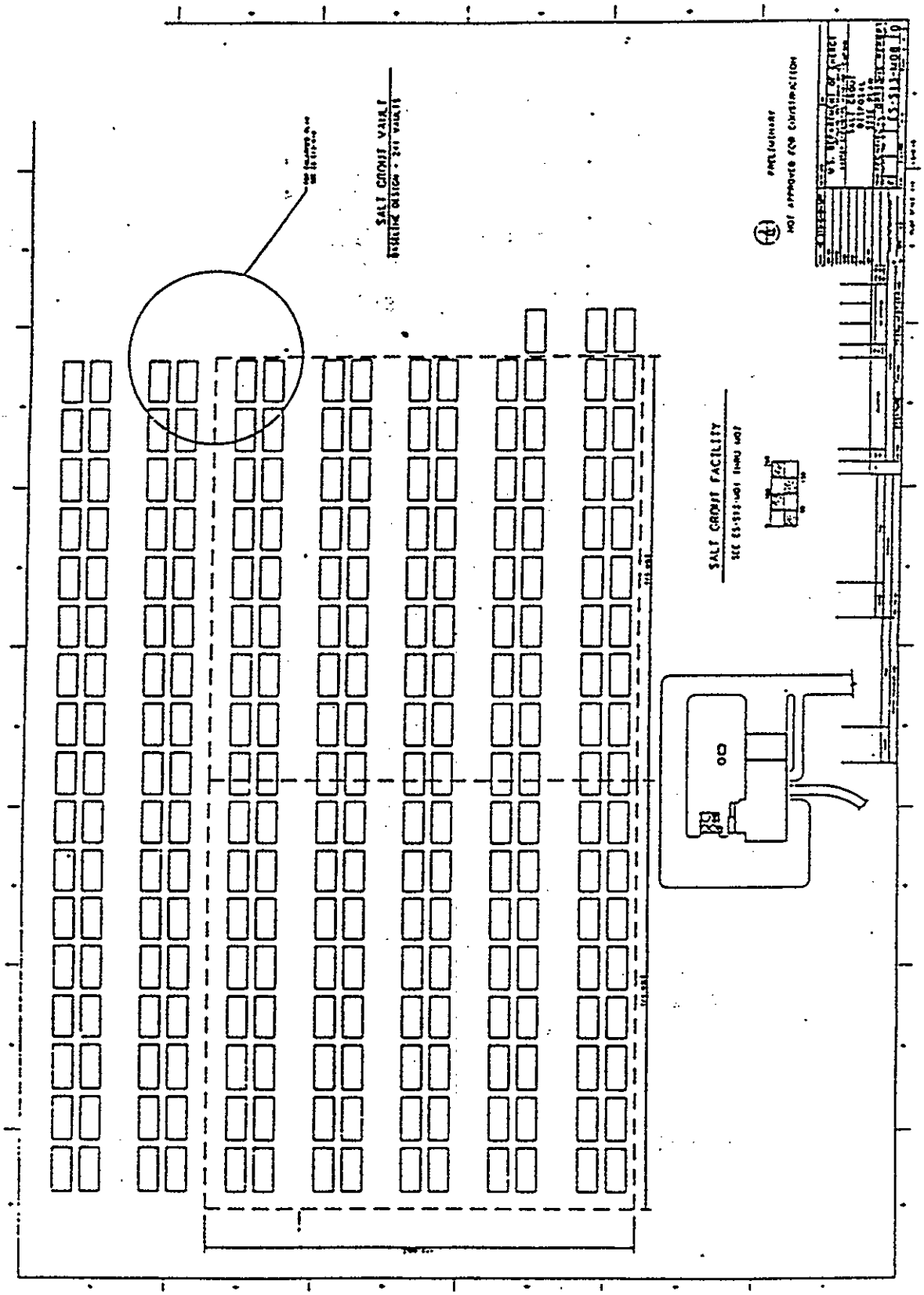
Figure A2. Extensive Separations Pretreatment: Low-Level Waste Grout Vault Configuration (Backup to Tables 5-1, 5-2D, 5-3B and 5-4 through 5-13).



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A. Transportation considerations for following items -

E2.0 no action alternative - none

Page E-59. E3.0 long term management - yes construction of DST's & piping systems
yes W-314 upgrades.

E-67 E4.0 In Situ fill and cap - yes W-314 upgrade
yes grout musts

E-84 E5.0 In Situ Vitrification - yes W-314 upgrade.
yes grout musts.

E-104 E6.0 Ex Situ Intermediate Separations - yes W-314.
& E-105
- grout musts.

E-138 E7.0 Ex Situ No-Separations - yes W-314 upgrades
& E-139
- grout musts.

E-151 E7.4 Calcination - yes W-314 upgrades.
& E-152
yes grout MUSTS

E-157 E-8.0 Ex Situ Extreme Separations - yes W-314 upgrades
& E-158
- grout musts.

E-174 E.9.0 Ex Situ / In Situ Combination - yes W-314 upgrades.
& E-175
- grout musts.

E-193 E10.0 Phased Implementation. yes W-314 upgrades. - Phase I
10.1 Phase I site Restoration phase I

E-205 10.2 Phase II (total alternative) - W-314 upgrades.
& E-206
- grout musts.

11.0 No action Capsules. - none.

E-223 12.0 Onsite Disposal - yes Dry well Construction. onsite.

E-231 13.0 over pack and Ship - yes WESF bldg mods on site

E-240 14.0 activity with wastes - yes. WESF bldg mods.
Potential for addition vitrification
Process materials -

Sheet A-243

RDW 7-30-96

W314 TANK FARM Upgrades.

	T-Plant Transfer Line	PFP Transfer Line	241-SY Piping	241-SY Valve Pit Liner	A Farm Trunk Line	241-AY/241-AZ Piping Look at SY FARM.	204-AR Piping	Misc. Diversion Box and valve pit liner
Construction Personnel								
RAD (man hours)	2,550	3,762	14,814	10,488	132,323	TBD	5,121	104,356
Non RAD (man hours)	23,849	14,217	0	0	0	TBD	147	0
Air Emissions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Construction Resources								
Land (ha)	0.43	0.25	0.66	0.00	0.58	TBD	0.02	0.00
Temporary Committments (ha)	0.85	0.49	0.10	0.10	1.15	TBD	0.04	0.10
Water (L)	102,195	81,037	586,389	0	137,857	TBD	5,004	0
Energy	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Materials:								
Concrete (cubic meters)	1,550	763	210	0	1,065	TBD	121	0
Steel:								
Misc. Carbon Steel (kg)	86,174	81,199	0	0	0	TBD	0	0
Misc. Stainless Steel (kg)	76,167	26,665	0	1,739	133,809	TBD	0	16,157
Carbon Steel pipe (m)	2,953	2,261	2,184	0	3,780	TBD	141	0
Stainless Steel pipe(m)	3,157	2,251	2,184	0	3,780	TBD	137	0
Electrical Conduit (m)	1,082	459	866	0	3,780	TBD	0	0
10484 Excavation (cubic meters)	3,030	1,184	2,293	0	1,538	TBD	146	0
16829 Backfill (cubic meters)	3,384 354	778	2,293	0	7,935	TBD	146	0
Transportation of Construction Material								
Truck Hauling (cubic meters)	142	73	459	TBD	TBD	TBD	88	TBD
Capital Costs								
Labor	$975,000	$615,000	$999,945	$707,910	$12,700,000	TBD	$165,000	$7,044,030
Materials & supplies	$2,600,000	$1,800,000	$699,961	$495,558	$2,750,000	TBD	$90,000	$4,930,821
Equipment	$600,000	$500,000	$27,998	$19,822	$0	TBD	$0	$197,232
Local Purchases	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Engineering/Inspection	$2,400,000	$1,220,000	$339,978	$283,176	$4,860,000	TBD	$190,000	$2,817,612
Subcontracts	$1,900,000	$1,200,000	INCL	INCL	$16,300,000	TBD	$155,000	INCL
Total Costs	$8,475,000	$5,335,000	$2,067,882	$1,506,496	$36,610,000	TBD	$600,000	$14,989,695

JACOBS ENGINEERING GROUP INC.

DATE 2-16-96 SUBJECT

Sheet A-244
RDW 7-30-96
SHEET NO.

BY _____ CHKD. _____

JOB NO.

Items for Next Round of Revisions

1. Calcination alternative
   - Define number of canisters
   - Revise table B.11.0.3 accordingly.
   - prepare input for other tables affected.

2. Based on the results of the exercise for the operating and construction resource tables evaluate the revised numbers on a comparative basis for travel by rail or by truck.
   - Revise the transportation tables as required to more adequately depict the impact of material traffic to the area for each alternative.

3. Revise Resource summary table and other resource tables accordingly as changes may impact.

4. Re-evaluate the calculation for Strontium and Cesium capsule disposition in the HLW glass product for the no separations alternative.

5. Incorporate the blending factor sensitivity into next revision of chapter 3 and appendix B for the Explicit intermediate alternative.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

Sheet A-2-45
RDW 7-30-96

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Operations Support (table 9.4) TPA Intermediate Separations

1. Resins trucked at 9.6 m^3/truck load

2. Chemicals + glassformers to be shipped by Rail
20 Cars/train 102 mg/car 2048 mg/train

Resins 220 m^3 23 trucks.

Glassformers 290000 mg.
Chemicals ~~47474 mg~~ } 242791
Kerosene 58,000 mg. }
Σ = 532791 mg @ 2048 mg/train 260 trains.

Not included
Concrete DAW vaults 160600 m^3

Steel 19000 mg 102 mg/car = 186.3 Cars

Cement ~~(160000)(1.1)(0.63)(407)~~ 102 mg/RCar = 392 Cars.
(5)(160000)(1.1)(1/20) = 44,000 tons = 40,000 (mg)(MT)

Concrete Sand
(160000)(1.1)(0.63)(407) = 1186416 cu yds
17 cu yd dump trailer = 6979 trucks.

* Glass formers SiO_2 should be broken out
silica sand

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. Sheet A-746 BDW 7-30-96

BY _____ CHKD. _____ JOB NO. _____

operations support (table 9.4) TPA Intermediate Operations

1. Resins trucked at 9.6 m^3/truck load

2. Chemicals + glassformers to be shipped by Rail
20 Cars/train 102 mg/car 2048 mg/train

Resins 220 m^3 23 trucks.

Glassformers 290000 mg.
Chemicals
Kerosene
Σ = 3 260 trains.

Review of WHC data pkgs. for resources & transportation

Not included
Concrete LAW vaults

Steel = 186.3 Cars

~~Cement (160000)(1.1)(0.5)~~ = 392 Cars.
(5)(160000)(1.1)(1/20) = 27,500 100 = 40,000 (mg)(mt)

Concrete Sand
(160000)(1.1)(0.63)(407) = 1186416 cu yds
17 cu yd dump trailer = 6979 trucks.

* Glass formers SiO_2 should be broken out silica sand.

FORM 91-005-1 (4/81)

JE JACOBS ENGINEERING GROUP INC.

Sheet A-247
RDW 7-30-96

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Construction Support (Table 9-10) TPA Intermediate Separations

P/S Construction Steel 114300 Mg. 15 tons/load truck 8382 TRUCKS

TC Sand for Concrete
(480000)(1.1)(0.63)(1.07) = 355924.8 17 yd³ dump trailer 20937

TC Miscellaneous materials (tools, etc
assumed APP F page F-91 at 2800 using 7550
Tabulated in table F-34 at 5000 (1.51) = 7550
Σ = 28487
or roundup 2.9E+04
(Table 9-13 Value)

NOT Included.

Diesel Fuel 2.1E+07 Liters
5548217 gallons 5000 gallon tank truck 1110 TRUCKS

Gasoline 7.6E+06 Liter 5000 gallon tank truck. 402 TRUCKS
2007926 gallons.

Portland Cement Type I 5 sacks/cy mix
(480000)(1.1)(5)(1/20) = 132000 TONS at 102 mg/car 1177 Ton ~~[illegible]~~ Hopper Cars.
= 120,000 mg or MTons
25 Ton Hopper Trucks 5280 TRUCKS

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

Sheet A-248
Rev 9-30-96

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Operations Support (Table 9.4) Extensive Separations.

1. Resins to be trucked @ 9.6 m^3/truck load.

2. Chemicals and glassformers to be shipped by rail.
20 Car/trains 102 mg/car 2048 mg/train

9.6 m^3/truck.

Resins 4900 m^3 513 Trips

glass formers 355000 mg.

Chemicals 872127 mg.

Kerosene (93560 m^3) 77810 mg.
$\rho = 0.832$ mg/m^3

$\Sigma = 1304937$ 637 Trains
$\div 2048$

Concrete = 1.4 E+05 m^3 = 1.54 E+05 cu yds.

Cement 7.7 E+05 sacks. $\div 20$ = 38500 Tons 102 mT/car train 343 Cars
= 35000 m Tons. (mg)

Steel 1.6 E+04 mg (mT) 102 mT/car train 157 Cars.

(Concrete) (Sand c/a) (wastage)
Concrete sand (1.54E+05)(0.63)(1.07) = 1.03812 cu yds. 6107 Trips
tricitin 17 yd^3 dump trailer

vaults.

Glassformer sand should be broken out of the glass formers total.
SiO_2 2.87 E+05 mg.

These were not included in transportation.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

Sheet A-249
REW 7-30-96

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Construction Materials (from table 9-16) — Extension Separations.

			Truck Trips at 15 Tons/Load
P/S	Construction Steel	1.488 Mg	11,000
			Truck at 17 yd³ Trailer
T/C	Sand for Concrete	W/B 398060 yd³	23415 Truck Loads.
T/C	Misc Materials, tools, etc	(5) (200) (3.5)	3500

5(23415) + (3500) = 26915 = 2.7E+4

			5000 gallon tank truck
Gasoline fuel	2.9E+07 L		1533 TRUCKS
Diesel fuel	9.7E+06 L.		513 TRUCKS
			25 ton tank truck (Hopper)
Cement (Portland type I)	(using 5 sack/yd³ mix)		11780 TRUCKS
			at 102 MT/car = 2635 rail cars

These RESOURCES WERE NOT Included in TRANSPORTATION.

FORM 91-005-1 (4/81)

JE JACOBS ENGINEERING GROUP INC.

Sheet A-250

DATE _____ SUBJECT _____ SHEET NO. RGW 9-30-96

BY _____ CHKD. _____ JOB NO. _____

Operations Support (Table 6.4) No Separations Vitrification

using assumption of Resins by truck.

other materials by train

Glass formers 250000 mg @ 2048 mg/train. [122 trains]

Kerosene 56400 m³/yr 15 yrs. = 703872 mg

Chemicals 8929 mg

O_2 185000 mg.

HNO_3 + NAOH 896 m³ = 1218 mg.

(630) + (266) m³

without O_2 Σ = 964019 mg trains at 2048 mg/train 471 trains

P Kerosene 0.832 mg/m³ with O_2 Σ = 1149019 mg. 561 trains

Totals

(46929.8 mg/m³)(15) = 703872

P HNO_3 @ 50% ~ 1.3 (630)(1.3) = 819

P NAOH @ 50% ~ 1.5 (266)(1.5) = 399

Resins 0 0 trucks

Steel for multipurpose unshielded Convertors.

Stainless steel. 146000 mg. by rail 2048/train = 72 trains

at 15 tons = 10,707

Concrete 2040000 mg

Cement = (2040000)(1.1)(13.5) = (30294000 cu yd.)(5/20) = 6885000 mg

@ 2048 mg/train = 3362 trains

Concrete

Sand at tri cities

~~(27540000)~~

(30254000)(0.63)(1.07) = 2039422 1 cu yds Sand. = ~~1,199,660~~ 1,203,449 trucks.

at 17 cy dump trailer

Shielding Casks.

~~need to recheck this calculation~~

NOTE: Cost of site in tri cities only 21,400 special truck trips

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

Sheet A-251

DATE _____ SUBJECT _____ SHEET NO. RLW 9-30-96

BY _____ CHKD. _____ JOB NO. _____

Construction Resources. (Table 6-10) No Separations Vitrification.

P/S

Carbon Steel 51200 MT

Stainless Steel 8610 MT

Hastelloy 1510 MT

61320 MT = 67452

15 tons/load PER TRUCK 4497 ~~[illegible]~~ trucks

T/C

Concrete Sand

(207000)(1.1)(0.63)(1.07) = 153492.57 cy 17 cy/truck 9029

Tc assumed ~~[illegible]~~ trips for miscellaneous materials 2800

Σ = 11829 trucks.

Portland Cement

(207000)(1.1)(5)(1/20) = 56925 Tons

90 Ton Rail Hopper Car = 633 Cars

25 Ton Hopper truck = 2277 trucks.

Diesel fuel liters = 1.19E7 = 3143989.4 gallons 629 TRUCKS

Gasoline liters = 5.1E6 = 1347424.0 gallons 270 TRUCKS

using 5000 gallon tankstruck

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. Sheet A-252 Rev 7-30-96

BY _____ CHKD. _____ JOB NO. _____

APPENDIX D Changes.

1) REVISE DURATIONS ✓?

2) ADD TO ADDITIONAL IODINE-129

IN SITU VIT ✓
INT. SEPARATIONS ✓
NO SEPARATIONS VIT & CALCINATION ✓
EXTENSIVE SEPARATIONS ✓
COMBO 1 ✓
COMBO 2 ✓
PHASED Implementation ✓

I-129. HAD 16 Ci before. ADDED 22 Ci ⇒ total = 38 Ci

3) REVISE Emission Rates for EX SITU PORTION of Alternatives that have revised operating durations.

Example

C-14 = 58 Ci/yr for 15 yrs.

New duration = 14 yrs.

New Emission Rate = $58 \text{ Ci/yr} \times \frac{15}{14} = 62 \text{ Ci/yr}$.

FORM 91-005-1 (4/81)

Sheet A-253
RGW 7-30-96

combo low

SST +DST total			Combo Low
Radionuclide			% Recovered for Ex Situ Processing
Ac-225	4.4E-06		33%
Ac-227	0.010816		57%
Ac-228	0		0%
Am-241	76187.93		73%
Am-242	35.1641		56%
Am-242m	35.33228		56%
Am-243	19.59712		61%
At-217	4.4E-06		33%
Ba-135m	0		0%
Ba-137m	40362246		75%
Bi-210	1.55E-08		33%
Bi-211	0.010816		57%
Bi-212	0		0%
Bi-213	4.4E-06		33%
Bi-214	6.12E-08		30%
C-14	4253.385		80%
Cm-242	29.16645		56%
Cm-244	92.49279		69%
Cm-245	0.00694		68%
Cs-135	72.73039		51%
Cs-137	31887379		83%
Eu-154	75040.88		99%
Fr-221	4.4E-06		33%
Fr-223	0.000149		57%
I-129	30.87092		81%
Nb-93m	541.2141		17%
Ni-59	0		0%
Ni-63	74990.81		28%
Np-237	83.29269		79%
Np-238	0.168182		56%
Np-239	19.59712		61%
Pa-231	0.019377		56%
Pa-233	38.24489		64%
Pa-234	0.384643		51%
Pa-234m	240.4019		51%
Pb-209	4.4E-06		33%
Pb-210	1.55E-08		33%
Pb-211	0.010816		57%
Pb-212	0		0%
Pb-214	6.12E-08		30%
Pd-107	49.22507		65%
Po-210	1.55E-08		33%
Po-211	2.95E-05		57%
Po-212	0		0%
Po-213	4.31E-06		33%
Po-214	6.12E-08		30%
Po-215	0.010816		57%

Combination 2
SST + DST Combined
Recovery

Sheet A-254
RAW 7-30-96

combo low

Po-216	0		0%
Po-218	6.12E-08		30%
Pu-236	0		0%
Pu-238	323.3833		13%
Pu-239	7647.107		29%
Pu-240	1904.529		28%
Pu-241	18933.88		21%
Pu-242	0.000174		56%
Ra-223	0.010816		57%
Ra-224	0		0%
Ra-225	4.4E-06		33%
Ra-226	6.12E-08		30%
Ra-228	0		0%
Rh-106	0.05246		9%
Rn-219	0.010816		57%
Rn-220	0		0%
Rn-222	6.12E-08		30%
Ru-106	0.05246		9%
Sb-126	19.23266		22%
Sb-126m	137.3762		22%
Se-79	512.1212		64%
Sm-151	138914		21%
Sn-126	137.3762		22%
Sr-90	21015666		36%
Tc-99	27392.43		85%
Th-227	0.010666		57%
Th-228	0		0%
Th-229	4.4E-06		33%
Th-230	8.26E-06		27%
Th-231	10.07772		50%
Th-232	0		0%
Th-233	0		0%
Th-234	240.4019		51%
Tl-207	0.010786		57%
Tl-208	0		0%
Tl-209	9.51E-08		33%
U-232	0		0%
U-233	0.004521		48%
U-234	0.0486		25%
U-235	10.07772		50%
U-236	0.000315		14%
U-237	0.144499		14%
U-238	240.4019		51%
Y-90	21401117		35%
Zr-93	419.4471		11%

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Percentage of the DST inventory recovered from 10 DSTs					
for the Selective Retrieval alterative (based on 99% retrieval)					
Radionuclides					
(Ci)					
Na, kgs	77.68				
14C	98.79				
90Sr	87.14				
90Y	87.14				
99Tc	91.44				
137Cs	89.36				
137Ba	89.36				
154Eu	97.60				
235U	N/A				
238U	N/A				
237Np	97.87				
238Pu	11.92				
239Pu	28.27				
240Pu	26.13				
241Pu	23.98				
241Am	70.66				
Curies	88.69				

Combo 1

DST Percent Recovery

Sheet A-256
RCW 7-30-96

Combo 1
SST Percent Recovered

Percentage of the SST inventory recovered from 60 tanks for the Selective Retrieval alternative (based on 99% retrieval)					
	Gmol				
	Ac225	74.28			
	Ac227	89.37			
	Am241	89.22			
	Am242	91.09			
	Am242m	91.09			
	Am243	92.60			
	At217	74.27			
	Ba135m	N/A			
	Ba137m	88.32			
	Bi210	82.97			
	Bi211	89.36			
	Bi213	74.28			
	Bi214	83.72			
	C14	92.89			
	Cm242	91.09			
	Cm244	93.89			
	Cm245	93.89			
	Cs135	84.79			
	Cs137	88.32			
	Fr221	74.29			
	Fr223	89.38			
	I129	91.65			
	Nb93m	77.38			
	Ni59	N/A			
	Ni63	78.79			
	Np237	89.57			
	Np239	92.59			
	Pa231	90.46			
	Pa233	89.58			
	Pa234m	91.42			
	Pb209	74.27			
	Pb210	82.96			
	Pb211	89.36			
	Pb214	83.72			
	Pd107	91.97			
	Po210	82.91			
	Po213	74.26			
	Po214	83.71			
	Po215	89.37			
	Po218	83.71			
	Pu238	74.21			
	Pu239	78.55			
	Pu240	79.83			
	Pu241	81.48			
	Ra223	89.37			
	Ra225	74.28			

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BDW 7-30-96

	Ra226	83.72			
	Ru106	36.50			
	Sb126	72.34			
	Sb126m	72.33			
	Se79	91.67			
	Sm151	71.82			
	Sn126	72.31			
	Sr90	65.38			
	Tc99	91.62			
	Th227	89.37			
	Th229	74.31			
	Th230	81.60			
	Th231	91.08			
	Th233	N/A			
	Th234	91.42			
	Tl207	89.37			
	U233	78.32			
	U234	80.43			
	U235	91.07			
	U238	91.42			
	Y90	65.38			
	Zr93	66.40			

Sheet A-25E
Rev
7-30-96

Table G.3.1.7 Emission Rates for the Ex Situ Intermediate Separations Alternative - Construction Phase

Pollutant	Source	Emission Rate (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W	1.77E-03
	TF6W	1.77E-03
	TA1W	7.18E-03
	TA2W	3.77E-02
	TA3W	7.18E-03
	TA1E	7.18E-03
	TA2E	7.18E-03
	PROC	2.13E-01
Carbon Monoxide	TF5W	3.72E-02
	TF6W	3.72E-02
	TA1W	9.69E-02
	TA2W	0.510
	TA3W	9.69E-02
	TA1E	9.69E-02
	TA2E	9.69E-02
	PROC	1.60E+02
Nitrogen Dioxide	TF5W	1.46E-01
	TF6W	1.46E-01
	TA1W	3.15E-01
	TA2W	1.66
	TA3W	3.15E-01
	TA1E	3.15E-01
	TA2E	3.15E-01
	PROC	1.6E+01
PM-10	TF5W	1.03E-02
	TF6W	1.03E-02
	TA1W	7.40E-02
	TA2W	3.88E-01
	TA3W	7.40E-02
	TA1E	7.40E-02
	TA2E	7.40E-02
	PROC	6.67E+00
	BTCH	3.17E+00
Hazardous Air Pollutants		
Formaldehyde	TF5W	3.61E-05
	TF6W	3.61E-05
	TA1W	9.33E-05
	TA2W	4.89E-04
	TA3W	9.33E-05
	TA1E	9.33E-05
	TA2E	9.33E-05
	PROC	3.89E-03

Notes:
g/sec = Grams per second
Routine emissions from tank farms and evaporator would occur as shown in Table G.3.1.2

Sheet A-254
Brown
7-30-96

Table G.3.1.8 Emission Rates for the Ex Situ Intermediate Separations Alternative - Operation Phase

Pollutant	Source	Emission Rates (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W, TF6W	1.77E-03
	ST-H	2.75E-02
	ST-L	7.56E-01
Carbon Monoxide	TF5W, TF6W	3.72E-02
	ST-H	1.21E+00
	ST-L	8.5E+00
Nitrogen Dioxide	TF5W, TF6W	1.46E-01
	ST-H	2.62E-02
	ST-L	5.14E-01
PM-10	TF5W, TF6W	1.03E-02
Hazardous Air Pollutants		
Formaldehyde	TF5W, TF6W	3.61E-05
Arsenic Compounds	ST-H	1.83E-09
	ST-L	8.8E-10
Beryllium Compounds	ST-H	4.67E-11
	ST-L	6.3E-12
Cadmium Compounds	ST-H	1.75E-08
	ST-L	7.6E-09
Cobalt Compounds	ST-H	1.96E-09
	ST-L	2.2E-10
Chromium Compounds	ST-H	9.86E-08
	ST-L	5.7E-07
Manganese Compounds	ST-H	3.50E-07
	ST-L	6.5E-08
Lead Compounds	ST-H	6.19E-08
	ST-L	9.4E-09
Antimony Compounds	ST-H	4.42E-09
	ST-L	2.3E-10
Selenium Compounds	ST-H	5.39E-09
	ST-L	2.7E-09
Nickle Compounds	ST-H	3.50E-04
	ST-L	3.2E-09
Hydrogen Chloride	ST-H	1.16E-02
	ST-L	9.6E-03
Iodine	ST-H	1.21E-05
	ST-L	1.39E-03
Ammonia	ST-H	0.000
	ST-L	1.12E-01
Silver Oxide	ST-H	8.03E-10
	ST-L	1.1E-10
Boric Oxide	ST-H	5.3E-06
	ST-L	3.0E-09

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RDW
7-30-96

Table G.3.1.8 Emission Rates for the Ex Situ Intermediate Separations Alternative - Operation Phase (cont'd)

Pollutant	Source	Emission Rate (g/sec)
Calcium Oxide	ST-H	0
	ST-L	9.6E-06
Ferric Oxide	ST-H	2.12E-06
	ST-L	4.0E-08
Magnesium Oxide	ST-H	1.58E-08
	ST-L	9.5E-06
Tellurium Trioxide	ST-H	6.19E-10
	ST-L	2.1E-11
Uranium Trioxide	ST-H	2.81E-06
	ST-L	2.9E-07
Vanadium Pentoxide	ST-H	1.26E-10
	ST-L	5.2E-11
Zinc Oxide	ST-H	3.33E-09
	ST-L	3.3E-09
Zirconium Oxide	ST-H	1.36E-06
	ST-L	5.7E-08
Fluoride	ST-H	2.71E-02
	ST-L	2.24E-02
Nitric Acid	ST-H	5.06E-03
	ST-L	4.18E-03
Barium Oxide	ST-H	4.17E-09
	ST-L	1.0E-09

Notes:
g/sec = Grams per second
In addition, routine and retrieval emissions from tank farms and evaporator would occur as shown in Table G.3.1.3.

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Table G.3.1.23 Radionuclide Emission Rates for the In Situ Vitrification Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	8.0E-09	IS6W	2.0E-07	--	--
C-14	IS6W	1.1E+03	--	--	--	--
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	IS6W	7.0E-05
	WESF	2.6E-06	--	--	--	--
I-129	TF6E	2.3E-05	TF7E	2.3E-05	IS6W	7.6E +00
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	2.4E-07
	IS6W	6.6E-08	EVAP	1.4E-04	WESF	2.4E-07
Ru-106	IS6W	7.6E-14	--	--	--	--
Sm-151	IS6W	1.3E-06	--	--	--	--
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	9.1E-08	IS6W	1.4E-04	EVAP	8.0E-05
	WESF	5.1E-06	--	--	--	--
Zr-93	IS6W	7.8E-09	--	--	--	--

Notes:
Ci/yr = Curie per year
-- indicates no additional sources or emission rates.

7/24/96 correction

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Table G.3.1.24 Radionuclide Emission Rates for the Ex Situ Intermediate Separations Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	3.2E-03	STH	2.1E-03	--	--
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	TF6W	3.1E-03
	STH	1.5E-00	WESF	2.6E-06	--	--
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF6W	6.9E-05
	STL	2.0E+00	--	--	--	--
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	3.0E-03
	STH	2.3E-03	EVAP	1.4E-04	WESF	2.4E-07
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	2.1E-01	STH	1.4E-04	EVAP	8.0E-05
	WESF	5.1E-06	--	--	--	--
Tc-99	STH	1.3E-04	--	--	--	--

Note:
Ci/yr = Curie per year
-- indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

C-14	STL	3.4E-02	--	--	--	--

7/2/96 comments

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Table G.3.1.25 Radionuclide Emission Rates for the Ex Situ No Separations Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	3.2E-03	SMIN	3.8E-03	--	--
C-14	SMIN	3.8E-02	--	--	--	--
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	TF6W	3.1E-03
	SMIN	2.5E-00	WESF	2.6E-06	--	--
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF6W	6.9E-05
	SMIN	2.2E+00	--	--	--	--
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	3.0E-03
	SMIN	3.9E-03	EVAP	1.4E-04	WESF	2.4E-07
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	2.1E-01	SMIN	3.9E-00	EVAP	8.0E-05
	WESF	5.1E-06	--	--	--	--
Tc-99	SMIN	1.2E-03	--	--	--	--

Note:
Ci\yr = Curie per year
-- indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

7/21/91 correction

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Table G.3.1.26 Radionuclide Emission Rates for the Ex Situ Extensive Separations Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	3.2E-03	ESEP	2.7E-03	--	--
C-14	ESEP	2.8E-02	--	--	--	--
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	TF6W	3.1E-03
	ESEP	8.9E-01	WESF	2.6E-06	--	--
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF6W	6.9E-05
	ESEP	2.1E+00	--	--	--	--
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	3.0E-03
	EVAP	1.4E-04	ESEP	8.4E-04	WESF	2.4E-07
Ru-106	ESEP	1.0E-09	--	--	--	--
Sm-151	ESEP	1.7E-02	--	--	--	--
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	2.1E-01	EVAP	8.0E-05	ESEP	1.4E-00
	WESF	5.1E-06	--	--	--	--
Tc-99	ESEP	8.4E-04	--	--	--	--
Zr-93	ESEP	1.1E-04	--	--	--	--

Note:
Ci/yr = Curie per year
-- indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

7/2/96 correction

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Table G.3.1.13 Emission Rates for the Ex Situ/In Situ Combination Alternative - Construction Phase

Pollutant	Source	Emission Rate (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W	8.7E-04
	TF6W	0.24
	TA1W	3.6E-03
	TA2W	1.9E-02
	TA3W	3.6E-03
	TA1E	3.6E-03
	TA2E	3.6E-03
	PROC	8.0E-02
Carbon Monoxide	TF5W	1.9E-02
	TF6W	5.2E-01
	TA1W	4.8E-02
	TA2W	2.5E-01
	TA3W	4.8E-02
	TA1E	4.8E-02
	TA2E	4.8E-02
	PROC	6.17E+01
Nitrogen Dioxide	TF5W	7.3E-02
	TF6W	1.19E+00
	TA1W	1.6E-01
	TA2W	8.3E-01
	TA3W	1.6E-01
	TA1E	1.6E-01
	TA2E	1.6E-01
	PROC	5.86E+00
PM-10	TF5W	5.2E-03
	TF6W	6.7E-01
	TA1W	3.7E-02
	TA2W	1.94E-01
	TA3W	3.7E-02
	TA1E	3.7E-02
	TA2E	3.7E-02
	PROC	3.54E+00
	BTCH	1.20E+00
Hazardous Air Pollutants		
Formaldehyde	TF5W	1.81E-05
	TF6W	2.08E-04
	TA1W	4.67E-05
	TA2W	2.45E-04
	TA3W	4.67E-05
	TA1E	4.67E-05
	TA2E	4.67E-05
	PROC	1.51E-03

Notes:
g/sec = Grams per second
Additional emissions from tank farms and evaporator would occur as shown in Table G.3.1.2.

Table [redacted] Emission Rates for the Ex Situ/In Situ Combination Alternative 2 - Operation Phase

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Pollutant	Source	Emission Rates (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W, TF6W	3.5E-04 [redacted]
	ST-H	2.0E-03 [redacted] *
	ST-L	2.6E-01 [redacted]
Carbon Monoxide	TF5W, TF6W	7.6E-03 [redacted]
	ST-H	9.0E-02 [redacted] *
	ST-L	3.0E+00 [redacted]
Nitrogen Dioxide	TF5W, TF6W	2.9E-02 [redacted]
	ST-H	2.0E-03 [redacted] *
	ST-L	1.8E-01 [redacted]
PM-10	TF6W	5.2E-03 [redacted]
	TF5W	1.3E-02 [redacted]
	BTCH	2.4E-01 [redacted]
Hazardous Air Pollutants		
Formaldehyde	TF5W, TF6W	7.2E-06 [redacted]
[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
Arsenic Compounds	ST-H	1.4E-10 [redacted] *
	ST-L	3.1E-10 [redacted]
Beryllium Compounds	ST-H	3.6E-12 [redacted] *
	ST-L	2.2E-12 [redacted]
Cadmium Compounds	ST-H	1.3E-09 [redacted] *
	ST-L	2.7E-09 [redacted]
Cobalt Compounds	ST-H	1.5E-10 [redacted] *
	ST-L	7.7E-11 [redacted]
Chromium Compounds	ST-H	7.5E-09 [redacted] *
	ST-L	2.0E-07 [redacted]
Manganese Compounds	ST-H	3.7E-08 [redacted] *
	ST-L	2.3E-08 [redacted]
Lead Compounds	ST-H	4.6E-09 [redacted] *
	ST-L	3.3E-09 [redacted]
Antimony Compounds	ST-H	3.3E-10 [redacted] *
	ST-L	1.2E-10 [redacted]
Selenium Compounds	ST-H	4.0E-10 [redacted] *
	ST-L	1.0E-09 [redacted]
Nickle Compounds	ST-H	2.7E-05 [redacted] *
	ST-L	1.1E-09 [redacted]
Hydrogen Chloride	ST-H	8.5E-04 [redacted] *
	ST-L	3.4E-03 [redacted]
Iodine	ST-H	9.0E-07 [redacted] *
	ST-L	4.6E-04 [redacted]
Ammonia	ST-H	0.0 [redacted] *
	ST-L	3.7E-02 [redacted]
Silver Oxide	ST-H	6.0E-11 [redacted] *
	ST-L	3.8E-11 [redacted]
Boric Oxide	ST-H	4.2E-10 [redacted] *
	ST-L	1.1E-09 [redacted]

Notes:
g/sec = Grams per second

* 7/2/96 correction

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Table ~~G.3.1.3~~ Emission Rates for the ~~Ex Situ Intermediate Separations~~ Alternative - Operation Phase (cont'd)

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Pollutant	Source	Emission Rate (g/sec)
Calcium Oxide	ST-H	0 0
	ST-L	4.8E-06 ~~9.6E-06~~
Ferric Oxide	ST-H	1.1E-06 ~~2.12E-06~~
	ST-L	2.0E-08 ~~4.0E-08~~
Magnesium Oxide	ST-H	8.0E-09 ~~1.68E-08~~
	ST-L	4.8E-06 ~~9.5E-06~~
Tellurium Trioxide	ST-H	3.1E-10 ~~6.19E-10~~
	ST-L	1.0E-11 ~~2.1E-11~~
Uranium Trioxide	ST-H	1.4E-06 ~~2.81E-06~~
	ST-L	1.4E-07 ~~2.9E-07~~
Vanadium Pentoxide	ST-H	6.3E-11 ~~1.26E-10~~
	ST-L	2.6E-11 ~~5.2E-11~~
Zinc Oxide	ST-H	1.6E-09 ~~3.33E-09~~
	ST-L	1.6E-09 ~~3.3E-09~~
Zirconium Oxide	ST-H	6.8E-07 ~~1.36E-06~~
	ST-L	2.8E-08 ~~5.7E-08~~
Fluoride	ST-H	1.3E-02 ~~2.71E-02~~
	ST-L	1.1E-02 ~~2.24E-02~~
Nitric Acid	ST-H	2.5E-03 ~~5.06E-03~~
	ST-L	2.1E-03 ~~4.18E-03~~
Barium Oxide	ST-H	2.1E-09 ~~4.17E-09~~
	ST-L	5.0E-10 ~~1.0E-09~~

Notes:
g/sec = Grams per second
In addition, routine and retrieval emissions from tank farms and evaporator would occur as shown in Table G.3.1.3.

this table should have been in previou issue. Add here now.

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Table G.3.1.27 Radionuclide Emission Rates for the Ex Situ/In Situ Combination Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF5W	1.7E-03	TF6W	1.7E-03	STH	1.9E-03
C-14	STL	2.7E-02	–	–	–	–
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	1.6E-03	TF6W	1.6E-03
	STH	1.3E-00	WESF	2.6E-06	–	–
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF5W	3.6E-05
	TF6W	3.6E-05	STL	1.8E+00	–	–
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	1.6E-03	TF6W	1.6E-03
	STH	2.1E-03	EVAP	1.4E-04	WESF	2.4E-07
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	1.1E-01
	TF6W	1.1E-01	STH	1.3E-04	EVAP	8.0E-05
	WESF	5.1E-06	–	–	–	–
Tc-99	STH	1.2E-04	–	–	–	–

Note:
Ci/yr = Curie per year
– indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

7/2/96 changes

G.3.1.?

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Table ~~G.3.1.3~~ Emission Rates for the Ex Situ/In Situ Combination Alternative 2 - Construction Phase

Pollutant	Source	Emission Rate (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W	8.7E-04
	TF6W	0.24
	TA1W	3.6E-03
	TA2W	1.9E-02
	TA3W	3.6E-03
	TA1E	3.6E-03
	TA2E	3.6E-03
	PROC	8.0E-02
Carbon Monoxide	TF5W	1.9E-02
	TF6W	5.2E-01
	TA1W	4.8E-02
	TA2W	2.5E-01
	TA3W	4.8E-02
	TA1E	4.8E-02
	TA2E	4.8E-02
	PROC	6.17E+01
Nitrogen Dioxide	TF5W	7.3E-02
	TF6W	1.19E+00
	TA1W	1.6E-01
	TA2W	8.3E-01
	TA3W	1.6E-01
	TA1E	1.6E-01
	TA2E	1.6E-01
	PROC	5.86E+00
PM-10	TF5W	5.2E-03
	TF6W	6.7E-01
	TA1W	3.7E-02
	TA2W	1.94E-01
	TA3W	3.7E-02
	TA1E	3.7E-02
	TA2E	3.7E-02
	PROC	3.54E+00
	BTCH	1.20E+00
Hazardous Air Pollutants		
Formaldehyde	TF5W	1.81E-05
	TF6W	2.08E-04
	TA1W	4.67E-05
	TA2W	2.45E-04
	TA3W	4.67E-05
	TA1E	4.67E-05
	TA2E	4.67E-05
	PROC	1.51E-03

Notes:
g/sec = Grams per second
Additional emissions from tank farms and evaporator would occur as shown in Table G.3.1.2.

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Table ~~G-[illegible]~~ Emission Rates for the Ex Situ/In Situ Combination Alternative 2 - Operation Phase

Pollutant	Source	Emission Rates (g/sec)
Criteria Pollutants		
Sulfur Oxides	TF5W, TF6W	3.5E-04 ~~8.9E-04~~
	ST-H	4.1E-03 ~~1.[illegible]E-03~~
	ST-L	2.6E-01 ~~3.[illegible]E-01~~
Carbon Monoxide	TF5W, TF6W	7.6E-03 ~~1.[illegible]E-02~~
	ST-H	1.8E-01 ~~6.[illegible]E-01~~
	ST-L	3.0E+00 ~~[illegible]E+00~~
Nitrogen Dioxide	TF5W, TF6W	2.9E-02 ~~7.[illegible]E-02~~
	ST-H	4.0E-03 ~~1.[illegible]E-02~~
	ST-L	1.8E-01 ~~[illegible]~~
PM-10	TF6W	5.2E-03 ~~[illegible]E-03~~
	TF5W	1.3E-02 ~~3.[illegible]E-02~~
	BTCH	2.4E-01 ~~4.7E-01~~
Hazardous Air Pollutants		
Formaldehyde	TF5W, TF6W	7.2E-06 ~~1.8E-04~~
~~Chlorine~~	~~ST-H~~	~~[illegible]E-03~~
	~~ST-L~~	~~[illegible]E-03~~
Arsenic Compounds	ST-H	2.8E-10 ~~9.2E-10~~
	ST-L	3.1E-10 ~~4.[illegible]E-10~~
Beryllium Compounds	ST-H	7.2E-12 ~~2.[illegible]E-11~~
	ST-L	2.2E-12 ~~3.[illegible]E-12~~
Cadmium Compounds	ST-H	2.6E-09 ~~8.[illegible]E-09~~
	ST-L	2.7E-09 ~~3.[illegible]E-09~~
Cobalt Compounds	ST-H	2.9E-10 ~~9.[illegible]E-10~~
	ST-L	7.7E-11 ~~1.[illegible]E-10~~
Chromium Compounds	ST-H	1.5E-08 ~~4.[illegible]E-08~~
	ST-L	2.0E-07 ~~2.[illegible]E-07~~
Manganese Compounds	ST-H	5.4E-08 ~~1.[illegible]E-07~~
	ST-L	2.3E-08 ~~7.[illegible]E-08~~
Lead Compounds	ST-H	9.3E-09 ~~3.[illegible]E-08~~
	ST-L	3.3E-09 ~~4.[illegible]E-09~~
Antimony Compounds	ST-H	6.6E-10 ~~2.[illegible]E-09~~
	ST-L	1.2E-10 ~~1.[illegible]E-10~~
Selenium Compounds	ST-H	8.1E-10 ~~2.[illegible]E-09~~
	ST-L	1.0E-09 ~~1.[illegible]E-09~~
Nickle Compounds	ST-H	5.4E-05 ~~1.[illegible]E-04~~
	ST-L	1.1E-09 ~~1.[illegible]E-09~~
Hydrogen Chloride	ST-H	1.7E-03 ~~5.[illegible]E-03~~
	ST-L	3.4E-03 ~~4.[illegible]E-03~~
Iodine	ST-H	1.8E-06 ~~6.[illegible]E-06~~
	ST-L	4.6E-04 ~~8.[illegible]E-04~~
Ammonia	ST-H	0.0 ~~0.0~~
	ST-L	3.9E-02 ~~[illegible]E-02~~
Silver Oxide	ST-H	1.2E-10 ~~4.[illegible]E-10~~
	ST-L	3.8E-11 ~~3.[illegible]E-11~~
Boric Oxide	ST-H	8.4E-10 ~~2.[illegible]E-09~~
	ST-L	1.1E-09 ~~1.5E-09~~

Notes:
g/sec = Grams per second

Ex Situ/In Situ Combination 2

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Table ~~G.3.1.8~~ Emission Rates for the ~~In Situ Intermediate Separations~~ Alternative - Operation Phase (cont'd)

Pollutant	Source	Emission Rate (g/sec)	
Calcium Oxide	ST-H	0.0	* 7-30-96
	ST-L	6.7E-06	
Ferric Oxide	ST-H	3.2E-07	*
	ST-L	2.8E-08	
Magnesium Oxide	ST-H	2.3E-09	*
	ST-L	6.6E-06	
Tellurium Trioxide	ST-H	1.0E-10	*
	ST-L	1.5E-11	
Uranium Trioxide	ST-H	4.2E-07	*
	ST-L	2.0E-07	
Vanadium Pentoxide	ST-H	1.9E-11	*
	ST-L	3.6E-11	
Zinc Oxide	ST-H	5.0E-10	*
	ST-L	2.3E-09	
Zirconium Oxide	ST-H	2.0E-07	*
	ST-L	4.0E-08	
Fluoride	ST-H	4.0E-03	*
	ST-L	1.6E-02	
Nitric Acid	ST-H	7.5E-04	*
	ST-L	2.9E-03	
Barium Oxide	ST-H	6.5E-10	*
	ST-L	7.0E-10	

Notes:
g/sec = Grams per second
In addition, routine and retrieval emissions from tank farms and evaporator would occur as shown in Table G.3.1.3.

* 7/2/96 correction

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Table [redacted] Radionuclide Emission Rates for the Ex Situ/In Situ Combination Alternative

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF5W	1.7E-03	TF6W	1.7E-03	[redacted] STH	[redacted]
C-14	STL	[redacted] 1.9E-02	–	–	–	5.7E-04
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	1.6E-03	TF6W	1.6E-03
	[redacted] STH	[redacted] 3.9E-01	WESF	2.6E-06	–	–
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF5W	3.6E-05
	TF6W	3.6E-05	STL	[redacted] 1.6E+00	–	–
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	1.6E-03	TF6W	1.6E-03
	[redacted] STH	[redacted] 6.3E-04	EVAP	1.4E-04	WESF	2.4E-07
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	1.1E-01
	TF6W	1.1E-01	[redacted] STH	[redacted] 6.3E-01	EVAP	8.0E-05
	WESF	5.1E-06	–	–	–	–
Tc-99	[redacted] STH	[redacted] 3.6E-05	–	–	–	–

Note:
Ci/yr = Curie per year
– indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

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Table G.3.1.15 Emission Rates for the Phased Implementation Alternative Phase 1 - Construction Phase

Pollutant	Source	Emission Rate (g/sec)
Criteria Pollutants		
Sulfur Oxides	FCPI	1.93E-01
Carbon Monoxide	FCPI	46.2
Nitrogen Dioxide	FCPI	8.59E+00
PM-10	FCPI BTCH	6.8E+00 3.15E+00
Hazardous Air Pollutants		
Formaldehyde	FCPI	3.50E-05

Notes:
g/sec = Grams per second
Routine emissions from tank farms and evaporator would occur as shown in Table G.3.1.2

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Table G.3.1.16 Emission Rates for the Phased Implementation Alternative Phase 1 - Operation Phase

Pollutant	Source	Emission Rates (g/sec)
Criteria Pollutants		
Sulfur Oxides	SSPI	1.358E-01
	NSPI	2.338E-01
Carbon Monoxide	SSPI	2.27E+00
	NSPI	3.78E+00
Nitrogen Dioxide	SSPI	9.589E-02
	NSPI	1.613E-01
PM-10	SSPI	6.215E-03
	NSPI	1.287E-02
Hazardous Air Pollutants		
Chromium Compounds	SSPI	4.78E-08
	NSPI	8.88E-08
Manganese Compounds	SSPI	4.62E-09
	NSPI	3.70E-08
Nickle Compounds	SSPI	1.33E-09
	NSPI	3.70E-09
Fluoride (as HF)	SSPI	3.92E-02
	NSPI	6.69E-02
Nitric Acid	SSPI	8.88E-03
	NSPI	2.37E-02
Ammonia	SSPI	1.08E-02
	NSPI	2.62E-02
Hydrogen Chloride	SSPI	1.07E-03
	NSPI	1.79E-03

Notes:
g/sec = Grams per second
Additional emissions from routine operations and retrieval operations would occur as shown in Table G.3.1.2.
Emission rates of all inorganic compounds are not given; however, negligible impacts similar to those predicted for the Ex Situ Intermediate Separations and Ex Situ No Separations alternatives are expected.

Table G.3.1.17 Emission Rates for the Phased Implementation Alternative Phase 2 - Construction Phase

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Pollutant	Source	Emission Rate (g/sec)
Criteria Pollutants		
Sulfur Oxides	TP5W	1.77E-03
	TP6W	1.77E-03
	TA1W	7.18E-03
	TA2W	3.77E-02
	TA3W	7.18E-03
	TA1E	7.18E-03
	TA2E	7.18E-03
	PROC	2.34E-01 ~~2.13E-01~~
Carbon Monoxide	TP5W	3.72E-02
	TP6W	3.72E-02
	TA1W	9.69E-02
	TA2W	0.510
	TA3W	9.69E-02
	TA1E	9.69E-02
	TA2E	9.69E-02
	PROC	1.76E+02 ~~[illegible]~~
Nitrogen Dioxide	TP5W	1.46E-01
	TP6W	1.46E-01
	TA1W	3.15E-01
	TA2W	1.66
	TA3W	3.15E-01
	TA1E	3.15E-01
	TA2E	3.15E-01
	PROC	1.76E+02 ~~[illegible]~~
PM-10	TP5W	1.03E-02
	TP6W	1.03E-02
	TA1W	7.40E-02
	TA2W	3.88E-01
	TA3W	7.40E-02
	TA1E	7.40E-02
	TA2E	7.40E-02
	PROC	7.34E+00 ~~[illegible]~~
	BTCH	3.17E+00
Hazardous Air Pollutants		
Formaldehyde	TP5W	3.61E-05
	TP6W	3.61E-05
	TA1W	9.33E-05
	TA2W	4.89E-04
	TA3W	9.33E-05
	TA1E	9.33E-05
	TA2E	9.33E-05
	PROC	4.28E-03 ~~[illegible]~~

Notes:
g/sec = Grams per second
Routine emissions from tank farms and evaporator would occur as shown in Table G.3.1.2

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BY _____ CHKD. _____ JOB NO. _____

Table G.3.1.18 Emission Rates for The Phased Implementation Alternative Phase 2 - Operation Phase

Pollutant	Source	Emission Rates (g/sec)
Sulfur Oxides	TF5W, TF6W	1.77E-03
	STH	1.38E-02
	STL1	3.78E-01
	STL2	3.78E-01
Carbon Monoxide	TF5W, TF6W	3.72E-02
	STH	6.10E-01
	STL1	4.25E+00
	STL2	4.25E+00
Nitrogen Dioxide	TF5W, TF6W	1.46E-01
	STH	1.31E-02
	STL1	2.57E-01
	STL2	2.57E-01
PM-10	TF5W, TF6W	1.03E-02
Hazardous Air Pollutants		
Formaldehyde	TF5W, TF6W	3.61E-05
Arsenic Compounds	STH	9.20E-10
	STL1	4.40E-10
	STL2	4.40E-10
Beryllium Compounds	STH	2.34E-11
	STL1	3.15E-12
	STL2	3.15E-12
Cadmium Compounds	STH	8.80E-09
	STL1	3.80E-09
	STL2	3.80E-09
Cobalt Compounds	STH	9.80E-10
	STL1	1.10E-10
	STL2	1.10E-10
Chromium Compounds	STH	4.93E-08
	STL1	2.85E-07
	STL2	2.85E-07

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DATE _____ SUBJECT Table G.3.1.18 Cont'd SHEET NO. Sheet A-282

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Manganese Compounds	STH	1.75E-07
	STL1	3.25E-08
	STL2	3.25E-08
Lead Compounds	STH	3.10E-08
	STL1	4.70E-09
	STL2	4.70E-09
Antimony Compounds	STH	2.21E-09
	STL1	1.15E-10
	STL2	1.15E-10
Selenium Compounds	STH	2.70E-09
	STL1	1.35E-09
	STL2	1.35E-09
Nickel Compounds	STH	1.75E-04
	STL1	1.60E-09
	STL2	1.60E-09
Hydrogen Chloride	STH	5.80E-03
	STL1	4.80E-03
	STL2	4.80E-03
Iodine	STH	6.10E-06
	STL1	7.00E-04
	STL2	7.00E-04
Ammonia	STH	0.0
	STL1	5.60E-02
	STL2	5.60E-02
Silver Oxide	STH	4.01E-10
	STL1	5.50E-11
	STL2	5.50E-11
Boric Oxide	STH	2.65E-06
	STL1	1.50E-09
	STL2	1.50E-09

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JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT Table G.3.1.18 cont'd SHEET NO. Sheet A-283

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Pollutant		
Calcium Oxide	STH	0.0
	STL1	4.8E-06
	STL2	4.8E-06
Ferric Oxide	STH	1.0E-06
	STL1	2.0E-08
	STL2	2.0E-08
Magnesium Oxide	STH	1.3E-08
	STL1	4.8E-06
	STL2	4.8E-06
Tellarium Trioxide	STH	3.1E-10
	STL1	1.0E-11
	STL2	1.0E-11
Uranium Trioxide	STH	1.4E-06
	STL1	1.4E-07
	STL2	1.4E-07
Vanadium Pentoxide	STH	1.1E-10
	STL1	2.6E-11
	STL2	2.6E-11
Zinc Oxide	STH	1.6E-09
	STL1	1.6E-09
	STL2	1.6E-09
Zirconium Oxide	STH	6.9E-07
	STL1	2.8E-08
	STL2	2.8E-08
Fluoride	STH	1.3E-02
	STL1	1.1E-02
	STL2	1.1E-02
Nitric Acid	STH	2.5E-03
	STL1	2.1E-03
	STL2	2.1E-03
Barium Oxide	STH	2.1E-09
	STL1	5.0E-10
	STL2	5.0E-10

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Table G.3.1.28 Radionuclide Emission Rates for the Phased Implementation Alternative Phase 1

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	8E-09	SSPI	3.26E-07	NSPI	2.40E-04
C-14	SSPI	4.0E+01	NSPI	7.0E+01	--	--
Cs-137	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	WESF	2.60E-06
	SSPI	1.87E-03	NSPI	1.73E-01	--	--
Pu-239	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	2.4E-07
	EVAP	1.4E-04	WESF	2.4E-07	SSPI	7.90E-08
	NSPI	2.63E-04	--	--	--	--
Sr-90	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	9.1E-08	EVAP	8.0E-05	WESF	5.1E-06
	SSPI	7.20E-05	NSPI	2.67E-01	--	--
Tc-99	SSPI	9.83E-07	--	--	--	--

Notes:
Ci\yr = Curie per year
-- indicates no additional sources or emission rates.

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Table G.3.1.29 Radionuclide Emission Rates for the Phased Implementation Alternative Phase 2

Radionuclide	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)	Source	Emission Rate (Ci/yr)
Am-241	[redacted]	[redacted]	[redacted]	[redacted]	--	--
	TF1W	7.6E-08	TF2W	4.0E-04	TF4W	1.1E-03
	TF6W	3.2E-03	STH	1.05 [redacted]E-03	--	--
C-14	STL1	1.7E-02 [redacted]	[redacted] STL2	1.7E-02 [redacted]	[redacted]	[redacted]
Cs-137	[redacted]	[redacted]	[redacted]	[redacted]	--	--
	TF1E	2.4E-05	TF2E	2.1E-04	TF3E	9.1E-05
	TF6E	2.7E-05	TF7E	2.7E-05	TF8E	2.4E-05
	TF9E	2.9E-05	TF10E	2.8E-08	TF2W	4.3E-04
	TF4W	1.0E-03	TF5W	8.2E-08	TF6W	3.1E-03
	STH	[redacted] 7.6E-01	WESF	2.6E-06	--	--
I-129	TF6E	2.3E-05	TF7E	2.3E-05	TF6W	6.9E-05
	STL1	[redacted] 1.0E+00	STL2	1.0E+00	--	--
Pu-239	[redacted]	[redacted]	[redacted]	[redacted]	--	--
	TF6E	2.9E-09	TF7E	2.9E-09	TF10E	1.5E-08
	TF1W	2.3E-08	TF2W	2.3E-04	TF3W	7.1E-05
	TF4W	1.0E-03	TF5W	8.1E-09	TF6W	3.0E-03
	STH	[redacted] 1.15E-03	EVAP	1.4E-04	WESF	2.4E-07
Sr-90	SSP1	7.20E-05	[redacted]	[redacted]	--	--
	TF1E	2.4E-05	TF2E	5.4E-06	TF3E	2.5E-03
	TF4E	2.5E-05	TF5E	1.2E-07	TF6E	4.1E-06
	TF7E	4.1E-06	TF8E	6.7E-04	TF9E	8.3E-04
	TF10E	1.6E-07	TF11E	6.6E-08	TF2W	2.4E-04
	TF3W	7.0E-02	TF4W	1.1E-03	TF5W	3.1E-06
	TF6W	2.1E-01	[redacted]	[redacted]	EVAP	8.0E-05
	WESF	5.1E-06	STH	7.0E-05 [redacted]	--	--
Tc-99	STH	[redacted] 6.5E-05	[redacted]	[redacted]	--	--

Note:
Ci/yr = Curie per year
-- indicates no additional sources or emission rates.
Emission rates shown are for the operational phase of the alternative. Emission rates for the construction phase are the same as those shown for the No Action alternative (tank waste) (Table G.3.1.19). No radionuclides will be emitted from the construction areas.

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TANK FARM OPERATIONS DATA FOR THE TWRS-EIS

1.0 Introduction

Subsequent to initiation of preparation of the engineering data packages for the TWRS-EIS, it was decided that routine tank farm operations would be included in the scope of the EIS. Appendix A of this document provides data for manpower, cost, material resources, nonradioactive and radioactive air emissions, and solid waste for routine tank farm operations, for each of the tank waste disposal alternatives.

2.0 Scope

Routine tank farm operations is defined as the Operations and Maintenance Program Element, minus salt well pumping (SST stabilization). The primary facilities operated and maintained within this scope are the DST and SST farms and the 242-A evaporator. Functions within this scope include management, integration and planning, regulatory compliance and reporting, surveillance, and operation and maintenance of facilities and equipment. Salt well pumping is not included in the data tables in this report because that is considered a safety action covered by separate NEPA documentation.

3.0 Sources of Information

Manpower information provided by L. C. Mercado, Operations and Maintenance Program Office (TWRS), includes the following:

1) Cost Loading Report, Primavera Project Planner, O&M: Total Cost by FY-Summary by Activity, Report Date 08 June 1994. (Input to the Multi-Year Program Plan).

2) Spreadsheet for the 1N1 Program - Tank Farm Operations and Mainenance, FY 1995 Funded Staffing Levels, by Activity and Cost Account.

3) FY 1995 Tank Farms distribution of Exempt, Non-Exempt, and Bargaining Unit personnel, by shift, and by organization code.

Estimated solid waste quantities provided by J. M. Thurman, Waste Characterization and Preplanning (TWRS):

4) 1994 30-Year Solid Waste Forecast for Waste Tank Operations (Draft).

Modified Multi-Year Program Plan manpower and cost information for Tank Farms for the TPA Preferred Alternative provided by K. O. Boomer and E. J. Slaathaug (TWRS):

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5) Spreadsheet, "Person-Year Totals for TPA Case" (1995 through 2040).

6) TWRS Baseline Estimate Escalation of 4/14 File (in 1994 dollars without excalation, and with escalation from FY 2000 through FY 2000).

Other data sources include the following:

7) Environmental Releases for Calendar Year 1993, S. P. Thomas and B. L. Corn, WHC-EP-0527-3, release date 8/17/1994.

8) Hanford Defense Waste Disposal Alternatives: Engineering Support Data for the Hanford Defense Waste Environmental Impact Statement, RHO-RE-ST-30-P, December 1985.

9) No Disposal Action Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement, C. D. Meng, WHC-SD-WM-EV-099, Rev. B (Draft), March 1995.

4.0 Assumptions

The following assumptions were used in developing the data in the data tables in Appendix A of this report:

1) Data does not include emissions or resource requirements for the 200 East and 200 West Area powerhouses (steam plants) which are the largest contributors to nonradioactive air emissions in the 200 Area, but are not part of TWRS.

2) Exempt Full Time Equivalents (FTEs) are assumed to be 80% non-radiation workers, and 20% radiation workers (personal communication with L. C. Mercado).

3) Bargaining Unit worker quantities from the Multi-Year Program Plan are assumed to be non-exempt radiation workers in the data tables in this report.

4) Non-Exempt worker quantities from the Multi-Year Program Plan are assumed to be non-exempt non-radiation workers in the data tables in this report.

5) Non-radioactive air emissions annual quantities are assumed proportional to total work force.

6) Radioactive air emissions annual quantities are assumed proportional to volume of waste remaining in tanks through tank waste retrieval and disposal operations.

7) The volume of waste remaining in tanks, by fiscal year, was estimated based on an exponential decay function of the form $P = 100 \times (2 - \exp[A \times (t-t_0)])$, where P = percent of waste

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remaining, A = value selected to reach 0% at the end of the waste processing schedule, t = year of interest, t_0 = year before start of waste processing.

8) Water usage is based on 22 gal per FTE per work day.

5.0 Reconciliation with Engineering Data Packages

TPA Preferred Alternative

Data tables do not presently include routine tank farm operations, except for footnote 4 to Table 9-17. Since program management, tank farm safety, tank farm upgrades, and characterization are not part of the scope of the TWRS-EIS, the dollar value in this footnote should be replaced by the sum of the annual costs included in the data table in Appendix A of this report addressing the TPA Preferred Alternative.

No Separations Alternative

Data tables do not presently include routine tank farm operations, except for footnote 6 to Table 6-18. Since program management, tank farm safety, tank farm upgrades, and characterization are not part of the scope of the TWRS-EIS, the dollar value in this footnote should be replaced by the sum of the annual costs included in the data table in Appendix A of this report addressing the No Separations Alternative.

Extensive Separations Alternative

When Rev. B of this document is transmitted, it will not include data for routine tank farm operations.

Tank Waste Retrieval and Transfer

This data package did not include routine tank farm operations.

Closure

This data package did not include routine tank farm operations.

In Situ Disposal

Entries in Table 7-2 that are not part of the scope of the TWRS-EIS, and should be deleted, are listed for the following unit processes, for each in-situ disposal sub-alternative:

Program Management
Tank Safety

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In addition, the entries for Operations and Maintenance should be deleted. Manpower resources for tank farm operations and maintenance are provided instead in the data tables in Appendix A for the in situ disposal subalternatives.

In Table 7-3, total staff hours for each in situ disposal subalternative should be reduced to reflect the changes in Table 7-2 specified above. Distribution of total staff hours by the operating personnel categories listed should be in the same proportions as in existing Table 7-3.

Operating costs provided in Table 7-19, note 1, under the heading "Additional Staffing" totaling $1,800 million should be deleted from the operating cost for labor indicated for each alternative. Operating costs for Operations and Maintenance are provided in Appendix A for each of the in situ disposal subalternatives, by fiscal year.

Appendix B provides revised annual % distribution plots, to replace Figures 8-1, 8-2, and 8-3.

No Disposal Action

Values in Table 5-3 should be replaced with the staffing values given in the data table in Appendix A of this report, for the No Disposal Action alternative (annual average summed over 100 years, multiplied by 1812 manhours per FTE). Water utilization in Table 5-4 should be replaced by the value in Appendix A for this alternative. Operating cost in Table 5-17 should be replaced with the sum of the annual operating costs in the data table in Appendix A for this alternative, extended over the 100 year operating period.

Prepared by: E. A. Fredenburg — Date 3/24/95
E. A. Fredenburg (Technical Integration)

Approved by: G. L. Dunford — Date 3/24/95
G. L. Dunford (Technical Integration)

Reviewed by: L. C. Mercado — Date 3/24/95
L. C. Mercado (O & M Program)

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Appendix A

Data Tables

Tank Waste Operations Data -- TPA Preferred Alternative

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exempt FTEs												
Rad	89	90	92	89	90	88	97	97	97	96	95	89
Non-Rad	354	358	366	358	358	352	388	388	386	384	379	357
Non-Exempt FTEs												
Rad	416	422	431	421	422	414	457	456	455	452	446	420
Non-Rad	89	90	92	90	90	89	98	97	97	97	95	90
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016	955
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158	$150
Non-Radiological Emissions												
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11	1.11E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21	0.20
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73	0.69
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83	0.78
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61	7.15
Radiological Emissions (curies)												
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.51E-05	4.41E-05	4.31E-05	4.21E-05	4.11E-05	3.87E-05	3.64E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.44E-05	4.27E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	7.07E-06	6.89E-06	6.73E-06	6.56E-06	6.40E-06	6.02E-06	5.65E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.67E-07	1.60E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	6.05E-05	5.90E-05	5.76E-05	5.62E-05	5.48E-05	5.16E-05	4.84E-05
Solid Wastes (cu. m)												
radiological	270	300	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources												
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12	11
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04	2.10E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24	0.22
Steel (t)	10	10	10	10	10	10	10	10	10	10	10	9

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Tank Waste Operations Data -- TPA Preferred Alternative

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
87	77	76	75	74	71	70	70	66	67	62	60	56	55
348	308	306	300	296	285	281	279	266	266	247	240	224	220
410	363	360	353	348	335	331	329	313	313	290	282	264	258
88	78	77	75	74	72	71	70	67	67	62	60	56	55
933	826	819	804	792	762	753	748	712	713	661	642	600	588
$147	$133	$132	$130	$129	$125	$124	$123	$118	$115	$113	$110	$107	$106
1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.68E+10	8.26E+10	8.27E+10	7.67E+10	7.45E+10	6.96E+10	6.82E+10
0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.12
0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.51	0.51	0.47	0.46	0.43	0.42
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.58	0.58	0.54	0.52	0.49	0.48
0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.60	5.33	5.34	4.95	4.81	4.49	4.40
3.41E-05	3.18E-05	2.96E-05	2.74E-05	2.53E-05	2.31E-05	2.10E-05	1.90E-05	1.69E-05	1.49E-05	1.29E-05	1.09E-05	9.00E-06	7.08E-06
4.09E-05	3.91E-05	3.72E-05	3.53E-05	3.32E-05	3.11E-05	2.90E-05	2.67E-05	2.44E-05	2.20E-05	1.95E-05	1.69E-05	1.42E-05	1.15E-05
5.29E-06	4.93E-06	4.58E-06	4.23E-06	3.89E-06	3.56E-06	3.23E-06	2.90E-06	2.59E-06	2.28E-06	1.97E-06	1.67E-06	1.37E-06	1.08E-06
1.54E-07	1.47E-07	1.40E-07	1.33E-07	1.25E-07	1.17E-07	1.09E-07	1.00E-07	9.17E-08	8.26E-08	7.33E-08	6.36E-08	5.35E-08	4.31E-08
4.52E-05	4.22E-05	3.92E-05	3.62E-05	3.33E-05	3.04E-05	2.76E-05	2.49E-05	2.21E-05	1.95E-05	1.68E-05	1.43E-05	1.17E-05	9.20E-06
300	300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	10	10	9	9	9	9	9	8	8	8	7	7	7
2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.65E+04	1.57E+04	1.57E+04	1.45E+04	1.41E+04	1.32E+04	1.29E+04
0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.15	0.15	0.14	0.14
9	8	8	8	7	7	6	6	5	5	4	4	3	2

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Tank Waste Operations Data -- TPA Preferred Alternative

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
53	52	51	15	7	7	8	8	5	1
210	208	202	60	29	30	30	30	19	4
247	244	238	71	34	35	36	36	22	4
53	52	51	15	7	7	8	8	5	1
563	556	541	162	77	79	81	81	50	10
$103	$102	$100	$92	$88	$87	$86	$83	$18	$1
				18	1				
6.53E+10	6.45E+10	6.28E+10	1.88E+10	8.93E+09	9.17E+09	9.40E+09	9.40E+09	5.80E+09	1.16E+09
0.12	0.12	0.11	0.03	0.02	0.02	0.02	0.02	0.01	0.00
0.40	0.40	0.39	0.12	0.06	0.06	0.06	0.06	0.04	0.01
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.46	0.45	0.44	0.13	0.06	0.06	0.07	0.07	0.04	0.01
0.07	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.00
4.22	4.16	4.05	1.21	0.58	0.59	0.61	0.61	0.37	0.07
5.19E-06	3.32E-06	1.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.60E-06	5.63E-06	2.55E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.86E-07	5.02E-07	2.22E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.23E-08	2.12E-08	9.59E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.73E-06	4.30E-06	1.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
300	300	300	300	300	300	300	300	200	100
40	40	40	40	40	40	40	40	30	20
190	190	190	190	190	190	190	190	130	70
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7	6	6	2	1	1	1	1	1	0
1.24E+04	1.22E+04	1.19E+04	3.56E+03	1.69E+03	1.74E+03	1.78E+03	1.78E+03	1.10E+03	2.20E+02
0.13	0.13	0.13	0.04	0.02	0.02	0.02	0.02	0.01	0.00
2	1	1	0	0	0	0	0	0	0

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Tank Waste Operations Data -- No Separations

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exempt FTEs												
Rad	89	90	92	89	90	88	97	97	97	96	95	89
Non-Rad	354	358	366	358	358	352	388	388	386	384	379	357
Non-Exempt FTEs												
Rad	416	422	431	421	422	414	457	456	455	452	446	420
Non-Rad	89	90	92	90	90	89	98	97	97	97	95	90
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016	955
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158	$150
Non-Radiological Emissions												
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11	1.11E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21	0.20
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73	0.69
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83	0.78
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61	7.15
Radiological Emissions (curies)												
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.51E-05	4.41E-05	4.31E-05	4.21E-05	4.11E-05	3.82E-05	3.54E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.38E-05	4.15E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	7.07E-06	6.89E-06	6.73E-06	6.56E-06	6.40E-06	5.94E-06	5.49E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.65E-07	1.56E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	6.05E-05	5.90E-05	5.76E-05	5.62E-05	5.48E-05	5.09E-05	4.70E-05
Solid Wastes (cu. m)												
radiological	270	300	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources												
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12	11
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04	2.10E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24	0.22
Steel (t)	10	10	10	10	10	10	10	10	10	10	10	9

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Tank Waste Operations Data -- No Separations

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
87	77	76	75	74	71	70	70	66	67	62	60	15	7
348	308	306	300	296	285	281	279	266	266	247	240	60	29
410	363	360	353	348	335	331	329	313	313	290	282	71	34
88	78	77	75	74	72	71	70	67	67	62	60	15	7
933	826	819	804	792	762	753	748	712	713	661	642	600	588
$147	$133	$132	$130	$129	$125	$124	$123	$118	$115	$113	$110	$107	$106
1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.68E+10	8.26E+10	8.27E+10	7.67E+10	7.45E+10	6.96E+10	6.82E+10
0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.12
0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.51	0.51	0.47	0.46	0.43	0.42
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.58	0.58	0.54	0.52	0.49	0.48
0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.60	5.33	5.34	4.95	4.81	4.49	4.40
3.25E-05	2.97E-05	2.69E-05	2.41E-05	2.13E-05	1.86E-05	1.58E-05	1.31E-05	1.03E-05	7.55E-06	4.80E-06	2.05E-06	0.00E+00	0.00E+00
3.90E-05	3.65E-05	3.38E-05	3.10E-05	2.81E-05	2.50E-05	2.18E-05	1.84E-05	1.49E-05	1.11E-05	7.26E-06	3.18E-06	0.00E+00	0.00E+00
5.04E-06	4.60E-06	4.16E-06	3.72E-06	3.29E-06	2.86E-06	2.43E-06	2.00E-06	1.58E-06	1.15E-06	7.32E-07	3.13E-07	0.00E+00	0.00E+00
1.47E-07	1.37E-07	1.27E-07	1.17E-07	1.06E-07	9.40E-08	8.19E-08	6.92E-08	5.58E-08	4.19E-08	2.73E-08	1.19E-08	0.00E+00	0.00E+00
4.32E-05	3.94E-05	3.56E-05	3.19E-05	2.81E-05	2.44E-05	2.08E-05	1.71E-05	1.35E-05	9.87E-06	6.27E-06	2.68E-06	0.00E+00	0.00E+00
300	300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	10	10	9	9	9	9	9	8	8	8	7	7	7
2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.65E+04	1.57E+04	1.57E+04	1.45E+04	1.41E+04	1.32E+04	1.29E+04
0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.15	0.15	0.14	0.14
8	8	7	7	6	5	5	4	3	2	2	1	0	0

10353

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RGW
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Tank Waste Operations Data -- No Separations

2021	2022	2023	2024	2025
7	8	8	5	1
30	30	30	19	4
35	36	36	22	4
7	8	8	5	1
563	556	541	162	77
$103	$102	$100	$92	$88
6.53E+10	6.45E+10	6.28E+10	1.88E+10	8.93E+09
0.12	0.12	0.11	0.03	0.02
0.40	0.40	0.39	0.12	0.06
n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a
0.46	0.45	0.44	0.13	0.06
0.07	0.07	0.07	0.02	0.01
4.22	4.16	4.05	1.21	0.58
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
300	300	300	200	100
40	40	40	30	20
190	190	190	130	70
n/a	n/a	n/a	n/a	n/a
7	6	6	2	1
1.24E+04	1.22E+04	1.19E+04	3.56E+03	1.69E+03
0.13	0.13	0.13	0.04	0.02
0	0	0	0	0

1899 + 10353 + 11863

24115 301 m - 1 yr.

4067 Δ = -275 million 1995

Ref =
2015
+9477
11492

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Tank Farm Operations Data -- Extensive Separations

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Exempt FTEs											
Rad	89	90	92	89	90	88	97	97	97	96	95
Non-Rad	354	358	366	358	358	352	388	388	386	384	379
Non-Exempt FTEs											
Rad	416	422	431	421	422	414	457	456	455	452	446
Non-Rad	89	90	92	90	90	89	98	97	97	97	95
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158
Non-Radiological Emissions											
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61
Radiological Emissions (curies)											
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.51E-05	4.41E-05	4.31E-05	4.21E-05	4.11E-05	3.87E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.44E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	7.07E-06	6.89E-06	6.73E-06	6.56E-06	6.40E-06	6.02E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.67E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	6.05E-05	5.90E-05	5.76E-05	5.62E-05	5.48E-05	5.16E-05
Solid Wastes (cu. m)											
radiological	270	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources											
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24
Steel (t)	10	10	10	10	10	10	10	10	10	10	10

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Tank Farm Operations Data -- Extensive Separations

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
89	87	77	76	75	74	71	70	70	66	67	62	60
357	348	308	306	300	296	285	281	279	266	266	247	240
420	410	363	360	353	348	335	331	329	313	313	290	282
90	88	78	77	75	74	72	71	70	67	67	62	60
955	933	826	819	804	792	762	753	748	712	713	661	642
$150	$147	$133	$132	$130	$129	$125	$124	$123	$118	$115	$113	$110
1.11E+11	1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.68E+10	8.26E+10	8.27E+10	7.67E+10	7.45E+10
0.20	0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.14	0.14
0.69	0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.51	0.51	0.47	0.46
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.78	0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.58	0.58	0.54	0.52
0.12	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08
7.15	6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.60	5.33	5.34	4.95	4.81
3.64E-05	3.41E-05	3.18E-05	2.96E-05	2.74E-05	2.53E-05	2.31E-05	2.10E-05	1.90E-05	1.69E-05	1.49E-05	1.29E-05	1.09E-05
4.27E-05	4.09E-05	3.91E-05	3.72E-05	3.53E-05	3.32E-05	3.11E-05	2.90E-05	2.67E-05	2.44E-05	2.20E-05	1.95E-05	1.69E-05
5.65E-06	5.29E-06	4.93E-06	4.58E-06	4.23E-06	3.89E-06	3.56E-06	3.23E-06	2.90E-06	2.59E-06	2.28E-06	1.97E-06	1.67E-06
1.60E-07	1.54E-07	1.47E-07	1.40E-07	1.33E-07	1.25E-07	1.17E-07	1.09E-07	1.00E-07	9.17E-08	8.26E-08	7.33E-08	6.36E-08
4.84E-05	4.52E-05	4.22E-05	3.92E-05	3.62E-05	3.33E-05	3.04E-05	2.76E-05	2.49E-05	2.21E-05	1.95E-05	1.68E-05	1.43E-05
300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	11	10	10	9	9	9	9	9	8	8	8	7
2.10E+04	2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.65E+04	1.57E+04	1.57E+04	1.45E+04	1.41E+04
0.22	0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.15	0.15
9	9	8	8	8	7	7	6	6	5	5	4	4

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Tank Farm Operations Data -- Extensive Separations

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
56	55	53	52	51	15	7	7	8	8	5	1
224	220	210	208	202	60	29	30	30	30	19	4
264	258	247	244	238	71	34	35	36	36	22	4
56	55	53	52	51	15	7	7	8	8	5	1
600	588	563	556	541	162	77	79	81	81	50	10
$107	$106	$103	$102	$100	$92	$88	$87	$86	$83	$18	$1
6.96E+10	6.82E+10	6.53E+10	6.45E+10	6.28E+10	1.88E+10	8.93E+09	9.17E+09	9.40E+09	9.40E+09	5.80E+09	1.16E+09
0.13	0.12	0.12	0.12	0.11	0.03	0.02	0.02	0.02	0.02	0.01	0.00
0.43	0.42	0.40	0.40	0.39	0.12	0.06	0.06	0.06	0.06	0.04	0.01
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.49	0.48	0.46	0.45	0.44	0.13	0.06	0.06	0.07	0.07	0.04	0.01
0.08	0.07	0.07	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.00
4.49	4.40	4.22	4.16	4.05	1.21	0.58	0.59	0.61	0.61	0.37	0.07
9.00E-06	7.08E-06	5.19E-06	3.32E-06	1.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.42E-05	1.15E-05	8.60E-06	5.63E-06	2.55E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.37E-06	1.08E-06	7.86E-07	5.02E-07	2.22E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.35E-08	4.31E-08	3.23E-08	2.12E-08	9.59E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.17E-05	9.20E-06	6.73E-06	4.30E-06	1.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
300	300	300	300	300	300	300	300	300	300	200	100
40	40	40	40	40	40	40	40	40	40	30	20
190	190	190	190	190	190	190	190	190	190	130	70
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7	7	7	6	6	2	1	1	1	1	1	0
1.32E+04	1.29E+04	1.24E+04	1.22E+04	1.19E+04	3.56E+03	1.69E+03	1.74E+03	1.78E+03	1.78E+03	1.10E+03	2.20E+02
0.14	0.14	0.13	0.13	0.13	0.04	0.02	0.02	0.02	0.02	0.01	0.00
3	2	2	1	1	0	0	0	0	0	0	0

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12 750,000

Tank Farm Operations Data -- No Disposal Action

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exempt FTEs												
Rad	89	90	92	89	90	88	97	97	97	96	95	95
Non-Rad	354	358	366	358	358	352	388	388	386	384	379	379
Non-Exempt FTEs												
Rad	416	422	431	421	422	414	457	456	455	452	446	446
Non-Rad	89	90	92	90	90	89	98	97	97	97	95	95
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016	1016
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158	$158
Non-Radiological Emissions												
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11	1.18E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21	0.21
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73	0.73
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83	0.83
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61	7.61
Radiological Emissions (curies)												
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.51E-05	4.41E-05	4.31E-05	4.21E-05	4.11E-05	4.02E-05	3.93E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	7.07E-06	6.89E-06	6.73E-06	6.56E-06	6.40E-06	6.25E-06	6.09E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	6.05E-05	5.90E-05	5.76E-05	5.62E-05	5.48E-05	5.35E-05	5.22E-05
Solid Wastes (cu. m)												
radiological	270	300	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources												
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12	12
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04	2.24E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24	0.24
Steel (t)	10	10	10	10	10	10	10	10	10	10	10	10

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BRW
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Tank Farm Operations Data -- No Disposal Action

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
95	95	95	95	95	95	95	95	95	95	95	95	95	95
379	379	379	379	379	379	379	379	379	379	379	379	379	379
446	446	446	446	446	446	446	446	446	446	446	446	446	446
95	95	95	95	95	95	95	95	95	95	95	95	95	95
1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016
$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158
1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11
0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61
3.84E-05	3.75E-05	3.66E-05	3.58E-05	3.50E-05	3.42E-05	3.34E-05	3.26E-05	3.19E-05	3.12E-05	3.04E-05	2.97E-05	2.91E-05	2.84E-05
4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05
5.94E-06	5.80E-06	5.66E-06	5.52E-06	5.39E-06	5.25E-06	5.13E-06	5.00E-06	4.88E-06	4.76E-06	4.64E-06	4.53E-06	4.42E-06	4.31E-06
1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07
5.09E-05	4.96E-05	4.84E-05	4.72E-05	4.61E-05	4.50E-05	4.39E-05	4.28E-05	4.18E-05	4.07E-05	3.97E-05	3.88E-05	3.78E-05	3.69E-05
300	300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12	12	12	12	12	12	12	12	12	12	12	12	12	12
2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04
0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
10	10	10	10	10	10	10	10	10	10	10	10	10	10

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Tank Farm Operations Data -- No Disposal Action

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
95	95	95	95	95	95	95	95	95	95	95	95	95	95
379	379	379	379	379	379	379	379	379	379	379	379	379	379
446	446	446	446	446	446	446	446	446	446	446	446	446	446
95	95	95	95	95	95	95	95	95	95	95	95	95	95
1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016
$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158	$158
1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11	1.18E+11
0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61	7.61
2.78E-05	2.71E-05	2.65E-05	2.59E-05	2.53E-05	2.47E-05	2.42E-05	2.36E-05	2.31E-05	2.25E-05	2.20E-05	2.15E-05	2.10E-05	2.06E-05
4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05
4.21E-06	4.10E-06	4.00E-06	3.91E-06	3.81E-06	3.72E-06	3.63E-06	3.54E-06	3.45E-06	3.37E-06	3.29E-06	3.21E-06	3.13E-06	3.05E-06
1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07
3.60E-05	3.51E-05	3.43E-05	3.34E-05	3.26E-05	3.18E-05	3.10E-05	3.03E-05	2.95E-05	2.88E-05	2.81E-05	2.74E-05	2.68E-05	2.61E-05
300	300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12	12	12	12	12	12	12	12	12	12	12	12	12	12
2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04	2.24E+04
0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
10	10	10	10	10	10	10	10	10	10	10	10	10	10

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2035	2036	
95	95	3,965
379	379	
446	446	18,618
95	95	
1016	1016	
$158	$158	6618 · 15940
1.18E+11	1.18E+11	
0.21	0.21	
0.73	0.73	
n/a	n/a	
n/a	n/a	
0.83	0.83	
0.13	0.13	
7.61	7.61	
2.01E-05	1.96E-05	
4.60E-05	4.60E-05	
2.98E-06	2.90E-06	
1.73E-07	1.73E-07	
2.55E-05	2.49E-05	
200	100	
30	20	
130	70	
n/a	n/a	
12	12	
2.24E+04	2.24E+04	
0.24	0.24	
10	10	

2037 - 2095 = 59 years = 5,605

+59 yrs = 26314

Exempt Rad TOTAL wgts = 9570

Non Exempt Rad total wgts = 44932

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Tank Farm Operations Data -- In Situ Chemical Stabilization

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Exempt FTEs											
Rad	89	90	92	89	90	88	97	97	97	96	95
Non-Rad	354	358	366	358	358	352	388	388	386	384	379
Non-Exempt FTEs											
Rad	416	422	431	421	422	414	457	456	455	452	446
Non-Rad	89	90	92	90	90	89	98	97	97	97	95
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158
Non-Radiological Emissions											
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61
Radiological Emissions (curies)											
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.29E-05	3.97E-05	3.65E-05	3.34E-05	3.02E-05	2.71E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.38E-05	4.15E-05	3.90E-05	3.65E-05	3.38E-05	3.10E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	6.73E-06	6.21E-06	5.71E-06	5.20E-06	4.71E-06	4.21E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.65E-07	1.56E-07	1.47E-07	1.37E-07	1.27E-07	1.17E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	5.76E-05	5.32E-05	4.89E-05	4.45E-05	4.03E-05	3.60E-05
Solid Wastes (cu. m)											
radiological	270	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources											
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24
Steel (t)	10	10	10	10	10	10	9	8	8	7	7

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2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
89	87	77	76	75	74	71	70	70	47	23
357	348	308	306	300	296	285	281	281	187	94
420	410	363	360	353	348	335	331	331	221	110
90	88	78	77	75	74	72	71	71	47	24
955	933	826	819	804	792	762	753	753	502	251
$150	$147	$133	$132	$130	$129	$125	$124	$123	$118	$115
1.11E+11	1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.74E+10	5.82E+10	2.91E+10
0.20	0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.11	0.05
0.69	0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.36	0.18
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.78	0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.41	0.20
0.12	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.06	0.03
7.15	6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.64	3.76	1.88
2.40E-05	2.08E-05	1.77E-05	1.46E-05	1.16E-05	8.47E-06	5.39E-06	2.31E-06	0.00E+00	0.00E+00	0.00E+00
2.81E-05	2.50E-05	2.18E-05	1.84E-05	1.49E-05	1.11E-05	7.26E-06	3.18E-06	0.00E+00	0.00E+00	0.00E+00
3.72E-06	3.23E-06	2.75E-06	2.26E-06	1.78E-06	1.30E-06	8.29E-07	3.54E-07	0.00E+00	0.00E+00	0.00E+00
1.06E-07	9.40E-08	8.19E-08	6.92E-08	5.59E-08	4.19E-08	2.73E-08	1.19E-08	0.00E+00	0.00E+00	0.00E+00
3.18E-05	2.77E-05	2.35E-05	1.94E-05	1.53E-05	1.12E-05	7.09E-06	3.03E-06	0.00E+00	0.00E+00	0.00E+00
300	300	300	300	300	300	300	300	300	200	100
40	40	40	40	40	40	40	40	40	30	20
190	190	190	190	190	190	190	190	190	130	70
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	11	10	10	9	9	9	9	9	6	3
2.10E+04	2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.66E+04	1.10E+04	5.52E+03
0.22	0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.12	0.06
6	5	5	4	3	2	2	1	0	0	0

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Rev. 7-30-96

Tank Farm Operations Data -- In Situ Disposal, Radio Frequence Drying

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exempt FTEs												
Rad	89	90	92	89	90	88	97	97	97	96	95	89
Non-Rad	354	358	366	358	358	352	388	388	386	384	379	357
Non-Exempt FTEs												
Rad	416	422	431	421	422	414	457	456	455	452	446	420
Non-Rad	89	90	92	90	90	89	98	97	97	97	95	90
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016	955
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158	$150
Non-Radiological Emissions												
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11	1.11E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21	0.20
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73	0.69
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83	0.78
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61	7.15
Radiological Emissions (curies)												
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.37E-05	4.12E-05	3.89E-05	3.65E-05	3.42E-05	3.20E-05	2.97E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.46E-05	4.31E-05	4.15E-05	3.99E-05	3.83E-05	3.66E-05	3.49E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	6.84E-06	6.45E-06	6.07E-06	5.70E-06	5.33E-06	4.97E-06	4.62E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.68E-07	1.62E-07	1.56E-07	1.50E-07	1.44E-07	1.38E-07	1.31E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	5.86E-05	5.52E-05	5.20E-05	4.87E-05	4.56E-05	4.25E-05	3.95E-05
Solid Wastes (cu. m)												
radiological	270	300	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources												
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12	11
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04	2.10E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24	0.22
Steel (t)	10	10	10	10	10	10	9	9	9	8	8	8

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RQW
7-30-96

thru 2009
$7,783

Tank Farm Operations Data -- In Situ Disposal, Radio Frequence Drying

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
87	77	76	75	74	71	70	70	66	67	62	60	56	55
348	308	306	300	296	285	281	279	266	266	247	240	224	220
410	363	360	353	348	335	331	329	313	313	290	282	264	258
88	78	77	75	74	72	71	70	67	67	62	60	56	55
933	826	819	804	792	762	753	748	712	713	661	642	600	588
$147	$133	$132	$130	$129	$125	$124	$123	$118	$115	$113	$110	$107	$106
1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.68E+10	8.26E+10	8.27E+10	7.67E+10	7.45E+10	6.96E+10	6.82E+10
0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.12
0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.51	0.51	0.47	0.46	0.43	0.42
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.58	0.58	0.54	0.52	0.49	0.48
0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.60	5.33	5.34	4.95	4.81	4.49	4.40
2.76E-05	2.54E-05	2.33E-05	2.12E-05	1.92E-05	1.72E-05	1.52E-05	1.33E-05	1.14E-05	9.54E-06	7.70E-06	5.88E-06	4.10E-06	2.34E-06
3.31E-05	3.12E-05	2.93E-05	2.73E-05	2.53E-05	2.32E-05	2.10E-05	1.88E-05	1.65E-05	1.41E-05	1.16E-05	9.10E-06	6.49E-06	3.80E-06
4.27E-06	3.93E-06	3.60E-06	3.28E-06	2.96E-06	2.65E-06	2.34E-06	2.04E-06	1.75E-06	1.46E-06	1.17E-06	8.96E-07	6.23E-07	3.56E-07
1.24E-07	1.17E-07	1.10E-07	1.03E-07	9.50E-08	8.71E-08	7.89E-08	7.05E-08	6.19E-08	5.29E-08	4.37E-08	3.42E-08	2.44E-08	1.43E-08
3.66E-05	3.37E-05	3.08E-05	2.80E-05	2.53E-05	2.27E-05	2.00E-05	1.75E-05	1.49E-05	1.25E-05	1.00E-05	7.67E-06	5.34E-06	3.05E-06
300	300	300	300	300	300	300	300	300	300	300	300	300	300
40	40	40	40	40	40	40	40	40	40	40	40	40	40
190	190	190	190	190	190	190	190	190	190	190	190	190	190
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	10	10	9	9	9	9	9	8	8	8	7	7	7
2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.65E+04	1.57E+04	1.57E+04	1.45E+04	1.41E+04	1.32E+04	1.29E+04
0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.15	0.15	0.14	0.14
7	7	6	6	5	5	5	4	4	3	3	2	1	1

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RDU 7-30-96

Tank Farm Operations Data -- In Situ Disposal, Radio Frequence Drying

2021	2022	2023	2024	
53	53	35	18	
210	210	140	70	
247	247	165	83	
53	53	35	18	
563	563	375	188	23905
$103	$102	$100	$92	3979
6.53E+10	6.53E+10	4.35E+10	2.18E+10	
0.12	0.12	0.08	0.04	
0.40	0.40	0.27	0.13	
n/a	n/a	n/a	n/a	
n/a	n/a	n/a	n/a	
0.46	0.46	0.30	0.15	
0.07	0.07	0.05	0.02	
4.22	4.22	2.81	1.41	
6.15E-07	0.00E+00	0.00E+00	0.00E+00	
1.02E-06	0.00E+00	0.00E+00	0.00E+00	
9.33E-08	0.00E+00	0.00E+00	0.00E+00	
3.83E-09	0.00E+00	0.00E+00	0.00E+00	
7.98E-07	0.00E+00	0.00E+00	0.00E+00	
300	300	200	100	
40	40	30	20	
190	190	130	70	
n/a	n/a	n/a	n/a	
7	7	4	2	
1.24E+04	1.24E+04	8.25E+03	4.14E+03	
0.13	0.13	0.09	0.04	
0	0	0	0	

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RLW 7-30-96

Tank Farm Operations Data -- In Situ Vitrification

Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exempt FTEs												
Rad	89	90	92	89	90	88	97	97	97	96	95	89
Non-Rad	354	358	366	358	358	352	388	388	386	384	379	357
Non-Exempt FTEs												
Rad	416	422	431	421	422	414	457	456	455	452	446	420
Non-Rad	89	90	92	90	90	89	98	97	97	97	95	90
Total FTEs	948	960	981	958	960	943	1040	1038	1035	1029	1016	955
Cost (1995 $M)	$149	$152	$155	$156	$158	$153	$159	$160	$160	$160	$158	$150
Non-Radiological Emissions												
thermal (J)	1.10E+11	1.11E+11	1.14E+11	1.11E+11	1.11E+11	1.09E+11	1.21E+11	1.20E+11	1.20E+11	1.19E+11	1.18E+11	1.11E+11
particulate (kg)	0.20	0.20	0.21	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.21	0.20
volatile organics (kg)	0.68	0.69	0.70	0.69	0.69	0.68	0.75	0.74	0.74	0.74	0.73	0.69
fugitive dust (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
toxic air pollutants (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx (as NO2) (kg)	0.77	0.78	0.80	0.78	0.78	0.77	0.84	0.84	0.84	0.84	0.83	0.78
SOx (as SO2) (kg)	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12
carbon monoxide (kg)	7.10	7.19	7.35	7.17	7.19	7.06	7.79	7.77	7.75	7.71	7.61	7.15
Radiological Emissions (curies)												
Cs-137	5.06E-05	4.95E-05	4.83E-05	4.72E-05	4.61E-05	4.33E-05	4.05E-05	3.77E-05	3.50E-05	3.23E-05	2.96E-05	2.69E-05
I-129	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.42E-05	4.23E-05	4.03E-05	3.82E-05	3.61E-05	3.39E-05	3.16E-05
Sr-90	8.00E-06	7.80E-06	7.61E-06	7.42E-06	7.24E-06	6.79E-06	6.33E-06	5.89E-06	5.45E-06	5.02E-06	4.60E-06	4.18E-06
Total Alpha	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.66E-07	1.59E-07	1.51E-07	1.44E-07	1.36E-07	1.27E-07	1.19E-07
Total Beta	6.84E-05	6.68E-05	6.51E-05	6.35E-05	6.20E-05	5.81E-05	5.42E-05	5.04E-05	4.67E-05	4.30E-05	3.94E-05	3.58E-05
Solid Wastes (cu. m)												
radiological	270	300	300	300	300	300	300	300	300	300	300	300
toxic	35	40	40	40	40	40	40	40	40	40	40	40
mixed	170	190	190	190	190	190	190	190	190	190	190	190
other	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Resources												
Electric Power (GWh)	11	11	11	11	11	11	12	12	12	12	12	11
Water (cu. m)	2.09E+04	2.11E+04	2.16E+04	2.11E+04	2.11E+04	2.07E+04	2.29E+04	2.28E+04	2.28E+04	2.26E+04	2.24E+04	2.10E+04
Diesel Fuel (cu. m)	0.22	0.22	0.23	0.22	0.22	0.22	0.24	0.24	0.24	0.24	0.24	0.22
Steel (t)	10	10	10	10	10	10	9	9	8	8	7	7

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Tank Farm Operations Data -- In Situ Vitrification

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
87	77	76	75	74	71	70	70	66	67	67	44	22
348	308	306	300	296	285	281	279	266	266	266	177	89
410	363	360	353	348	335	331	329	313	313	313	209	105
88	78	77	75	74	72	71	70	67	67	67	45	22
933	826	819	804	792	762	753	748	712	713	713	475	238
$147	$133	$132	$130	$129	$125	$124	$123	$118	$115	$113	$110	$107
1.08E+11	9.58E+10	9.50E+10	9.33E+10	9.19E+10	8.84E+10	8.74E+10	8.68E+10	8.26E+10	8.27E+10	8.27E+10	5.51E+10	2.76E+10
0.20	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.15	0.10	0.05
0.67	0.59	0.59	0.58	0.57	0.55	0.54	0.54	0.51	0.51	0.51	0.34	0.17
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
0.76	0.67	0.67	0.65	0.64	0.62	0.61	0.61	0.58	0.58	0.58	0.39	0.19
0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.06	0.03
6.99	6.19	6.13	6.02	5.93	5.71	5.64	5.60	5.33	5.34	5.34	3.56	1.78
2.43E-05	2.17E-05	1.92E-05	1.66E-05	1.41E-05	1.16E-05	9.14E-06	6.69E-06	4.26E-06	1.85E-06	0.00E+00	0.00E+00	0.00E+00
2.92E-05	2.67E-05	2.41E-05	2.14E-05	1.85E-05	1.56E-05	1.26E-05	9.43E-06	6.15E-06	2.73E-06	0.00E+00	0.00E+00	0.00E+00
3.77E-06	3.36E-06	2.96E-06	2.56E-06	2.17E-06	1.78E-06	1.40E-06	1.03E-06	6.52E-07	2.83E-07	0.00E+00	0.00E+00	0.00E+00
1.10E-07	1.00E-07	9.04E-08	8.03E-08	6.97E-08	5.87E-08	4.73E-08	3.54E-08	2.31E-08	1.03E-08	0.00E+00	0.00E+00	0.00E+00
3.23E-05	2.88E-05	2.53E-05	2.19E-05	1.86E-05	1.53E-05	1.20E-05	8.77E-06	5.58E-06	2.42E-06	0.00E+00	0.00E+00	0.00E+00
300	300	300	300	300	300	300	300	300	300	300	200	100
40	40	40	40	40	40	40	40	40	40	40	30	20
190	190	190	190	190	190	190	190	190	190	190	130	70
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	10	10	9	9	9	9	9	8	8	8	6	3
2.05E+04	1.82E+04	1.80E+04	1.77E+04	1.74E+04	1.68E+04	1.66E+04	1.65E+04	1.57E+04	1.57E+04	1.57E+04	1.05E+04	5.24E+03
0.22	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.11	0.06
6	6	5	5	4	3	3	2	1	1	0	0	0

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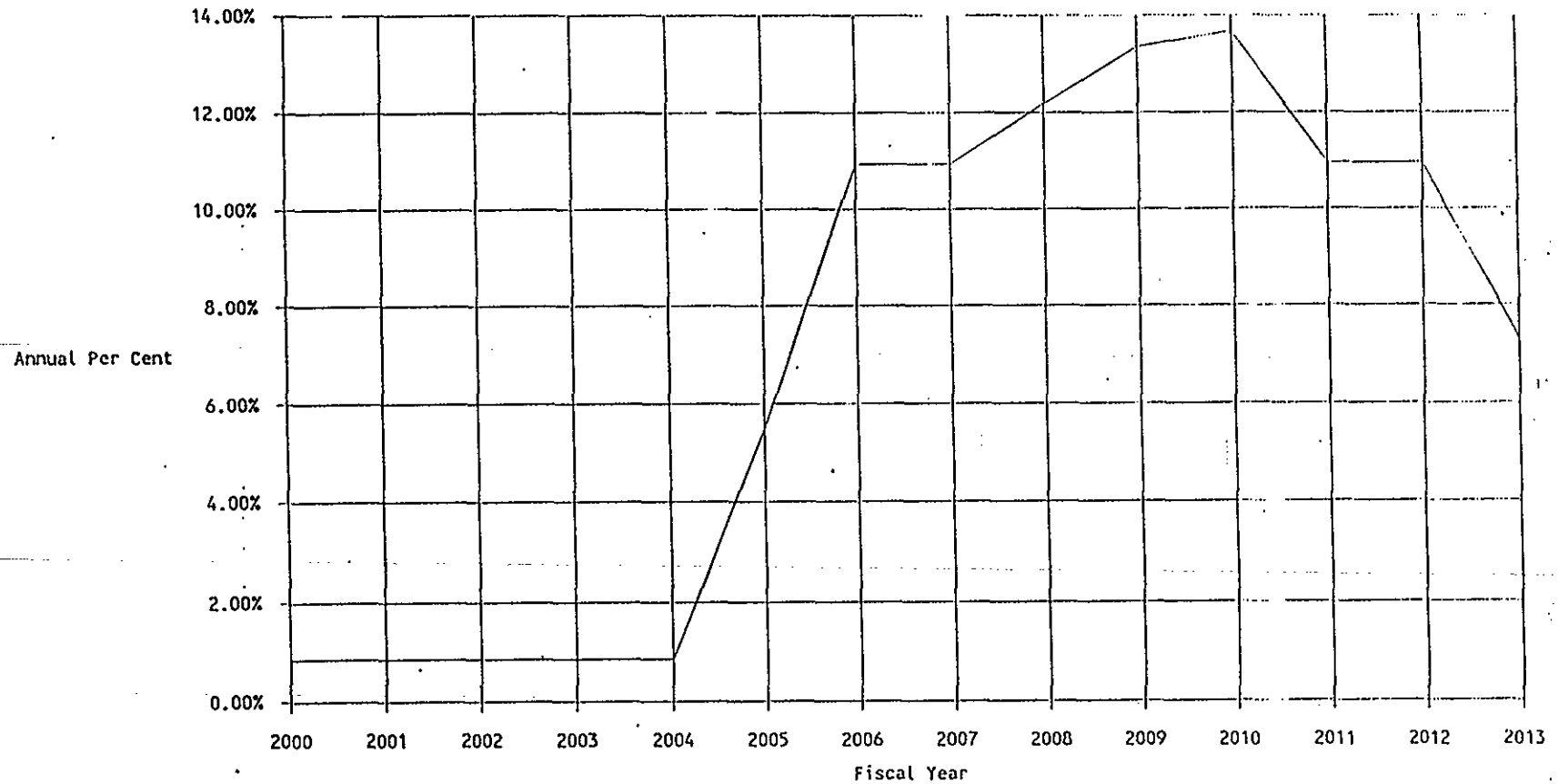
Appendix B

Annual Percent Distribution functions for In Situ Disposal

Annual Per Cent Distribution of Operating Manhours -- In Situ Chemical Stabilization



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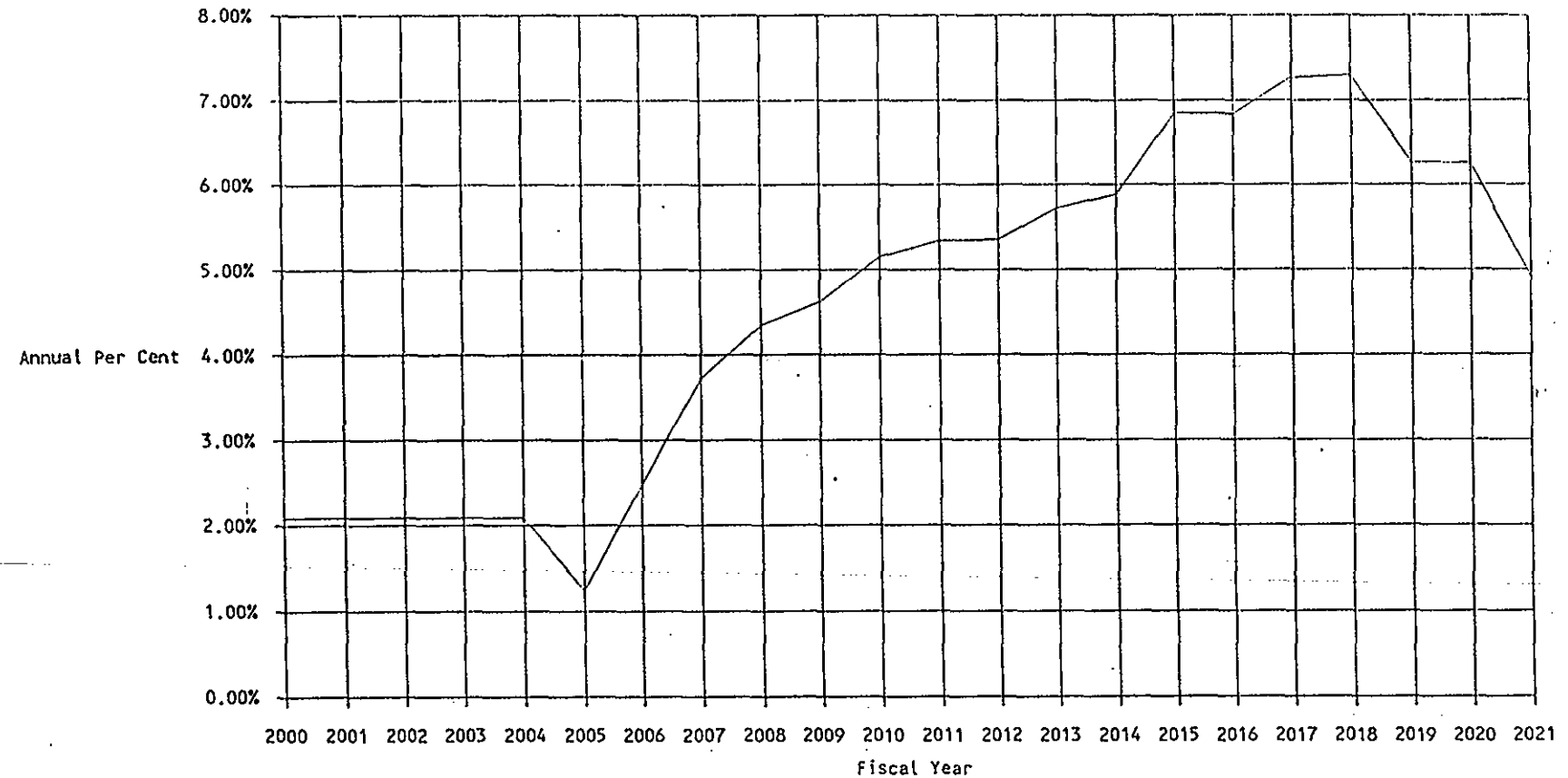
KPW - 7-30-96

Annual Per Cent Distribution of Operating Manhours -- Drying and Gravel Fill



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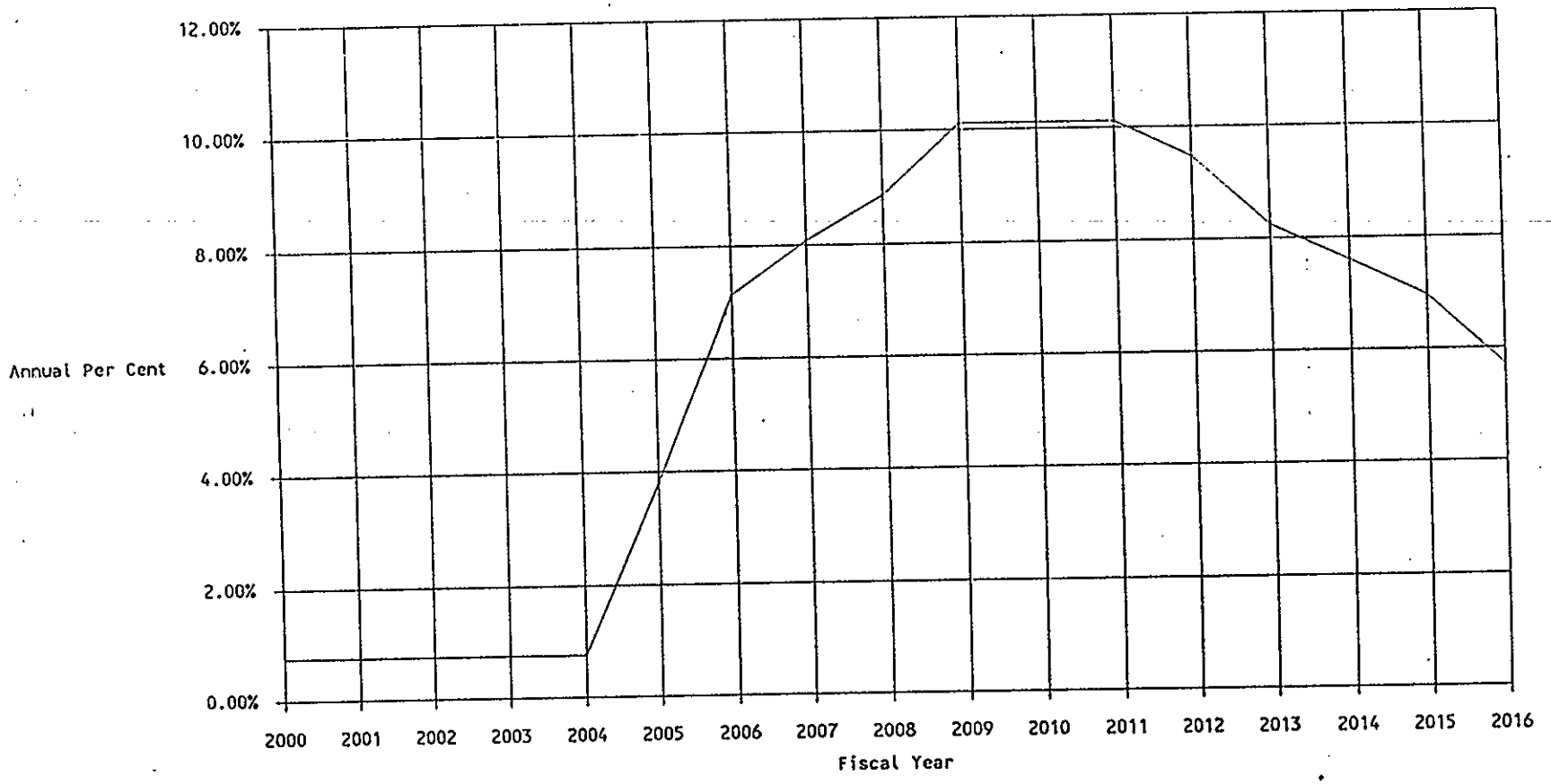
BOU-7-30-86

Sheet A-314
BDW 7-30-96

Annual Percent Distribution of Operating Manhours -- In Situ Vitrification



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					FEIS SCHEDULE	
	NO ACTION SCHEDULE					
Continued Operations					1997-2097	
	LONG-TERM MANAGEMENT SCHEDULE					
Continued Operations						
Construction						
	Waste Retrieval				2033-2037	2083-2087
	New Tanks				2033-2037	2083-2087
Operations					2037-2042	2087-2092
D&D					2042-2047	2092-2097
Monitoring & Maintenance					1997-2097	
	IN SITU FILL AND CAP SCHEDULE					
Continued Operations					1997-2009	
Research and Development					N/A	
Construction					2003-2005	
Operation					2000-2009	
D&D					2009-2012	
Monitoring and Maintenance					2009-2029	
Closure					2012-2029	
Post Closure Monitoring					2029-2129	
	IN SITU VITRIFICATION SCHEDULE					
					FEIS	
Continued Operations					1997-2013	
Research and Development					1997-2002	
Construction					1999-2016	
Operation					2005-2016	
	DST evaporation				2000-2005	
	ISV strart up				2005-2008	
.	ISV operation				2008-2013	
D&D					2013-2016	
	Monitoring and Maintenance				2016-2033	
	Closure				2016-2033	
	Post Closure Monitoring				2033-2133	
	EX SITU INTERMEDIATE SEPARATIONS SCHEDULE					
Continued Operations					1997-2022	
Research and Development					1997-2018	
Construction						
	Waste Retrieval and Transfer				1998-2017	
	Waste Treatment				1999-2009	
	HLW				2003-2009	
	LAW				1999-2004	
Operation						
	Waste Retrieval				2001-2022	
	Treatment					
	Pretreatment				2004-2022	
	LLW Vitrification				2005-2022	
	HLW Vitrification				2011-2022	
	LLW Disposal				2005-2022	
	HLW Transportation and Disposal				2022-2040	
D&D						
	Waste Retrieval facilities				2013-2025	
	Treatment Facilities				2022-2031	

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Monitoring and Maintenance						
	HLW	(assess impacts for 50 yr period)			2022-2040	
	LLW Disposal					
Closure					2010-2034	
Post Closure Monitoring					2034-2134	
EX SITU NO SEPARATIONS (VITRIFICATION AND CALCINATION)						
Continued Operations					1997-2020	
Research and Development					1997-2007	
Construction						
	Waste Retrieval and Transfer				1998-2017	
	Waste Treatment				1999-2005	
Operation						
	Waste Retrieval				2003-2020	
	HLW Vitrification				2006-2020	
	HLW Transportation and Disposal				2020-2040	
D&D						
	Waste Retrieval facilities				2015-2023	
	Treatment Facilities				2020-2025	
Monitoring and Maintenance						
	HLW	(assess impacts for 50 yrs)			2020-2040	
Closure					2011-2025	
Post Closure Monitoring					2025-2125	
	EX SITU EXTENSIVE SEPARATIONS SCHEDULE					
Continued Operations					1997-2023	
Research and Development					1997-2018	
Construction						
	Waste Retrieval and Transfer				1998-2016	
	Waste Treatment				1999-2011	
	HLW				2001-2006	
	LAW				1999-2004	
Operation						
	Waste Retrieval				2003-2023	
	Treatment				2004-2023	
	Pretreatment				2004-2023	
	LLW Vitrification				2006-2023	
	HLW Vitrification				2013-2023	
	LLW Disposal				2006-2023	
	HLW Transportation and Disposal				2022-2025	
D&D						
	Waste Retrieval facilities				2014-2024	
	Treatment Facilities				2023-2028	
Monitoring and Maintenance						
	HLW				2023-2025	
	LLW Disposal					
Closure					2012-2032	
Post Closure Monitoring					2032-2132	
EX SITU/IN SITU COMBINATION 2						
Continued Operations					1997-2022	
Research and Development					1997-2018	
Construction						
	Waste Retrieval and Transfer				1998-2016	
	Waste Treatment				1999-2008	
	HLW				2002-2008	

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	LAW				1999-2004	
	Fill & Cap				2003-2005	
Operation						
	Waste Retrieval				2002-2022	
	Treatment				2004-2022	
	Pretreatment				2004-2022	
	LLW Vitrification				2005-2022	
	HLW Vitrification				2009-2022	
	LLW Disposal					
	HLW Transportation and Disposal				2022-2040	
	Fill and Cap Operations				2000-2009	
D&D						
	Waste Retrieval facilities				2013-2024	
	Treatment Facilities				2022-2031	
	Fill and Cap Equipment				2022-2025	
Monitoring and Maintenance						
	HLW				2022-2040	
Closure					2010-2032	
Post Closure Monitoring					2032-2132	
EX SITU/IN SITU COMBINATION 1						
Continued Operations					1997-2023	
Research and Development					1997-2018	
Construction						
	Waste Retrieval and Transfer				1998-2016	
	Waste Treatment				1999-2009	
	HLW				2003-2009	
	LAW				1999-2005	
	Fill & Cap				2003-2005	
Operation						
	Waste Retrieval				2002-2022	
	Treatment				2005-2023	
	Pretreatment				2005-2023	
	LLW Vitrification				2006-2023	
	HLW Vitrification				2010-2023	
	LLW Disposal				2006-2023	
	HLW Transportation and Disposal				2022-2040	
	Fill and Cap Operations				2000-2009	
D&D						
	Waste Retrieval facilities				2013-2024	
	Treatment Facilities				2023-2032	
	Fill and Cap Equipment				2022-2025	
Monitoring and Maintenance						
	HLW				2023-2040	
Closure					2011-2035	
Post Closure Monitoring					2035-2135	
PHASED IMPLEMENTATION SCHEDULE					Phase 1	Phase 2
Continued Operations					1997-2028	
Research and Development						
Construction						
	Phase 1				1998-2002	
	Retrieval					2004-2020
	Phase 2					2006-2012

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	HLW					2007-2012
	LAW					2006-2011
Operation						
	Phase 1					
	LAW Treatment Plants				2002-2012	
	HLW Treatment Plant				2002-2008	
	Phase 2					
	Waste Retrieval					2008-2028
	Treatment					
	HLW					2012-2028
	LAW					2011-2024
D&D						2015-2031
Monitoring and Maintenance						
	HLW					2028-2040
HLW Transportation						2022-2040
Closure						2016-2040
Post Closure M&M						2040-2140
	CAPSULES NO ACTION					
Continued Operation					1997-2007	
Research and Development						
Construction						
Operation						
D&D						
Monitoring and Maintenance						
	CAPSULES ONSITE DISPOSAL					
Continued Operation					1997-2028	
Research and Development						
Construction					2002-2009	
Operation					2010-2029	
D&D						
Monitoring and Maintenance					2029-2129	
	CAPSULES OVERPACK AND SHIP					
Continued Operation					1997-2028	
Research and Development						
Construction					2002-2009	
Operation					2010-2028	
HLW Transportation and Disposal					2028-2029	
D&D						
Monitoring and Maintenance					2010-2029	
	CAPSULES VITRIFY WITH TANK WASTES					
Continued Operation					1997-2023	
Research and Development						
Construction					2007-2012	
Operation					2012-2028	
D&D					2028-2033	
Monitoring and Maintenance					2028-2040	
HLW Transporation to Repository					2022-2040	

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGINEERING / UTILIZATION of the CROSS-SITE TRANSFER LINE during waste RETRIEVAL

ORIGINATOR COLIN Henderson DATE 2/10/96

REVISION NO. 0

OBJECTIVE Calculate the Average number of hours that the XSITE, TRANSFER LINE would be used

METHODOLOGY Noted

ASSUMPTIONS Noted

(Continue on another sheet if necessary)

SIGNATURE

checked by PHW 2-13-96

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE 2/8/96 SUBJECT SHEET NO.

BY CH CHKD. JOB NO.

WASTE RETRIEVAL & TRANSFER ACTIVITIES

OPS. FOR INTERMEDIATE SEPARATIONS RETRIEVAL = 2001/2024 = 23 yrs.

200 WEST TANK FARMS

DSTS = SY
SSTS = T, TX, TY, U, S, SX

SY = 870 + 1738 = 2608 ← DST
T = 43 + 1986 = 2029 SST
TX = 5 + 7004 = 7009 ↓
TY = 3 + 635 = 638
U = 168 + 3382 = 3550
S = 58 + 5452 = 5510
SX = 63 + 4362 = 4425

25569 Kgal (FROM HANFORD 1995 TABLE E-4)

AT a 3:1 DILUTION THE VOLUME TO BE TRANSFERRED ACROSS SITE = 25569 x 4 = 102,276 kgal

at a 4:1 DILUTION VOLUME = 5 x 25569 = 127845 kgal.

LINE IS 3 in ϕ

TRANSFER Velocity = 4.5 - 6 ft/sec

FROM CRANE Q = 100 - 138 GPM.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

	LOW TIME	HIGH TIME
Volume	102276 kgal	127845 Kgal
Q	138 GPM	100 GPM
No. Months	276	276
Minutes/Month	2685	4632
Hours/Month	45 hrs.	77 hrs.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

The Replacement Crossite Transfer
Line Design Parameter Assumptions

Line size 3" dia.

Solids Transfer Capability 0 - 33% Vol %

Design Velocity 4.5 - 6 ft/sec.
(Suitable for Solids Transfer)

Design Pressure 1200 psi (Max Pressure 1500 psi)

Particle size: up to 4000 microns

In 200 West there would be:

2 Waste transfer annexes with

1 Waste Staging and Sampling facility with
6-100,000 gal tanks.

- Wastes would be batched thru the X site transfer line in ~~as large~~ batches as large as possible to minimize secondary waste generation.

- Assumptions included:
  a) Waste Staging and Sampling Facility would condition the retrieved waste to achieve the required solids size and concentration.
  b) Design Parameters used for the RCSTS would provide the capability to transfer SST & DST wastes including solids slurry.

FORM 91-005-1 (4/81)

FAX COVER SHEET

Date: February 29, 1996

Page 1 of 3 Pages (Coversheet included)

Fax Number To:	Fax Number From:
736-7504	373-6594
Name:	**Name:**
Colin Henderson	John Guberski
Phone Number/Location:	**Phone Number/Location:**
736-0616	376-5084/2750/A-123
Organization:	**Organization:**
Jacobs Engineering	TFTP Environmental Compliance

Message

Here are details on W-058, Cross site transfer.

A-5000-865 (01/92) WEF189

3.3 RANGE OF OPERATION

~~The primary and secondary containment piping and all system components shall be designed to transfer tank wastes with the following characteristics:~~

~~RCSIS equipment shall be designed such that the following velocities can be achieved for wastes with the corresponding parameters shown below. Actual transfer velocity will be determined by the cognizant engineer before each transfer, based on waste characterization.~~

	Design parameters	
Achievable design velocity	4.5 ft/s	6.0 ft/s
Specific gravity	1.5	1.25
Viscosity	30.0 cP	10 cP
Solid content	30.0 displacement vol%	20.0 displacement vol%
Miller number	<100	<100
Minimum pH (Harris 1992)		
Transfers/flushes	11.0	11.0
Temperature		
Transfers/flushes	35 to 200 °F	35 to 200 °F
Insulation	Required	Required
Particle size*	0.5 to 4,000 μm	0.5 to 4,000 μm
Friction factor	0.0404 ~~(Non-Newtonian)~~	Newtonian flow

ΔP for Booster 1200 or 1500 depending on Sp Gr.

3.4 PIPING

The pipeline system shall consist of pipe-in-pipe transfer lines in a routing configuration as shown in Figure 1-2. The pipe-in-pipe transfer lines shall comply with the secondary containment requirements in WAC 173-303-400; WAC 173-303-640; and DOE Order 6430.1A, *General Design Criteria* (DOE 1989).

The primary piping shall be 304L stainless steel and the encasement piping shall be carbon steel (Parsons 1994). The piping components shall be chemically compatible with the alkaline radioactive mixed liquid waste listed in Appendix A. The system also shall be designed with a 230 psi relief valve to prevent overpressurization of the existing connecting transfer line network. Pump 102-SY will be capable of supplying 140 gal/min and 20 ft of net positive suction head to the suction of the Project W-058 booster pump~~(s)~~.

All pipe and pipe fittings outside the diversion boxes and other boxes are to (1) be joined with welds, (2) be provided with the capability for periodic pressure tests, and (3) have water flush capabilities. Piping within the boxes may be joined via jumpers, welds, or mechanical means, ~~except national pipe thread connections~~ as required for transfer flexibility and ease of maintenance. ~~However, National Pipe thread connections shall not be used~~

*0- to 50-μm particles will comprise approximately 95% of total.
50- to 500-μm particles will comprise <5% of total.
500- to 4,000-μm particles will comprise <1% of total.

3-2

Post-it® Fax Note 7671
To Colin Henderson
Co./Dept.
Phone #
Fax #

3.4 PIPING

The pipeline system shall consist of pipe-in-pipe transfer lines in a routing configuration as shown in Figure 1-2. The pipe-in-pipe transfer lines shall comply with the secondary containment requirements in WAC 173-303-400; WAC 173-303-640; and DOE Order 6430.1A, *General Design Criteria* (DOE 1989).

The primary piping shall be 304L stainless steel and the encasement piping shall be carbon steel (Parsons 1994). The piping components shall be chemically compatible with the alkaline radioactive mixed liquid waste listed in Appendix A. The system also shall be designed with a 230 psi relief valve to prevent overpressurization of the existing connecting transfer line network. Pump 102-SY will be capable of supplying 140 gal/min and 20 ft of net positive suction head to the suction of the Project W-058 booster pump(s).

All pipe and pipe fittings outside the diversion boxes and other boxes are to (1) be joined with welds, (2) be provided with the capability for periodic pressure tests, and (3) have water flush capabilities. Piping within the boxes may be joined via jumpers, welds, or mechanical means as required for transfer flexibility and ease of maintenance. However, national pipe thread connections shall not be used for piping in contact with the waste. Provisions for maintenance shall be incorporated.

The system shall be designed and constructed to minimize the settling of solids in the pipes, pipe fittings, or other piping components during and after the batch transfers. The system also shall be designed such that the

Table 3-1. Design Parameters.

Achievable design velocity*	4.5 ft/s	6.0 ft/s
Specific gravity (mixture)	1.5	1.25
Viscosity	30.0 cP	10 cP
Solid content	30% solids volume fraction	20% solids volume fraction
Miller number		
Minimum pH (Harris 1992) Transfers/flushes	<100	<100
Temperature Transfers/flushes	11.0	11.0
Insulation	35 to 200 °F	35 to 200 °F
Particle size**	Required	Required
Friction factor	0.5 to 4,000 μm 0.0404 (non-Newtonian)	0.5 to 4,000 μm Newtonian flow

*Achievable design velocity is the theoretical velocity at which the pumped materials with the characteristics shown in this table can be transferred. It is not intended or implied that these velocities are the optimal transfer velocities for waste with the given characteristics.

**0- to 50-μm particles will comprise approximately 95% of total.
50- to 500-μm particles will comprise <5% of total.
500- to 4,000-μm particles will comprise <1% of total.

ΔP = 740-1120 for booster

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering / Int Separations Land Use Numbers for Sensitivity Analysis

ORIGINATOR Carl Henderson DATE 2/13/96

REVISION NO. 0

OBJECTIVE For the Int Separations alternative, ~~Land~~ Calculate the change in Land Use for the Sensitivity Cases Shown

METHODOLOGY Noted.

ASSUMPTIONS Noted.

(Continue on another sheet if necessary)

Checked by RDW 2-13-96

J.C. Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE 2/6/96 SUBJECT INT Sep Sensitivity. SHEET NO.

BY CH CHKD. JOB NO.

LAND USE:

LOW LOADING (15 wt% HLW, 10 wt% LAW)

VAULTS = 124
CANISTERS = 44500

From Previous Calc's For Revised Base Case
the Increased Area in going from 40 → 83 vaults
the Increased VAULT Area was 69,160 m^2

so the additional LAW Vault area going from

83 to 124 Vaults = 69160 m^2 (7 ha)

Additional HLW Storage = 19000 m^2 (2 ha)

Borrow Material Increases = 115,000 m^3 SILT
126,000 m^3 RIPRAP
138,000 m^3 Aggregate
} Based on SAME delta in going from 40 → 80 Vaults.

The increase in SAND/Gravel = 311,000 m^3

Based on Rikhead transportation Calc.

TOTAL BORROW SITE INCREASES:
PIT 30 = 15 ha
Venita = 4 ha
SH McGee = 4 ha
23 ha.

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. _____

BY _____ CHKD. _____ JOB NO. _____

Then the borrow matl required
= Base Case + Change.

Temp Area = Base Case + Additional Area.

= 250 ha + 23 ha (borrow sites) + 7 ha (Vaults) + 2 ha (HLW Storage)

= 280 ha (700 ac)

Permanent = 49 ha + 7 vaults + 2 (barrier toe)

= 58 ha (140 ac)

<u>High Waste Loading</u> 40% HLW, 25% LAW.

50 Vaults for LAW.
16700 canisters = 4175 HMPC's

Borrow Change from Base Case.

- 103,000 m³ (Aggregate Sand Const/Ops from B. Wood Calc)
- 86,250 m³ SILT BARRIER
- 103,500 m³ (Aggregate Barrier)
- 94,500 m³ Rip Rap Barrier

Based on 75% decrease in going from 80 + 40 to Vaults.
80 - 40 = 40
.25 x 40 = 10 = 50-40

AREA TEMP = 13 ha less than Base Case (Borrow Sites)
= No Change for Interim HLW Storage.
= 69160 m² x (.75) x 1/10,000 = 5 ha (13 ac) less for vault area.
= 18 ha (44 ac) temp.

= 5 ha (Vaults) + 2 ha (barrier toe) less permanent

FORM 91-005-1 (4/81)

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Risk Assessment Risk Assessor

ORIGINATOR ALER NAZARALI DATE 8/30/96

REVISION NO. _____

OBJECTIVE Calculation of total (accumulation) post-Remediation risk including New Alt. (Combo 2) and New Scenario (Native American).

METHODOLOGY Used Contour area and corresponding risk (cancer incidence) and number of receptors. Use spreadsheet to do calculation (Please see attached)

ASSUMPTIONS All the assumptions are presented in the table 0.5.15.1 (a copy is attached).

(Continue on another sheet if necessary)

A. H. Nazarali 8/30/96
SIGNATURE/DATE

L. Chou 8/30/96
CHECKED/DATE

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\CALCVR.SHT

Table D.5.15.1 **All the alternative post-remediation total cancer incidence and cancer fatality for 10,000 years from present time**

Alternatives	Native American		Residential Farmer		Industrial Worker		Recreational user	
	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]
No Action	2597	2164	759	632	441	367	52	43
Long-Term Management	2720	2266	681	567	441	367	50	41
In Situ Fill and Cap	1261	1051	400	333	459	383	29	24
In Situ Vitrification	3	2	0	0	2	1	0	0
Ex Situ intermediate Separation	40	33	12	10	18	15	0	0
Ex Situ No Separation	40	33	12	10	18	15	0	0
Ex Situ Extensive Separation	40	33	12	10	18	15	0	0
Ex Situ In Situ Combination 1	200	166	72	60	183	153	1	0
Ex Situ In Situ Combination 2	225	204	76	64	183	153	4	3
Phased Implementation	40	33	12	10	18	15	0	0
Population Density (# of Indv./ km^2)	1.91		4.97		NA		18.75	
Population per Generation (# of Indv)	1500		3900		2200		1950	
Total population in 10,000 yr (# of Indv)	214,286		557,143		733,333		650,000	
Area of Land Use (km^2)	785		785		Maximum Risk		104	

1 Dose to risk conversion factor for cancer incidence used is 6.0E-04 (ICRP 1991)
2 Dose to risk conversion factor for cancer fatality used is 5.0E-04 (ICRP 1991)

NA	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50
1	93	507.51	253.76	17	927.71	463.86	0	0.00	0.00	0	0.00	0.00
0.9	17	92.77	41.75	5	272.86	122.79	0	0.00	0.00	0	0.00	0.00
0.8	21	114.60	45.84	2	109.14	43.66	0	0.00	0.00	0	0.00	0.00
0.7	14	76.40	26.74	5	272.86	95.50	0	0.00	0.00	0	0.00	0.00
0.6	23	125.51	37.65	6	327.43	98.23	0	0.00	0.00	0	0.00	0.00
0.5	27	147.34	36.84	9	491.14	122.79	0	0.00	0.00	0	0.00	0.00
0.4	55	300.14	60.03	16	873.14	174.63	0	0.00	0.00	0	0.00	0.00
0.3	37	201.91	30.29	18	982.29	147.34	0	0.00	0.00	0	0.00	0.00
0.2	35	191.00	19.10	67	3656.29	365.63	0	0.00	0.00	0	0.00	0.00
0.1	6	32.74	1.64	9	491.14	24.56	0	0.00	0.00	0	0.00	0.00
0.09	5	27.29	1.23	8	436.57	19.65	0	0.00	0.00	0	0.00	0.00
0.08	8	43.66	1.75	16	873.14	34.93	0	0.00	0.00	0	0.00	0.00
0.07	4	21.83	0.76	17	927.71	32.47	0	0.00	0.00	0	0.00	0.00
0.06	9	49.11	1.47	19	1036.86	31.11	0	0.00	0.00	0	0.00	0.00
0.05	13	70.94	1.77	34	1855.43	46.39	0	0.00	0.00	0	0.00	0.00
0.04	13	70.94	1.42	28	1528.00	30.56	1	68.21	1.36	0	0.00	0.00
0.03	19	103.69	1.56	43	2346.57	35.20	0	0.00	0.00	0	0.00	0.00
0.02	19	103.69	1.04	74	4038.29	40.38	3	204.64	2.05	0	0.00	0.00
0.01	21	114.60	0.57	39	2128.29	10.64	10	682.14	3.41	0	0.00	0.00
0.005	48	261.94	0.65	153	8349.43	20.87	114	7776.43	19.44	60	8185.71	20.46
0.001	82	447.49	0.22	72	3929.14	1.96	127	8663.21	4.33	214	29195.71	14.60
0.0001	85	463.86	0.02	36	1964.57	0.10	100	6821.43	0.34	183	24966.43	1.25
0.00001	33	180.09	0.00	33	1800.86	0.01	93	6343.93	0.03	176	24011.43	0.12
0.000001	21	114.60	0.00	17	927.71	0.00	42	2865.00	0.00	43	5866.43	0.00
0	77	420.20	0.00	42	2292.00	0.00	295	20123.21	0.00	109	14870.71	0.00
	785		566.10	785		1963.23	785		30.97	785		36.43
Total												
2596.73												
2163.94												

LTM	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	36	196.46	98.23	12	654.86	327.43	0	0.00	0.00	0	0.00	0.00					
0.9	28	152.80	68.76	8	436.57	196.46	0	0.00	0.00	0	0.00	0.00					
0.8	21	114.60	45.84	6	327.43	130.97	0	0.00	0.00	0	0.00	0.00					
0.7	28	152.80	53.48	7	382.00	133.70	0	0.00	0.00	0	0.00	0.00					
0.6	18	98.23	29.47	11	600.29	180.09	0	0.00	0.00	0	0.00	0.00					
0.5	36	196.46	49.11	9	491.14	122.79	0	0.00	0.00	0	0.00	0.00					
0.4	47	256.49	51.30	20	1091.43	218.29	0	0.00	0.00	0	0.00	0.00					
0.3	79	431.11	64.67	30	1637.14	245.57	0	0.00	0.00	0	0.00	0.00					
0.2	48	261.94	26.19	51	2783.14	278.31	0	0.00	0.00	0	0.00	0.00					
0.1	4	21.83	1.09	8	436.57	21.83	0	0.00	0.00	0	0.00	0.00					
0.09	7	38.20	1.72	10	545.71	24.56	0	0.00	0.00	0	0.00	0.00					
0.08	5	27.29	1.09	11	600.29	24.01	0	0.00	0.00	0	0.00	0.00					
0.07	7	38.20	1.34	18	982.29	34.38	0	0.00	0.00	0	0.00	0.00					
0.06	6	32.74	0.98	18	982.29	29.47	0	0.00	0.00	0	0.00	0.00					
0.05	9	49.11	1.23	32	1746.29	43.66	0	0.00	0.00	0	0.00	0.00					
0.04	14	76.40	1.53	27	1473.43	29.47	1	68.21	1.36	0	0.00	0.00					
0.03	28	152.80	2.29	44	2401.14	36.02	0	0.00	0.00	0	0.00	0.00					
0.02	46	251.03	2.51	71	3874.57	38.75	3	204.64	2.05	0	0.00	0.00					
0.01	27	147.34	0.74	41	2237.43	11.19	10	682.14	3.41	0	0.00	0.00					
0.005	48	261.94	0.65	152	8294.86	20.74	114	7776.43	19.44	60	8185.71	20.46					
0.001	131	714.89	0.36	70	3820.00	1.91	127	8663.21	4.33	214	29195.71	14.60	4				
0.0001	28	152.80	0.01	38	2073.71	0.10	100	6821.43	0.34	184	25102.86	1.26	32				
0.00001	22	120.06	0.00	32	1746.29	0.01	93	6343.93	0.03	175	23875.00	0.12	196				
0.000001	19	103.69	0.00	18	982.29	0.00	42	2865.00	0.00	43	5866.43	0.00	300				
0.0000001	43	234.66	0.00	41	2237.43	0.00	295	20123.21	0.00	109	14870.71	0.00					
	785		502.59	785		2149.68	785		30.97	785		36.44					
Total																	
2719.68																	
2266.40																	

ISFC Native American

ISFC	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	409.29	40.93					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	136.43	6.82					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	136.43	6.14					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	10	1364.29	54.57					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	75	10232.14	358.13					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	60	8185.71	245.57					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	88	12005.71	300.14					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	31	4229.29	84.59	8				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	24	3274.29	49.11	16				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	49	6685.00	66.85	18				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	22	3001.43	15.01	189				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	69	9413.57	23.53	200				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	124	16917.14	8.46	89				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	125	17053.57	0.85	143				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	25	3410.71	0.02	29				
0.000001	0	0.00	0.00	0	0.00	0.00	65	4433.93	0.00	23	3137.86	0.00	32				
0	785	4283.86	0.00	785	42838.57	0.00	720	49114.29	0.00	55	7503.57	0.00	61				
	785		0.00	785		0.00	785		0.00	785		1260.72	785				
Total																	
1260.72																	
1050.60																	

ISV	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	10	1364.29	0.68	18				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	315	42975.00	2.15	332				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	146	19918.57	0.10	158				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	174	23738.57	0.01	152				
0	785	4283.86	0.00	785	42838.57	0.00	785	53548.21	0.00	140	19100.00	0.00	125				
	785		0.00	785		0.00	785		0.00	785		2.94	785				
Total																	
2.94																	
2.45																	

ESIS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	39	5320.71	13.30					
0.001	0	0.00	0.00	0	0.00	0.00	1	68.21	0.03	366	49932.86	24.97	271				
0.0001	0	0.00	0.00	0	0.00	0.00	143	9754.64	0.49	112	15280.00	0.76	49				
0.00001	0	0.00	0.00	0	0.00	0.00	218	14870.71	0.07	148	20191.43	0.10	29				
0.000001	0	0.00	0.00	0	0.00	0.00	109	7435.36	0.00	30	4092.86	0.00	28				
0	785	4283.86	0.00	785	42838.57	0.00	314	21419.29	0.00	90	12278.57	0.00	#VALUE!				
	785		0.00	785		0.00	785		0.60	785		39.14	#VALUE!				
Total																	
39.74																	
33.11																	

ESNS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	38	5184.29	12.96					
0.001	0	0.00	0.00	0	0.00	0.00	1	68.21	0.03	365	49796.43	24.90					
0.0001	0	0.00	0.00	0	0.00	0.00	143	9754.64	0.49	114	15552.86	0.78					
0.00001	0	0.00	0.00	0	0.00	0.00	218	14870.71	0.07	146	19918.57	0.10					
0.000001	0	0.00	0.00	0	0.00	0.00	109	7435.36	0.00	32	4365.71	0.00	4				
0	785	4283.86	0.00	785	42838.57	0.00	314	21419.29	0.00	90	12278.57	0.00					
	785		0.00	785		0.00	785		0.60	785		38.74					
Total																	
39.34																	
32.78																	

ESES	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	38	5184.29	12.96					
0.001	0	0.00	0.00	0	0.00	0.00	1	68.21	0.03	365	49796.43	24.90	1				
0.0001	0	0.00	0.00	0	0.00	0.00	143	9754.64	0.49	114	15552.86	0.78	283				
0.00001	0	0.00	0.00	0	0.00	0.00	218	14870.71	0.07	146	19918.57	0.10	39				
0.000001	0	0.00	0.00	0	0.00	0.00	109	7435.36	0.00	32	4365.71	0.00	34				
0	785	4283.86	0.00	785	42838.57	0.00	314	21419.29	0.00	90	12278.57	0.00					
	785		0.00	785		0.00	785		0.60	785		38.74					
Total																	
39.34																	
32.78																	

ESISC1	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	136.43	3.41					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	409.29	6.14					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	2046.43	20.46					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	128	17462.86	87.31	1				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	210	28650.00	71.63	200				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	124	16917.14	8.46	259				
0.0001	0	0.00	0.00	0	0.00	0.00	84	5730.00	0.29	173	23602.14	1.18	68				
0.00001	0	0.00	0.00	0	0.00	0.00	256	17462.86	0.09	32	4365.71	0.02	145				
0.000001	0	0.00	0.00	0	0.00	0.00	83	5661.79	0.00	24	3274.29	0.00	28				
0	785	4283.86	0.00	785	42838.57	0.00	362	24693.57	0.00	75	10232.14	0.00					
	785		0.00	785		0.00	785		0.38	785		198.62					
Total																	
198.99																	
165.83																	

ESISC2	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	136.43	3.41					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	8	1091.43	16.37					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	14	1910.00	19.10	7				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	230	31378.57	156.89	18				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	114	15552.86	38.88	308				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	126	17190.00	8.60	153				
0.0001	0	0.00	0.00	0	0.00	0.00	3	204.64	0.01	162	22101.43	1.11	59				
0.00001	0	0.00	0.00	0	0.00	0.00	208	14188.57	0.07	37	5047.86	0.03	140				
0.000001	0	0.00	0.00	0	0.00	0.00	167	11391.79	0.01	20	2728.57	0.00	25				
0	785	4283.86	0.00	785	42838.57	0.00	407	27763.21	0.00	73	9959.29	0.00					
	785		0.00	785		0.00	785		0.09	785		244.38					
Total																	
244.47																	
203.73																	

ESES	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.9	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.8	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.7	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.6	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.4	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	39	5320.71	13.30					
0.001	0	0.00	0.00	0	0.00	0.00	1	68.21	0.03	366	49932.86	24.97	271				
0.0001	0	0.00	0.00	0	0.00	0.00	143	9754.64	0.49	112	15280.00	0.76	49				
0.00001	0	0.00	0.00	0	0.00	0.00	218	14870.71	0.07	148	20191.43	0.10	29				
0.000001	0	0.00	0.00	0	0.00	0.00	109	7435.36	0.00	30	4092.86	0.00	28				
0	785	4283.86	0.00	785	42838.57	0.00	314	21419.29	0.00	90	12278.57	0.00					
	785		0.00	785		0.00	785		0.60	785		39.14					
Total																	
39.74																	
33.11																	

NATIVE

Sheet1

AMERICAN

Time Period	Alternative	Risk = 1 Are	Risk > .9 Are	Risk > .8 Are	Risk > .7 Are	Risk > .6 Are	Risk > .5 Are	Risk > .4 Are
T1	Alt1	74	19	17	21	14	23	27
	Alt2	25	11	28	21	28	18	36
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T2	Alt1	13	4	5	2	5	6	9
	Alt2	10	2	8	6	7	11	9
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T3	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T4	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T5	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0

Risk > .3 Are	Risk > .2 Are	Risk > .1 Are	Risk > .09 Ar	Risk > .08 Ar	Risk > .07 Ar	Risk > .06 Ar	Risk > .05 Ar	Risk > .04 Ar
55	37	35	6	5	8	4	9	13
47	79	48	4	7	5	7	6	9
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
16	18	67	9	8	16	17	19	34
20	30	51	8	10	11	18	18	32
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	3	1	1	10	75	60	88
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Risk > .03 Ar	Risk > .02 Ar	Risk > .01 Ar	Risk > .005 A	Risk > .001 A	Risk > .0001	Risk > .0000	Risk > .0000	Risk > .0000
13	19	19	21	48	82	85	33	21
14	28	46	27	48	131	28	22	19
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
28	43	74	39	153	72	36	33	17
27	44	71	41	152	70	38	32	18
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	3	10	114	127	100	93	42
1	0	3	10	114	127	100	93	42
0	0	0	0	0	0	0	0	65
0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	143	218	109
0	0	0	0	0	1	143	218	109
0	0	0	0	0	1	143	218	109
0	0	0	0	0	0	84	256	83
0	0	0	0	0	0	3	208	167
0	0	0	0	0	1	143	218	109
0	0	0	0	60	214	183	176	43
0	0	0	0	60	214	184	175	43
31	24	49	22	69	124	125	25	23
0	0	0	0	0	10	315	146	174
0	0	0	0	39	366	112	148	30
0	0	0	0	38	365	114	146	32
0	0	0	0	38	365	114	146	32
0	3	15	128	210	124	173	32	24
0	8	14	230	114	126	162	37	20
0	0	0	0	39	366	112	148	30
0	0	0	0	0	3	28	189	301
0	0	0	0	0	3	28	189	301
0	0	22	19	304	155	155	32	22
0	0	0	0	0	18	332	158	152
0	0	0	0	0	256	60	30	25
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	3
0	0	0	0	18	395	93	117	69
0	0	0	6	203	250	69	143	30
0	0	0	0	0	256	60	30	25

Total Affecte	Percent of Site	
708	0.488276	
742	0.511724	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
743	0.512414	
744	0.513103	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
490	0.337931	
490	0.337931	
65	0.044828	
0	0	
471	0.324828	
471	0.324828	
471	0.324828	
423	0.291724	
378	0.26069	
471	0.324828	
676	0.466207	
676	0.466207	
730	0.503448	
645	0.444828	
695	0.47931	
695	0.47931	
695	0.47931	
710	0.489655	
712	0.491034	
695	0.47931	
521	0.35931	
521	0.35931	
709	0.488966	
660	0.455172	
371	0.255862	
3	0.002069	
3	0.002069	
692	0.477241	
701	0.483448	
371	0.255862	

NA Residential Farmer

NA	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50
0.5	1	14.20	3.55	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.3	3	42.60	6.39	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.2	51	724.20	72.42	10	1420.00	142.00	0	0.00	0.00	0	0.00	0.00
0.1	21	298.20	14.91	4	568.00	28.40	0	0.00	0.00	0	0.00	0.00
0.09	24	340.80	15.34	3	426.00	19.17	0	0.00	0.00	0	0.00	0.00
0.08	16	227.20	9.09	5	710.00	28.40	0	0.00	0.00	0	0.00	0.00
0.07	21	298.20	10.44	3	426.00	14.91	0	0.00	0.00	0	0.00	0.00
0.06	23	326.60	9.80	6	852.00	25.56	0	0.00	0.00	0	0.00	0.00
0.05	23	326.60	8.17	8	1136.00	28.40	0	0.00	0.00	0	0.00	0.00
0.04	51	724.20	14.48	12	1704.00	34.08	0	0.00	0.00	0	0.00	0.00
0.03	49	695.80	10.44	18	2556.00	38.34	0	0.00	0.00	0	0.00	0.00
0.02	33	468.60	4.69	60	8520.00	85.20	0	0.00	0.00	0	0.00	0.00
0.01	35	497.00	2.49	69	9798.00	48.99	0	0.00	0.00	0	0.00	0.00
0.005	65	923.00	2.31	185	26270.00	65.68	0	0.00	0.00	0	0.00	0.00
0.001	68	965.60	0.48	190	26980.00	13.49	1	177.50	0.09	0	0.00	0.00
0.0001	77	1093.40	0.05	81	11502.00	0.58	11	1952.50	0.10	0	0.00	0.00
0.00001	90	1278.00	0.01	37	5254.00	0.03	189	33547.50	0.17	77	27335.00	0.14
0.000001	33	468.60	0.00	30	4260.00	0.00	155	27512.50	0.01	305	108275.00	0.05
0	101	1434.20	0.00	64	9088.00	0.00	429	76147.50	0.00	403	143065.00	0.00
	785		185.04	785		573.22	785		0.37	785		0.19
Total												
758.81												
632.35												

LTM Residential Farmer

LTM	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	1	14.20	2.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	4	56.80	5.68	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	10	1420.00	71.00	0	0.00	0.00	0	0.00	0.00					
0.09	6	85.20	3.83	5	710.00	31.95	0	0.00	0.00	0	0.00	0.00					
0.08	15	213.00	8.52	7	994.00	39.76	0	0.00	0.00	0	0.00	0.00					
0.07	25	355.00	12.43	7	994.00	34.79	0	0.00	0.00	0	0.00	0.00					
0.06	39	553.80	16.61	13	1846.00	55.38	0	0.00	0.00	0	0.00	0.00					
0.05	45	639.00	15.98	12	1704.00	42.60	0	0.00	0.00	0	0.00	0.00					
0.04	70	994.00	19.88	18	2556.00	51.12	0	0.00	0.00	0	0.00	0.00					
0.03	46	653.20	9.80	26	3692.00	55.38	0	0.00	0.00	0	0.00	0.00					
0.02	80	1136.00	11.36	46	6532.00	65.32	0	0.00	0.00	0	0.00	0.00					
0.01	31	440.20	2.20	61	8662.00	43.31	0	0.00	0.00	0	0.00	0.00					
0.005	103	1462.60	3.66	177	25134.00	62.84	0	0.00	0.00	0	0.00	0.00					
0.001	81	1150.20	0.58	190	26980.00	13.49	1	177.50	0.09	0	0.00	0.00					
0.0001	127	1803.40	0.09	81	11502.00	0.58	12	2130.00	0.11	0	0.00	0.00					
0.00001	26	369.20	0.00	40	5680.00	0.03	188	33370.00	0.17	77	27335.00	0.14					
0.000001	25	355.00	0.00	32	4544.00	0.00	155	27512.50	0.01	305	108275.00	0.05	6				
0	61	866.20		60	8520.00	0.00	429	76147.50	0.00	403	143065.00	0.00					
	785		112.74	785		567.54	785		0.38	785		0.19					
Total																	
680.85																	
567.37																	

ISFC Residential Farmer

ISFC	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	710.00	7.10					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	93	33015.00	165.08					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	235	83425.00	208.56	15				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	92	32660.00	16.33	312				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	115	40825.00	2.04	167				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	143	50765.00	0.25	144				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	25	8875.00	0.00	46				
0	785	11147.00		785	111470.00	0.00	785	139337.50	0.00	80	28400.00	0.00					
	785		0.00	785		0.00	785		0.00	785		399.37					
Total																	
399.37																	
332.81																	

ISV Residential Farmer

ISV	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	9	3195.00	0.16	1				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	301	106855.00	0.53	127				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	141	50055.00	0.03	300				
0	785	11147.00		785	111470.00	0.00	785	139337.50	0.00	334	118570.00	0.00	356				
	785		0.00	785		0.00	785		0.00	785		0.56	785				
Total																	
0.56																	
0.47																	

ESIS Residential Farmer

ESIS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	364	129220.00	6.46	254				
0.00001	0	0.00	0.00	0	0.00	0.00	123	21832.50	0.11	116	41180.00	0.21	62				
0.000001	0	0.00	0.00	0	0.00	0.00	232	41180.00	0.02	154	54670.00	0.03	30				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	121	42955.00	0.00	439				
	785		0.00	785		0.00	785		0.13	785		12.02	785				
Total																	
12.15																	
10.12																	

ESNS Residential Farmer

ESNS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	360	127800.00	6.39					
0.00001	0	0.00	0.00	0	0.00	0.00	123	21832.50	0.11	119	42245.00	0.21					
0.000001	0	0.00	0.00	0	0.00	0.00	232	41180.00	0.02	153	54315.00	0.03					
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	123	43665.00	0.00					
	785		0.00	785		0.00	785		0.13	785		11.95					
Total																	
12.08																	
10.07																	

ESES Residential Farmer

ESES	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	361	128155.00	6.41					
0.00001	0	0.00	0.00	0	0.00	0.00	123	21832.50	0.11	118	41890.00	0.21					
0.000001	0	0.00	0.00	0	0.00	0.00	232	41180.00	0.02	153	54315.00	0.03	227				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	123	43665.00	0.00	558				
	785		0.00	785		0.00	785		0.13	785		11.97	785				
Total																	
12.10																	
10.08																	

ESISC1 Residential Farmer

ESISC1	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	12	4260.00	10.65					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	330	117150.00	58.58	12				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	117	41535.00	2.08	364				
0.00001	0	0.00	0.00	0	0.00	0.00	58	10295.00	0.05	191	67805.00	0.34	122				
0.000001	0	0.00	0.00	0	0.00	0.00	270	47925.00	0.02	33	11715.00	0.01	83				
0	785	11147.00		785	111470.00	0.00	457	81117.50	0.00	102	36210.00	0.00	204				
	785		0.00	785		0.00	785		0.08	785		71.65	785				
Total																	
71.72																	
59.77																	

ESISC2 Residential Farmer

ESISC2	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	5325.00	13.31					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	342	121410.00	60.71	49				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	124	44020.00	2.20	406				
0.00001	0	0.00	0.00	0	0.00	0.00	2	355.00	0.00	173	61415.00	0.31	66				
0.000001	0	0.00	0.00	0	0.00	0.00	192	34080.00	0.02	33	11715.00	0.01	149				
0	785	11147.00		785	111470.00	0.00	591	104902.50	0.00	98	34790.00	0.00	115				
	785		0.00	785		0.00	785		0.02	785		76.53	785				
Total																	
76.55																	
63.79																	

PI Residential Farmer

PI	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	364	129220.00	6.46	254				
0.00001	0	0.00	0.00	0	0.00	0.00	123	21832.50	0.11	116	41180.00	0.21	62				
0.000001	0	0.00	0.00	0	0.00	0.00	232	41180.00	0.02	154	54670.00	0.03	30				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	121	42955.00	0.00	439				
	785		0.00	785		0.00	785		0.13	785		12.02	785				
Total																	
12.15																	
10.12																	

Residential

Sheet1

Farmer

Time Period	Alternative	Risk = 1 Are	Risk > .9 Are	Risk > .8 Are	Risk > .7 Are	Risk > .6 Are	Risk > .5 Are	Risk > .4 Are
T1	Alt1	0	0	0	0	0	0	1
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T2	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T3	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T4	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T5	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0

Risk > .3 Are	Risk > .2 Are	Risk > .1 Are	Risk > .09 Ar	Risk > .08 Ar	Risk > .07 Ar	Risk > .06 Ar	Risk > .05 Ar	Risk > .04 Ar
0	3	51	21	24	16	21	23	23
0	1	4	0	6	15	25	39	45
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	10	4	3	5	3	6	8
0	0	0	10	5	7	7	13	12
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Risk > .03 Ar	Risk > .02 Ar	Risk > .01 Ar	Risk > .005 A	Risk > .001 A	Risk > .0001	Risk > .0000	Risk > .0000	Risk > .0000
51	49	33	35	65	68	77	90	33
70	46	80	31	103	81	127	26	25
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
12	18	60	69	185	190	81	37	30
18	26	46	61	177	190	81	40	32
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	11	189	155
0	0	0	0	0	1	12	188	155
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	123	232
0	0	0	0	0	0	0	123	232
0	0	0	0	0	0	0	123	232
0	0	0	0	0	0	0	58	270
0	0	0	0	0	0	0	2	192
0	0	0	0	0	0	0	123	232
0	0	0	0	0	0	0	77	305
0	0	0	0	0	0	0	77	305
0	0	2	93	235	92	115	143	25
0	0	0	0	0	0	9	301	141
0	0	0	0	0	30	364	116	154
0	0	0	0	0	30	360	119	153
0	0	0	0	0	30	360	119	153
0	0	0	0	12	330	117	191	33
0	0	0	0	15	342	124	173	33
0	0	0	0	0	30	364	116	154
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	6
0	0	0	0	15	312	167	144	46
0	0	0	0	0	0	14	323	168
0	0	0	0	0	0	254	62	30
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	12	364	122	83
0	0	0	0	0	49	406	66	149
0	0	0	0	0	0	254	62	30

Total Affecte	Percent of Site	
684	0.471724	
724	0.49931	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
721	0.497241	
725	0.5	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
356	0.245517	
356	0.245517	
0	0	
0	0	
355	0.244828	
355	0.244828	
355	0.244828	
328	0.226207	
194	0.133793	
355	0.244828	
382	0.263448	
382	0.263448	
705	0.486207	
451	0.311034	
664	0.457931	
662	0.456552	
662	0.456552	
683	0.471034	
687	0.473793	
664	0.457931	
6	0.004138	
6	0.004138	
684	0.471724	
505	0.348276	
346	0.238621	
0	0	
0	0	
581	0.40069	
670	0.462069	
346	0.238621	

NA Industria Worker

NA	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	2	14666.67	73.33	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	2	146666.67	366.67	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	1	91666.67	0.46	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	1	91666.67	0.05	2	366666.67	0.18	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	2		73.33	2		366.67	2		0.50	2		0.18	785				
Total																	
440.69																	
367.24																	

LTM Industrial Worker

LTM	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	2	14666.67	73.33	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	2	146666.67	366.67	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	1	91666.67	0.46	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	1	91666.67	0.05	2	366666.67	0.18	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	2		73.33	2		366.67	2		0.50	2		0.18	785				
Total																	
440.69																	
367.24																	

ISFC Industrial Worker

ISFC	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	183333.33	458.33					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	183333.33	0.92					
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	0		0.00	2		459.25	785				
Total																	
459.25																	
382.71																	

ISV Industrial Worker

ISV	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	1.83					
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	0		0.00	2		1.83	785				
Total																	
1.83																	
1.53																	

ESIS Industrial Worker

ESIS	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	18.33					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		18.33	785				
Total																	
18.43																	
15.35																	

ESNS Industrial Worker

ESNS	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	18.33					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		18.33	785				
Total																	
18.43																	
15.35																	

ESES Industrial Worker

ESES	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	18.33					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		18.33	785				
Total																	
18.43																	
15.35																	

ESISC1 Industrial Worker

ESISC1	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	183.33					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		183.33	785				
Total																	
183.43																	
152.85																	

ESISC2 Industrial Worker

ESISC1	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	183.33					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		183.33	785				
Total																	
183.43																	
152.85																	

PI Industrial Worker

PI	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	366666.67	18.33					
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
1.00E-06	0	0.00	0.00	0	0.00	0.00	2	183333.33	0.09	0	0.00	0.00	2				
1.00E-07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	783				
	0		0.00	0		0.00	2		0.09	2		18.33	785				
Total																	
18.43																	
15.35																	

Time Period	Alternative	Risk = 1 Are	Risk > .9 Are	Risk > .8 Are	Risk > .7 Are	Risk > .6 Are	Risk > .5 Are	Risk > .4 Are
T1	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T2	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T3	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T4	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T5	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0

Risk > .3 Are	Risk > .2 Are	Risk > .1 Are	Risk > .09 Ar	Risk > .08 Ar	Risk > .07 Ar	Risk > .06 Ar	Risk > .05 Ar	Risk > .04 Ar
0	0	1	0	1	0	2	1	1
0	0	1	0	0	1	0	2	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Risk > .03 Ar	Risk > .02 Ar	Risk > .01 Ar	Risk > .005 A	Risk > .001 A	Risk > .0001	Risk > .0000	Risk > .0000	Risk > .0000
22	67	81	101	79	84	66	106	54
17	61	88	102	100	105	83	116	24
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	17	22	32	163	202	188	49	29
0	17	24	34	159	202	189	48	29
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	7	129	156
0	0	0	0	0	0	7	129	156
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	5	257
0	0	0	0	0	0	0	5	257
0	0	0	0	0	0	0	5	257
0	0	0	0	0	0	0	3	194
0	0	0	0	0	0	0	0	22
0	0	0	0	0	0	0	5	257
0	0	0	0	0	0	0	31	284
0	0	0	0	0	0	0	31	284
0	0	0	0	212	149	108	182	39
0	0	0	0	0	0	0	24	359
0	0	0	0	0	1	264	198	129
0	0	0	0	0	1	246	213	130
0	0	0	0	0	1	246	213	130
0	0	0	0	1	105	288	132	139
0	0	0	0	1	276	134	130	126
0	0	0	0	0	1	264	198	129
0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	2
0	0	0	0	0	44	408	70	143
0	0	0	0	0	0	0	41	378
0	0	0	0	0	0	0	257	59
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	177	280	71
0	0	0	0	0	7	322	157	59
0	0	0	0	0	0	0	257	59

Total Affecte	Percent of Site	
666	0.45931	
701	0.483448	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
702	0.484138	
702	0.484138	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
0	0	
292	0.201379	
292	0.201379	
0	0	
0	0	
262	0.18069	
262	0.18069	
262	0.18069	
197	0.135862	
22	0.015172	
262	0.18069	
315	0.217241	
315	0.217241	
690	0.475862	
383	0.264138	
592	0.408276	
590	0.406897	
590	0.406897	
665	0.458621	
667	0.46	
592	0.408276	
2	0.001379	
2	0.001379	
665	0.458621	
419	0.288966	
316	0.217931	
0	0	
0	0	
528	0.364138	
545	0.375862	
316	0.217931	

NA Recreational shoreline

NA	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of IN	Risk		
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	8	1000.00	2.50	12	15000.00	37.50	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	13	1625.00	0.81	16	20000.00	10.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	5	625.00	0.03	13	16250.00	0.81	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	8	1000.00	0.01	26	32500.00	0.16	0	0.00	0.00	0	0.00	0.00	0				
1.00E-06	11	1375.00	0.00	3	3750.00	0.00	0	0.00	0.00	1	3125.00	0.00	0				
0	59	7375.00	0.00	34	42500.00	0.00	104	162500.00	0.00	103	321875.00	0.00	104				
	104		3.35	104		48.48	104		0.00	104		0.00	104				
Total																	
51.83																	
43.19																	

LTM Recreational Shoreline

LTM	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	7	875.00	2.19	11	13750.00	34.38	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	21	2625.00	1.31	17	21250.00	10.63	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	10	1250.00	0.06	13	16250.00	0.81	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	20	2500.00	0.01	26	32500.00	0.16	0	0.00	0.00	0	0.00	0.00	0				
1.00E-06	12	1500.00	0.00	3	3750.00	0.00	0	0.00	0.00	1	3125.00	0.00	0				
1.00E-07	34	4250.00	0.00	34	42500.00	0.00	104	162500.00	0.01	103	321875.00	0.02	104				
	104		3.58	104		45.98	104		0.01	104		0.02	104				
Total																	
49.58																	
41.32																	

ISFC Recreational Shoreline

ISFC	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	17	53125.00	26.56	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	14	43750.00	2.19	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	8	25000.00	0.13	33				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	26	81250.00	0.04	10				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	39	121875.00	0.01	61				
	104		0.00	104		0.01	104		0.01	104		28.92	104				
Total																	
28.94																	
24.11																	

ISV Recreational Shoreline

ISV	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	104	325000.00	0.02	104				
	104		0.00	104		0.01	104		0.01	104		0.02	104				
Total																	
0.03																	
0.03																	

ESIS Recreational Skoreline

ESIS	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	16	50000.00	0.03	27				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	67	209375.00	0.01	77				
	104		0.00	104		0.01	104		0.01	104		0.36	104				
Total																	
0.38																	
0.32																	

ESNS Recreational Shoreline

ESNS	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	0				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	68	212500.00	0.01	104				
	104		0.00	104		0.01	104		0.01	104		0.36	104				
Total																	
0.38																	
0.31																	

ESES Recreational Shoreline

ESES	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	21				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	68	212500.00	0.01	83				
	104		0.00	104		0.01	104		0.01	104		0.36	104				
Total																	
0.38																	
0.31																	

ESISC1 Recreational Shoreline

ESISC	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	33	103125.00	0.52	12				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	11	34375.00	0.02	21				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	60	187500.00	0.01	71				
	104		0.00	104		0.01	104		0.01	104		0.54	104				
Total																	
0.56																	
0.46																	

ESISC2 Recreational Shoreline

ESISC	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	24	75000.00	3.75	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	10	31250.00	0.16	23				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	11	34375.00	0.02	14				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	59	184375.00	0.01	67				
	104		0.00	104		0.01	104		0.01	104		3.93	104				
Total																	
3.95																	
3.29																	

PI Recreational Shoreline

IP	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
5.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
1.00E-05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
1.00E-06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	16	50000.00	0.03	27				
1.00E-07	104	13000.00	0.00	104	130000.00	0.01	104	162500.00	0.01	67	209375.00	0.01	77				
	104		0.00	104		0.01	104		0.01	104		0.36	104				
Total																	
0.00																	
0.00																	

Time Period	Alternative	Risk = 1 Are	Risk > .9 Are	Risk > .8 Are	Risk > .7 Are	Risk > .6 Are	Risk > .5 Are	Risk > .4 Are
T1	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T2	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T3	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T4	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0
T5	Alt1	0	0	0	0	0	0	0
	Alt2	0	0	0	0	0	0	0
	Alt3	0	0	0	0	0	0	0
	Alt4	0	0	0	0	0	0	0
	Alt5	0	0	0	0	0	0	0
	Alt6	0	0	0	0	0	0	0
	Alt7	0	0	0	0	0	0	0
	Alt8	0	0	0	0	0	0	0
	Alt9	0	0	0	0	0	0	0
	Alt10	0	0	0	0	0	0	0

Risk > .3 Are	Risk > .2 Are	Risk > .1 Are	Risk > .09 Ar	Risk > .08 Ar	Risk > .07 Ar	Risk > .06 Ar	Risk > .05 Ar	Risk > .04 Ar
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Risk > .03 Ar	Risk > .02 Ar	Risk > .01 Ar	Risk > .005 A	Risk > .001 A	Risk > .0001	Risk > .0000	Risk > .0000	Risk > .0000
0	0	0	0	8	13	5	8	11
0	0	0	0	7	21	10	20	12
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	12	16	13	26	3
0	0	0	0	11	17	13	26	3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	1
0	0	0	0	0	17	14	8	26
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	21	16
0	0	0	0	0	0	0	21	15
0	0	0	0	0	0	0	21	15
0	0	0	0	0	0	0	33	11
0	0	0	0	0	0	24	10	11
0	0	0	0	0	0	0	21	16
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	33	10
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	27
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	12	21
0	0	0	0	0	0	0	23	14
0	0	0	0	0	0	0	0	27

Total Affecte	Percent of Site
45	0.031034
70	0.048276
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
70	0.048276
70	0.048276
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
1	0.00069
1	0.00069
65	0.044828
0	0
37	0.025517
36	0.024828
36	0.024828
44	0.030345
45	0.031034
37	0.025517
0	0
0	0
43	0.029655
0	0
27	0.018621
0	0
0	0
33	0.022759
37	0.025517
27	0.018621

Ed 10/2

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering - Re-Estimation of TPA Construction Emissions

ORIGINATOR D. Murray DATE 6/16/95

REVISION NO. 0

OBJECTIVE Attached

METHODOLOGY Attached

ASSUMPTIONS Attached

(Continue on another sheet if necessary)

David J. Murray
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

A.D

6.10

1.43

JE JACOBS ENGINEERING GROUP INC.

DATE 6/16/95 SUBJECT Re-Estimation of TPA Construction Emissions SHEET NO. 1/3

BY [illegible] CHKD. JOB NO. 01P47101

Objective: Reduce the small equipment quantities so that emission limits for CO & NOx are not exceeded

Methodology: Determine the major contributors to emissions and use engineering judgement to reduce the small equipment quantities

Reference: TPA Data Pkg WHC-SD-WM-EV-104, Rev B.

① Nonradiological Emissions are shown for construction in Table 9-11, attached. The backup for this table is Tables F-24 through F-30, also attached. Examination of Table F-24 shows that the major contributor to emissions occurs on Table F-29.

② Table 9-21, attached shows that most construction activities take place during a 6-yr period, 1997-2003. This is in general agreement with the 5-year duration of construction in Tables F-24 through F-30. Table 9-25, attached, shows construction durations by type. From Table 9-25, one can generalize that structural, mechanical, electrical & piping activities would take place during a 3 year period, and that the equipment shown on Table F-29 would be used for 3 yrs, not 5. Using 3 yrs instead of 5 yrs will reduce the amounts of pollutants by a factor of 0.6

JACOBS ENGINEERING GROUP INC.

DATE 6/16/95 SUBJECT Re-Estimation of TPA Construction Emissions SHEET NO. 2B

BY [illegible] CHKD. _____ JOB NO. 01X47101

③ The table below shows the total pieces of equipment in each category for No Sepas and TPA

Category	No Sepas	TPA
Air Compressors	50	70
Welders	140	196
Generators	75	105
Light Plants	50	70
Compactors	80	112

④ Building dimensions for TPA (approximate)

LLW 250 x 325 = 80,000 ft²

HLW 175 x 510 = 90,000 ft²

Total = 170,000 ft²

Assume that half the welders (98) are used indoors & the other half are used outdoors, for retrieval, pipe runs, utilities, etc.

The area serviced by a welder is 170,000 ft²/98 welders = 1730 ft². This is a square, 42 ft on a side. Since the welder is in the center of the square, it can reach 30 ft to a corner and not even have to move. This approximation indicates that the small equipment could be high by a factor of two.

JACOBS ENGINEERING GROUP INC.

DATE 6/16/95 SUBJECT Re-Estimation of TPA Construction Emissions SHEET NO. 3/3

BY [illegible] CHKD. ____ JOB NO. D1K4701

(5) So the overall reduction in small equipment (and accompanying emissions) is

0.6 (sch. reduction) × 0.5 (equip. reduction)

= 0.3 overall

(6) For Table F-29, the emissions (Kg) are re-calculated as follows for small equipment.

CO = 9.56×10^6

Hydrocarbons (total) = 4.7×10^5

NOx = 3.36×10^5

HCHO = 1.19×10^4

SOx = 510

Particulate = 22,000

(7) Total construction emissions and reduction factors are then as follows:

Pollutant	Kg	Red Factor
CO	1×10^7	0.30
Hydrocarbon	5.5×10^5	0.34
NOx	9.5×10^5	0.56
HCHO	2.5×10^4	0.48
SOx	12,900	0.92
Particulate	69,000	0.58

As a guide, these reduction factors can be applied to those data packages which provide only the total nonroad construction emissions

Table 9-11. Nonradiological Construction Emissions. (Units As Indicated)

Construction Emission Pollutant		Tri-Party Agreement Preferred Alternative
Particulate[2]	kg	1.2 ~~1.3~~E+5
SO_x (as SO_2)[2]	kg	1.4 ~~1.6~~E+4
CO	kg	3.2E+7
Hydrocarbons[2,3] (exhaust & fugitive)	kg	1.6E+6
NO_x(as NO_2)[2]	kg	1.7 ~~1.9~~E+6
Aldehydes[2] (as HCHO)	kg	5.3 ~~5.6~~E+4
Organic Acids	kg	n/a
Thermal Releases[4]	J	8.0E+14
Fugitive Dust[5]	t	497 ~~840~~

Notes:

CO_2 = carbon dioxide
EPA = U.S. Environmental Proctection Agency
LLW = low-level waste
NOx = nitrgen oxide and nitrogen dioxide
SOx = sulfur oxide and sulfur dioxide

[1]Includes LLW vault construction.

F.7 Backup for Table 9-11

Table F-24. Summary of Construction Emissions.

Period of Release During Construction	Carbon Monoxide (CO)	Exhaust Hydrocarbons (Hydrocarbons)	Fugitive Hydrocarbons (Hydrocarbons)	Nitrogen Oxides as NO_2 (NOx)	Aldehydes as HCHO (Aldehydes)	Sulfur Oxides as SO_2 (SOx)	Particulate Matter (PM_{10})[2] (Particulate)
Year 1 (Table F-26)	46510.8 4.7×10^4	6431.14 6.4×10^3	217.577	92510.6 9.2×10^4	2817.39 2.8×10^3	2834.9 2.8×10^3	7746.52 7.7×10^3
Years 2-4 (Table F-27)	40398.5 4×10^4	5331.53 5.3×10^3	2.478	96685.2 9.7×10^4	2492.64 2.5×10^3	1752.9 1.7×10^3	6135.2 6.1×10^3
5-Year Duration (Table F-28)	344346 3.4×10^5	49170.9 4.9×10^4	3080.9	404620 4×10^5	8113.84 8.1×10^3	4730.6 4.7×10^3	33157.6 3.3×10^4
5-Year Duration (Table F-29)	31869115 3.2×10^7	1091332. 1.1×10^6	478297. 4.8×10^5	1121044. 1.1×10^6	39606.6 3.9×10^4	1709.3 1.7×10^3	73430.4 7.3×10^4
5-Year Duration (Table F-30)	83749.8 8.4×10^4	8484.49 8.5×10^3	5466.72	21206.6 2.1×10^4	0	3075.0 3×10^3	0
Totals	32384120.1 3.2×10^7	1160750.06 1.1×10^6	487064.68 4.8×10^5	1736066.4 1.7×10^6	53030.47 5.3×10^4	14102.7 1.4×10^4	120469.72 1.2×10^5

Notes:

[1]AP-42 emission factors present separate exhaust hydrocarbon and fugitive hydrocarbons emission factors for gasoline powered engines. The total hydrocarbon emissions is the sum of these two emissions.

[2]Exhaust particulate is assumed to be PM_{10}.

Major Contributor

Table F-25. Summary of Fugitive Dust Emissions.

Total PM_{10} Fugitive Emissions (metric tons)		
	No Separations	Tri-Party Agreement
1. Clear and Grub		
A. Bulldozer grading	5.1	
B. Paved road traffic	7.8	
2. Construction Site Excavation		
A. Unpaved road traffic	176	
B. Scraper unloading	2.6	
C. Dozer grading	6.4	
D. Wind erosion (storage and waste piles)	42.1	
3. Aggregate Borrow Pit Excavation		
A. Dump truck loading, truck unloading and crusher loading	1.6	
B. Unpaved road traffic	1.4	
4. Batch Plant Operation		
A. Dump truck unloading	Included in IIIA	
B. Batch plant operation	10.4	
C. Wind erosion (aggregate and sand piles)	0.1	
D. Paved road traffic	100.2	
E. Unpaved road traffic	0.86	
TOTAL (tonnes)	355	497[1]

Note:

[1]Tri-Party Agreement fugitive dust emissions = 1.4 x no separations emissions.

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

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission Factor	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_x		Aldehydes as HCHO		Sulfur Oxides as SO_x		Particulate Matter	
					units	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss	fact	emiss
X ton pickup	250	LDGT1	1	64800 ml	g/ml	10.25	664.2	0.81	52.488	0.59	38.232	1.06	68.688	-	-	-	-	-	-
D8 dozer	335	wheeled dozer D	4	3770 hr	g/hr	816.8	3079.37	86.84	327.387	-	0	1889	7122.13	29.5	111.215	-	-	75	282.75
Cat 966 loader	200	wheeled loader D	1	120 hr	g/hr	259.6	31.1496	113.2	13.5804	-	0	858.2	102.983	18.8	2.256	-	-	77.9	9.348
10 cy dump truck	250	off-highway truck D	8	960 hr	g/hr	816.8	784.138	86.84	83.3664	-	0	1889	1813.59	51	48.96	-	-	116	[illegible]
Cat D9 dozer	460	wheeled dozer D	2	2800 hr	g/hr	816.8	2287.07	86.84	243.152	-	0	1889	5289.65	29.5	82.6	-	-	75	210
Cat 637E scraper	450	scraper D	6	7780 hr	g/hr	568.2	4420.52	128.2	997.007	-	0	1741	13543	65	505.7	-	-	184	1431.52
(Twin engine)	250	scraper D	6	7780 hr	g/hr	568.2	4420.52	128.2	997.007	-	0	1741	13543	65	505.7	-	-	184	1431.52
Towed vibratory roller	50	roller G	1	1400 hr	g/hr	6080	8512	277	387.8	83.7	117.18	164	229.6	7.57	10.598	-	-	11.8	16.52
Cat 14G Motor Grader	200	motor grader D	2	4370 hr	g/hr	68.46	299.17	18.07	78.9659	-	0	324.4	1417.76	5.54	24.2098	-	-	27.7	121.049
Cat 235B Backhoe	215	misc. D	1	80 hr	g/hr	306.4	24.5096	69.35	5.548	-	0	767.3	61.384	13.9	1.112	-	-	63.2	5.056
Cat 623E Elevating Scraper	330	scraper D	4	6270 hr	g/hr	568.2	3562.55	128.2	803.501	-	0	1741	10914.4	65	407.55	-	-	184	1153.68
Cat 815B Compactor	210	misc. D	1	1570 hr	g/hr	306.4	481.001	69.35	108.88	-	0	767.3	1204.66	13.9	21.823	-	-	63.2	99.224
5000 gal Water Tanker	300	off-highway truck D	1	1570 hr	g/hr	816.8	1282.39	86.84	136.339	-	0	1889	2965.98	51	80.07	-	-	116	182.12

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

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

Notes:

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

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

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

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

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

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emiss Factor Units	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_x		Aldehydes as HCHO		Sulfur Oxides as SO_2		Particulate Matter	
						fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
D8 dozer	335	wheeled dozer D	1	920 hr	g/hr	816.8	751.465	86.84	79.8928	-	0	1889	1738.03	29.5	27.14	-	-	75	69
966 FII loader	200	wheeled loader D	4	8160 hr	g/hr	259.6	2118.17	113.2	923.467	-	0	858.2	7002.83	18.8	153.408	-	-	77.9	635.66
10 cy dump truck	250	off-highway truck D	10	12730 hr	g/hr	816.8	10398	86.84	1105.47	-	0	1889	24049	51	649.23	-	-	116	1476.7
Cat 623II scraper	330	scraper D	4	610 hr	g/hr	568.2	346.596	128.2	78.1715	-	0	1741	1061.85	65	39.65	-	-	184	112.24
Cat 14G motor grader	200	motor grader D	1	150 hr	g/hr	68.46	10.269	18.07	2.7105	-	0	324.4	48.6645	5.54	0.831	-	-	27.7	4.155
X ton pickup	250	LDGTI	1	3000 ml	g/ml	10.25	30.75	0.81	2.43	0.59	1.77	1.06	3.18	-	-	-	-	-	-
Cat D6 dozer	165	wheeled dozer D	1	1810 hr	g/hr	816.8	1478.43	86.84	157.18	-	0	1889	3419.38	29.5	53.395	-	-	75	135.75
8 cy concrete mixer trucks	250	off-highway truck D	4	16800 hr	g/hr	816.8	13722.4	86.84	1458.91	-	0	1889	31737.9	51	856.8	-	-	116	1948.8
Totals			26	No Separations Baseline			28856.1		3808.24		1.77		69060.8		1780.5		1252		4382.3
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							40398.5		5331.53		2.478		96685.2		2492.6		1753		6135.2

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

Notes:

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

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

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

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

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

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission factor	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_x		Aldehydes as HCHO		Sulfur Oxides as SO_2†		Particulate Matter	
					units	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
Utility dozer	65	wheeled dozer D	5	16000 hr	g/hr	816.8	13069	86.84	1389.44	-	0	1889	30226.6	29.5	472	-	-	75	1200
Utility loader/ backhoe	65	wheeled loader D	6	19000 hr	g/hr	259.6	4932.02	113.2	2150.23	-	0	858.2	16305.6	18.8	357.2	-	-	77.9	1480.1
Backhoe-1 cy	65	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Backhoe-2 cy	120	wheeled loader D	2	3000 hr	g/hr	259.6	778.74	113.2	339.51	-	0	858.2	2574.57	18.8	56.4	-	-	77.9	233.7
Loader-2 cy	120	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Loader-4 cy	200	wheeled loader D	2	3000 hr	g/hr	259.6	778.74	113.2	339.51	-	0	858.2	2574.57	18.8	56.4	-	-	77.9	233.7
Crane-15 ton	150	misc. D	10	64000 hr	g/hr	306.4	19607.7	69.35	4438.4	-	0	767.3	49107.2	13.9	889.6	-	-	63.2	4044.8
Crane-25 ton	185	misc. D	10	48000 hr	g/hr	306.4	14705.8	69.35	3328.8	-	0	767.3	36830.4	13.9	667.2	-	-	63.2	3033.6
Crane-50 ton	200	misc. D	5	16000 hr	g/hr	306.4	4901.92	69.35	1109.6	-	0	767.3	12276.8	13.9	222.4	-	-	63.2	1011.2
Crane-100 ton	300	misc. D	2	6000 hr	g/hr	306.4	1838.22	69.35	416.1	-	0	767.3	4603.8	13.9	83.4	-	-	63.2	379.2
Forklift-2 ton	60	wheeled loader D	10	56000 hr	g/hr	259.6	14536.5	113.2	6337.52	-	0	858.2	48058.6	18.8	1052.8	-	-	77.9	4362.4
Forklift-4 ton	70	wheeled loader D	6	29000 hr	g/hr	259.6	7527.82	113.2	3281.93	-	0	858.2	24887.5	18.8	545.2	-	-	77.9	2259.1
Forklift-6 ton	100	wheeled loader D	4	16000 hr	g/hr	259.6	4153.28	113.2	1810.72	-	0	858.2	13731	18.8	300.8	-	-	77.9	1246.4
Forklift-10 ton	130	wheeled loader D	4	13000 hr	g/hr	259.6	3374.54	113.2	1471.21	-	0	858.2	11156.5	18.8	244.4*	-	-	77.9	1012.7
Forklift-15 ton	150	wheeled loader D	4	10000 hr	g/hr	259.6	2595.8	113.2	1131.7	-	0	858.2	8581.9	18.8	188	-	-	77.9	779
Motor grader	125	motor grader D	4	22000 hr	g/hr	68.46	1506.12	18.07	397.54	-	0	324.4	7137.46	5.54	121.88	-	-	27.7	609.4
Pumps-1 in.	2	IC gasoline	40	128000 hr	g/hp * hr	199	50944	6.68	1710.08	2.99	765.44	5.16	1320.96	0.22	56.32	-	-	0.327	83.712
Pumps-2 in.	3	IC gasoline	20	64000 hr	g/hp * hr	199	63680	6.68	2137.6	2.99	956.8	5.16	1651.2	0.22	70.4	-	-	0.327	104.64

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

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Usage	Emission factor units	Carbon Monoxide		Exhaust Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides as NO_x		Aldehydes as HCHO		Sulfur Oxides as SO_x†		Particulate Matter	
						fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)	fact	emiss (kg)
Pumps-6 in.	10	IC gasoline	10	16000 hr	g/hp * hr	199	31840	6.68	1068.8	2.99	478.4	5.16	825.6	0.22	35.2	-	-	0.327	52.32
Totals			152	No Separations Baseline			245962		35122.1		2200.64		219014		5795.6		3379.0		23684
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							344346		49170.9		3080.9		406620		8113.84		4730.6		33138

Notes:

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

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

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

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

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

Equipment Description	Rated Power (hp)	AP-42 Category	Number of Units	Total Hours	Emission Factor	Carbon Monoxide		Hydrocarbons		Hydrocarbons		Nitrogen Oxides as NO2		Aldehydes as HCHO		Sulfur Oxides as SO2		Particulate Matter	
						fuel	emissions (kg)	fuel	emissions (kg)	fuel	emissions (kg)	fuel	emissions (kg)	fuel	emissions (kg)	fuel	emissions (kg)	fuel	emissions (kg)
Air Comp - 100 cfm	50	IC gasoline	20	112000	g/hp/hr	199	1114400	6.68	37408	2.99	16744	5.16	28896	0.22	1232	-	-	0.327	1831.2
Air Comp - 250 cfm	90	IC diesel	20	80000	g/hp/hr	3.03	21816	1.12	8064	0.02	144	14	100800	0.21	1512	-	-	1	7200
Air Comp - 600 cfm	180	IC diesel	10	24000	g/hp/hr	3.03	13089.6	1.12	4838.4	0.02	86.4	14	60480	0.21	907.2	-	-	1	4320
Welders - 200 amp	100	IC gasoline	60	336000	g/hp/hr	199	6686400	6.68	224448	2.99	100464	5.16	173376	0.22	7392	-	-	0.327	10987.2
Welders - 400 amp	200	IC gasoline	80	320000	g/hp/hr	199	12736000	6.68	427520	2.99	191360	5.16	330240	0.22	14080	-	-	0.327	20928
Generators - 0.5 kW	5	IC gasoline	20	96000	g/hp/hr	199	95520	6.68	3206.4	2.99	1435.2	5.16	2476.8	0.22	105.6	-	-	0.327	156.96
Generators - 5 kW	10	IC gasoline	20	64000	g/hp/hr	199	127360	6.68	4275.2	2.99	1913.6	5.16	3302.4	0.22	140.8	-	-	0.327	209.28
Generators - 10 kW	20	IC gasoline	15	36000	g/hp/hr	199	143280	6.68	4809.6	2.99	2152.8	5.16	3715.2	0.22	158.4	-	-	0.327	235.44
Generators - 100 kW	75	IC diesel	10	16000	g/hp/hr	3.03	3636	1.12	1344	0.02	24	14	16800	0.21	252	-	-	1	1200
Generators - 250 kW	150	IC diesel	10	16000	g/hp/hr	3.03	7272	1.12	2688	0.02	48	14	33600	0.21	504	-	-	1	2400
Light Plants - 10 kW	20	IC gasoline	30	280000	g/hp/hr	199	1114400	6.68	37408	2.99	16744	5.16	28896	0.22	1232	-	-	0.327	1831.2
Compactors - Walk	5	IC gasoline	60	192000	g/hp/hr	199	191040	6.68	6412.8	2.99	2870.4	5.16	4953.6	0.22	211.2	-	-	0.327	313.92
Compactors - Ride	40	IC gasoline	20	64000	g/hp/hr	199	509440	6.68	17100.8	2.99	7654.4	5.16	13209.6	0.22	563.2	-	-	0.327	837.12
Totals			395	No Separations Baseline			22763654		779523		341641		800746		28290.4		1220.9		52450.3
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							31869115		1091332		478297		1121014		39606.6		1709.3		73430.4

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

Notes:

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

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

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

Prepared by: Andy Kimbrough, Fluor Daniel Inc.

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

Equipment Description	Rated Power (hp)	AMAS Category	Number of Units	Total Hours	Emission Factor Units	Carbon Monoxide		Hydrocarbons		Fugitive Hydrocarbons		Nitrogen Oxides (NO_2)		Aldehydes (Acrolein)		Sulfur Oxides (SO_2)		Particulate Matter	
						(fact.)	(mass (kg))	(fact.)	(mass (kg))	(fact.)	(mass (kg))	(fact.)	(mass (kg))	(fact.)	(mass (kg))	(fact.)	(mass (kg))	(fact.)	(mass (kg))
½ ton Pickup	200	LDGTI	50	1600000	g/mi	10.25	16400	0.81	1296	0.59	944	1.06	1696	-	-	-	-	-	-
¾ ton Pickup	250	LDGTI	25	800000	g/mi	10.25	8200	0.81	648	0.59	472	1.06	848	-	-	-	-	-	-
3 ton Flat bed	300	HDGV	20	800000	g/mi	16.16	12928	1.42	1136	1.59	1272	5.1	4080	-	-	-	-	-	-
5 ton Flat bed	350	HDGV	10	320000	g/mi	16.16	5171.2	1.42	454.4	1.59	508.8	5.1	1632	-	-	-	-	-	-
40' Float and Tractor	350	HDDV	10	320000	g/mi	8.67	2774.4	2.53	809.6	-	0	11.44	3660.8	-	-	-	-	-	-
Low Boy with Tractor	400	HDDV	2	15000	g/mi	8.67	130.05	2.53	37.95	-	0	11.44	171.6	-	-	-	-	-	-
Shuttle Bus	250	LDGTI	10	480000	g/mi	10.25	4920	0.81	388.8	0.59	283.2	1.06	508.8	-	-	-	-	-	-
Van	200	LDGTI	10	720000	g/mi	10.25	7380	0.81	583.2	0.59	424.8	1.06	763.2	-	-	-	-	-	-
Fuel/Service Truck	250	LDDT	5	400000	g/mi	1.53	612	0.63	252	-	0	1.09	436	-	-	-	-	-	-
Mechanic's Truck	250	LDDT	5	400000	g/mi	1.53	612	0.63	252	-	0	1.09	436	-	-	-	-	-	-
Water Trucks	300	HDDV	2	80000	g/mi	8.67	693.6	2.53	202.4	-	0	11.44	915.2	-	-	-	-	-	-
Totals			149	No Separations Baseline			59821.3		6060.35		3904.8		15147.6		0		2196.4		0
Tri-Party Agreement Scale Factor							1.4		1.4		1.4		1.4		1.4		1.4		1.4
Emissions							83749.8		8484.49		5466.7		21206.6		0		3075.0		0

Table 9-25. Construction Type by Duration.
(Percentage of Construction)

Unit Process	Tri-Party Agreement Preferred Alternative	For 0 5yr proj
Clearing	1.6	0.08 yr
Grubbing	1.6	0.08 "
Earthwork	4.9	0.25 "
Foundations	7.8	0.40 "
Structure	25.9	1.30 "
Mechanical/electrical	29.1	1.50 "
Piping	29.1	1.50 "

Table 9-21. Unit Process: Sequence of Construction.
(Calendar Year Start\Completion Date)

Unit process	Tri-Party Agreement Preferred Alternative
Sludge wash	12/1997 - 12/2003[4]
Cesium removal	12/1997 - 12/2003[4]
Other radionuclide removal	n/a
Low-level waste vitrification	12/1997-12/2003[1]
Low-level waste disposal	12/2003-12/2019[2]
High-level waste vitrification	06/2002-12/2007[3]
High-level waste transportation/disposal	n/a

Vault Const

Notes:

[1]Boomer, 1994, Figure 4.4-5, pp. 92.

[2]Construction of the low-level waste (LLW) vaults will commence when LLW Vitrification construction is complete which is approximately 1.5 years prior to LLW operations. Vault construction will continue as required through LLW operations.

[3]Tri-Party Agreement Milestone M-51-03-T04.

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.

Ecology, EPA and DOE, 1994, Hanford Federal Facility Agreement and Consent Order, 2 vols, as amended, Washington State Department of Ecology, Olympia, Washington, and U.S. Environmental Protection Agency and U.S. Department of Energy, Washington, D.C.

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering - Selective Retrieval Costs

ORIGINATOR D. Murray DATE 5/25/95

REVISION NO. Ø 1 C#.

OBJECTIVE Develop Costs for Selective Retrieval

METHODOLOGY Proportion Costs from Engineering Data Packages

ASSUMPTIONS Attached (on 1/19)
Revised for November DEIS.

(Continue on another sheet if necessary)

David J. Murray
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE 5/24 SUBJECT Sective Retrieval Costs SHEET NO. 1/19

BY MM CHKD. JOB NO. 01K47101

Objective: Use the data from the WHC packages to develope costs for selective retrieval

From Selective Retrieval paper

Tank Type	# Retrieved	# In Situ
SST	60	89
DST	10	18

So for SSTs, 40% Retrieved, 60% In Situ

and for DST's 35% Retrieved 65% In Situ

Now look at cost components for Retrieval & Transfer, TPA, and Grave Fill

A. Retrieval & Transfer

References Tables 5-13, 5-14 & Backup to 5-13

Assumption: Overall schedule doesn't change, but operating rate is slower (capacity less) This won't affect transfer, since it is governed by hydraulic considerations. Staffing will be less to operate a plant with lesser capacity.

1. SST's

Retrieval, build 40% of arms, sluicing and confinement. Transfer, cap cost unchanged, op cost, unchanged. R&D cost unchanged, barriers - omit

JACOBS ENGINEERING GROUP INC.

DATE 5/24/95 SUBJECT Selective Retrieval Costs SHEET NO. 2/19

BY [illegible] CHKD. _____ JOB NO. 01K47101

SST Cost $millions

Retrieval	Cap	Op	R+D	Total
Arms	113	428	57	598
Sluicing	232	197	29	458
Confinement	235	350	29	614
Transfer	408	1528	20	1956
Total:	988	2503	135	3626

2 DST's

Retrieval, build 35% of mixer pumps & sluicing transfer, costs unchanged, R+D unchanged

DST Cost $millions

Retrieval	Cap	Op	R+D	Total
Mixer Pumps	321	88	46	455
Sluicing	17	15	2	34
Transfer	0	458	0	458
Total	338	561	48	947

3 MUST's - No Change

Retrieval	Cap	Op	R+D	Total
Sluicing	39	33	2	74
Transfer	23	69	1	93
Total	62	102	3	167

Overall Total	1388	3166	186	4740

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 5/24/95 SUBJECT Selective Retrieval Costs SHEET NO. 3/19

BY [illegible] CHKD. _____ JOB NO. 01K47101

B. TPA

References: Table 9-17 & Fill

Capital: Overall retrieval is 70 tanks out of 177, or 40%. Using 6/10's rule

Cap $ = $(0.4)^{0.6} \times 3{,}640$ = 2,100

Operating = 0.4 × 3880 = 1550

R&D (unchanged) = 630

Repository = 0.4 × 1750 = 700

Total 4980

C. Gravel Fill

Capital = 0.6 × ~~148~~ 25 = 89

Operating = 0.6 × 471 = 283

R&D (unchanged) = 10

Total 382

D. Closure Activities

TPA: Tank & Equip Stab (Gravel Fill); Barrier Const, Tank & Vault Mo

(Grout Fill)

In Situ Barrier Const, Monit

FORM 91-005-1 (4/81)

JACOBS ENGINEERING GROUP INC.

DATE 5/25/95 SUBJECT Selective Retrieval Costs SHEET NO. 4/19

BY [illegible] CHKD. JOB NO. 01K47101

Reference Table 5-9 (Replacement)

1. For TPA w/gravel tank fill, the total capital cost is 0.4 × 169.4 = 67.8

2 For In Situ Dry & Fill, the total capital cost is 0.6 × 115.5 = 69.3

3 Total = 137.1

For M&M, round the numbers from Table 5-10 of data pkg to 1 million

Summary Table
$Millions, 1995

Cost Component	R&T	TPA	In Situ	Closure	Total
Continued Ops					8600
Capital ①	1388	2100	89	137	3714
Operating ②	3166	1550	283	0	4999
M&M	0	Note 2	Note 2	1	1
D&D	0	Note 2	Note 2	0	Note 2
R&D	186	~~630~~ 670	~~10~~ 0	0	~~826~~ 856
Repository Fee	0	~~700~~ 3706	0	0	~~700~~ 3706
Total	4740	4980	382	138	~~10,240~~ 21,876

① Includes 30-40% contingency
② Includes start-up, D&D, and M&M.

FORM 01 006-1 (4/81)

Table 5-13. Comparison of Alternatives by Process Module for Retrieval and Transfer: (Millions of 1995 Dollars)[1].

Process Module	No Disposal Action	In Situ Disposal	Extensive Pretreatment	No Separations	TPA Preferred Alternative
SST retrieval	$0	$0	$2,508	$2,508	$2,508
SST confinement	$0	$0	$1,492	$1,492	$1,492
SST waste transfers	$0	$0	$1,956	$1,956	$1,956
SST subsurface barriers	$0	$0	$768	$768	$768
DST retrieval	$2,198	$0	$1,306	$1,213	$1,306
DST waste transfers	$272	$0	$458	$344	$458
MUST retrieval	$0	$0	$74	$74	$74
MUST waste transfers	$0	$0	$93	$93	$93
Total	$2,470	$0	$8,657	$8,466	$8,657

Note:

DST = double-shell tank
MUST = miscellaneous underground storage tanks
SST = single-shell tank
TPA = Tri-Party Agreement

[1]For basis of estimate, see Appendix A, Backup to Table 5-13, Overall Retrieval Costs for no action alternative.

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Table 5-14. Comparison of Alternatives by Overall Cost Component for Retrieval and Transfer (Millions of 1995 Dollars).

Cost Component	No Disposal Action	In Situ Disposal	Extensive Pretreatment	No Separations	TPA Preferred Alternative
Capital[1]	$1,930	$0	$3,270	$3,270	$3,270
Operating[2]	$440	$0	$5,180	$4,990	$5,180
Research and Development[3]	$100	$0	$210	$210	$210
Total	$2,470	$0	$8,660	$8,470	$8,660

Notes:

TPA = Tri-Party Agreement

[1]For basis of capital cost estimate, see Table 5-15.

[2]For basis of operating cost estimate, see Table 5-16.

[3]Research and development cost is estimated as 5 percent of capital cost.

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Backup to Table 5-13. Overall Retrieval Costs for Tri-Party Agreement and Extensive Separations Alternatives (2 sheets).

Tanks	Cap Cost Millions	Operating Staff Hours	Op. Cost Millions	M&M Cost Millions	R&D Cost Millions	Total Cost Millions
SSTs						
Retrieval						
Arm-based	$283	13,514,932	$1,069	$0	$57	$1,408
Sluicing	$579	6,224,163	$492	$0	$29	$1,100
Confinement						
Arm-based	$587	11,080,075	$876	$0	$29	$1,492
Sluicing	$0	0	$0	$0	$0	$0
Barriers	~~$390~~	~~4,540,061~~	~~$359~~	~~$0~~	~~$20~~	~~$768~~
Transfer						
Pipeline	$408	19,329,408	$1,528	$0	$20	$1,956
Container	$0	0	$0	$0	$0	$0
SST Total =	$2,247	54,688,639	$4,324	$0	$155	~~$6,725~~ 5956
DSTs						
Retrieval						
Mixer pumps	$916	3,172,608	$251	$0	$46	$1,213
Sluicing	$48	541,987	$43	$0	$2	$93
Transfer						
Pipeline	$0	5,798,822	$458	$0	$0	$458
DST Total =	$964	9,513,418	$752	$0	$48	$1,764
MUSTs						
Retrieval						
Sluicing	$39	421,546	$33	$0	$2	$74

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Backup to Table 5-13. Overall Retrieval Costs for Tri-Party Agreement and Extensive Separations Alternatives (2 sheets).

Transfer Container	$23	870,998	$69	$0	$1	$93
MUST Total =	$62	1,292,544	$102	$0	$3	$167
Retrieval =	$3,273	65,494,600	$5,177	$0	$207	$8,657

Notes:

DST = double-shell tank
MUST = miscellaneous underground storage tank
SST = single-shell tank

As indicated in Section 5.0, the values in these tables are imported from spreadsheet calculations. The number of significant figures shown does not imply level of accuracy or degree of confidence in the estimated values.

See Notes to Backup Table 5-6 Construction Staff Hours for capital cost basis.

See Table 5-1 and Table 5-16 for operating cost staff hours and basis.

D&D cost basis is included in operating cost, and is based on entombment in place, per the Hanford Mission Plan, DOE/RL-93-102.

Operating cost includes startup cost.

Retrieval R&D cost is assumed to be 5 percent of retrieval capital cost, except R&D cost for arm-based SST retrieval includes additional $43 million for SST retrieval test facility.

Boomer, K. D., et al., 1993, *Tank Waste Technical Options Report*, WHC-EP-0616, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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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] } 7,500
Research and development	630[3]
Repository fee	1,750
~~Other related costs~~	~~8,600[4]~~
Total	~~$18,500~~ 9880

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

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.

F.11 Backup for Table 9-16

Table F-36. Total Cost by Unit Operation.

	Construction	Labor	Equipment	Materials and Supplies			Low-Level Vaults	HLW Canisters	Research and Development	Repository Fee	Totals
				Start-up	D and D	Operations					
Sludge wash	$43	$129	$6	$2	$12	$6			$9		$207
Cesium removal	$380	$276	$54	$21	$105	$56			$83		$975
Centralized facilities	$520										$520
LLW vitrification	$1,300	$624	$170	$68	$332	$176			$264		$2,934
LLW disposal		$16	$9	$4	$17	$9	$225		$14		$294
HLW vitrification	$1,400	$639	$70	$78	$384	$126			$260		$2,957
HLW transportation		$24									$24
HLW disposal								$239		$1,750	$1,989
Total	$3,643	$1,708	$308	$173	$850	$373	$225	$239	$630	$1,750	$9,900

3640

Notes:

Table values are in millions of 1995 dollars.

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Table 7-17. Comparison of Alternatives by Overall Cost Component (Millions of 1994 Dollars).

Cost Component	In Situ Chemical Stabilization	Drying and Gravel Fill	In Situ Vitrification
Capital[1]	4,300	~~150~~ 148	4,700
Operating[2]	4,200	~~3,000~~ 471	4,800
Monitoring/maintenance (after closure)[3]	n/a	n/a	n/a
Research and development[4]	--	10	67
Total	8,500	~~3,200~~ 629	9,600

Notes:

[1]Capital cost - See Table 7-18

[2]Operating cost - See Table 7-19

[3]Monitoring and maintenance costs are provided in the *Closure Technical Data Package for the Tank Waste Remediation System Environmental Impact Statement* (Scanlon et al. 1995).

[4]Radio frequency drying will require two years of research and development at $5 million per year, based on engineering judgement.

The in situ vitrification option will require seven years of research and development at a total cost of $67 million. This is an escalated Pacific Northwest Laboratory estimate 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 Pakcage for the Tank Waste Remediation System*, Draft, Westinghouse Hanford Company, Richland, Washington.

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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	~~1~~ 5	2,800
Materials/Supplies	1,450	~~11~~ 13	1.550
Equipment	20	~~110~~ 111	50
Local Purchases	260	~~21~~ 19	280
Total	4,300	~~150~~ 148	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.

In Situ Chem Stab:

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

Notes: (Continued)

Drying & Gravel Fill

Radio Frequency Drying

Labor	= $0
M/S	= $0
Equipment	= ~~$121~~ 105 million
{Local purchases	= 0.15(M/S + Equipment)} -16
Total	= $121 million[3]

M/S + Eq + .15(M/S+Eq) = 121

M/S + Eq = 121/1.15 = 105

Eq = 105

Gravel Fill

Labor	= $ 5.4 million
M/S	= $13 million ? typo?
Equipment	= $ 6.4 million
{Local purchases	= 0.15 (M/S + Equipment)} = 3
Total	= $25 million[3]

[3]Tables M9-4 (In Situ Vitrification Capital Cost Summary modified to include sand excavation) and F7-7 (Tank Farm Confinement Capital Cost) of the *Tank Waste Technical Options Report* were used as a basis.

ISV:

242-A Evaporator

Capital cost	= 0

TFCF

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

In Situ Vitrification

Labor	= $163 million
M/S	= $123 million
Equipment	= $ 64 million
{Local purchases	= 0.15 (M/S + Equipment)}
Total	= $350 million

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.

Higley, B. A., 1985, *Hanford Defense Waste environmental Impact Statement Working Papers - Existing Tank Waste*, SD-WM-TI-111 Rev. 1, Rockwell Hanford Operations, Richland, Washington.

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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[2]	In Situ Vitrification[3]
Labor	2,100	~~2,700~~ 186	2,600
Materials/Supplies	10	~~28~~ 34	100
Equipment	110	~~33~~ 39	24
Local purchases	20	~~10~~ 11	22
Startup	370	92	430
Decontamination and decommissioning	1,600	~~110~~ 109	1,600
Total	4,200	~~3,000~~ 471	4,800

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)

Following numbers based on Tables F7-8 and F7-9 of the *Tank Waste Technical Options Report* (Boomer et al. 1993), modified to include 15-m (48-ft)-dia. dome penetration.

1005
- Labor = 239 Exempt x 130,000 per year = $31 million per year x 2 yr = $ 62 million
- 83 Nonexempt x 50,000 per year = $ 4 million per year x 2 yr = $ 8 million
- 683 Bargaining units x 90,000 per year = $62 million per year x 2 yr = $124 million

Labor Total = $97 million per year x 2 yr = $194 million

Materials/Supplies

Electricity	= 4 E4 kwh x $0.025/kwh = $1,000 per year x 2 yr = $2,000
Equipment	= $53 million (1993) x 1.05 = $55.7 million per year x 2yr = $111 million
{Local purchases	= 15% of (Materials/Supplies + Equipment)}
TFCF Total	= $153 million per year = $305 million

Startup = 2($153 million) = $306 million
Decontamination and decommissioning = 2($97 million) + 0.3($4,300 million) = $1,484 million

Grout Mixing = 2-year operating life
Total operating cost = $100 million
Annual operating cost = $16.5 million

Following numbers based on Tables M4-6 and M4-7 of the *Tank Waste Technical Options Report*, modified to include mixing systems.

Labor 141
- 36 Exempt x 130,000 per year = $4.7 million per year x 2 yr = $9 million
- 15 Nonexempt x 50,000 per year = $0.8 million per year x 2 yr = $2 million
- 90 Bargaining units x 90,000 per year = $8.1 million per year x 2 yr = $16 million

Labor Total = $14 million per year x 2 yr = $28 million

Materials/Supplies

Water (includes potable water for all in situ chemical stabilization personnel)	= 1.2 E6 m^3 x $3/$m^3$ = $3,500,000 = 600,000 m^3/yr = 523 m^3/person.yr (1146 people)
Electricity	= 1.6 E6 kwh x $0.025/kwh = $ 40,000
Cement	= 7.1 E6 kg x $0.09/kg = $640,000
Flyash	= 71.2 E6 kg x $0.04/kg = $2,850,000
M/S Total	= $3.5 million per year x 2yr = $7.0 million
Equipment	= $643,500 (1993) x 1.05 = $680,000 per year x 2yr = $1.4 million
{Local purchases	= 15% of (Materials/Supplies + Equipment)}

Startup = 2($18 million) = $36 million
Decontamination and decommissioning = 2($14 million) + 0.3($40 million) = $40 million

Out

Additional Staffing (includes Program Management, Operations and Maintenance, Tank Safety, Tank Upgrades, and Characterization)

Exempt	= 6.1 E3 staff-yrs x $130,000/staff-yr = $790 million
Nonexempt	= 1.2 E3 staff-yrs x $50,000/staff-yr = $ 61 million
Bargaining units	= 1.0 E4 staff-yrs x $90,000/staff-yr = $940 million
Total	= $1,800 million

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

Notes: (Continued)

Drying and Gravel Fill

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 yr = $40 million
60 nonexempt x 50,000 per year = $3 million per year x 5 yr = $15 million } 55
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 75/5 = 15

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~~ 186
~~Annual operating cost = $12 million~~

93 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 } 79
Total Labor = $9 million per year = ~~$80 million~~ 79

Materials/Supplies = 29
Electricity = 1.1E8 kwh x $0.025/kwh = $2.8 million per year x 9 yr = ~~$25 million~~ 26
Water (includes potable water for all drying and gravel fill staff) = 224 people
= 1.1 E6 m³ x $3/m³ = $370,000 per year ~~x 9 yr~~ = ~~$ 3 million~~
Equipment = 0
~~(Local purchases = 15% of (Materials/Supplies + Equipment))~~
Total = $12 million = $108 million

$3/m³ = $0.01/gal (1¢/gal)

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

224 people x 9 yrs x 523 m³/person·yr = 1.05×10⁶ m³
x $3/m³ = $3 million-checks

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

Notes: (Continued)

131 Labor 47 exempt x 130,000 per year = $6.1 million per year x 4 yr = $24 million
14 nonexempt x 50,000 per year = $0.7 million per year x 4 yr = $ 3 million
70 Bargaining units x 90,000 per year = $6.3 million per year x 4 yr = $25 million
Total Labor = $13 million per year = $52 million 52

Materials/Supplies = 0
Electricity = 5E4 kwh x $0.025/kwh = $1250 per year x 4 yr = $ 0 million
Equipment = $6 million per year x 4 yr = $24 million
{Local purchases = 15% of (Materials/Supplies + Equipment)}
Total = $19 million = $76 million

Startup = 2 ($19 million) = $38 million
Decontamination and decommissioing = 2($13 million) + 0.3($24 million) = $33 million

Continuing Opns - Don't Include

Additional Staffing (includes Program Management, Operations and Maintenance, Tank Safety, Tank Upgrades, and Characterization)

Exempt = 8.8 E3 staff years x $130,000/staff years = $1,100 million
Nonexempt = 1.8 E3 staff years x $50,000/staff years = $ 88 million
Bargaining units = 1.5 E4 staff years x $90,000/staff years = $1,100 million
Total = $2,500 million

[3]In Situ Vitrification
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 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 (millionaterials/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

Vitrification = 5-year operating life
Total operating cost = $2400 million
Annual operating cost = $110 million per year

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

Additional Staffing (includes Program Management, Operations and Maintenance, Tank Safety, Tank Upgrades, and Characterization)

Exempt	= 7.2 E3 staff years x $130,000/staff years = $ 930 million
Nonexempt	= 1.4 E3 staff years x $50,000/staff years = $ 72 million
Bargaining units	= 1.3 E4 staff years x $90,000/staff years = $1,100 million
Total	= $2,100 million

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 5-9 Comparison of Alternatives by Capital Cost Component ($ millions, 1995) 19/19

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	$29.5	$52.1/$58.1	$97.9/$104	$42.7/$48.7	$51.6/$57.6
Materials & Supplies	$28.5	$42.9/$37.4	$81.1/$75.6	$34.1/$28.6	$42.5/$37.0
Equipment	n/a	$0.25/$0.35	$0.25/$0.35	$0.25/$0.35	$0.25/$0.35
Local Purchases	$57.5	(3) ~~$13.5/$35.1~~	$130/$121	(1) $82.9/$74.5	(2) ~~$42.5/$34.1~~ 123.3/11.
TOTAL	$115.5	~~$139/$131~~ 178.1/170.3	$309/$301	$160/$152	~~$137/$129~~ ~~$35.6/114.9~~ 177.2/169.4

122.3/113.9

Replacement Table.

Notes

(1) Minimum Cost for Ex-Situ Alt

(2) Costs cant go down for TPA. It appears that 40.4 was subtracted instead of added. So add 40.4 to ~~TPA~~ No Sepns local purchases, making them 123.3/114.9 for TPA

(3) Same must be done for Ext Spns, Option A. Δ = 39.4 in this case.

C11

1/11

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Engineering - Flux From TPA LLW Vaults

ORIGINATOR D. Murray DATE 2/1/95

REVISION NO. 0

OBJECTIVE Estimate the concentration of radionuclides released from the LLW vaults, and time required for release

METHODOLOGY See p1

ASSUMPTIONS 1. Cullet/sulfur waste form is stored in vaults similar to grout vaults
2. All concrete structures fail after 500 yrs
3 Hanford Barrier fails after 1000 yrs
4 Recharge rate is 0.05 cm/yr until barrier fails, it then becomes 0.1 cm/yr

(Continue on another sheet if necessary) (cont, p3)

David J Murray
SIGNATURE

CALCULATION & RESULTS ATTACHED

JACOBS\FORMS\CALCVR.SHT

1.9.3

6.1.2

JACOBS ENGINEERING GROUP INC.

DATE 2/11/95 SUBJECT Flux From TPA LLW Vaults SHEET NO. 2/11

BY DJM CHKD. JOB NO. 01R4701

Methodology

A Calculate time for water/leach solution to reach vaults

B Calculate release time of radionuclides

C Calculate feed rate of liquid into vaults

D Calculate number of vaults required

E Calculate amount leached per year, and total mass dissolved. Compare with solubility tables

F Calculate concentrations of ions in solution

FORM 91-005-1 (4/93)

JACOBS ENGINEERING GROUP INC.

DATE 2/1/95 SUBJECT SHEET NO. 3/11

BY DJM CHKD. _____ Flux From TPA LLW Vaults JOB NO. 01K47101

Assumptions (cont)

5. Vitrified waste is uniform spheres, 1 cm in dia. Packing fraction is 0.7
6. Glass will have composition shown in TPA Eng. Data Pkg.
7. Matrix is 95% sulfur + 5% organic binders
8. The vaults are 15 m below the surface of the barrier
9. Leaching commences when the recharge reaches the vaults
10. Leach products form in the same proportion as in the glass
11. Release time is approximated by $\left(\frac{\text{Particle Radius}}{\text{Corrosion Rate}}\right)$ (Ref. 1)
12. Corrosion rate is 3×10^{-6} cm/yr
13. Glass density = 2.6 g/cm^3
14. Vaults are 37 m × 15 m × 10 m deep
15. Soln resulting from dissolution of glass will contain the ions shown in the ASPEN tables in the TPA Eng Data Pkg
16. Radioactive decay is not taken into account

References

1. R.A. Kornesky, et al. Impacts of Disposal System Design Options on Low Level Glass Waste Disposal System Performance (Working Draft) July 29, 1994
2. John A. Dean, ed., Lange's Handbook of Chemistry McGraw-Hill, 11th Edition

JACOBS ENGINEERING GROUP INC.

DATE 2/1/95 SUBJECT Flux From TPA LLW Vaults SHEET NO. 4/11

BY [illegible] CHKD. _____ JOB NO. 01K47101

Calculation

① How far will recharge penetrate in the 1st thousand years?

$$.05 \frac{cm}{yr} \times 1{,}000\ yrs = 50\ cm = 0.5\ m.$$

② How long will it take for recharge to reach vaults?

$$t = d/r = \frac{14.5\ m}{0.1\ cm/yr} = \frac{1450\ cm}{0.1\ cm/yr} = 14{,}500\ yrs$$

③ What is the release time?

$$t \equiv \frac{0.5\ cm}{3 \times 10^{-6}} = 1.7 \times 10^5\ yrs\ (\text{Assumption } 11)$$

④ What is liquid feed rate on top of one vault?

$$Q = VA = \frac{.1\ cm}{yr} \times (15 \times 37)\ m^2 \times \frac{10^4\ cm^2}{m^2}$$

$$= 555{,}000 \frac{cm^3}{yr} \times \frac{1\ liter}{1000\ cm^3} = 555 \frac{liters}{yr}$$

⑤ What is the vol of LLW spheres in one vault?

$$V = 0.7LWH = 0.7(37 \times 15 \times 10) = 3{,}885\ m^3$$

FORM 01M61 (4/89)

JACOBS ENGINEERING GROUP INC.

DATE 2/1/95 SUBJECT Flux From TPA LLW Vaults SHEET NO. 5/11

BY AJM CHKD. JOB NO. 01K47101

(6) How many vaults are required?

$V = LWH = 5{,}550\ m^3$ = vol of one vault

From data pkg, p10-3, vol of LLW mix $= 2.27 \times 10^5\ m^3$

$$\text{Vaults} = 2.27 \times 10^5\ m^3 \times \frac{\text{vault}}{5{,}550\ m^3} = 40.9 \text{ vaults}$$

(7) From data pkg, p A-114, total mass of cullet $= 4.00 \times 10^5$ MT

$$4 \times 10^5\ MT \times \frac{m^3}{2.6\ MT} = 154{,}000\ m^3 \text{ cullet}$$

(8) Vol of cullet/sulfur mix $= \frac{154{,}000}{.7} = 220{,}000\ m^3$ mix

Checks with $227{,}000\ m^3$ mix from step (6)

(9) Wt of LLW spheres in one vault

$= 4 \times 10^5\ MT / 40.9 = 9779.9$ Call it 9780 MT

$$\text{Total solution flow} = 555 \frac{L}{yr \cdot vault} \times 40.9 \text{ vaults} = 22{,}700\ L/yr$$

(10) Amount leached in a yr (from one vault) $= \frac{9780\ MT}{170{,}000\ yrs}$

$= .0575\ MT/yr$

$= 57{,}500\ g/yr$

(11) Dissolved concentration = $\frac{57500\ g/yr}{555\ liters/yr}$

= 104 g/L total

From p10-107 of Lange, this doesn't exceed the solubility of sodium silicate (Ref 2)

(12) From all vaults (total inventory) what fraction is leached every year?

$$\frac{1}{170{,}000} = 5.88 \times 10^{-6}\ yr^{-1}$$

(13) Multiplying the glass components by this fraction will give the metric tons per year of each component, which when divided by total flow will give the concentration in the leach product.

For total mass, for example

$$4 \times 10^5\ MT \times \left\{ \frac{5.88 \times 10^{-6}\ yr^{-1} \times \frac{10^6\ g}{MT}}{\frac{555\ L}{yr \cdot vault} \times 40.9\ vaults} \right\} \rightarrow 2.59 \times 10^{-4}\ \text{Combined Factor}$$

= 104 $\frac{g}{L}$ total solids

(14) To get the concentrations of ions in soln, the metric tons of oxides must be converted to metric tons of the element

For Sm as an example, table shows 3.98×10^{-4} MT Sm_2O_3

$$\text{Then } 3.98\times10^{-4}\ MT\ Sm_2O_3 \times \frac{2\times150}{(2\times150)+(3\times16)}\ \frac{MT\ Sm}{MT\ Sm_2O_3}$$

Subscript of Sm

At wt of SM

Subscript of O

At of O

$= 3.43 \times 10^{-4}$ MT Sm

(15) Now multiply by conversion fraction from step (13)

$$(3.43\times10^{-4})(2.59\times10^{-4}) = 8.89\times10^{-8}\ \frac{g}{L}\ Sm^{+3}$$

Results

At 14,500 yrs after a barrier is emplaced, the leach vaults begin to release solution to the vadose zone.

This continues for 170,000 yrs until all of the LL glass is leached.

The total flow of leachate is 22,700 L/yr.

The concentrations of elements in the leachate are shown in the following table in the column titled "Conc. g/L".

	Estimated Vaults Release Concentrations, g/L					
Glass Component	Metric Tons	Conc. g/L	Ionic Form	Metal Subscript	Metal At Wt	Oxygen Subscript
Ag2O	3.52E-02	8.49E-06	Ag+1	2	108	1
Al2O3	7.65E+03	1.05E+00	Al+3	2	27	3
Am2O3	2.20E-03	5.19E-07	Am+3	2	243	3
As2O5	2.90E-01	4.90E-05	As+5	2	75	5
B2O3	4.41E+04	1.02E+01	B+3	2	209	3
BaO	3.46E-01	8.02E-05	Ba+2	1	137	1
BeO	2.08E-03	1.94E-07	Be+2	1	9	1
Bi2O3	7.16E+01	1.66E-02	Bi+3	2	209	3
CaO	3.16E+03	5.85E-01	Ca+2	1	40	1
CdO	2.54E+00	5.76E-04	Cd+2	1	112	1
Ce2O3	3.05E+00	6.74E-04	Ce+3	2	140	3
Cm2O3	4.76E-07	1.12E-10	Cm+3	2	247	3
Co2O3	7.35E-02	1.35E-05	Co+3	2	59	3
Cr2O3	1.88E+02	3.33E-02	Cr+3	2	52	3
Cs2O	5.20E-01	1.27E-04	Cs+1	2	133	1
CuO	2.76E-01	5.72E-05	Cu+2	1	64	1
Fe2O3	1.32E+01	2.39E-03	Fe+3	2	56	3
K2O	1.70E+03	3.65E-01	K+1	2	39	1
La2O3	4.29E-01	9.48E-05	La+3	2	139	3
Li2O	1.57E+04	1.90E+00	Li+1	2	7	1
MgO	3.15E+03	4.90E-01	Mg+2	1	24	1
MnO2	2.16E+01	3.54E-03	Mn+4	1	55	2
MoO3	4.90E+00	8.46E-04	Mo+6	1	96	3
Na2O	1.00E+05	1.92E+01	Na+1	2	23	1
Ni2O3	8.25E-01	1.52E-04	Ni+3	2	59	3
NiO	2.43E-01	4.95E-05	Ni+3	1	59	1
NpO2	5.35E-03	1.22E-06	Np+4	1	237	2
P2O5	3.77E+03	6.53E-01	PO4-3	2	31	5
PbO2	3.13E+00	7.02E-04	Pb+4	1	207	2
PuO2	9.46E-03	2.16E-06	Pu+4	1	242	2
RbO2	8.53E-02	1.61E-05	Rb+4	1	85	2
Re2O7	6.05E-03	1.20E-06	Re+7	2	186	7
Rh2O3	1.55E-02	3.26E-06	Rh+3	2	103	3
Ru2O3	3.37E-02	7.05E-06	Ru+3	2	101	3
Sb2O5	7.67E-02	1.50E-05	Sb+5	2	122	5
SeO3	8.86E-01	1.43E-04	Se+6	1	79	3
SiO2	2.20E+05	2.66E+01	Si+4	1	28	2
Sm2O3	3.98E-04	8.89E-08	Sm+3	2	150	3
SnO2	6.28E-03	1.28E-06	Sn+4	1	119	2
SrO	4.61E-01	1.01E-04	Sr+2	1	88	1
Tc2O7	2.81E+00	3.83E-04	TcO4-1	2	99	7
TeO3	7.41E-03	1.40E-06	Te+6	1	128	3
ThO2	2.00E-01	4.55E-05	Th+4	1	232	2
TiO2	1.16E-02	1.80E-06	Ti+4	1	48	2
Tl2O3	3.39E-01	7.86E-05	Tl+3	2	204	3
UO3	9.74E+01	2.38E-02	UO2+2	1	238	3
V2O5	1.71E-02	2.48E-06	V+5	2	51	5
WO2	1.83E-02	5.44E-06	WO4-2	1	184	2
WO3	4.12E+00	1.14E-03	WO4-2	1	184	3
ZnO	1.10E+00	2.29E-04	Zn+2	1	65	1
ZrO2	1.86E+01	4.19E-03	ZrO+2	1	91	2
VAULTCON.WKS						

9/11

Stream Name	436	437	438	439	440	441	442	443	444	445
Solid Components										
Total Mass FLOW, (MT)	4.00E+00	4.00E+03	4.00E+01	4.00E+03	4.00E+03	3.32E+03		4.00E-01	4.00E-01	
Al, (MT)	4.05E-02	4.05E+03	4.05E-01	4.05E+03	4.05E+03	4.05E+03		4.05E-01	4.05E-01	
Fe, (MT)	9.24E-05	9.25E+00	9.25E-04	9.25E+00	9.25E+00	9.25E+00		9.25E-04	9.25E-04	
Cr, (MT)	1.25E-03	1.25E+02	1.25E-02	1.25E+02	1.25E+02	1.25E+02		1.25E-02	1.25E-02	
Na, (MT)	7.42E-01	7.42E+04	7.42E+00	7.42E+04	7.42E+04	7.42E+04		7.42E-00	7.42E+00	
Si, (MT)	1.00E+00	1.00E+05	1.00E+01	1.00E+05	1.00E+05	1.00E+05		1.00E-01	1.00E-01	
Y, (MT)	1.65E-02	1.65E+03	1.65E-01	1.65E+03	1.65E+03	1.65E+03		1.65E-01	1.65E-01	
NO2-, and NO3-, (MT)										
Cs and Ba, (MCl)	4.02E-04	4.03E+01	4.03E-03	4.03E+01	4.03E+01	4.03E+01		4.03E-03	4.03E-03	
Sr and Y, (MCl)	1.46E-05	1.46E+00	1.46E-04	1.46E+00	1.46E+00	1.46E+00		1.46E-04	1.46E-04	
Ic, (MCl)	3.05E-07	3.05E-02	3.05E-06	3.05E-02	3.05E-02	3.05E-02		3.05E-06	3.05E-06	
TRU, (MCl)	8.77E-03	8.77E-03	8.77E-07	8.77E-03	8.77E-03	8.77E-03		8.77E-07	8.77E-07	
Total MCl	4.17E-04	4.18E+01	4.18E-03	4.18E+01	4.18E+01	4.18E+01		4.18E-03	4.18E-03	
Ag+, (MT)										
Ag2O, (MT)	3.52E-07	3.52E-02	3.52E-06	3.52E-02	3.52E-02	3.52E-02		3.52E-06	3.52E-06	
Al+3, (MT)										
Al2O3, (MT)	7.65E-02	7.65E+03	7.65E-01	7.65E+03	7.65E+03	7.65E+03		7.65E-01	7.65E-01	
Am+3, (MT)										
Am2O3, (MT)	2.20E-08	2.20E-03	2.20E-07	2.20E-03	2.20E-03	2.20E-03		2.20E-07	2.20E-07	
As+5, (MT)										
As2O5, (MT)	2.91E-06	2.91E-01	2.91E-05	2.91E-01	2.91E-01	2.91E-01		2.91E-05	2.91E-05	
B+3, (MT)										
B2O3, (MT)	4.41E-01	4.41E+04	4.41E+00	4.41E+04	4.41E+04	4.41E+04		4.41E+00	4.41E+00	
Ba+2, (MT)										
BaO, (MT)	3.46E-06	3.46E-01	3.46E-05	3.46E-01	3.46E-01	3.46E-01		3.46E-05	3.46E-05	
Be+2, (MT)										
BeO, (MT)	2.08E-08	2.08E-03	2.08E-07	2.08E-03	2.08E-03	2.08E-03		2.08E-07	2.08E-07	
Bi+3, (MT)										
Bi2O3, (MT)	7.16E-04	7.16E+01	7.16E-03	7.16E+01	7.16E+01	7.16E+01		7.16E-03	7.16E-03	
Carbon-14, (MT)										
Ca+2, (MT)										
Cancrinite, (MT)										
CaO, (MT)	3.16E-02	3.16E+03	3.16E-01	3.16E+03	3.16E+03	3.16E+03		3.16E-01	3.16E-01	
Cd+2, (MT)										
CdO, (MT)	2.54E-05	2.54E+00	2.54E-04	2.54E+00	2.54E+00	2.54E+00		2.54E-04	2.54E-04	
Ce+3, (MT)										
Ce2O3, (MT)	3.05E-05	3.05E+00	3.05E-04	3.05E+00	3.05E+00	3.05E+00		3.05E-04	3.05E-04	
Cl-, (MT)										
Cr+3, (MT)										
Cr2O3, (MT)	4.76E-12	4.76E-07	4.76E-11	4.76E-07	4.76E-07	4.76E-07		4.76E-11	4.76E-11	
Co+3, (MT)										
Co2O3, (MT)	7.35E-07	7.35E-02	7.35E-06	7.35E-02	7.35E-02	7.35E-02		7.35E-06	7.35E-06	
CO3-2, (MT)										
Cs+3, (MT)										
Cs2O3, (MT)	1.88E-03	1.88E+02	1.88E-02	1.88E+02	1.88E+02	1.88E+02		1.88E-02	1.88E-02	
Cs+, (MT)										
Cs2O, (MT)	5.20E-06	5.20E-01	5.20E-05	5.20E-01	5.20E-01	5.20E-01		5.20E-05	5.20E-05	
Cu, (MT)										
Cu+2, (MT)										
CuO, (MT)	2.76E-06	2.76E-01	2.76E-05	2.76E-01	2.76E-01	2.76E-01		2.76E-05	2.76E-05	
CuSO4, (MT)										
F-, (MT)										
Fe+3, (MT)										
Fe2O3, (MT)	1.32E-04	1.32E+01	1.32E-03	1.32E+01	1.32E+01	1.32E+01		1.32E-03	1.32E-03	
H+, (MT)										
Hg+2, (MT)										
I-, (MT)										
K+, (MT)										
K2O, (MT)	1.70E-02	1.70E+03	1.71E-01	1.71E+03	1.71E+03	1.70E+03		1.71E-01	1.71E-01	
La+3, (MT)										
La2O3, (MT)	4.29E-06	4.29E-01	4.29E-05	4.29E-01	4.29E-01	4.29E-01		4.29E-05	4.29E-05	
Li+, (MT)										
Li2O, (MT)	1.57E-01	1.57E+04	1.56E-00	1.56E+04	1.56E+04	1.57E+04		1.56E+00	1.56E+00	
Mg+2, (MT) MgtZ										
MgO, (MT) MgO	3.15E-02	3.15E+03	3.15E-01	3.15E+03	3.15E+03	3.15E+03		3.15E-01	3.15E-01	
? — MnO2, (MT) MnO2	2.16E-04	2.16E+01	2.16E-03	2.16E+01	2.16E+01	2.16E+01		2.16E-03	2.16E-03	
MoO3, (MT) Mo+6										
? — MoO3, (MT) MoO3	4.90E-05	4.90E+00	4.90E-04	4.90E+00	4.90E+00	4.90E+00		4.90E-04	4.90E-04	
Na+, (MT)										
Na2O, (MT)	1.00E+00	1.00E+05	1.00E-01	1.00E+05	1.00E+05	1.00E+05		1.00E-01	1.00E+01	
Nb+5, (MT)										
Nb2O5, (MT)										
Ni+3, (MT)										
Ni2Fe4O8, (MT)										
Ni2O3, (MT)	8.25E-06	8.25E-01	8.25E-05	8.25E-01	8.25E-01	8.25E-01		8.25E-05	8.25E-05	
NiO, (MT)	2.43E-06	2.43E-01	2.43E-05	2.43E-01	2.43E-01	2.43E-01		2.43E-05	2.43E-05	
NO2-, (MT)										
NO3-, (MT)										
Np+4, (MT)										
NpO2, (MT)	5.35E-08	5.35E-03	5.35E-07	5.35E-03	5.35E-03	5.35E-03		5.35E-07	5.35E-07	
OH-, (MT)										
P2O5, (MT)	3.77E-02	3.77E+03	3.77E-01	3.77E+03	3.77E+03	3.77E+03		3.77E-01	3.77E-01	
P2O5:2H2O:4H2O (MT										
Pu+4, (MT)										
PuO2, (MT)	3.13E-05	3.13E+00	3.13E-04	3.13E+00	3.13E+00	3.13E+00		3.13E-04	3.13E-04	
PO4-3, (MT)										
Poly, (MT)										
Pu+4, (MT)										
PuO2, (MT)	9.46E-08	9.46E-03	9.46E-07	9.46E-03	9.46E-03	9.46E-03		9.46E-07	9.46E-07	
Sr+, (MT)										

Stream Name	436	437	438	439	440	441	442	443	444	445
Solid Components										
NSO2, (MT)	6.50E-07	6.50E-02	6.50E-06	6.50E-02	6.50E-02	6.50E-02		6.50E-06	6.50E-06	
Re+7, (MT) Re2O7, (MT)	6.05E-08	6.05E-03	6.05E-07	6.05E-03	6.05E-03	6.05E-03		6.05E-07	6.05E-07	
Rh+3, (MT) Rh2O3, (MT)	1.55E-07	1.55E-02	1.55E-06	1.55E-02	1.55E-02	1.55E-02		1.55E-06	1.55E-06	
Ru+3, (MT) Ru2O3, (MT)	3.37E-07	3.37E-02	3.37E-06	3.37E-02	3.37E-02	3.37E-02		3.37E-06	3.37E-06	
Sb+5, (MT) Sb2O5, (MT)	7.67E-07	7.67E-02	7.67E-06	7.67E-02	7.67E-02	7.67E-02		7.67E-06	7.67E-06	
Se+6, (MT) SeO3, (MT)	6.66E-06	6.66E-01	6.66E-05	6.66E-01	6.66E-01	6.66E-01		6.66E-05	6.66E-05	
Si+4, (MT) SiO2, (MT)	2.20E+00	2.20E+05	2.20E+01	2.20E+05	2.20E+05	2.20E+05		2.20E+01	2.20E+01	
Sn+3, (MT) Sn2O3, (MT)	3.98E-09	3.98E-04	3.98E-08	3.98E-04	3.98E-04	3.98E-04		3.98E-08	3.98E-08	
Sn+4, (MT) SnO2, (MT)	6.25E-08	6.25E-03	6.25E-07	6.25E-03	6.25E-03	6.25E-03		6.25E-07	6.25E-07	
SO4-2, (MT) Sr+2, (MT) SrO, (MT)	4.61E-06	4.61E-01	4.61E-05	4.61E-01	4.61E-01	4.61E-01		4.61E-05	4.61E-05	
S, (MT)						1.32E+05				
Tc2O7, (MT)	2.81E-05	2.81E+00	2.81E-04	2.81E+00	2.81E+00	2.81E+00		2.81E-04	2.81E-04	
TcO4-, (MT) Te+6, (MT) TeO3, (MT)	7.41E-08	7.41E-03	7.41E-07	7.41E-03	7.41E-03	7.41E-03		7.41E-07	7.41E-07	
Th+4, (MT) ThO2, (MT)	2.00E-06	2.00E-01	2.00E-05	2.00E-01	2.00E-01	2.00E-01		2.00E-05	2.00E-05	
Ti+4, (MT) TiO2, (MT)	1.16E-07	1.16E-02	1.16E-06	1.16E-02	1.16E-02	1.16E-02		1.16E-06	1.16E-06	
Tl+3, (MT) Tl2O3, (MT)	3.39E-06	3.39E-01	3.39E-05	3.39E-01	3.39E-01	3.39E-01		3.39E-05	3.39E-05	
TOC, (MT) UO2+2, (MT) UO3, (MT)	9.74E-04	9.74E+01	9.74E-03	9.74E+01	9.74E+01	9.74E+01		9.74E-03	9.74E-03	
V+5, (MT) V2O5, (MT)	1.71E-07	1.71E-02	1.71E-06	1.71E-02	1.71E-02	1.71E-02		1.71E-06	1.71E-06	
WO2, (MT)	1.83E-07	1.83E-02	1.83E-06	1.83E-02	1.83E-02	1.83E-02		1.83E-06	1.83E-06	
WO3, (MT)	4.11E-05	4.12E+00	4.12E-04	4.12E+00	4.12E+00	4.12E+00		4.12E-04	4.12E-04	
Zn+2, (MT) ZnO, (MT)	1.10E-05	1.10E+00	1.10E-04	1.10E+00	1.10E+00	1.10E+00		1.10E-04	1.10E-04	
ZrO2, (MT) ZrO2:Zr2O, (MT)	1.66E-04	1.66E+01	1.69E-03	1.69E+01	1.69E+01	1.66E+01		1.69E-03	1.69E-03	

Table 10-1. Average Radionuclide Inventory in the Final Glass Form (Ci/m³).[a]

Radionuclide inventory[b]	TPA preferred alternative	
	LLW glass	HLW glass
^{241}Am	3.03E-02	1.63E+01
^{243}Am	2.04E-05	1.10E-02
^{14}C		
^{244}Cm	1.31E-05	1.86E-02
^{135}Cs		
^{137}Cs	1.03E+00	5.89E+03
^{129}I		
^{63}Ni	5.52E-03	3.54E+01
^{237}Np	2.67E-05	6.45E-03
^{238}Pu	9.25E-05	7.30E-02
^{239}Pu	3.68E-03	2.90E+00
^{240}Pu	8.99E-04	7.09E-01
^{241}Pu	9.46E-03	7.46E+00
^{226}Ra		
^{106}Ru	5.00E-06	2.57E-03
^{151}Sm	3.20E-02	7.89E+01
^{126}Sn	6.37E-04	4.98E-02
^{90}Sr	3.23E+00	8.07E+03
^{99}Tc	1.36E-01	1.09E+00
^{230}Th		
^{233}U	1.49E-09	6.25E-07
^{234}U	4.10E-08	1.72E-05
^{235}U	5.28E-06	2.22E-03
^{238}U	1.21E-04	5.09E-02
^{93}Zr	1.13E-03	4.76E-01
Total (m3)[c]	2.27E+05	8.53E+03

[a]Values are calculated from the material balance. Percentages of the feed of each component in the final streams were determined. These percentages were then used along with the inventory data to determine the final values.

[b]Curies from decay daughter products are not included.

[c]Volumes of HLW and LLW taken from material balance. Streams used were final disposal streams (TPA LLW includes sulfur cement).

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGINEERING "TANK POST REMEDIATION FLUX"

ORIGINATOR COLIN HENDERSON DATE 2/2/95

REVISION NO. _____

OBJECTIVE Estimate POST REMEDIATION Emissions RESULTING FROM TANK Residuals Of 1% & 5%.

METHODOLOGY See ATTACHED

ASSUMPTIONS See Attached

(Continue on another sheet if necessary)

Colin Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

PRELIMINARY

JACOBS\FORMS\CALCVR.SHT

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 2/16

BY _____ CHKD. _____ JOB NO. _____

METHODOLOGY-

A) CALCULATE VOLUMETRIC FLOW INTO TANKS

B) CALCULATE TIME REQUIRED TO DISSOLVE NITRATE

C) CALCULATE TIME REQUIRED TO BREACH BARRIER

D CALCULATE CONCENTRATIONS IN SATURATED SOLUTIONS RELEASED FROM TANKS.

REFERENCES:

SERNE, R.J AND M.I WOOD 1990 HANFORD WASTE FORM RELEASES AND SEDIMENT INTERACTIONS, PNL 7297, BATELLE PACIFIC NORTHWEST LABORATORY, RICHLAND WA

PELTON M AND J DAVIS 1/27/95 AGGREGATED TANK FARM INVENTORIES

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 3/16

BY _____ CHKD. _____ JOB NO. _____

POST REMEDIATION RELEASE ASSUMPTIONS

1. INVENTORY 1% AND 5% OF CURRENT INVENTORY

2. SOLUBILITY OF EACH element is proportional to the SOLUBILITY of NO_3^- (360 g/l) Congruent dissolution (Serne & Wood 1990)

3. RECHARGE Rate .05 cm/yr for first 1000 yrs.
   .10 cm/yr for 1000 + yrs.
   HANFORD BARRIER FAILS AFTER 1,000 YEARS.

4. ASSUME BARRIER 5 m thick.

5. Release Point 50 ft below Surface.

6. Time for Water to Reach Waste after penetrating barrier equals 0.

7. TANK AND CONCRETE WILL HAVE FAILED AFTER 500 YEARS.

8. CONCENTRATIONS IN TANK GROUPS ARE AS SHOWN IN REFERENCE 2.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 4/16

BY _____ CHKD. _____ JOB NO. _____

1. TANK AREAS.
GROUP

1WSS. 40 tanks 36 @ 75' dia 4 @ 20' dia.

1 ft = 30.48 cm.

$$\Sigma \text{AREA} = 36\left(\pi \cdot \frac{(75(30.48))^2}{4}\right) + 4\left(\pi \frac{(20(30.48))^2}{4}\right)$$

$$= 147.8E6 + 1.167E6 \text{ cm}^2$$

1WSS = 149.0 E6 cm² ←

2WSS = 43 tanks. 39 @ 75'φ + 4 @ 20'φ

AREA = Σ 39[4.1E6] + 4(.292E6) cm²

2WSS AREA = 161.1 E6 cm² ←

1ESS = 40 tanks. = 36 @ 75'φ & 4 @ 20'φ

AREA = 36[4.1E6] + 1.167E6 cm²

1ESS AREA = 148.8E6 cm² ←

2ESS = 16 TANKS. 12 @ 75'φ 4 @ 20'φ

AREA = 12(4.1E6) + 1.167E6

2ESS = 50.4 E6 cm² ←

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 5/16

BY _____ CHKD. _____ JOB NO. _____

4ESS 10 TANKS. 10@ 75'φ

4ESS. AREA = 10 (4.1E6) = 41E6 cm² ←

2. VOLUMETRIC INFILTRATION.

1WSS ΔT .05 cm/yr

Q= .05cm/yr (149E6 cm²)(1 l / 1000 cc)

Q= 7450 l/yr. ← at .05 cm/yr

ΔT .1 cm/yr

Q= 14900 l/yr ← at .10 cm/yr

2WSS

A= 161E6 cm²

@ .05cm/yr Q= 161E6 cm²(.05 cm/yr)(1 l / 1000 cc)

Q= 8,050 l/yr ← at .05 cm/yr

@ .10 cm/yr Q= 16,100 l/yr. ← at .10 cm/yr

1ESS

A= 148.8E6 cm²

@ .05 cm/yr Q= (148.8E6 cm²)(.05 cm/yr)(1 l / 1000 cm²) = 7,440 l/yr.

Q= 7440 l/yr ← at .05 cm/yr

at .10 cm/yr Q= 14880 l/yr. ←

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. -6/16

BY _____ CHKD. _____ JOB NO. _____

2ESS

$A = 50.4E6\ cm^2$

@ .05 cm/yr $Q = 50.4E6\ cm^2 (.05\ cm/yr)(1/1000) = 2{,}520\ l/yr$

$Q = 2520\ l/yr$ ← at .05 cm/yr

@ .10 cm/yr $Q = 5040\ l/yr$ ←

4ESS $A = 41E6\ cm^2$

@ .05 cm/yr $Q = 41E6\ cm^2 (.05\ cm/yr)(1/1000) = 2050\ l/yr.$

$Q = 2050\ l/yr$ ← at .05 cm/yr

at .10 cm/yr $Q = 4100\ l/yr.$ ← at .10 cm/yr

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 7/16

BY _____ CHKD. _____ JOB NO. _____

3, POST REMEDIATION NITRATE INVENTORY. (1% Residual)

1WSS 263 MT (10^6 g)

2WSS 455 MT ($\times 10^6$ g)

1ESS 189 MT (10^6 g)

2ESS 2.59 MT (10^6 g)

4ESS. 48.9 MT (10^6 g)

SOLUBILITY = 360 g/L

4, TIME REQUIRED to dissolve NITRATE.

$$\text{Time (yrs)} = \frac{\text{Inventory}}{\text{Solubility (Infiltration)}}$$

FOR 1WSS

$$\text{Time yrs} = \frac{263 \times 10^6 \text{ g}}{(360 \text{ g/L})(7450 \text{ l/yr})} = 98 \text{ years.} \leftarrow \text{at .05 cm/yr}$$

$(263E6)/(360 \times 14900) = 49$ yrs @ 0.1 cm/yr ←

2WSS.

$$\text{Time} = \frac{455E6 \text{ g}}{360(8050)} = 157 \text{ years.} \leftarrow \text{at .05 cm/yr}$$

$455E6/(360 \times 16100) = 78$ yrs @ 0.1 cm/yr ←

1ESS

$$\text{Time} = \frac{189E6 \text{ g}}{360(7440 \text{ l/yr})} = 71 \text{ years.} \leftarrow \text{at .05 cm/yr}$$

$189E6/(360 \times 14880) = 35$ yrs at 0.1 cm/yr ←

2ESS.

$$\text{Time} = 2.59E6 \text{ g}/360(2520 \text{ l/yr}) = 3 \text{ yrs.} \leftarrow \text{at .05 cm/yr}$$

$= 2.59E6/(360 \times 5040 \text{ l/yr}) = 1.5$ yrs at 0.1 cm/yr

4ESS

TIME = 48.9E6g / 360 (2050 l/yr) = 66 years. — at .05cm/yr.

= 48.9E6/(360 × 4100 l/yr) = 33 yrs @ 0.1 cm/yr

5. TIME REQUIRED TO Breach Barrier

FIRST 1000 yrs. Water goes 1000(.05 cm/yr) = 50cm.

then infiltration goes to .10 cm/yr.

$$\text{Time} = \frac{500\text{ cm} - 50\text{ cm}}{.10\text{ cm/yr}} + 1000\text{ yrs.}$$

Time = 5,500 yrs.

Assume time to reach waste once barrier is breached is 0.

RESULTS FOR SSTs

AT TIME = 5,500 years. the tanks begin to release waste to VADOSE ZONE. THE Concentration of the release will be Saturated at the concentrations shown ON TABLES 1 and 2 attached. The duration OF Release will be as follows:

1WSS	49 years	245 yr	for 5% residual
2WSS	78 years	390 yr	
1ESS	35 years	175 yr	
2ESS	1.5 years	7.5 yr	
4ESS	33 years	165 yr	

for 1% Residual

NOTE: TABLE 1 & 2 ARE FROM Retrieval leakage Estimate.

NOTE FOR 5% Residual the Concentration leaking will be the Same.

Table 1

Tank Release Concentration grams/ liter for Radionuclides

Decayed to 12/31/95.

Solubility Calculation — For each tank group solubility = (mass elem/mass nitrate)x360 g/l

# of Tanks	40	43	40	16	10
grams	1WSS	2WSS	1ESS	2ESS	4ESS
Ac-225	4.07E-19	3.92E-19	1.99E-18	5.38E-17	2.82E-13
Ac-227	9.80E-13	4.66E-13	2.33E-12	2.98E-11	3.03E-14
Ac-228	1.13E-07	3.65E-07	6.95E-07	6.58E-05	1.66E-06
Am-241	1.07E-08	4.47E-08	1.05E-07	8.09E-06	1.86E-07
Am-242	4.58E-12	1.91E-11	4.48E-11	3.47E-09	7.98E-11
Am-243	6.99E-08	3.11E-07	9.16E-07	8.13E-05	1.16E-06
At-217	1.47E-26	1.41E-26	7.13E-26	1.94E-24	1.30E-25
Ba-135m	1.44E-06	3.71E-06	8.37E-06	2.18E-05	1.25E-06
Ba-137m	3.83E-25	1.71E-25	4.75E-25	1.82E-23	3.86E-25
Bi-210	5.72E-16	2.72E-16	1.36E-15	1.74E-14	1.64E-16
Bi-211					
Bi-212	1.62E-19	1.56E-19	7.87E-19	2.14E-17	1.43E-18
Bi-213	6.03E-20	2.88E-20	7.18E-20	3.00E-18	8.41E-20
Bi-214	6.06E-13	6.05E-13	5.44E-12	4.66E-11	2.09E-12
C-14	6.83E-09	2.86E-08	6.68E-08	5.17E-06	1.19E-07
Cm-242	1.33E-11	5.73E-11	2.89E-10	2.25E-08	1.61E-10
Cm-244	3.52E-14	1.71E-13	9.02E-13	7.04E-11	5.02E-13
Cm-245	1.64E-06	3.12E-06	5.84E-06	1.30E-05	9.12E-07
Cs-135	1.06E+01	2.75E+01	6.20E+01	1.61E+02	9.24E+00
Cs-137	2.73E-16	2.63E-16	1.33E-15	3.61E-14	2.42E-15
Fr-221	5.53E-21	2.63E-21	1.31E-20	1.68E-19	1.59E-21
Fr-223	1.84E-15	2.74E-15	1.38E-14	6.56E-14	9.93E-16
I-129	6.64E-03	3.04E-02	4.02E-02	3.20E+00	6.29E-01
Nb-93m		5.14E-08	2.41E-07		
Ni-59	1.16E-03	4.77E-03	1.25E-02	1.01E+00	9.95E-02
Ni-63	1.92E-09	1.48E-09	1.61E-08	7.96E-09	5.61E-10
Np-237	2.49E-07	1.04E-06	2.44E-06	1.89E-04	4.34E-06
Np-238	5.37E-14	2.39E-13	7.04E-13	6.25E-11	8.88E-13
Np-239	5.67E-16	2.50E-16	1.25E-15	2.02E-14	2.02E-16
Pa-231	2.40E-06	1.84E-06	2.00E-05	9.92E-06	6.99E-07
Pa-233	1.82E-13	3.96E-14	2.40E-13	6.93E-12	9.39E-14
Pa-234	1.18E-10	2.57E-11	1.56E-10	4.51E-09	6.10E-11
Pa-234m	3.44E-23	3.32E-23	1.67E-22	4.55E-21	3.05E-22
Pb-209	4.48E-21	2.00E-21	5.56E-21	2.13E-19	4.51E-21
Pb-210	9.28E-13	4.41E-13	2.20E-12	2.82E-11	2.67E-13
Pb-211					
Pb-212	6.03E-20	2.88E-20	7.18E-20	3.00E-18	8.41E-20
Pb-214	3.77E-15	5.61E-15	2.88E-14	1.55E-13	2.19E-15
Pd-107	4.00E-13	1.79E-13	4.96E-13	1.90E-11	4.03E-13
Po-210	4.31E-17	2.05E-17	1.02E-16	1.31E-15	1.24E-17
Po-211					
Po-212	1.30E-31	1.25E-31	6.31E-31	1.72E-29	1.15E-30
Po-213	6.61E-32	3.16E-32	7.87E-32	3.29E-30	9.21E-32
Po-214	2.20E-25	1.05E-25	5.23E-25	6.70E-24	6.33E-26
Po-216					
Po-218	2.94E-24	1.40E-24	3.50E-24	1.46E-22	4.10E-24
Pu-236	5.41E-09	4.41E-09	6.63E-09	5.20E-07	3.10E-08
Pu-238	2.02E-06	2.01E-06	3.92E-06	4.77E-04	2.40E-05
Pu-239	1.08E-04	1.20E-04	2.54E-04	3.31E-02	1.65E-03
Pu-240	2.36E-04	2.22E-04	7.10E-04	8.07E-02	3.59E-03
Pu-241	1.76E-15	7.37E-15	1.72E-14	1.33E-12	3.07E-14
Pu-242	1.80E-08	8.57E-09	4.29E-08	5.49E-07	5.19E-09
Ra-223					
Ra-224	1.47E-19	1.41E-19	7.13E-19	1.94E-17	1.30E-18
Ra-225	2.12E-20	1.01E-20	2.53E-20	1.06E-18	2.96E-20
Ra-226					
Ra-228	3.08E-15	4.93E-13	5.78E-12	4.97E-10	1.07E-10

Table 1

Tank Release Concentration grams/ liter for Radionuclides

Rh-106	2.00E-20	9.49E-21	4.75E-20	6.03E-19	5.74E-21
Rn-219					
Rn-220	9.04E-25	4.32E-25	1.03E-24	4.50E-23	1.25E-24
Rn-222	5.43E-18	8.72E-16	1.02E-14	8.78E-13	1.90E-13
Ru-106	3.25E-11	5.52E-11	3.83E-11	5.80E-09	7.92E-10
Sb-126	9.29E-12	1.58E-11	1.09E-11	1.66E-09	2.26E-10
Sb-126m	1.69E-14	2.53E-14	1.27E-13	5.72E-13	8.92E-15
Se-79	1.26E-02	2.15E-02	1.54E-02	2.03E+00	2.70E-01
Sm-151	2.95E-08	5.00E-08	3.47E-08	5.26E-06	7.19E-07
Sn-126	7.32E-01	4.05E+00	5.66E+00	2.43E+02	4.99E+01
Sr-90	3.34E-07	4.98E-07	2.49E-06	1.13E-05	1.76E-07
Tc-99	4.14E-09	1.97E-09	9.83E-09	1.26E-07	1.19E-09
Th-227					
Th-228	2.88E-17	2.78E-17	1.40E-16	3.81E-15	2.55E-16
Th-229	5.81E-13	2.94E-13	6.75E-13	2.96E-11	1.03E-12
Th-231	1.87E-11	4.39E-12	2.49E-11	7.38E-10	9.71E-12
Th-232	2.30E-15	2.57E-15	5.42E-15	7.06E-13	3.53E-14
Th-233	6.50E-14	1.41E-14	8.58E-14	2.48E-12	3.36E-14
Th-234	3.06E-15	1.45E-15	7.27E-15	9.32E-14	8.80E-16
Tl-208					
Tl-209	1.25E-24	1.20E-24	6.07E-24	1.65E-22	1.10E-23
U-232	7.67E-13	6.48E-13	5.26E-12	5.24E-11	4.05E-12
U-233	6.97E-08	3.77E-08	8.51E-08	4.38E-06	1.92E-07
U-234	1.58E-05	3.72E-06	2.11E-05	6.26E-04	8.23E-06
U-235	1.37E-06	1.53E-06	3.23E-06	4.21E-04	2.10E-05
U-236	2.03E-05	1.91E-05	6.11E-05	6.95E-03	3.09E-04
U-237	2.89E-11	6.28E-12	3.81E-11	1.10E-09	1.49E-11

Table 2
Chemical Release Concentrations Nonradioactive Chemicals for Single_Shell Tanks

concentration grams/liter

Chemical	1WSS	2WSS	1ESS	2ESS	4ESS
Ag	5.63E-10	5.11E-10	3.80E-09	1.24E-08	1.97E-10
Al	4.55E+00	8.75E+00	1.53E+01	5.37E+02	1.94E+00
Al+3	9.75E-01	5.73E+00	1.13E+01	8.06E+02	1.87E+00
AlO2-	6.23E+00	8.47E+00	1.37E+01	1.05E+02	1.34E+00
Ba+2	4.91E-04	1.34E-03	1.95E-03	1.52E-01	1.40E-02
Bi+3	2.28E+00	2.21E-03	1.79E+00	8.27E-01	
C2H3O3	7.28E-02	2.25E-02	6.15E-03	1.65E-01	2.19E-01
C6H5O7	7.47E+00	5.21E+00	2.33E+01	1.53E+02	1.79E+00
CO3-2	9.68E+00	1.27E+00	1.22E+01	8.62E+01	2.80E+00
Ca+2	2.72E-03	4.60E-02	1.04E+00	9.16E+01	1.13E-01
Cd+2					
Ce+3	1.59E+00	2.50E-01	1.68E+00	3.67E-01	1.29E-01
Cl-	3.00E-01	4.28E-02	2.40E-01	5.58E-02	4.44E-03
Cr+3	1.73E-02	6.59E-01	1.38E-02	2.30E-01	6.07E-02
CrO4-2	4.28E-03	1.63E-01	3.42E-03	5.69E-02	1.50E-02
EDTA	5.58E-01	1.73E-01	4.71E-02	1.27E+00	1.67E+00
F-	1.97E+00	2.38E-01	4.42E+00	5.56E+02	2.27E-02
Fe+3	2.33E+00	6.47E-01	2.70E+00	7.72E+01	1.31E+01
Fe(CN)6-4	3.00E-02	1.08E-02	4.72E+00	9.73E+01	3.90E-03
HEDTA	1.01E+00	3.14E-01	9.41E-02	2.30E+00	3.04E+00
Hg+					
K+	6.85E-02	2.00E-01	5.50E-01	2.56E-01	3.33E-02
La+	2.03E-02		7.60E-03		
Mn+4	2.87E-01	8.92E-02	2.49E-01	7.12E+01	1.73E+00
Na+	1.99E+02	1.67E+02	2.20E+02	2.92E+03	2.78E+02
Ni+2	6.88E-02	2.64E-02	2.37E+00	6.12E+01	7.31E-02
NO2-	2.41E+01	6.33E+00	3.92E+01	6.59E-01	1.71E+01
NO3-	3.60E+02	3.60E+02	3.60E+02	3.60E+02	3.60E+02
OH-	6.20E+00	1.82E+01	1.98E+01	1.97E+03	1.28E+01
PO4-3	3.66E+01	8.70E-01	3.44E+01	4.14E+01	6.34E-02
Pb	3.22E-02	3.06E-02	8.04E+00	9.48E+00	7.60E-03
SiO3-	7.67E+00	1.90E+00	7.68E+00	9.83E-01	1.54E-01
Sn			1.02E-04		
SO4-2	8.68E+00	1.96E+00	1.05E+01	1.86E+02	6.15E+00
Sr+2	1.28E-05	5.52E-04	6.82E-01	3.52E-02	4.25E-03
W+4					
Zr+4	1.92E-01	1.83E-01	1.24E-01	2.82E+02	9.41E-03

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 12/16

BY _____ CHKD. _____ JOB NO. _____

DSTs

3WDS - 3 TANKS. Dia = 22.9m

3EDS = 11 TANKS

5EDS = 14 TANKS.

$$\text{AREA PER TANK} = \frac{\pi(75 \times 30.48)^2}{4} = 4.1E6 \text{ cm}^2$$

1. 3WDS · AREA = 3(4.1E6 cm²) = 12.3E6 cm²

3EDS = 11(4.1E6 cm²) = 45.1E6 cm²

5EDS = 14(4.1E6 cm²) = 57.4E6 cm²

2. VOLUMETRIC INFILTRATION at (0.1cm/yr)

3WDS Q = 0.1cm/yr (12.3E6 cm²)(1 l/1000 cc) = 1230 l/yr.

Q = 1230 l/yr

3EDS Q = 0.1 cm/yr (45.1E6 cm²)(1 l/1000 cc) = 4510 l/yr

Q = 4510 l/yr.

5EDS Q = 0.1 cm/yr (57.4E6 cm²)(1 l/1000 cc) = 5740 l/yr.

Q = 5740 l/yr

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 13/16

BY _____ CHKD. _____ JOB NO. _____

3. POST REMEDIATION NITRATE INVENTORY.

	INVENTORY	1%	5%
3WDS	1040 MT	10.4 MT	52 MT
3EDS	2198 MT	21.98 MT	110 MT
5EDS	4450 MT	44.5 MT (10^6 g)	222.5 MT

SOLUBILITY NO_3^- = 360 g/L

4. TIME REQ to dissolve NO_3^-

$$\text{TIME} = \frac{\text{INVENTORY}}{\text{SOLUBILITY (INFILTRATION)}}$$

FOR 3WDS.

$$\frac{10.4 \times 10^6 g}{360 \frac{g}{L} \times 1230 \frac{L}{yr}}$$

1% → $\text{TIME} = \frac{10.4E6\ g}{360 g/L\ (1230\ l/yr)}$ = 23.5 years for 1% residual

5% TIME = 5x(1% TIME) = 118 years.

FOR 3EDS.

1% → $\text{TIME} = \frac{21.98E6\ g}{360 g/L\ (4510\ l/yr)}$ = 13.5 years for 1%

5% TIME = 13.5 (5) = 67.5 or .68 years.

FOR 5EDS.

1% TIME = $\frac{44.5E6\ g}{360\ (5740\ l/yr)}$ = 21.5 years for 1%.

5% TIME = 5(21.5) = 107.5 or 108 years.

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT _____ SHEET NO. 14/16

BY _____ CHKD. _____ JOB NO. _____

RESULTS FOR DSTs

AT TIME = 5,500 years the tanks begin to release waste into the VADOSE ZONE. THE CONCENTRATION of the RELEASE WILL BE SATURATED at the CONCENTRATIONS SHOWN ON TABLES 3 and 4 for DSTs attached. THE DURATION OF THE RELEASE IS AS FOLLOWS:

	1% Residual	5% Residual
3WDS	23.5 years	118 years
3EDS	13.5 years	68 years
5EDS	21.5 years	108 years.

Table 3
DST Tank Release Concentration grams/ liter for Radionuclides

DST INVENTORY RADIONUCLIDES IN GRAMS

Decayed to 12/31/1995				
Radionuclide	ACT Ci/g	3WDS	3EDS	5EDS
grams				
C-14	4.45	1.81E-01	5.22E+02	1.18E+00
Sr-90	139	4.39E+02	7.89E+04	5.01E+02
Y-90	5140	1.19E+01	2.13E+03	1.35E+01
Tc-99	0.0169	2.17E+05	9.37E+05	9.46E+04
Cs-137	86.4	4.24E+04	2.53E+05	4.51E+04
Ba-137	537000000	6.82E-03	4.07E-02	7.25E-03
Eu-154	270	1.62E+00	2.72E+02	1.97E+00
Np-237	0.000704	5.39E+02	6.40E+04	2.02E+02
Pu-238	17.1	6.15E+01	9.98E+00	1.14E+01
Pu-239	0.0619	3.45E+04	7.99E+04	2.07E+04
Pu-240	0.227	3.36E+03	5.60E+03	1.58E+03
Pu-241	103	1.80E+02	1.05E+02	1.00E+02
Am-241	3.43	3.47E+03	1.71E+04	1.45E+02

CONCENTRATION IN GRAMS/LITER = (MASS NUCLIDE/MASS NO3)*360

Radionuclide		3WDS	3EDS	5EDS
NO3 mass g		1.04E+09	2.20E+09	4.45E+09
C-14		6.27E-08	8.56E-05	9.52E-08
Sr-90		1.52E-04	1.29E-02	4.05E-05
Y-90		4.11E-06	3.49E-04	1.10E-06
Tc-99		7.50E-02	1.54E-01	7.66E-03
Cs-137		1.47E-02	4.14E-02	3.65E-03
Ba-137		2.36E-09	6.66E-09	5.87E-10
Eu-154		5.61E-07	4.45E-05	1.60E-07
Np-237		1.86E-04	1.05E-02	1.63E-05
Pu-238		2.13E-05	1.63E-06	9.22E-07
Pu-239		1.20E-02	1.31E-02	1.67E-03
Pu-240		1.16E-03	9.17E-04	1.28E-04
Pu-241		6.23E-05	1.71E-05	8.12E-06
Am-241		1.20E-03	2.80E-03	1.17E-05

Table 4

Tank Release Concentration grams/liter for Non Rad Chemicals

CONCENTRATION GRAMS/LITER

Chemical	5EDS	3EDS	3WDS
Ag+	1.16E-01	3.43E-02	2.01E-02
Al+3	3.47E+00	1.72E+00	5.00E+00
As+5	8.42E-02	4.26E-03	6.97E-02
B+3	8.23E-02	1.09E-02	1.48E-01
Ba+2	2.52E-01	1.22E-01	1.13E-02
Be+2	5.43E-03	3.66E-03	
Bi+3	1.40E-01	8.53E-02	
Ca+2	1.06E+00	3.92E-01	2.15E+00
Cd+2	4.75E-01	1.16E-02	8.36E-02
Ce+3	2.27E-01		9.12E-02
Cr+3	7.53E-01	1.28E-01	8.32E+00
Cu+2	3.86E-02	1.71E-02	1.18E-01
Fe+3	1.09E+01	4.48E-01	4.31E+00
Hg+	4.65E-03	1.54E-04	
K+	1.21E+01	6.19E+01	1.30E+01
La+	1.60E+00	2.21E-01	3.42E-02
Li+	2.00E-03		1.94E-03
Mg+2	8.13E-01	2.28E-01	1.76E-01
Mn+4	1.69E+00	1.81E-01	1.28E+00
Mo+6	3.26E-01	1.31E-01	2.95E-01
Na+	4.91E+02	4.81E+02	7.48E+02
Nd+3	9.61E-01		4.04E-02
Ni+2	6.77E-01	1.00E-01	5.75E-01
Pb+4	2.84E-01	2.28E-01	1.16E-01
Pd	9.70E-02		
Rb	5.18E-03		
Re	2.95E-03	3.50E-02	
Rh	6.91E-03	2.41E-01	4.78E-02
Ru	2.33E-02	1.37E-01	4.70E-02
Sb	1.72E-01	2.21E-01	3.40E-02
Se	1.56E-01	4.25E-01	2.20E-01
SiO3-	1.69E+01	2.37E+00	2.10E+00
Sn	2.60E-06	6.24E-05	
Te	5.46E-03	1.85E-01	3.56E-02
Th	3.26E-02	4.18E-01	2.16E-01
Ti	2.13E-02	4.58E-02	1.34E-02
Tl	3.14E-01	4.79E+00	1.90E-01
UO2+2	2.41E-01	4.48E+00	
V+5	5.67E-03	2.72E-02	4.74E-03
W+6	6.04E-02		
Zn+2	6.23E-02	3.95E-01	4.66E-01
Zr+4	1.51E+00	4.23E+01	6.39E-02
Al(OH)4-2	1.97E+02	1.37E+02	4.13E+02
CO3-2	8.03E+01	1.38E+02	3.03E+01
Cl-	1.19E+01	8.59E+00	2.59E+01
Cr(OH)4-	3.28E+00	1.87E+00	2.08E+01
F-	2.93E+00	5.24E+01	3.11E+00
SO4-2	2.26E+01	1.18E+01	1.45E+01
NO3-	3.60E+02	3.60E+02	3.60E+02
NO2-	1.57E+02	1.46E+02	8.51E+01
PO4-3	6.91E+00	1.23E+01	2.54E+01
OH-	8.28E+01	1.24E+02	8.37E+01
TOC	7.04E+01	9.73E+00	4.46E+01

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE ENGINEERING ; FLUX FROM TANKS DURING RETRIEVAL

ORIGINATOR COLIN HENDERSON DATE

REVISION NO. ~~0~~ 1 2/27/

OBJECTIVE DETERMINE FLUX and Concentration of leakage ASSOCIATED WITH Retrieval of SSTs.

METHODOLOGY See ATTACHED

ASSUMPTIONS SEE ATTACHED

(Continue on another sheet if necessary)

Colin Henderson
SIGNATURE

CALCULATION & RESULTS ATTACHED

PRELIMINARY

METHOD:

— CALCULATE THE SOLUBILITY OF TANK CONSTITUENTS BASED ON THE RATIO OF THE MASS OF EACH CONSTITUENT TO THE MASS OF NITRATE MULTIPLIED BY SOLUBILITY OF NO_3

— SOLUBILITY NO_3 = 360 g/L (Serne & Wood 1990)

— CONVERT RADIONUCLIDES from Ci to grams using SPECIFIC ACTIVITY CHART FROM ASI. (ATTACHED) AND FROM WHC-EP-0063-4 Appendix C

— THE TANK INVENTORY provided ON DISK BY ASI.

ASSUMPTIONS

1. LEAKAGE VOLUME PER TANK = 15140 l (4,000 gal)

   BASED ON Waste Retrieval and transfer data package WHICH USED 1/10 of LEAKAGE VOL estimated for TANK 106C

2. RETRIEVAL DURATION IS 15 YR (2003/2018)

3. SOLUBILITIES are proportional to mass Ratio of each CONSTITUENT TO NITRATE.

4. LEAKAGE IS saturated WITH CONTAMINANTS.

5. NO LEAKAGE FROM DSTs

6. RADIONUCLIDES Decayed to 1995 USED AS INVENTORY DOES NOT CORRESPOND TO RETRIEVAL DATE.

RESULTS:

FOR EACH TANK GROUP THE Release Concentration is taken from TABLE 1 FOR RADIONUCLIDES AND TABLE 2 for CHEMICALS. BOTH TABLES ARE IN grams/liter, THE ANNUAL LEAKAGE FROM EACH TANK GROUP IS FROM TABLE 3.

TABLE 1A Provided for Reference and is the inventory in grams. Specific Activity Shown IN left hand Column.

4/16

		Radionucli	Decayed to 12/31/1995				
	Specific Act	# of Tanks	40	43	40	16	10
	Ci/g.	Ci	1WSS	2WSS	1ESS	2ESS	4ESS
	5.80E+04	Ac-225	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06
	72.3	Ac-227	0.005179	0.004258	0.008844	0.001552	0.000277
	3.43	Am-241	2261.046	12602.86	9961.252	12927.14	6139.114
	8040	Am-242	2.676083	19.36104	18.82025	19.97412	8.668311
	9.71	Am-242m	2.688882	19.45364	18.91026	20.06965	8.70977
	0.199	Am-243	1.015628	7.824369	9.568559	11.64296	3.122778
	1.61E+12	At-217	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06
	5.37E+08	Ba-137m	844480.3	3775456	3538440	126183.6	136522.7
	1.24E+05	Bi-210	1.5E-08	1.16E-08	1.34E-08	7.03E-09	2.81E-09
	4.18E+08	Bi-211	0.005179	0.004258	0.008844	0.001552	0.000277
	1.46E+05	Bi-212	0	0	0	0	0
	1.38E+04	Bi-213	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06
	4.41E+07	Bi-214	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08
	4.45	C-14	1952.428	3373.591	12587.81	1479.091	1250.91
	3300	Cm-242	2.219645	16.05879	15.61023	16.5673	7.189828
	80.8	Cm-244	3.216887	23.89107	50.0855	53.42385	7.202217
	0.172	Cm-245	0.000208	0.001744	0.003826	0.004092	0.000551
	1.15E-03	Cs-135	20.65955	67.89432	52.72478	1.611265	2.130069
	86.4	Cs-137	892685.3	3990968	3740423	133386.4	144315.7
	1.77E+08	Fr-221	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06
	3.86E+07	Fr-223	7.15E-05	5.88E-05	0.000122	2.14E-05	3.82E-06
	1.76E-04	I-129	5.189401	13.39034	27.88373	1.821797	0.520811
	2.63E+02	Nb-93m	85.37654	675.9455	371.1179	404.9119	1504.691
	0.0807	Ni-59	0	1707.296	3325.23	0	0
	58.8	Ni-63	6834.228	48601.69	53030.59	58729.78	109051.8
	7.04E-04	Np-237	8.264374	11.00118	49.58412	0.3368	0.448371
	2.59E+05	Np-238	0.012799	0.092599	0.090013	0.095532	0.041459
	2.32E+05	Np-239	1.015628	7.824369	9.568559	11.64296	3.122778
	4.72E-02	Pa-231	0.009613	0.007326	0.01526	0.003377	0.000637
	2.07E+04	Pa-233	8.264374	11.00118	49.58412	0.3368	0.448371
	1.99E+04	Pa-234	0.275063	0.103494	0.260803	0.103241	0.026397
	6.86E+08	Pa-234m	171.9143	64.68359	163.0022	64.52547	16.49811
	4.59E+04	Pb-209	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06
	76.4	Pb-210	1.5E-08	1.16E-08	1.34E-08	7.03E-09	2.81E-09
	2.47E+07	Pb-211	0.005179	0.004258	0.008844	0.001552	0.000277
	1.38E+04	Pb-212	0	0	0	0	0
	3.28E+07	Pb-214	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08
	5.14E-04	Pd-107	9.0336	23.27601	49.54251	3.664392	0.974433
	4.49E+03	Po-210	1.5E-08	1.16E-08	1.34E-08	7.03E-09	2.81E-09
	1.04E+11	Po-211	1.41E-05	1.16E-05	2.41E-05	4.24E-06	7.56E-07
	2.95E+13	Po-212	0	0	0	0	0
	1.26E+16	Po-213	1.69E-06	2.81E-06	5.9E-06	2.2E-06	2.78E-06
	3.22E+14	Po-214	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08
	2.95E+13	Po-215	0.005179	0.004258	0.008844	0.001552	0.000277
	3.57E+11	Po-216	0	0	0	0	0
	2.83E+08	Po-218	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08

Sheet1

CONT FROM PG 1

	17.1	Pu-238	209.6931	296.1764	184.9489	198.7904	223.7023	
	0.0619	Pu-239	2522.875	4350.621	3522.892	5871.238	5570.596	
	0.227	Pu-240	486.5172	940.262	825.2579	1472.858	1389.286	
	103	Pu-241	3917.129	6358.175	8460.234	13183.46	11080.7	
	3.93E-03	Pu-242	1.33E-05	9.59E-05	9.32E-05	9.89E-05	4.29E-05	
	5.12E+04	Ra-223	0.005179	0.004258	0.008844	0.001552	0.000277	
	1.61E+05	Ra-224	0	0	0	0	0	
	3.92E+04	Ra-225	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06	
	0.988	Ra-226	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08	
	272	Ra-228	0	0	0	0	0	
	3.55E+09	Rh-106	6.11E-05	0.016964	0.082485	0.097283	0.396806	
	1.30E+10	Rn-219	0.005179	0.004258	0.008844	0.001552	0.000277	
	9.21E+08	Rn-220	0	0	0	0	0	
	1.54E+05	Rn-222	6.08E-08	5.03E-08	5.2E-08	2.98E-08	1.58E-08	
	3.34E+03	Ru-106	6.11E-05	0.016964	0.082485	0.097283	0.396806	
	8.35E+04	Sb-126	7.936369	23.28679	6.712138	13.94531	35.94768	
	7.85E+07	Sb-126m	56.68835	166.3342	47.94384	99.60934	256.7691	
	6.96E-02	Se-79	97.05961	251.0777	521.4021	32.2847	9.509629	
	26.3	Sm-151	64317.33	189324.1	56333.67	104150.4	255351.4	
	0.0283	Sn-126	56.68835	166.3342	47.94384	99.60934	256.7691	
	139	Sr-90	1513650	14476169	8411675	4949226	19174943	
	0.0169	Tc-99	3387.614	8743.647	18136.74	1132.886	331.8042	
	3.07E+04	Th-227	0.005107	0.004199	0.008722	0.001531	0.000273	
	819	Th-228	0	0	0	0	0	
	0.212	Th-229	1.72E-06	2.88E-06	6.03E-06	2.25E-06	2.84E-06	
	2.02E-02	Th-230	9E-06	7.86E-06	7.51E-06	4.51E-06	3.11E-06	
	5.29E+03	Th-231	7.217891	2.933397	6.922466	2.809554	0.697812	
	1.10E-07	Th-232	1.85E-14	3.57E-14	3.13E-14	5.59E-14	5.27E-14	
	2.31E+04	Th-234	171.9143	64.68359	163.0022	64.52547	16.49811	
	1.90E+08	Tl-207	0.005164	0.004247	0.008819	0.001548	0.000276	
	2.96E+08	Tl-208	0	0	0	0	0	
	4.09E+08	Tl-209	3.73E-08	6.21E-08	1.3E-07	4.85E-08	6.13E-08	
	9.64E-03	U-233	0.001199	0.001753	0.00591	0.000807	0.001178	
	6.24E-03	U-234	0.04907	0.045905	0.043094	0.030365	0.025199	
	2.16E-06	U-235	7.217891	2.933397	6.922466	2.809554	0.697812	
	6.46E-05	U-236	0.000216	0.000418	0.000367	0.000654	0.000617	
	8.15E+04	U-237	0.09597	0.155775	0.207276	0.322995	0.271477	
	3.36E-07	U-238	171.9143	64.68359	163.0022	64.52547	16.49811	
	5.41E+03	Y-90	1513650	14476169	8411675	4949226	19174943	
	2.51E-03	Zr-93	45.38102	800.02	241.6636	562.6344	2286.793	

tank contents in grams				
40	43	40	16	10
1WSS	2WSS	1ESS	2ESS	4ESS
2.97E-11	4.96E-11	1.04E-10	3.87E-11	4.89E-11
7.16E-05	5.89E-05	0.000122	2.15E-05	3.83E-06
659.197	3674.302	2904.155	3768.847	1789.829
0.000333	0.002408	0.002341	0.002484	0.001078
0.276919	2.003464	1.947504	2.066906	0.89699
5.10366	39.31844	48.08321	58.50734	15.69235
1.07E-18	1.79E-18	3.75E-18	1.39E-18	1.76E-18
0.001573	0.007031	0.006589	0.000235	0.000254
1.21E-13	9.36E-14	1.08E-13	5.67E-14	2.27E-14
1.24E-11	1.02E-11	2.12E-11	3.71E-12	6.62E-13
0	0	0	0	0
1.25E-10	2.08E-10	4.37E-10	1.63E-10	2.06E-10
1.38E-15	1.14E-15	1.18E-15	6.76E-16	3.58E-16
438.7478	758.1104	2828.721	332.38	281.1035
0.000673	0.004866	0.00473	0.00502	0.002179
0.039813	0.295682	0.61987	0.661186	0.089136
0.001209	0.010138	0.022243	0.023793	0.003206
17964.83	59038.54	45847.63	1401.1	1852.234
10332.01	46191.76	43291.93	1543.824	1670.321
9.75E-15	1.63E-14	3.41E-14	1.27E-14	1.6E-14
1.85E-12	1.52E-12	3.16E-12	5.55E-13	9.9E-14
29485.23	76081.49	158430.3	10351.12	2959.154
0.324626	2.570135	1.411095	1.539589	5.721258
0	21156.09	41204.83	0	0
116.2284	826.5593	901.8807	998.8058	1854.622
11739.17	15626.67	70431.98	478.4089	636.8901
4.94E-08	3.58E-07	3.48E-07	3.69E-07	1.6E-07
4.38E-06	3.37E-05	4.12E-05	5.02E-05	1.35E-05
0.203666	0.155203	0.323304	0.071551	0.013501
0.000399	0.000531	0.002395	1.63E-05	2.17E-05
1.38E-05	5.2E-06	1.31E-05	5.19E-06	1.33E-06
2.51E-07	9.43E-08	2.38E-07	9.41E-08	2.4E-08
3.76E-11	6.27E-11	1.31E-10	4.89E-11	6.19E-11
1.97E-10	1.52E-10	1.75E-10	9.2E-11	3.68E-11
2.1E-10	1.72E-10	3.58E-10	6.28E-11	1.12E-11
0	0	0	0	0
1.85E-15	1.53E-15	1.59E-15	9.09E-16	4.81E-16
17575.1	45284.06	96386.22	7129.167	1895.785
3.34E-12	2.58E-12	2.98E-12	1.57E-12	6.27E-13
1.36E-16	1.12E-16	2.32E-16	4.07E-17	7.27E-18
0	0	0	0	0
1.34E-22	2.23E-22	4.68E-22	1.74E-22	2.2E-22
1.89E-22	1.56E-22	1.62E-22	9.26E-23	4.9E-23
1.76E-16	1.44E-16	3E-16	5.26E-17	9.39E-18
0	0	0	0	0
2.15E-16	1.78E-16	1.84E-16	1.05E-16	5.57E-17

12.26275	17.32026	10.81573	11.62517	13.082
40757.26	70284.68	56912.63	94850.37	89993.48
2143.248	4142.124	3635.497	6488.36	6120.203
38.03038	61.72985	82.13819	127.9948	107.5796
0.003372	0.024397	0.023715	0.025169	0.010923
1.01E-07	8.32E-08	1.73E-07	3.03E-08	5.41E-09
0	0	0	0	0
4.4E-11	7.34E-11	1.54E-10	5.73E-11	7.24E-11
6.15E-08	5.09E-08	5.27E-08	3.02E-08	1.6E-08
0	0	0	0	0
1.72E-14	4.78E-12	2.32E-11	2.74E-11	1.12E-10
3.98E-13	3.28E-13	6.8E-13	1.19E-13	2.13E-14
0	0	0	0	0
3.95E-13	3.26E-13	3.38E-13	1.94E-13	1.02E-13
1.83E-08	5.08E-06	2.47E-05	2.91E-05	0.000119
9.5E-05	0.000279	8.04E-05	0.000167	0.000431
7.22E-07	2.12E-06	6.11E-07	1.27E-06	3.27E-06
1394.535	3607.438	7491.41	463.8606	136.6326
2445.526	7198.636	2141.965	3960.091	9709.18
2003.122	5877.533	1694.129	3519.765	9073.114
10889.57	104145.1	60515.65	35605.95	137949.2
200450.5	517375.5	1073180	67034.7	19633.39
1.66E-07	1.37E-07	2.84E-07	4.99E-08	8.89E-09
0	0	0	0	0
8.14E-06	1.36E-05	2.84E-05	1.06E-05	1.34E-05
0.000445	0.000389	0.000372	0.000223	0.000154
0.001364	0.000555	0.001309	0.000531	0.000132
1.68E-07	3.24E-07	2.85E-07	5.08E-07	4.79E-07
0.007442	0.0028	0.007056	0.002793	0.000714
2.72E-11	2.24E-11	4.64E-11	8.15E-12	1.45E-12
0	0	0	0	0
9.11E-17	1.52E-16	3.18E-16	1.19E-16	1.5E-16
0.124419	0.181847	0.61306	0.083734	0.122188
7.863758	7.356635	6.906132	4.866185	4.038277
3341616	1358054	3204845	1300719	323060.9
3.345725	6.465961	5.674911	10.12839	9.553981
1.18E-06	1.91E-06	2.54E-06	3.96E-06	3.33E-06
5.12E+08	1.93E+08	4.85E+08	1.92E+08	49101503
279.7875	2675.817	1554.838	914.8293	3544.352
18080.09	318733.1	96280.32	224157.1	911072.8

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Table 1 Rev A

Tank Release Concentration grams/liter for radionuclides

	release concentration grams/liter				
	1WSS	2WSS	1ESS	2ESS	4ESS
Ac-225	4.07E-19	3.92E-19	1.98E-18	5.4E-17	3.6E-18
Ac-227	9.8E-13	4.66E-13	2.33E-12	3E-11	2.82E-13
Am-241	9.02E-06	2.91E-05	5.53E-05	0.005259	0.000132
Am-242	4.56E-12	1.91E-11	4.46E-11	3.47E-09	7.94E-11
Am-242m	3.79E-09	1.59E-08	3.71E-08	2.88E-06	6.6E-08
Am-243	6.99E-08	3.11E-07	9.16E-07	8.16E-05	1.16E-06
At-217	1.47E-26	1.41E-26	7.13E-26	1.95E-24	1.3E-25
Ba-137m	2.15E-11	5.56E-11	1.26E-10	3.28E-10	1.87E-11
Bi-210	1.66E-21	7.4E-22	2.06E-21	7.91E-20	1.67E-21
Bi-211	1.7E-19	8.06E-20	4.03E-19	5.18E-18	4.88E-20
Bi-212	0	0	0	0	0
Bi-213	1.71E-18	1.65E-18	8.32E-18	2.27E-16	1.51E-17
Bi-214	1.89E-23	9.02E-24	2.25E-23	9.43E-22	2.63E-23
C-14	6.01E-06	6E-06	5.39E-05	0.000464	2.07E-05
Cm-242	9.21E-12	3.85E-11	9.01E-11	7.01E-09	1.6E-10
Cm-244	5.45E-10	2.34E-09	1.18E-08	9.23E-07	6.56E-09
Cm-245	1.65E-11	8.02E-11	4.24E-10	3.32E-08	2.36E-10
Cs-135	0.000246	0.000467	0.000873	0.001955	0.000136
Cs-137	0.000141	0.000365	0.000825	0.002154	0.000123
Fr-221	1.33E-22	1.29E-22	6.49E-22	1.77E-20	1.18E-21
Fr-223	2.53E-20	1.2E-20	6.02E-20	7.74E-19	7.29E-21
I-129	0.000404	0.000602	0.003018	0.014443	0.000218
Nb-93m	4.44E-09	2.03E-08	2.69E-08	2.15E-06	4.21E-07
Ni-59	0	0.000167	0.000785	0	0
Ni-63	1.59E-06	6.54E-06	1.72E-05	0.001394	0.000137
Np-237	0.000161	0.000124	0.001342	0.000668	4.69E-05
Np-238	6.76E-16	2.83E-15	6.62E-15	5.15E-13	1.18E-14
Np-239	5.99E-14	2.67E-13	7.86E-13	7E-11	9.91E-13
Pa-231	2.79E-09	1.23E-09	6.16E-09	9.98E-08	9.94E-10
Pa-233	5.46E-12	4.2E-12	4.56E-11	2.27E-11	1.59E-12
Pa-234	1.89E-13	4.11E-14	2.5E-13	7.24E-12	9.77E-14
Pa-234m	3.43E-15	7.46E-16	4.53E-15	1.31E-13	1.77E-15
Pb-209	5.14E-19	4.96E-19	2.5E-18	6.83E-17	4.55E-18
Pb-210	2.69E-18	1.2E-18	3.34E-18	1.28E-16	2.71E-18
Pb-211	2.87E-18	1.36E-18	6.82E-18	8.77E-17	8.25E-19
Pb-212	0	0	0	0	0
Pb-214	2.54E-23	1.21E-23	3.02E-23	1.27E-21	3.54E-23
Pd-107	0.000241	0.000358	0.001836	0.009948	0.00014
Po-210	4.58E-20	2.04E-20	5.68E-20	2.18E-18	4.61E-20
Po-211	1.86E-24	8.84E-25	4.42E-24	5.69E-23	5.35E-25
Po-212	0	0	0	0	0
Po-213	1.83E-30	1.77E-30	8.92E-30	2.43E-28	1.62E-29
Po-214	2.58E-30	1.23E-30	3.08E-30	1.29E-28	3.61E-30
Po-215	2.4E-24	1.14E-24	5.71E-24	7.34E-23	6.91E-25
Po-216	0	0	0	0	0
Po-218	2.94E-24	1.4E-24	3.5E-24	1.47E-22	4.1E-24

Conc = (mass isotope / mass NO_3 in tank gal) in grams/liter

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Table 1 Rev A

Tank Release Concentration grams/liter for radionuclides

Pu-238	1.68E-07	1.37E-07	2.06E-07	1.62E-05	9.63E-07
Pu-239	0.000558	0.000556	0.001084	0.132349	0.006625
Pu-240	2.93E-05	3.28E-05	6.92E-05	0.009054	0.000451
Pu-241	5.21E-07	4.88E-07	1.56E-06	0.000179	7.92E-06
Pu-242	4.62E-11	1.93E-10	4.52E-10	3.51E-08	8.04E-10
Ra-223	1.38E-15	6.58E-16	3.29E-15	4.23E-14	3.98E-16
Ra-224	0	0	0	0	0
Ra-225	6.02E-19	5.81E-19	2.93E-18	7.99E-17	5.33E-18
Ra-226	8.42E-16	4.02E-16	1E-15	4.21E-14	1.18E-15
Ra-228	0	0	0	0	0
Rh-106	2.36E-22	3.78E-20	4.43E-19	3.82E-17	8.23E-18
Rn-219	5.45E-21	2.59E-21	1.3E-20	1.67E-19	1.57E-21
Rn-220	0	0	0	0	0
Rn-222	5.4E-21	2.58E-21	6.44E-21	2.7E-19	7.54E-21
Ru-106	2.51E-16	4.02E-14	4.7E-13	4.06E-11	8.75E-12
Sb-126	1.3E-12	2.21E-12	1.53E-12	2.33E-10	3.17E-11
Sb-126m	9.88E-15	1.68E-14	1.16E-14	1.77E-12	2.41E-13
Se-79	1.91E-05	2.85E-05	0.000143	0.000647	1.01E-05
Sm-151	3.35E-05	5.7E-05	4.08E-05	0.005526	0.000715
Sn-126	2.74E-05	4.65E-05	3.23E-05	0.004911	0.000668
Sr-90	0.000149	0.000824	0.001153	0.049683	0.010156
Tc-99	0.002744	0.004094	0.020442	0.093537	0.001445
Th-227	2.28E-15	1.08E-15	5.41E-15	6.96E-14	6.55E-16
Th-228	0	0	0	0	0
Th-229	1.11E-13	1.07E-13	5.42E-13	1.48E-11	9.86E-13
Th-230	6.1E-12	3.08E-12	7.08E-12	3.12E-10	1.13E-11
Th-231	1.87E-11	4.39E-12	2.49E-11	7.41E-10	9.71E-12
Th-232	2.3E-15	2.57E-15	5.42E-15	7.09E-13	3.53E-14
Th-234	1.02E-10	2.22E-11	1.34E-10	3.9E-09	5.26E-11
Tl-207	3.72E-19	1.77E-19	8.84E-19	1.14E-17	1.07E-19
Tl-208	0	0	0	0	0
Tl-209	1.25E-24	1.2E-24	6.07E-24	1.65E-22	1.1E-23
U-233	1.7E-09	1.44E-09	1.17E-08	1.17E-07	9E-09
U-234	1.08E-07	5.82E-08	1.32E-07	6.79E-06	2.97E-07
U-235	0.045741	0.010745	0.061045	1.814957	0.023784
U-236	4.58E-08	5.12E-08	1.08E-07	1.41E-05	7.03E-07
U-237	1.61E-14	1.51E-14	4.84E-14	5.53E-12	2.45E-13
U-238	7.003571	1.523161	9.240486	267.9629	3.614835
Y-90	3.83E-06	2.12E-05	2.96E-05	0.001277	0.000261
Zr-93	0.000247	0.002522	0.001834	0.312777	0.067073

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Table 2
Chemical Release Concentrations Nonradioactive Chemicals for Single Shell Tanks

solubility grams/liter

Chemical	1WSS	2WSS	1ESS	2ESS	4ESS
Ag (1)	5.63E-10	5.11E-10	3.80E-09	1.24E-08	1.97E-10
Al (1)	4.55E+00	8.75E+00	1.53E+01	5.37E+02	1.94E+00
Al+3	9.75E-01	5.73E+00	1.13E+01	8.06E+02	1.87E+00
AlO2-	6.23E+00	8.47E+00	1.37E+01	1.05E+02	1.34E+00
Ba+2 (1)	4.91E-04	1.34E-03	1.95E-03	1.52E-01	1.40E-02
Bi+3	2.28E+00	2.21E-03	1.79E+00	8.27E-01	
C2H3O3 (1)	7.28E-02	2.25E-02	6.15E-03	1.65E-01	2.19E-01
C6H5O7 (1)	7.47E+00	5.21E+00	2.33E+01	1.53E+02	1.79E+00
CO3-2	9.68E+00	1.27E+00	1.22E+01	8.62E+01	2.80E+00
Ca+2	2.72E-03	4.60E-02	1.04E+00	9.16E+01	1.13E-01
Cd+2 (2)					
Ce+3	1.59E+00	2.50E-01	1.68E+00	3.67E-01	1.29E-01
Cl-	3.00E-01	4.28E-02	2.40E-01	5.58E-02	4.44E-03
Cr+3	1.73E-02	6.59E-01	1.38E-02	2.30E-01	6.07E-02
CrO4-2	4.28E-03	1.63E-01	3.42E-03	5.69E-02	1.50E-02
EDTA (1)	5.58E-01	1.73E-01	4.71E-02	1.27E+00	1.67E+00
F-	1.97E+00	2.38E-01	4.42E+00	5.56E+02	2.27E-02
Fe+3	2.33E+00	6.47E-01	2.70E+00	7.72E+01	1.31E+01
Fe(CN)6-4	3.00E-02	1.08E-02	4.72E+00	9.73E+01	3.90E-03
HEDTA (1)	1.01E+00	3.14E-01	9.41E-02	2.30E+00	3.04E+00
Hg+ (2)					
K+ (1)	6.85E-02	2.00E-01	5.50E-01	2.56E-01	3.33E-02
La+ (1)	2.03E-02		7.60E-03		
Mn+4	2.87E-01	8.92E-02	2.49E-01	7.12E+01	1.73E+00
Na+	1.99E+02	1.67E+02	2.20E+02	2.92E+03	2.78E+02
Ni+2	6.88E-02	2.64E-02	2.37E+00	6.12E+01	7.31E-02
NO2-	2.41E+01	6.33E+00	3.92E+01	6.59E-01	1.71E+01
NO3-	3.60E+02	3.60E+02	3.60E+02	3.60E+02	3.60E+02
OH-	6.20E+00	1.82E+01	1.98E+01	1.97E+03	1.28E+01
PO4-3	3.66E+01	8.70E-01	3.44E+01	4.14E+01	6.34E-02
Pb (1)	3.22E-02	3.06E-02	8.04E+00	9.48E+00	7.60E-03
SiO3-	7.67E+00	1.90E+00	7.68E+00	9.83E-01	1.54E-01
Sn (1)			1.02E-04		
SO4-2	8.68E+00	1.96E+00	1.05E+01	1.86E+02	6.15E+00
Sr+2	1.28E-05	5.52E-04	6.82E-01	3.52E-02	4.25E-03
W+4 (2)					
Zr+4	1.92E-01	1.83E-01	1.24E-01	2.82E+02	9.41E-03

TABLE 3

SST RETRIEVAL LEAK ESTIMATES

TANK GROUP	1WSS	2WSS	1ESS	2ESS	4ESS
NO. TANKS	40	43	40	16	10
RETRIEVAL LEAK VOLUME (LITERS)	605600	651020	605600	242240	151400
RETRIEVAL LEAK RATE (LITERS/YR)	40373	43401	40373	16149	10093
SST RETRIEVAL OPERATIONS =15 YRS MIN PRETREAT AND TPA					
SST RETRIEVAL PERIOD 2003/2018					

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(DK-ADJ.XLW)Radnuclide Data

Atomic Wieght (A)	Isotope	Half-Life (T)	Units	Specific Activity (TBq/g)	Specific Activity (Ci/g)	Decay Constant (per day)
3	H-3	1.24E+01	y	3.57E+02	9.64E+03	1.54E-04
7	Be-7	53.440	d	1.29E+04	3.49E+05	1.30E-02
11	C-11	20.380	m	3.10E+07	8.38E+08	4.90E+01
13	N-13	9.970	m	5.36E+07	1.45E+09	1.00E+02
14	C-14	5.73E+03	y	1.65E-01	4.45E+00	3.31E-07
16	N-16	7.20E+00	s	3.62E+09	9.78E+10	8.32E+03
18	F-18	1.829	h	3.50E+04	9.47E+05	9.10E+00
22	Na-22	2.60E+00	y	2.31E+02	6.24E+03	7.29E-04
24	Na-24	15.000	h	3.20E+03	8.66E+04	1.11E+00
32	P-32	14.290	d	1.06E+04	2.85E+05	4.85E-02
35	S-35	87.440	d	1.58E+03	4.26E+04	7.93E-03
36	Cl-36	3.01E+05	y	1.22E-03	3.30E-02	6.30E-09
41	Ar-41	1.827	h	1.54E+04	4.16E+05	9.11E+00
42	K-42	51.500	d	2.23E+03	6.03E+04	1.35E-02
45	Ca-45	163.000	d	6.58E+02	1.78E+04	4.25E-03
46	Sc-46	83.830	d	1.25E+03	3.38E+04	8.27E-03
51	Cr-51	27.704	d	3.42E+03	9.23E+04	2.50E-02
54	Mn-54	312.500	d	2.86E+02	7.73E+03	2.22E-03
55	Fe-55	2.70E+00	y	8.90E+01	2.41E+03	7.03E-04
56	Mn-56	2.579	h	7.99E+03	2.16E+05	6.45E+00
57	Co-57	270.900	d	3.13E+02	8.45E+03	2.56E-03
59	Ni-59	7.50E+04	y	2.99E-03	8.07E-02	2.53E-08
59	Fe-59	44.529	d	1.84E+03	4.97E+04	1.56E-02
60	Co-60	5.27E+00	y	4.18E+01	1.13E+03	3.60E-04
63	Ni-63	1.00E+02	y	2.10E+00	5.66E+01	1.90E-05
64	Cu-64	12.701	h	1.42E+03	3.84E+04	1.31E+00
65	Zn-65	243.900	d	3.04E+02	8.23E+03	2.84E-03
65	Ni-65	2.520	h	7.04E+03	1.90E+05	6.60E+00
72	Ga-72	14.100	h	1.14E+03	3.07E+04	1.18E+00
76	As-76	26.320	h	5.77E+02	1.56E+04	6.32E-01
79	Se-79	6.50E+04	y	2.57E-03	6.96E-02	2.92E-08
82	Br-82	35.300	h	3.99E+02	1.08E+04	4.71E-01
86	Rb-86	18.660	d	3.01E+03	8.13E+04	3.71E-02
89	Sr-89	50.500	d	1.07E+03	2.90E+04	1.37E-02
90	Sr-90	2.86E+01	y	5.13E+00	1.39E+02	6.64E-05
90	Y-90	64.100	h	2.00E+02	5.41E+03	2.60E-01
92	Y-92	3.540	h	3.54E+03	9.58E+04	4.70E+00
92	Sr-92	2.710	h	4.63E+03	1.25E+05	6.14E+00
93	Nb-93m	1.46E+01	y	9.73E+00	2.63E+02	1.30E-04
93	Zr-93	1.53E+06	y	9.29E-05	2.51E-03	1.24E-09
95	Zr-95	63.960	d	7.94E+02	2.15E+04	1.08E-02
95	Nb-95	35.150	d	1.45E+03	3.91E+04	1.97E-02
99	Mo-99	66.000	h	1.77E+02	4.77E+03	2.52E-01
99	Tc-99m	6.020	h	1.94E+03	5.23E+04	2.76E+00
99	Tc-99	2.13E+05	y	6.27E-04	1.69E-02	8.91E-09
103	Ru-103	39.280	d	1.19E+03	3.22E+04	1.76E-02
106	Ru-106	368.200	d	1.24E+02	3.34E+03	1.88E-03

(DK-ADJ.XLW)Radnuclide Data

Atomic Weight (A)	Isotope	Half-Life (T)	Units	Specific Activity (TBq/g)	Specific Activity (Ci/g)	Decay Constant (per day)
106	Rh-106	2.99E+01	s	1.31E+08	3.55E+09	2.00E+03
107	Pd-107	6.50E+06	y	1.90E-05	5.14E-04	2.92E-10
110	Ag-110m	249.900	d	1.76E+02	4.75E+03	2.77E-03
110	Ag-110	2.46E+01	s	1.54E+08	4.17E+09	2.43E+03
123	I-123	13.200	h	7.11E+02	1.92E+04	1.26E+00
125	I-125	60.140	d	6.42E+02	1.74E+04	1.15E-02
126	Sb-126	12.400	d	3.09E+03	8.35E+04	5.59E-02
126	Sb-126m	19.000	m	2.90E+06	7.85E+07	5.25E+01
126	Sn-126	1.00E+05	y	1.05E-03	2.83E-02	1.90E-08
129	I-129	1.57E+07	y	6.52E-06	1.76E-04	1.21E-10
131	I-131	8.040	d	4.58E+03	1.24E+05	8.62E-02
132	Te-132	78.200	h	1.12E+02	3.02E+03	2.13E-01
132	I-132	2.300	h	3.80E+03	1.03E+05	7.23E+00
133	Ba-133	1.05E+01	y	9.46E+00	2.56E+02	1.81E-04
133	Xe-133	5.245	d	6.92E+03	1.87E+05	1.32E-01
133	I-133	20.800	h	4.17E+02	1.13E+04	8.00E-01
133	Te-133	12.450	m	4.20E+08	1.13E+08	8.02E+01
134	Cs-134	2.06E+00	y	4.78E+01	1.29E+03	9.20E-04
135	I-135	6.610	h	1.29E+03	3.49E+04	2.52E+00
135	Ba-135m	28.700	h	2.98E+02	8.05E+03	5.80E-01
135	Cs-135	2.30E+06	y	4.26E-05	1.15E-03	8.25E-10
136	Cs-136	13.100	d	2.71E+03	7.32E+04	5.29E-02
137	Cs-137	3.02E+01	y	3.20E+00	8.64E+01	6.29E-05
137	Ba-137m	2.552	m	1.99E+07	5.37E+08	3.91E+02
140	Ba-140	12.740	d	2.71E+03	7.31E+04	5.44E-02
140	La-140	40.272	h	2.05E+02	5.53E+03	4.13E-01
141	Ce-141	32.501	d	1.05E+03	2.85E+04	2.13E-02
143	Ce-144	284.300	d	1.19E+02	3.21E+03	2.44E-03
143	Pr-143	13.580	d	2.49E+03	6.73E+04	5.11E-02
143	Ce-143	33.000	h	2.44E+02	6.61E+03	5.04E-01
144	Pr-144	17.280	m	2.79E+06	7.55E+07	5.78E+01
147	Pm-147	2.62E+00	y	3.43E+01	9.26E+02	7.23E-04
151	Sm-151	9.00E+01	y	9.72E-01	2.63E+01	2.11E-05
154	Eu-154	8.590	y	9.99E+00	2.70E+02	2.21E-04
181	Ta-181	121.200	d	2.20E+02	5.95E+03	5.72E-03
182	Ta-182	115.000	d	2.31E+02	6.23E+03	6.03E-03
185	W-185	75.100	d	3.47E+02	9.39E+03	9.22E-03
192	Ir-192	74.020	d	3.40E+02	9.18E+03	9.36E-03
198	Au-198	2.696	d	9.04E+03	2.44E+05	2.57E-01
199	Au-199	3.139	d	7.73E+03	2.09E+05	2.21E-01
203	Hg-203	46.600	d	5.10E+02	1.38E+04	1.49E-02
204	Tl-204	3.78E+00	y	1.71E+01	4.63E+02	5.02E-04
207	Tl-207	4.770	m	7.04E+06	1.90E+08	2.09E+02
208	Tl-208	3.053	m	1.09E+07	2.96E+08	3.27E+02
209	Pb-209	3.253	h	1.70E+03	4.59E+04	5.11E+00
209	Tl-209	2.200	m	1.51E+07	4.09E+08	4.54E+02
210	Pb-210	2.23E+01	y	2.83E+00	7.64E+01	8.53E-05

(DK-ADJ.XLW)Radnuclide Data

Atomic Weight (A)	Isotope	Half-Life (T)	Units	Specific Activity (TBq/g)	Specific Activity (Ci/g)	Decay Constant (per day)
210	Bi-210	5.012	d	4.59E+03	1.24E+05	1.38E-01
210	Po-210	138.378	d	1.66E+02	4.49E+03	5.01E-03
211	Bi-211	2.130	m	1.55E+07	4.18E+08	4.69E+02
211	Pb-211	36.100	m	9.12E+06	2.47E+07	2.76E+01
211	Po-211	5.16E-01	s	3.83E+09	1.04E+11	1.18E+05
212	Po-212	2.99E-07	s	6.60E+15	1.78E+17	2.01E+11
212	Bi-212	1.009	h	5.39E+03	1.46E+05	1.65E+01
212	Pb-212	10.643	h	5.11E+02	1.38E+04	1.56E+00
213	Bi-213	45.650	m	7.15E+05	1.93E+07	2.19E+01
213	Po-213	4.20E-06	s	4.66E+14	1.26E+16	1.43E+10
214	Bi-214	19.900	m	1.63E+06	4.41E+07	5.02E+01
214	Pb-214	26.800	m	1.21E+06	3.28E+07	3.72E+01
214	Po-214	1.64E-04	s	1.19E+13	3.22E+14	3.66E+08
215	Po-215	1.78E-03	s	1.09E+12	2.95E+13	3.37E+07
216	Po-216	1.46E-01	s	1.32E+10	3.57E+11	4.10E+05
217	At-217	3.23E-02	s	5.95E+10	1.61E+12	1.85E+06
218	Po-218	3.050	m	1.05E+07	2.83E+08	3.27E+02
219	Rn-219	3.96E+00	s	4.81E+08	1.30E+10	1.51E+04
220	Rn-220	5.56E+01	s	3.41E+07	9.21E+08	1.06E+03
221	Fr-221	4.800	m	6.55E+06	1.77E+08	2.08E+02
222	Rn-222	3.824	d	5.69E+03	1.54E+05	1.81E-01
223	Fr-223	21.800	m	1.43E+06	3.86E+07	4.59E+01
223	Ra-223	11.434	d	1.89E+03	5.12E+04	6.06E-02
224	Ra-224	3.620	d	5.95E+03	1.61E+05	1.91E-01
225	Ac-225	10.000	d	2.15E+03	5.80E+04	6.93E-02
225	Ra-225	14.800	d	1.45E+03	3.92E+04	4.68E-02
226	Ra-226	1.60E+03	y	3.65E-02	9.88E-01	1.19E-06
227	Th-227	18.718	d	1.14E+03	3.07E+04	3.70E-02
227	Ac-227	2.18E+01	y	2.67E+00	7.23E+01	8.72E-05
228	Ra-228	5.75E+00	y	1.01E+01	2.72E+02	3.30E-04
228	Th-228	1.91E+00	y	3.03E+01	8.19E+02	9.92E-04
228	Ac-228	6.130	h	8.25E+02	2.23E+04	2.71E+00
229	Th-229	7.34E+03	y	7.86E-03	2.12E-01	2.59E-07
230	Th-230	7.70E+04	y	7.46E-04	2.02E-02	2.46E-08
231	Th-231	25.520	h	1.96E+02	5.29E+03	6.52E-01
231	Pa-231	3.28E+04	y	1.75E-03	4.72E-02	5.79E-08
232	Th-232	1.41E+10	y	4.05E-09	1.10E-07	1.35E-13
232	U-232	7.20E+01	y	7.91E-01	2.14E+01	2.64E-05
233	U-233	1.59E+05	y	3.57E-04	9.64E-03	1.19E-08
233	Pa-233	27.000	d	7.67E+02	2.07E+04	2.57E-02
233	Th-233	22.300	m	1.34E+06	3.62E+07	4.46E+01
234	U-234	2.45E+05	y	2.31E-04	6.24E-03	7.76E-09
234	Th-234	24.100	d	8.56E+02	2.31E+04	2.88E-02
234	Pa-234	6.700	h	7.36E+02	1.99E+04	2.48E+00
234	Pa-234m	1.170	m	2.54E+07	6.86E+08	8.53E+02
235	U-235	7.04E+08	y	7.99E-08	2.16E-06	2.70E-12
236	U-236	2.34E+07	y	2.39E-06	6.46E-05	8.10E-11

(DK-ADJ.XLW)Radnuclide Data

Atomic Weight (A)	Isotope	Half-Life (T)	Units	Specific Activity (TBq/g)	Specific Activity (Ci/g)	Decay Constant (per day)
236	Pu-236	2.85E+00	y	1.96E+01	5.31E+02	6.66E-04
237	U-237	6.750	d	3.02E+03	8.15E+04	1.03E-01
237	Np-237	2.14E+06	y	2.61E-05	7.04E-04	8.87E-10
238	U-238	4.47E+09	y	1.24E-08	3.38E-07	4.26E-13
238	Pu-238	8.77E+01	y	6.33E-01	1.71E+01	2.16E-05
238	Np-238	2.117	d	8.58E+03	2.59E+05	3.27E-01
239	Pu-239	2.41E+04	y	2.29E-03	6.19E-02	7.86E-08
239	Np-239	2.355	d	8.57E+03	2.32E+05	2.94E-01
240	Pu-240	6.57E+03	y	8.38E-03	2.27E-01	2.89E-07
241	Am-241	4.32E+02	y	1.27E-01	3.43E+00	4.39E-06
241	Pu-241	1.44E+01	y	3.81E+00	1.03E+02	1.32E-04
242	Am-242	16.020	h	2.96E+02	8.04E+03	1.04E+00
242	Am-242m	1.52E+02	y	3.59E-01	9.71E+00	1.25E-05
242	Cm-242	163.200	d	1.22E+02	3.30E+03	4.25E-03
242	Pu-242	3.76E+05	y	1.45E-04	3.93E-03	5.05E-09
243	Am-243	7.38E+03	y	7.37E-03	1.99E-01	2.57E-07
244	Cm-244	1.81E+01	y	2.99E+00	8.08E+01	1.05E-04
245	Cm-245	8.50E+03	y	6.35E-03	1.72E-01	2.23E-07
252	Cf-252	2.64E+00	y	1.99E+01	5.37E+02	7.19E-04

JACOBS ENGINEERING GROUP INC.

DATE _____ SUBJECT

BY _____ CHKD. _____

SHEET NO. 16/16

JOB NO. _____

REFERENCES.

SERNE, R.J. AND M.I. WOOD, 1990 HANFORD WASTE FORM RELEASES AND SEDIMENT INTERACTIONS, PNL 7297, BATTELLE PACIFIC NORTHWEST LABORATORY, RICHLAND WASHINGTON.

WASTE RETRIEVAL AND TRANSFER DATA PACKAGE EA FREDENBURG, WHC-SD-WM-EV-097 REVA Draft RECVD 11/8/94.

TRANSMIT CONFIRMATION REPORT

NO.	:	005
RECEIVER	:	509 372 6328
TRANSMITTER	:	JACOBS ENG GRP HANFORD
DATE	:	APR 04'95 16:03
DURATION	:	20'30
MODE	:	STD
PAGES	:	44
RESULT	:	OK

TWRS EIS
CALCULATION COVER SHEET

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

ORIGINATOR Michael Harker DATE 02/12/96

REVISION NO. 0

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

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

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\NONRAD.TOX\CALCVR.SHT

	EX SITU INTERMEDIATE SEPARATIONS ALTERNATIVE - REMEDIATION CALCS							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04		
							Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement W-314		1.00E+02	1.40E+02		1.40E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.69E+05	1.00E+01		1.69E+06		
							Total	1.69E+06
Offsite Truck			trips	km/trip		total		
	concrete		5.45E+04	1.40E+02		7.63E+06		
	steel		1.51E+04	8.00E+02		1.21E+07		
			trips/yr	km/trip	yr			
	miscellaneous		7.54E+03	1.40E+02	1.00E+01	1.06E+07		
							Total	3.03E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.30E+03	8.00E+02	1.90E+01	3.50E+07		
	miscellaneous		6.70E+03	1.40E+02	1.90E+01	1.78E+07		
							Total	5.28E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		2.74E+02	8.00E+02	1.90E+01	4.16E+06		
							Total	4.16E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06		
							Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
							Total	0.00E+00
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.74E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.05E+08						
Offsite Rail (km)		7.90E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	1.73E+04	2.60E+02	1.40E+02	7.41E-01	4.67E+08		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
							Total	2.30E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.05E+08	5.00E-02			5.24E+06		
	Rail	7.90E+06	5.00E-02			3.95E+05		
Suburban								
	Truck	1.05E+08	5.00E-02		1.74E+06	6.98E+06		
	Rail	7.90E+06	5.00E-02			3.95E+05		
Rural								
	Truck	1.05E+08	9.00E-01			9.43E+07		
	Rail	7.90E+06	9.00E-01			7.11E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			5.24E+06	3.95E+05	6.98E+06	3.95E+05	9.43E+07	7.11E+06
urban truck fat/km		7.50E-09	3.93E-02					
urban truck inj/km		3.70E-07	1.94E+00					
urban rail fat/km		1.70E-08		6.71E-03				
urban rail inj/km		3.30E-08		1.30E-02				
sub truck fat.km		1.30E-08			9.07E-02			
sub truck inj/km		3.80E-07			2.65E+00			
sub rail fat/km		1.70E-08				6.71E-03		
sub rail inj/km		3.30E-08				1.30E-02		
rural truck fat/km		5.30E-08					5.00E+00	
rural truck inj/km		8.00E-07					7.55E+01	
rural rail fat/km		1.70E-08						1.21E-01
rural rail inj/km		3.30E-08						2.35E-01
	TOTAL FATALITIES		5.26E+00					
	TOTAL INJURIES		8.03E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.30E+09	8.98E-09	2.06E+01				
	injuries	2.30E+09	7.14E-07	1.64E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.26E+00	2.06E+01	2.59E+01			
	INJURIES		8.03E+01	1.64E+03	1.72E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.04E+04	=	2.96E+03			
	LWC =	2.45E-02	3.04E+04	=	7.45E+02			
	Fatality =	3.20E-05	3.04E+04	=	9.73E-01			
OPERATION ACCIDENTS								
		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								
	INJUR	5.89E+03						
	FATAL	2.86E+01						

			EX SITU NO SEPARATIONS ALTERNATIVE					
				VITRIFICATION - REMEDIATION CALCS				
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.18E+05	1.00E+01		1.18E+06	Total	1.18E+06
Offsite Truck			trips	km/trip		total		
	Try Cities		4.38E+04	1.40E+02		6.13E+06		
	Portland/Seattle		4.34E+04	8.00E+02		3.47E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	5.50E+00	4.00E+06	Total	4.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	Portand/Seattle		4.17E+02	8.00E+02	1.50E+01	5.00E+06		
	miscellaneous		6.85E+03	1.40E+02	1.50E+01	1.44E+07	Total	1.94E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	Portland/Seattle		1.03E+02	8.00E+02	1.50E+01	1.24E+06	Total	1.24E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		1.47E+04	4.28E+03		6.29E+07	Total	6.29E+07
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00	Total	0.00E+00
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.23E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		8.60E+07						
Offsite Rail (km)		6.43E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total	6.67E+04					Total	1.80E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	8.60E+07	5.00E-02			4.30E+06		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Suburban								
	Truck	8.60E+07	5.00E-02		1.23E+06	5.53E+06		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Rural								
	Truck	8.60E+07	9.00E-01			7.74E+07		
	Rail	6.43E+07	9.00E-01			5.79E+07		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			4.30E+06	3.22E+06	5.53E+06	3.22E+06	7.74E+07	5.79E+07
urban truck fat/km		7.50E-09	3.22E-02					
urban truck inj/km		3.70E-07	1.59E+00					
urban rail fat/km		1.70E-08		5.47E-02				
urban rail inj/km		3.30E-08		1.06E-01				
sub truck fat.km		1.30E-08			7.19E-02			
sub truck inj/km		3.80E-07			2.10E+00			
sub rail fat/km		1.70E-08				5.47E-02		
sub rail inj/km		3.30E-08				1.06E-01		
rural truck fat/km		5.30E-08					4.10E+00	
rural truck inj/km		8.00E-07					6.19E+01	
rural rail fat/km		1.70E-08						9.84E-01
rural rail inj/km		3.30E-08						1.91E+00
	TOTAL FATALITIES		5.30E+00					
	TOTAL INJURIES		6.77E+01					
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	1.28E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.30E+00	1.62E+01	2.15E+01			
	INJURIES		6.77E+01	1.28E+03	1.35E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.54E+04	=	2.48E+03			
	LWC =	2.45E-02	2.54E+04	=	6.22E+02			
	Fatality =	3.20E-05	2.54E+04	=	8.13E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS								
	INJUR	4.74E+03						
	FATAL	2.36E+01						

		EX SITU EXTENSIVE SEPARATIONS ALTERNATIVE - REMEDIATION CALCS						
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06	Total	2.12E+06
Offsite Truck			trips	km/trip		total		
	Tri-Cities		1.07E+05	1.40E+02		1.50E+07		
	Portland/Seattle		2.62E+04	8.00E+02		2.10E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	9.00E+00	6.55E+06	Total	4.25E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.17E+03	8.00E+02	1.90E+01	3.30E+07		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07	Total	4.68E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		6.77E+02	8.00E+02	1.90E+01	1.03E+07	Total	1.03E+07
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.00E+01	4.28E+03		1.71E+05	Total	1.71E+05
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00	Total	0.00E+00
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		2.17E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.11E+08						
Offsite Rail (km)		1.06E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	2.58E+04	2.60E+02	1.40E+02	7.41E-01	6.96E+08		
	Ops/D&D	6.95E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total	8.08E+04					Total	2.18E+09

Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	1.11E+08	5.00E-02			5.55E+06			
	Rail	1.06E+07	5.00E-02			5.31E+05			
Suburban									
	Truck	1.11E+08	5.00E-02		2.17E+06	7.72E+06			
	Rail	1.06E+07	5.00E-02			5.31E+05			
Rural									
	Truck	1.11E+08	9.00E-01			1.00E+08			
	Rail	1.06E+07	9.00E-01			9.56E+06			
Fatalities/Injuries resulting from Truck and Rail transportation accidents									
			urban km		suburban km		rural km		
			truck	rail	truck	rail	truck	rail	
			5.55E+06	5.31E+05	7.72E+06	5.31E+05	1.00E+08	9.56E+06	
urban truck fat/km		7.50E-09	4.16E-02						
urban truck inj/km		3.70E-07	2.05E+00						
urban rail fat/km		1.70E-08		9.03E-03					
urban rail inj/km		3.30E-08		1.75E-02					
sub truck fat.km		1.30E-08			1.00E-01				
sub truck inj/km		3.80E-07			2.93E+00				
sub rail fat/km		1.70E-08				9.03E-03			
sub rail inj/km		3.30E-08				1.75E-02			
rural truck fat/km		5.30E-08					5.30E+00		
rural truck inj/km		8.00E-07					8.00E+01		
rural rail fat/km		1.70E-08						1.63E-01	
rural rail inj/km		3.30E-08						3.15E-01	
	TOTAL FATALITIES		5.62E+00						
	TOTAL INJURIES		8.53E+01						
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		5.62E+00	1.96E+01	2.52E+01				
	INJURIES		8.53E+01	1.56E+03	1.64E+03				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	3.64E+04	=	3.55E+03				
	LWC =	2.45E-02	3.64E+04	=	8.92E+02				
	Fatality =	3.20E-05	3.64E+04	=	1.16E+00				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	4.44E+04	=	9.76E+02				
	LWC =	1.10E-02	4.44E+04	=	4.88E+02				
	Fatality =	3.20E-05	4.44E+04	=	1.42E+00				
TOTALS									
	INJUR	6.17E+03							
	FATAL	2.78E+01							

	IN SITU VITRIFICATION ALTERNATIVE - REMEDIATION CALCS							
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip		total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06		
							Total	2.12E+06
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07		
							Total	1.38E+07
Offsite Rail			cars	trip/cars	km/trip	total		
	steel		2.60E+03	5.00E-02	8.00E+02	1.04E+05		
	cement		1.70E+03	5.00E-02	8.00E+02	6.80E+04		
							Total	1.72E+05
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.20E+01	8.74E+06		
							Total	8.74E+06
Offsite Rail			trips/yr	km/trip	yr	total		
	chem.		4.00E+00	8.00E+02	1.20E+01	3.84E+04		
							Total	3.84E+04
Grout Fill IMUSTs (outside tank farm areas)								
Onsite Truck			trips	km/trip		total		
	sand/gravel		7.70E+02	1.00E+01		7.70E+03	Total	7.70E+03
Offsite Truck			trips	km/trip		total		
	cement		1.60E+02	1.40E+02		2.24E+04	Total	2.24E+04
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
							Total	0.00E+00
Onsite Truck (km)		2.14E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		2.27E+07						
Offsite Rail (km)		2.10E+05						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	W-314	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops	1.83E+04	2.60E+02	1.40E+02	7.41E-01	4.94E+08		
Vitrification								
	Const.	2.20E+04	2.60E+02	1.40E+02	7.41E-01	5.93E+08		
	Ops/D&D	8.05E+03	2.60E+02	1.40E+02	7.41E-01	2.17E+08		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
							Total	1.31E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.27E+07	5.00E-02			1.13E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Suburban								
	Truck	2.27E+07	5.00E-02		2.14E+06	3.27E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Rural								
	Truck	2.27E+07	9.00E-01			2.04E+07		
	Rail	2.10E+05	9.00E-01			1.89E+05		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.13E+06	1.05E+04	3.27E+06	1.05E+04	2.04E+07	1.89E+05
urban truck fat/km		7.50E-09	8.50E-03					
urban truck inj/km		3.70E-07	4.19E-01					
urban rail fat/km		1.70E-08		1.79E-04				
urban rail inj/km		3.30E-08		3.47E-04				
sub truck fat.km		1.30E-08			4.26E-02			
sub truck inj/km		3.80E-07			1.24E+00			
sub rail fat/km		1.70E-08				1.79E-04		
sub rail inj/km		3.30E-08				3.47E-04		
rural truck fat/km		5.30E-08					1.08E+00	
rural truck inj/km		8.00E-07					1.63E+01	
rural rail fat/km		1.70E-08						3.22E-03
rural rail inj/km		3.30E-08						6.25E-03
	TOTAL FATALITIES		1.14E+00					
	TOTAL INJURIES		1.80E+01					
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		1.14E+00	1.18E+01	1.29E+01			
	INJURIES		1.80E+01	9.34E+02	9.52E+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			
OPERATION ACCIDENTS								
		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								
	INJUR	3.69E+03						
	FATAL	1.44E+01						

			NO ACTION ALTERNATIVE - REMEDIATION CALCS					
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
			trips	km/trip				
	Tri-Cities		0.00E+00	0.00E+00		0.00E+00		
	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
	Onsite Truck (km)		0.00E+00					
	Onsite Rail (km)		0.00E+00					
	Offsite Truck (km)		0.00E+00					
	Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	0.00E+00				0.00E+00		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
							Total	2.81E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	0.00E+00	5.00E-02			0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	0.00E+00	5.00E-02		0.00E+00	0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	0.00E+00	9.00E-01			0.00E+00		
	Rail	0.00E+00	9.00E-01			0.00E+00		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
urban truck fat/km		7.50E-09	0.00E+00					
urban truck inj/km		3.70E-07	0.00E+00					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			0.00E+00			
sub truck inj/km		3.80E-07			0.00E+00			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					0.00E+00	
rural truck inj/km		8.00E-07					0.00E+00	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		0.00E+00					
	TOTAL INJURIES		0.00E+00					

Fatalities/Injuries resulting from Employee vehicle accidents				
		km	rate/km	TOTAL
	fatalities	2.81E+09	8.98E-09	2.52E+01
	injuries	2.81E+09	7.14E-07	2.00E+03

Cumulative fatalities/injuries from traffic impacts					
			transport	employee	TOTAL
	FATALITIES		0.00E+00	2.52E+01	2.52E+01
	INJURIES		0.00E+00	2.00E+03	2.00E+03
CONSTRUCTION ACCIDENTS					
		rate	person-yr		
	TRC =	9.75E-02	0.00E+00	=	0.00E+00
	LWC =	2.45E-02	0.00E+00	=	0.00E+00
	Fatality =	3.20E-05	0.00E+00	=	0.00E+00
OPERATION ACCIDENTS					
		rate	person-yr		
	TRC =	2.20E-02	1.04E+05	=	2.29E+03
	LWC =	1.10E-02	1.04E+05	=	1.14E+03
	Fatality =	3.20E-05	1.04E+05	=	3.33E+00
TOTALS					
	INJUR	4.29E+03			
	FATAL	2.85E+01			

		ONSITE DRY STORAGE ALTERNATIVE - REMEDIATION CALCS						
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.00E+02	1.00E+01		1.00E+03		
							Total	1.00E+03
Offsite Truck			trips	km/trip		total		
	encasement pipe		1.40E+01	8.00E+02		1.12E+04		
	WESF modification		2.00E+02	1.40E+02		2.80E+04		
							Total	3.92E+04
Capsule Transport								
Onsite Truck			trips	km/trip		total		
	to dry storage		1.84E+02	3.20E+01		5.89E+03		
							Total	5.89E+03
		Onsite Truck (km)		6.89E+03				
		Onsite Rail (km)		0.00E+00				
		Offsite Truck (km)		3.92E+04				
		Offsite Rail (km)		0.00E+00				
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	2.10E+02	2.60E+02	1.40E+02	7.41E-01	5.66E+06		
	Packaging	1.94E+02	2.60E+02	1.40E+02	7.41E-01	5.23E+06		
	Storage	8.90E+02	2.60E+02	1.40E+02	7.41E-01	2.40E+07		
							Total	3.49E+07
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	3.92E+04	5.00E-02			1.96E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	3.92E+04	5.00E-02		6.89E+03	8.85E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	3.92E+04	9.00E-01			3.53E+04		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	

			truck	rail	truck	rail	truck	rail	
			1.96E+03	0.00E+00	8.85E+03	0.00E+00	3.53E+04	0.00E+00	
urban truck fat/km		7.50E-09	1.47E-05						
urban truck inj/km		3.70E-07	7.25E-04						
urban rail fat/km		1.70E-08		0.00E+00					
urban rail inj/km		3.30E-08		0.00E+00					
sub truck fat.km		1.30E-08			1.15E-04				
sub truck inj/km		3.80E-07			3.36E-03				
sub rail fat/km		1.70E-08				0.00E+00			
sub rail inj/km		3.30E-08				0.00E+00			
rural truck fat/km		5.30E-08					1.87E-03		
rural truck inj/km		8.00E-07					2.82E-02		
rural rail fat/km		1.70E-08						0.00E+00	
rural rail inj/km		3.30E-08						0.00E+00	
	TOTAL FATALITIES		2.00E-03						
	TOTAL INJURIES		3.23E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	3.49E+07	8.98E-09	3.13E-01					
	injuries	3.49E+07	7.14E-07	2.49E+01					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		2.00E-03	3.13E-01	3.15E-01				
	INJURIES		3.23E-02	2.49E+01	2.50E+01				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	2.10E+02	=	2.05E+01				
	LWC =	2.45E-02	2.10E+02	=	5.15E+00				
	Fatality =	3.20E-05	2.10E+02	=	6.72E-03				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.08E+03	=	2.38E+01				
	LWC =	1.10E-02	1.08E+03	=	1.19E+01				
	Fatality =	3.20E-05	1.08E+03	=	3.47E-02				
TOTALS									
	INJUR	6.93E+01							
	FATAL	3.57E-01							

		OVERPACK AND SHIP ALTERNATIVE - REMEDIATION CALCS							
ROUTINE									
Construction									
Onsite Truck			trips	km/trip		total			
	borrow		0.00E+00	0.00E+00		0.00E+00			
							Total	0.00E+00	
Offsite Truck			trips	km/trip		total			
	encasement pipe		0.00E+00	0.00E+00		0.00E+00			
	WESF modification		2.00E+02	1.40E+02		2.80E+04			
							Total	2.80E+04	
Capsule Transport									
Offsite Rail			trips	km/trip		total			
	Yucca		5.00E+00	2.93E+03		1.47E+04			
							Total	1.47E+04	
		Onsite Truck (km)		0.00E+00					
		Onsite Rail (km)		0.00E+00					
		Offsite Truck (km)		2.80E+04					
		Offsite Rail (km)		1.47E+04					
EMPLOYEE VEHICLE									
Routine		person-yr	trip/yr	km/trip	car pool	total			
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06			
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06			
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06			
							Total	6.50E+06	
Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	2.80E+04	5.00E-02			1.40E+03			
	Rail	1.47E+04	5.00E-02			7.33E+02			
Suburban									
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03			
	Rail	1.47E+04	5.00E-02			7.33E+02			
Rural									
	Truck	2.80E+04	9.00E-01			2.52E+04			
	Rail	1.47E+04	9.00E-01			1.32E+04			
Fatalities/Injuries resulting from Truck and Rail transportation accidents									
			urban km		suburban km		rural km		
			truck	rail	truck	rail	truck	rail	

			1.40E+03	7.33E+02	1.40E+03	7.33E+02	2.52E+04	1.32E+04	
urban truck fat/km		7.50E-09	1.05E-05						
urban truck inj/km		3.70E-07	5.18E-04						
urban rail fat/km		1.70E-08		1.25E-05					
urban rail inj/km		3.30E-08		2.42E-05					
sub truck fat.km		1.30E-08			1.82E-05				
sub truck inj/km		3.80E-07			5.32E-04				
sub rail fat/km		1.70E-08				1.25E-05			
sub rail inj/km		3.30E-08				2.42E-05			
rural truck fat/km		5.30E-08					1.34E-03		
rural truck inj/km		8.00E-07					2.02E-02		
rural rail fat/km		1.70E-08						2.24E-04	
rural rail inj/km		3.30E-08						4.35E-04	
	TOTAL FATALITIES		1.61E-03						
	TOTAL INJURIES		2.17E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	6.50E+06	8.98E-09	5.84E-02					
	injuries	6.50E+06	7.14E-07	4.64E+00					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		1.61E-03	5.84E-02	6.00E-02				
	INJURIES		2.17E-02	4.64E+00	4.66E+00				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	1.00E+02	=	9.75				
	LWC =	2.45E-02	1.00E+02	=	2.45				
	Fatality =	3.20E-05	1.00E+02	=	0.0032				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.41E+02	=	3.102				
	LWC =	1.10E-02	1.41E+02	=	1.551				
	Fatality =	3.20E-05	1.41E+02	=	0.004512				
TOTALS									
	INJUR	1.75E+01							
	FATAL	6.77E-02							

		VITRIFY WITH TANK WASTE ALTERNATIVE - REMEDIATION CALCS						
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips	km/trip		total		
	encasement pipe		0.00E+00	0.00E+00		0.00E+00		
	WESF modification		2.00E+02	1.40E+02		2.80E+04		
							Total	2.80E+04
Capsule Transport								
Onsite Truck			trips	km/trip		total		
	to vitrification plant		1.84E+02	3.20E+01		5.89E+03		
							Total	5.89E+03
		Onsite Truck (km)		5.89E+03				
		Onsite Rail (km)		0.00E+00				
		Offsite Truck (km)		2.80E+04				
		Offsite Rail (km)		0.00E+00				
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06		
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06		
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06		
							Total	6.50E+06
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.80E+04	5.00E-02			1.40E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	2.80E+04	9.00E-01			2.52E+04		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail

			1.40E+03	0.00E+00	1.40E+03	0.00E+00	2.52E+04	0.00E+00	
urban truck fat/km		7.50E-09	1.05E-05						
urban truck inj/km		3.70E-07	5.18E-04						
urban rail fat/km		1.70E-08		0.00E+00					
urban rail inj/km		3.30E-08		0.00E+00					
sub truck fat.km		1.30E-08			1.82E-05				
sub truck inj/km		3.80E-07			5.32E-04				
sub rail fat/km		1.70E-08				0.00E+00			
sub rail inj/km		3.30E-08				0.00E+00			
rural truck fat/km		5.30E-08					1.34E-03		
rural truck inj/km		8.00E-07					2.02E-02		
rural rail fat/km		1.70E-08						0.00E+00	
rural rail inj/km		3.30E-08						0.00E+00	
	TOTAL FATALITIES		1.36E-03						
	TOTAL INJURIES		2.12E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	6.50E+06	8.98E-09	5.84E-02					
	injuries	6.50E+06	7.14E-07	4.64E+00					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		1.36E-03	5.84E-02	5.97E-02				
	INJURIES		2.12E-02	4.64E+00	4.66E+00				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	1.00E+02	=	9.75E+00				
	LWC =	2.45E-02	1.00E+02	=	2.45E+00				
	Fatality =	3.20E-05	1.00E+02	=	3.20E-03				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.41E+02	=	3.10E+00				
	LWC =	1.10E-02	1.41E+02	=	1.55E+00				
	Fatality =	3.20E-05	1.41E+02	=	4.51E-03				
TOTALS									
	INJUR	1.75E+01							
	FATAL	6.74E-02							

			IN SITU FILL AND CAP - REMEDIATION CALCS					
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip	yr	total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
Grout Fill IMUSTs								
Construction								
Onsite Truck			trips	km/trip		total		
	sand/gravel		2.20E+03	1.00E+01		2.20E+04		
							Total	2.20E+04
Offsite Truck			trips	km/trip		total		
	cement		4.63E+02	1.40E+02		6.48E+04		
	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
			trips/yr	km/trip	yr			
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	6.48E+04
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
							Total	0.00E+00
Onsite Truck (km)		3.58E+04						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.29E+05						
Offsite Rail (km)		0.00E+00						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	W-314	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops/D&D	2.39E+04	2.60E+02	1.40E+02	7.41E-01	6.45E+08		
Fill Tanks with Gravel								
	Const.	9.50E+01	2.60E+02	1.40E+02	7.41E-01	2.56E+06		
	Ops/D&D	1.51E+03	2.60E+02	1.40E+02	7.41E-01	4.07E+07		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total	2.57E+04					Total	6.92E+08
Distance traveled in population zones								

Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.29E+05	5.00E-02			6.43E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	1.29E+05	5.00E-02		3.58E+04	4.22E+04		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	1.29E+05	9.00E-01			1.16E+05		
	Rail	0.00E+00	9.00E-01			0.00E+00		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			6.43E+03	0.00E+00	4.22E+04	0.00E+00	1.16E+05	0.00E+00
urban truck fat/km		7.50E-09	4.82E-05					
urban truck inj/km		3.70E-07	2.38E-03					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			5.49E-04			
sub truck inj/km		3.80E-07			1.60E-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					6.14E-03	
rural truck inj/km		8.00E-07					9.26E-02	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		6.73E-03					
	TOTAL INJURIES		1.11E-01					
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		6.73E-03	6.22E+00	6.22E+00			
	INJURIES		1.11E-01	4.94E+02	4.94E+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			
OPERATION ACCIDENTS								
		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								
	INJUR	1.08E+03						
	FATAL	7.05E+00						

			EX SITU COMBINATION - REMEDIATION CALCS					
RETRIEVAL								
Waste Transport						total		
Onsite Truck						0.00E+00		
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		2.40E+02	1.40E+02	2.00E+01	6.72E+05		
	raw material		2.25E+01	8.00E+02	2.00E+01	3.60E+05		
	equipment		1.25E+01	1.00E+04	2.00E+01	2.50E+06		
	miscellaneous		2.60E+03	1.40E+02	2.00E+01	7.28E+06		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	1.09E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		5.00E+00	8.00E+02	2.00E+01	8.00E+04	Total	8.00E+04
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		8.40E+04	1.00E+01		8.40E+05	Total	8.40E+05
Offsite Truck			trips	km/trip		total		
	concrete		2.30E+04	1.40E+02		3.22E+06		
	steel		9.10E+03	8.00E+02		7.28E+06		
			trips/yr	km/trip	yr			
	miscellaneous		3.15E+03	1.40E+02	1.00E+01	4.41E+06	Total	1.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		1.30E+03	8.00E+02	1.90E+01	1.98E+07		
	miscellaneous		2.60E+03	1.40E+02	1.90E+01	6.92E+06	Total	2.67E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		1.37E+02	8.00E+02	1.90E+01	2.08E+06	Total	2.08E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.18E+02	4.28E+03		1.79E+06	Total	1.79E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00	Total	0.00E+00
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		8.76E+05						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		5.25E+07						
Offsite Rail (km)		3.95E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	6.36E+03	2.60E+02	1.40E+02	7.41E-01	1.72E+08		
	Ops/D&D	2.24E+04	2.60E+02	1.40E+02	7.41E-01	6.04E+08		
Vitrification								
	Const.	1.19E+04	2.60E+02	1.40E+02	7.41E-01	3.21E+08		
	Ops/D&D	1.04E+04	2.60E+02	1.40E+02	7.41E-01	2.81E+08		
Fill tank								
	Const.	5.70E+01	2.60E+02	1.40E+02	7.41E-01	1.54E+06		
	Ops/D&D	1.80E+03	2.60E+02	1.40E+02	7.41E-01	4.86E+07		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
							Total	1.43E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	5.25E+07	5.00E-02			2.63E+06		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Suburban								
	Truck	5.25E+07	5.00E-02		8.76E+05	3.50E+06		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Rural								
	Truck	5.25E+07	9.00E-01			4.73E+07		
	Rail	3.95E+06	9.00E-01			3.56E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			2.63E+06	1.98E+05	3.50E+06	1.98E+05	4.73E+07	3.56E+06
urban truck fat/km		7.50E-09	1.97E-02					
urban truck inj/km		3.70E-07	9.72E-01					
urban rail fat/km		1.70E-08		3.36E-03				
urban rail inj/km		3.30E-08		6.52E-03				
sub truck fat.km		1.30E-08			4.55E-02			
sub truck inj/km		3.80E-07			1.33E+00			
sub rail fat/km		1.70E-08				3.36E-03		
sub rail inj/km		3.30E-08				6.52E-03		
rural truck fat/km		5.30E-08					2.51E+00	
rural truck inj/km		8.00E-07					3.78E+01	
rural rail fat/km		1.70E-08						6.05E-02
rural rail inj/km		3.30E-08						1.17E-01
	TOTAL FATALITIES		2.64E+00					
	TOTAL INJURIES		4.03E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.43E+09	8.98E-09	1.28E+01				
	injuries	1.43E+09	7.14E-07	1.02E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		2.64E+00	1.28E+01	1.55E+01			
	INJURIES		4.03E+01	1.02E+03	1.06E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.83E+04	=	1.79E+03			
	LWC =	2.45E-02	1.83E+04	=	4.49E+02			
	Fatality =	3.20E-05	1.83E+04	=	5.86E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	3.46E+04	=	7.61E+02			
	LWC =	1.10E-02	3.46E+04	=	3.81E+02			
	Fatality =	3.20E-05	3.46E+04	=	1.11E+00			
TOTALS								
	INJUR	3.61E+03						
	FATAL	1.71E+01						

			LONG-TERM MANAGEMENT ALTERNATIVE - REMEDIATION CALCS						
RETRIEVAL									
Waste Transport									
Onsite Truck						0.00E+00			
							Total	0.00E+00	
Construction									
Offsite Truck			trips/yr	km/trip	yr	total			
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00			
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00			
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00			
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00			
							Total	0.00E+00	
Offsite Rail			trips/yr	km/trip	yr	total			
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00			
							Total	0.00E+00	
ROUTINE									
Construction									
Onsite Truck			trips	km/trip		total			
	borrow		3.24E+04	1.00E+01		3.24E+05			
							Total	3.24E+05	
Offsite Truck			trips/yr	km/trip	yr	total			
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07			
			trips	km/trip					
	Tri-Cities		2.01E+04	1.40E+02		2.81E+06			
	Portland/Seattle		7.75E+03	8.00E+02		6.20E+06			
							Total	2.28E+07	
	Onsite Truck (km)		3.24E+05						
	Onsite Rail (km)		0.00E+00						
	Offsite Truck (km)		2.28E+07						
	Offsite Rail (km)		0.00E+00						
EMPLOYEE VEHICLE									
Routine		person-yr	trip/yr	km/trip	car pool	total			
	Const.	3.75E+03	2.60E+02	1.40E+02	7.41E-01	1.01E+08			
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09			
							Total	2.91E+09	
Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	2.28E+07	5.00E-02			1.14E+06			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Suburban									
	Truck	2.28E+07	5.00E-02		3.24E+05	1.47E+06			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Rural									
	Truck	2.28E+07	9.00E-01			2.06E+07			
	Rail	0.00E+00	9.00E-01			0.00E+00			

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.14E+06	0.00E+00	1.47E+06	0.00E+00	2.06E+07	0.00E+00
urban truck fat/km		7.50E-09	8.57E-03					
urban truck inj/km		3.70E-07	4.23E-01					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			1.91E-02			
sub truck inj/km		3.80E-07			5.57E-01			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					1.09E+00	
rural truck inj/km		8.00E-07					1.64E+01	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		1.12E+00					
	TOTAL INJURIES		1.74E+01					

Fatalities/Injuries resulting from Employee vehicle accidents				
		km	rate/km	TOTAL
	fatalities	2.91E+09	8.98E-09	2.61E+01
	injuries	2.91E+09	7.14E-07	2.08E+03

Cumulative fatalities/injuries from traffic impacts					
			transport	employee	TOTAL
	FATALITIES		1.12E+00	2.61E+01	2.72E+01
	INJURIES		1.74E+01	2.08E+03	2.09E+03
CONSTRUCTION ACCIDENTS					
		rate	person-yr		
	TRC =	9.75E-02	3.75E+03	=	3.66E+02
	LWC =	2.45E-02	3.75E+03	=	9.19E+01
	Fatality =	3.20E-05	3.75E+03	=	1.20E-01
OPERATION ACCIDENTS					
		rate	person-yr		
	TRC =	2.20E-02	1.04E+05	=	2.29E+03
	LWC =	1.10E-02	1.04E+05	=	1.14E+03
	Fatality =	3.20E-05	1.04E+05	=	3.33E+00
TOTALS					
	INJUR	4.75E+03			
	FATAL	3.07E+01			

	TOTAL ALTERNATIVE PHASED IMPLEMENTATION 1 AND 2 - REMEDIATION CALCS							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	borrow (W-314)		1.38E+03	1.00E+01		1.38E+04	Total	2.16E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05		
	steel (W-314)		5.30E+01	8.00E+02		4.24E+04		
	cement (W-314)		1.00E+02	1.40E+02		1.40E+04	Total	2.16E+05
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.44E+05	1.00E+01		1.44E+06	Total	1.44E+06
Offsite Truck			trips	km/trip		total		
	concrete		2.61E+04	1.40E+02		3.65E+06		
	steel		9.70E+03	8.00E+02		7.76E+06		
	miscellaneous		3.11E+04	1.40E+02		4.35E+06	Total	1.58E+07
Processing								
Offsite Truck			trips	km/trip		total		
	glassformer/chem		1.65E+04	8.00E+02		1.32E+07		
	miscellaneous		1.03E+05	1.40E+02		1.44E+07		
	process material		3.00E+04	1.40E+02		4.20E+06	Total	3.18E+07
Offsite Rail			trips	km/trip		total		
	glassformer/chem		3.00E+03	8.00E+02		2.40E+06	Total	2.40E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06	Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	grout fill sand IMUST		0.00E+00	1.00E+01		0.00E+00	Total	0.00E+00
Offsite Truck			trips	km/trip		total		
	groutfill cement IMUS		4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.45E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.93E+07						
Offsite Rail (km)		6.19E+06						
EMPLOYEE VEHICLE								
Phase 1		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.16E+04	2.60E+02	1.40E+02	7.41E-01	3.13E+08		
	Ops/D&D	6.77E+03	2.60E+02	1.40E+02	7.41E-01	1.83E+08		
Phase 2								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	4.91E+04	2.60E+02	1.40E+02	7.41E-01	1.32E+09		
							Total	2.35E+09

Distance traveled in population zones

		Offsite km	zone fraction		Onsite	TOTALS
Urban						
	Truck	6.93E+07	5.00E-02			3.46E+06
	Rail	6.19E+06	5.00E-02			3.10E+05
Suburban						
	Truck	6.93E+07	5.00E-02		1.45E+06	4.92E+06
	Rail	6.19E+06	5.00E-02			3.10E+05
Rural						
	Truck	6.93E+07	9.00E-01			6.24E+07
	Rail	6.19E+06	9.00E-01			5.57E+06

Fatalities/Injuries resulting from Truck and Rail transportation accidents

			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			3.46E+06	3.10E+05	4.92E+06	3.10E+05	6.24E+07	5.57E+06
urban truck fat/km		7.50E-09	2.60E-02					
urban truck inj/km		3.70E-07	1.28E+00					
urban rail fat/km		1.70E-08		5.26E-03				
urban rail inj/km		3.30E-08		1.02E-02				
sub truck fat.km		1.30E-08			6.39E-02			
sub truck inj/km		3.80E-07			1.87E+00			
sub rail fat/km		1.70E-08				5.26E-03		
sub rail inj/km		3.30E-08				1.02E-02		
rural truck fat/km		5.30E-08					3.31E+00	
rural truck inj/km		8.00E-07					4.99E+01	
rural rail fat/km		1.70E-08						9.47E-02
rural rail inj/km		3.30E-08						1.84E-01
	TOTAL FATALITIES		3.50E+00					
	TOTAL INJURIES		5.32E+01					

Fatalities/Injuries resulting from Employee vehicle accidents

		km	rate/km	TOTAL
	fatalities	2.35E+09	8.98E-09	2.11E+01
	injuries	2.35E+09	7.14E-07	1.68E+03

Cumulative fatalities/injuries from traffic impacts

		transport	employee	TOTAL
	FATALITIES	3.50E+00	2.11E+01	2.46E+01
	INJURIES	5.32E+01	1.68E+03	1.73E+03

CONSTRUCTION ACCIDENTS		rate	person-yr		
	TRC =	9.75E-02	3.14E+04	=	3.06E+03
	LWC =	2.45E-02	3.14E+04	=	7.69E+02
	Fatality =	3.20E-05	3.14E+04	=	1.00E+00

OPERATION ACCIDENTS		rate	person-yr		
	TRC =	2.20E-02	5.59E+04	=	1.23E+03
	LWC =	1.10E-02	5.59E+04	=	6.15E+02
	Fatality =	3.20E-05	5.59E+04	=	1.79E+00

TOTALS		
	INJUR	6.02E+03
	FATAL	2.74E+01

	PHASE 1 IMPLEMENTATION SUB-ALTERNATIVE - REMEDIATION CALCS							
RETRIEVAL								
WASTE TRANSFER SYSTEM UPGRADE (W-314)								
Onsite Truck			trips	km/trip		total		
	borrow		1.38E+03	1.00E+00		1.38E+03	Total	1.38E+03
Offsite Truck								
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04	Total	5.64E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.96E+03	1.00E+01		1.96E+04	Total	1.96E+04
Offsite Truck			trips	km/trip		total		
	concrete		1.20E+03	1.40E+02		1.68E+05		
	steel		7.32E+03	8.00E+02		5.86E+06		
	miscellaneous		3.18E+03	1.40E+02		4.45E+05	Total	6.47E+06
Processing								
Offsite Truck			trips	km/trip		total		
	glassformer/chem		3.50E+03	8.00E+02		2.80E+06		
	glassformer/chem		3.57E+03	1.40E+02		5.00E+05		
	miscellaneous		5.20E+04	1.40E+02		7.28E+06	Total	1.06E+07
Offsite Rail			trips	km/trip		total		
	glassformer/chem		2.18E+02	8.00E+02		1.74E+05	Total	1.74E+05
VITRIFIED HLW TRANSPORT								
SITE RESTORATION								
Onsite Truck			trips	km/trip		total		
	contaminated waste		1.50E+03	1.61E+01		2.42E+04		
	noncont. waste		6.23E+04	1.61E+01		1.00E+06	Total	1.03E+06
GROUT FILL IMUST								
Onsite Truck (km)		1.05E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.71E+07						
Offsite Rail (km)		1.74E+05						
EMPLOYEE VEHICLE								
		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.07E+04	2.60E+02	1.40E+02	7.41E-01	2.89E+08		
	Ops/D&D	6.93E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08	Total	4.76E+08

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.71E+07	5.00E-02			8.55E+05		
	Rail	1.74E+05	5.00E-02			8.72E+03		
Suburban								
	Truck	1.71E+07	5.00E-02		1.05E+06	1.90E+06		
	Rail	1.74E+05	5.00E-02			8.72E+03		
Rural								
	Truck	1.71E+07	9.00E-01			1.54E+07		
	Rail	1.74E+05	9.00E-01			1.57E+05		
Fatalities/injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			8.55E+05	8.72E+03	1.90E+06	8.72E+03	1.54E+07	1.57E+05
urban truck fat/km		7.50E-09	6.41E-03					
urban truck inj/km		3.70E-07	3.16E-01					
urban rail fat/km		1.70E-08		1.48E-04				
urban rail inj/km		3.30E-08		2.88E-04				
sub truck fat.km		1.30E-08			2.47E-02			
sub truck inj/km		3.80E-07			7.23E-01			
sub rail fat/km		1.70E-08				1.48E-04		
sub rail inj/km		3.30E-08				2.88E-04		
rural truck fat/km		5.30E-08					8.16E-01	
rural truck inj/km		8.00E-07					1.23E+01	
rural rail fat/km		1.70E-08						2.67E-03
rural rail inj/km		3.30E-08						5.18E-03
	TOTAL FATALITIES		8.50E-01					
	TOTAL INJURIES		1.34E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	4.76E+08	8.98E-09	4.27E+00				
	injuries	4.76E+08	7.14E-07	3.40E+02				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		8.50E-01	4.27E+00	5.12E+00			
	INJURIES		1.34E+01	3.40E+02	3.53E+02			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.07E+04	=	1.04E+03			
	LWC =	2.45E-02	1.07E+04	=	2.62E+02			
	Fatality =	3.20E-05	1.07E+04	=	3.42E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	6.93E+03	=	1.52E+02			
	LWC =	1.10E-02	6.93E+03	=	7.62E+01			
	Fatality =	3.20E-05	6.93E+03	=	2.22E-01			
TOTALS								
	INJUR	1.55E+03						
	FATAL	5.68E+00						

			EX SITU NO SEPARATIONS ALTERNATIVE					
			CALCINATION - REMEDIATION CALCS					
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
CALCINATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		3.30E+04	1.00E+01		3.30E+05	Total	3.30E+05
Offsite Truck			trips	km/trip		total		
	Try Cities		3.40E+04	1.40E+02		4.76E+06		
	Portland/Seattle		1.07E+04	8.00E+02		8.56E+06		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	5.50E+00	4.00E+06	Total	1.73E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	Portand/Seattle		8.87E+02	8.00E+02	1.50E+01	1.06E+07		
	miscellaneous		5.20E+03	1.40E+02	1.50E+01	1.09E+07	Total	2.16E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	Portland/Seattle		1.03E+02	8.00E+02	1.50E+01	1.24E+06	Total	1.24E+06
CALCINED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.15E+03	4.28E+03		1.78E+07	Total	1.78E+07
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	1.00E-01	1.00E+01	0.00E+00		
	silt		0.00E+00	1.00E-01	3.00E+01	0.00E+00		
	riprap		0.00E+00	1.00E-01	3.20E+01	0.00E+00		
	ag/sand		0.00E+00	1.00E-01	1.00E+01	0.00E+00	Total	0.00E+00
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		3.78E+05						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.06E+07						
Offsite Rail (km)		1.92E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		0.00E+00	2.60E+02	1.40E+02	7.41E-01	0.00E+00		
	total	6.67E+04					Total	1.80E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	6.06E+07	5.00E-02			3.03E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Suburban								
	Truck	6.06E+07	5.00E-02		3.78E+05	3.41E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Rural								
	Truck	6.06E+07	9.00E-01			5.46E+07		
	Rail	1.92E+07	9.00E-01			1.72E+07		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			3.03E+06	9.58E+05	3.41E+06	9.58E+05	5.46E+07	1.72E+07
urban truck fat/km		7.50E-09	2.27E-02					
urban truck inj/km		3.70E-07	1.12E+00					
urban rail fat/km		1.70E-08		1.63E-02				
urban rail inj/km		3.30E-08		3.16E-02				
sub truck fat.km		1.30E-08			4.43E-02			
sub truck inj/km		3.80E-07			1.30E+00			
sub rail fat/km		1.70E-08				1.63E-02		
sub rail inj/km		3.30E-08				3.16E-02		
rural truck fat/km		5.30E-08					2.89E+00	
rural truck inj/km		8.00E-07					4.37E+01	
rural rail fat/km		1.70E-08						2.93E-01
rural rail inj/km		3.30E-08						5.69E-01
	TOTAL FATALITIES		3.29E+00					
	TOTAL INJURIES		4.67E+01					

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	1.28E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		3.29E+00	1.62E+01	1.94E+01			
	INJURIES		4.67E+01	1.28E+03	1.33E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.54E+04	=	2.48E+03			
	LWC =	2.45E-02	2.54E+04	=	6.22E+02			
	Fatality =	3.20E-05	2.54E+04	=	8.13E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS								
	INJUR	4.72E+03						
	FATAL	2.16E+01						

TWRS EIS
CALCULATION COVER SHEET

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

ORIGINATOR Michael Harker DATE 02/12/96

REVISION NO. 0

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

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

JACOBS\FORMS\NONTOX.RAD\CALCVR.SHT

	EX SITU INTERMEDIATE SEPARATIONS ALTERNATIVE							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04		
							Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement W-314		1.00E+02	1.40E+02		1.40E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.69E+05	1.00E+01		1.69E+06		
							Total	1.69E+06
Offsite Truck			trips	km/trip		total		
	concrete		5.45E+04	1.40E+02		7.63E+06		
	steel		1.51E+04	8.00E+02		1.21E+07		
			trips/yr	km/trip	yr			
	miscellaneous		7.54E+03	1.40E+02	1.00E+01	1.06E+07		
							Total	3.03E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.30E+03	8.00E+02	1.90E+01	3.50E+07		
	miscellaneous		6.70E+03	1.40E+02	1.90E+01	1.78E+07		
							Total	5.28E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		2.74E+02	8.00E+02	1.90E+01	4.16E+06		
							Total	4.16E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06		
							Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		
	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06		
							Total	8.45E+06
GROUT FILL IMUST								
Onsite Truck	sand/gravel		2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck	cement		4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.02E+07						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		1.05E+08						
Offsite Rail (km)		7.90E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	1.73E+04	2.60E+02	1.40E+02	7.41E-01	4.67E+08		
Closure		4.90E+02	2.60E+02	1.40E+02	7.41E-01	1.32E+07		
							Total	2.31E+09

Distance traveled in population zones

		Offsite km	zone fraction		Onsite	TOTALS
Urban						
	Truck	1.05E+08	5.00E-02			5.24E+06
	Rail	7.90E+06	5.00E-02			3.95E+05
Suburban						
	Truck	1.05E+08	5.00E-02		1.02E+07	1.54E+07
	Rail	7.90E+06	5.00E-02			3.95E+05
Rural						
	Truck	1.05E+08	9.00E-01			9.43E+07
	Rail	7.90E+06	9.00E-01			7.11E+06

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		5.24E+06	3.95E+05	1.54E+07	3.95E+05	9.43E+07	7.11E+06
urban truck fat/km	7.50E-09	3.93E-02					
urban truck inj/km	3.70E-07	1.94E+00					
urban rail fat/km	1.70E-08		6.71E-03				
urban rail inj/km	3.30E-08		1.30E-02				
sub truck fat.km	1.30E-08			2.01E-01			
sub truck inj/km	3.80E-07			5.86E+00			
sub rail fat/km	1.70E-08				6.71E-03		
sub rail inj/km	3.30E-08				1.30E-02		
rural truck fat/km	5.30E-08					5.00E+00	
rural truck inj/km	8.00E-07					7.55E+01	
rural rail fat/km	1.70E-08						1.21E-01
rural rail inj/km	3.30E-08						2.35E-01

TOTAL FATALITIES	5.37E+00
TOTAL INJURIES	8.35E+01

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	2.31E+09	8.98E-09	2.07E+01
injuries	2.31E+09	7.14E-07	1.65E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	5.37E+00	2.07E+01	2.61E+01
INJURIES	8.35E+01	1.65E+03	1.73E+03

CONSTRUCTION ACCIDENTS

	rate	person-yr		
TRC =	9.75E-02	3.09E+04	=	3011.775
LWC =	2.45E-02	3.09E+04	=	756.805
Fatality =	3.20E-05	3.09E+04	=	0.98848

OPERATION ACCIDENTS

	rate	person-yr		
TRC =	2.20E-02	5.47E+04	=	1203.4
LWC =	1.10E-02	5.47E+04	=	601.7
Fatality =	3.20E-05	5.47E+04	=	1.7504

TOTALS

INJUR	5.95E+03
FATAL	2.88E+01

			EX SITU NO SEPARATIONS ALTERNATIVE					
				VITRIFICATION				
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.18E+05	1.00E+01		1.18E+06	Total	1.18E+06
Offsite Truck			trips	km/trip		total		
	Try Cities		4.38E+04	1.40E+02		6.13E+06		
	Portland/Seattle		4.34E+04	8.00E+02		3.47E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	5.50E+00	4.00E+06	Total	4.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	Portand/Seattle		4.17E+02	8.00E+02	1.50E+01	5.00E+06		
	miscellaneous		6.85E+03	1.40E+02	1.50E+01	1.44E+07	Total	1.94E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	Portland/Seattle		1.03E+02	8.00E+02	1.50E+01	1.24E+06	Total	1.24E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		1.47E+04	4.28E+03		6.29E+07	Total	6.29E+07
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.35E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05	Total	5.68E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		6.91E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		8.60E+07						
Offsite Rail (km)		6.43E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		4.62E+02	2.60E+02	1.40E+02	7.41E-01	1.25E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.82E+09
	total	6.73E+04						

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	8.60E+07	5.00E-02			4.30E+06		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Suburban								
	Truck	8.60E+07	5.00E-02		6.91E+06	1.12E+07		
	Rail	6.43E+07	5.00E-02			3.22E+06		
Rural								
	Truck	8.60E+07	9.00E-01			7.74E+07		
	Rail	6.43E+07	9.00E-01			5.79E+07		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			4.30E+06	3.22E+06	1.12E+07	3.22E+06	7.74E+07	5.79E+07
urban truck fat/km		7.50E-09	3.22E-02					
urban truck inj/km		3.70E-07	1.59E+00					
urban rail fat/km		1.70E-08		5.47E-02				
urban rail inj/km		3.30E-08		1.06E-01				
sub truck fat.km		1.30E-08			1.46E-01			
sub truck inj/km		3.80E-07			4.26E+00			
sub rail fat/km		1.70E-08				5.47E-02		
sub rail inj/km		3.30E-08				1.06E-01		
rural truck fat/km		5.30E-08					4.10E+00	
rural truck inj/km		8.00E-07					6.19E+01	
rural rail fat/km		1.70E-08						9.84E-01
rural rail inj/km		3.30E-08						1.91E+00
	TOTAL FATALITIES		5.37E+00					
	TOTAL INJURIES		6.99E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.82E+09	8.98E-09	1.63E+01				
	injuries	1.82E+09	7.14E-07	1.30E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.37E+00	1.63E+01	2.17E+01			
	INJURIES		6.99E+01	1.30E+03	1.37E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.60E+04	=	2.54E+03			
	LWC =	2.45E-02	2.60E+04	=	6.38E+02			
	Fatality =	3.20E-05	2.60E+04	=	8.33E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS								
	INJUR	4.81E+03						
	FATAL	2.38E+01						

		EX SITU EXTENSIVE SEPARATIONS ALTERNATIVE						
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06	Total	2.12E+06
Offsite Truck			trips	km/trip		total		
	Tri-Cities		1.07E+05	1.40E+02		1.50E+07		
	Portland/Seattle		2.62E+04	8.00E+02		2.10E+07		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	9.00E+00	6.55E+06	Total	4.25E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		2.17E+03	8.00E+02	1.90E+01	3.30E+07		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07	Total	4.68E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		6.77E+02	8.00E+02	1.90E+01	1.03E+07	Total	1.03E+07
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.00E+01	4.28E+03		1.71E+05	Total	1.71E+05
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		
	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06	Total	8.45E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		1.06E+07						
Onsite Rail (km)		0						
Offsite Truck (km)		1.11E+08						
Offsite Rail (km)		1.06E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops/D&D	3.74E+04	2.60E+02	1.40E+02	7.41E-01	1.01E+09		
Vitrification								
	Const.	2.58E+04	2.60E+02	1.40E+02	7.41E-01	6.96E+08		
	Ops/D&D	6.95E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08		
Closure		4.90E+02	2.60E+02	1.40E+02	7.41E-01	1.32E+07		
	total	8.12E+04					Total	2.19E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.11E+08	5.00E-02			5.55E+06		
	Rail	1.06E+07	5.00E-02			5.31E+05		
Suburban								
	Truck	1.11E+08	5.00E-02		1.06E+07	1.62E+07		
	Rail	1.06E+07	5.00E-02			5.31E+05		
Rural								
	Truck	1.11E+08	9.00E-01			1.00E+08		
	Rail	1.06E+07	9.00E-01			9.56E+06		
Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			5.55E+06	5.31E+05	1.62E+07	5.31E+05	1.00E+08	9.56E+06
urban truck fat/km		7.50E-09	4.16E-02					
urban truck inj/km		3.70E-07	2.05E+00					
urban rail fat/km		1.70E-08		9.03E-03				
urban rail inj/km		3.30E-08		1.75E-02				
sub truck fat.km		1.30E-08			2.10E-01			
sub truck inj/km		3.80E-07			6.14E+00			
sub rail fat/km		1.70E-08				9.03E-03		
sub rail inj/km		3.30E-08				1.75E-02		
rural truck fat/km		5.30E-08					5.30E+00	
rural truck inj/km		8.00E-07					8.00E+01	
rural rail fat/km		1.70E-08						1.63E-01
rural rail inj/km		3.30E-08						3.15E-01
	TOTAL FATALITIES		5.73E+00					
	TOTAL INJURIES		8.85E+01					
Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.19E+09	8.98E-09	1.97E+01				
	injuries	2.19E+09	7.14E-07	1.56E+03				
Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		5.73E+00	1.97E+01	2.54E+01			
	INJURIES		8.85E+01	1.56E+03	1.65E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	3.69E+04	=	3596.775			
	LWC =	2.45E-02	3.69E+04	=	903.805			
	Fatality =	3.20E-05	3.69E+04	=	1.18048			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.44E+04	=	975.7			
	LWC =	1.10E-02	4.44E+04	=	487.85			
	Fatality =	3.20E-05	4.44E+04	=	1.4192			
TOTALS								
	INJUR	6.23E+03						
	FATAL	2.80E+01						

	IN SITU VITRIFICATION ALTERNATIVE							
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip		total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		2.12E+05	1.00E+01		2.12E+06		
							Total	2.12E+06
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07		
							Total	1.38E+07
Offsite Rail			cars	trip/cars	km/trip	total		
	steel		2.60E+03	5.00E-02	8.00E+02	1.04E+05		
	cement		1.70E+03	5.00E-02	8.00E+02	6.80E+04		
							Total	1.72E+05
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.20E+01	8.74E+06		
							Total	8.74E+06
Offsite Rail			trips/yr	km/trip	yr	total		
	chem.		4.00E+00	8.00E+02	1.20E+01	3.84E+04		
							Total	3.84E+04
Grout Fill IMUSTs (outside tank farm areas)								
Onsite Truck			trips	km/trip		total		
	sand/gravel		7.70E+02	1.00E+01		7.70E+03	Total	7.70E+03
Offsite Truck			trips	km/trip		total		
	cement		1.60E+02	1.40E+02		2.24E+04	Total	2.24E+04
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.34E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05		
							Total	4.69E+06
Onsite Truck (km)		6.83E+06						
Onsite Rail (km)		0						
Offsite Truck (km)		2.27E+07						
Offsite Rail (km)		2.10E+05						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	W-314	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops	1.83E+04	2.60E+02	1.40E+02	7.41E-01	4.94E+08		
Vitrification								
	Const.	2.20E+04	2.60E+02	1.40E+02	7.41E-01	5.93E+08		
	Ops/D&D	8.05E+03	2.60E+02	1.40E+02	7.41E-01	2.17E+08		
Closure		3.19E+02	2.60E+02	1.40E+02	7.41E-01	8.60E+06		
							Total	1.32E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.27E+07	5.00E-02			1.13E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Suburban								
	Truck	2.27E+07	5.00E-02		6.83E+06	7.97E+06		
	Rail	2.10E+05	5.00E-02			1.05E+04		
Rural								
	Truck	2.27E+07	9.00E-01			2.04E+07		
	Rail	2.10E+05	9.00E-01			1.89E+05		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.13E+06	1.05E+04	7.97E+06	1.05E+04	2.04E+07	1.89E+05
urban truck fat/km		7.50E-09	8.50E-03					
urban truck inj/km		3.70E-07	4.19E-01					
urban rail fat/km		1.70E-08		1.79E-04				
urban rail inj/km		3.30E-08		3.47E-04				
sub truck fat.km		1.30E-08			1.04E-01			
sub truck inj/km		3.80E-07			3.03E+00			
sub rail fat/km		1.70E-08				1.79E-04		
sub rail inj/km		3.30E-08				3.47E-04		
rural truck fat/km		5.30E-08					1.08E+00	
rural truck inj/km		8.00E-07					1.63E+01	
rural rail fat/km		1.70E-08						3.22E-03
rural rail inj/km		3.30E-08						6.25E-03
	TOTAL FATALITIES		1.20E+00					
	TOTAL INJURIES		1.98E+01					

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.32E+09	8.98E-09	1.18E+01				
	injuries	1.32E+09	7.14E-07	9.40E+02				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		1.20E+00	1.18E+01	1.30E+01			
	INJURIES		1.98E+01	9.40E+02	9.60E+02			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.25E+04	=	2191.995			
	LWC =	2.45E-02	2.25E+04	=	550.809			
	Fatality =	3.20E-05	2.25E+04	=	0.719424			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	2.64E+04	=	579.7			
	LWC =	1.10E-02	2.64E+04	=	289.85			
	Fatality =	3.20E-05	2.64E+04	=	0.8432			
TOTALS								
	INJUR	3.73E+03						
	FATAL	1.46E+01						

			NO ACTION ALTERNATIVE					
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
			trips	km/trip				
	Tri-Cities		0.00E+00	0.00E+00		0.00E+00		
	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
	Onsite Truck (km)		0.00E+00					
	Onsite Rail (km)		0.00E+00					
	Offsite Truck (km)		0.00E+00					
	Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	0.00E+00				0.00E+00		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
							Total	2.81E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	0.00E+00	5.00E-02			0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	0.00E+00	5.00E-02		0.00E+00	0.00E+00		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	0.00E+00	9.00E-01			0.00E+00		
	Rail	0.00E+00	9.00E-01			0.00E+00		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
urban truck fat/km		7.50E-09	0.00E+00					
urban truck inj/km		3.70E-07	0.00E+00					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			0.00E+00			
sub truck inj/km		3.80E-07			0.00E+00			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					0.00E+00	
rural truck inj/km		8.00E-07					0.00E+00	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		0.00E+00					
	TOTAL INJURIES		0.00E+00					

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	2.81E+09	8.98E-09	2.52E+01				
	injuries	2.81E+09	7.14E-07	2.00E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		0.00E+00	2.52E+01	2.52E+01			
	INJURIES		0.00E+00	2.00E+03	2.00E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	0.00E+00	=	0			
	LWC =	2.45E-02	0.00E+00	=	0			
	Fatality =	3.20E-05	0.00E+00	=	0			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	1.04E+05	=	2288			
	LWC =	1.10E-02	1.04E+05	=	1144			
	Fatality =	3.20E-05	1.04E+05	=	3.328			
TOTALS								
	INJUR	4.29E+03						
	FATAL	2.85E+01						

		ONSITE DRY STORAGE ALTERNATIVE							
ROUTINE									
Construction									
Onsite Truck			trips	km/trip		total			
	borrow		1.00E+02	1.00E+01		1.00E+03			
							Total	1.00E+03	
Offsite Truck			trips	km/trip		total			
	encasement pipe		1.40E+01	8.00E+02		1.12E+04			
	WESF modification		2.00E+02	1.40E+02		2.80E+04			
							Total	3.92E+04	
Capsule Transport									
Onsite Truck			trips	km/trip		total			
	to dry storage		1.84E+02	3.20E+01		5.89E+03			
							Total	5.89E+03	
		Onsite Truck (km)		6.89E+03					
		Onsite Rail (km)		0.00E+00					
		Offsite Truck (km)		3.92E+04					
		Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE									
Routine		person-yr	trip/yr	km/trip	car pool	total			
	Const.	2.10E+02	2.60E+02	1.40E+02	7.41E-01	5.66E+06			
	Packaging	1.94E+02	2.60E+02	1.40E+02	7.41E-01	5.23E+06			
	Storage	8.90E+02	2.60E+02	1.40E+02	7.41E-01	2.40E+07			
							Total	3.49E+07	
Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	3.92E+04	5.00E-02			1.96E+03			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Suburban									
	Truck	3.92E+04	5.00E-02		6.89E+03	8.85E+03			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Rural									
	Truck	3.92E+04	9.00E-01			3.53E+04			
	Rail	0.00E+00	9.00E-01			0.00E+00			
Fatalities/Injuries resulting from Truck and Rail transportation accidents									
			urban km		suburban km		rural km		

			truck	rail	truck	rail	truck	rail	
			1.96E+03	0.00E+00	8.85E+03	0.00E+00	3.53E+04	0.00E+00	
urban truck fat/km		7.50E-09	1.47E-05						
urban truck inj/km		3.70E-07	7.25E-04						
urban rail fat/km		1.70E-08		0.00E+00					
urban rail inj/km		3.30E-08		0.00E+00					
sub truck fat.km		1.30E-08			1.15E-04				
sub truck inj/km		3.80E-07			3.36E-03				
sub rail fat/km		1.70E-08				0.00E+00			
sub rail inj/km		3.30E-08				0.00E+00			
rural truck fat/km		5.30E-08					1.87E-03		
rural truck inj/km		8.00E-07					2.82E-02		
rural rail fat/km		1.70E-08						0.00E+00	
rural rail inj/km		3.30E-08						0.00E+00	
	TOTAL FATALITIES		2.00E-03						
	TOTAL INJURIES		3.23E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	3.49E+07	8.98E-09	3.13E-01					
	injuries	3.49E+07	7.14E-07	2.49E+01					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		2.00E-03	3.13E-01	3.15E-01				
	INJURIES		3.23E-02	2.49E+01	2.50E+01				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	2.10E+02	=	20.475				
	LWC =	2.45E-02	2.10E+02	=	5.145				
	Fatality =	3.20E-05	2.10E+02	=	0.00672				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.08E+03	=	23.848				
	LWC =	1.10E-02	1.08E+03	=	11.924				
	Fatality =	3.20E-05	1.08E+03	=	0.034688				
TOTALS									
	INJUR	6.93E+01							
	FATAL	3.57E-01							

		OVERPACK AND SHIP ALTERNATIVE							
ROUTINE									
Construction									
Onsite Truck			trips	km/trip		total			
	borrow		0.00E+00	0.00E+00		0.00E+00			
							Total	0.00E+00	
Offsite Truck			trips	km/trip		total			
	encasement pipe		0.00E+00	0.00E+00		0.00E+00			
	WESF modification		2.00E+02	1.40E+02		2.80E+04			
							Total	2.80E+04	
Capsule Transport									
Offsite Rail			trips	km/trip		total			
	Yucca		5.00E+00	2.93E+03		1.47E+04			
							Total	1.47E+04	
		Onsite Truck (km)		0.00E+00					
		Onsite Rail (km)		0.00E+00					
		Offsite Truck (km)		2.80E+04					
		Offsite Rail (km)		1.47E+04					
EMPLOYEE VEHICLE									
Routine		person-yr	trip/yr	km/trip	car pool	total			
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06			
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06			
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06			
							Total	6.50E+06	
Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	2.80E+04	5.00E-02			1.40E+03			
	Rail	1.47E+04	5.00E-02			7.33E+02			
Suburban									
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03			
	Rail	1.47E+04	5.00E-02			7.33E+02			
Rural									
	Truck	2.80E+04	9.00E-01			2.52E+04			
	Rail	1.47E+04	9.00E-01			1.32E+04			
Fatalities/Injuries resulting from Truck and Rail transportation accidents									
			urban km		suburban km		rural km		
			truck	rail	truck	rail	truck	rail	

			1.40E+03	7.33E+02	1.40E+03	7.33E+02	2.52E+04	1.32E+04	
urban truck fat/km		7.50E-09	1.05E-05						
urban truck inj/km		3.70E-07	5.18E-04						
urban rail fat/km		1.70E-08		1.25E-05					
urban rail inj/km		3.30E-08		2.42E-05					
sub truck fat.km		1.30E-08			1.82E-05				
sub truck inj/km		3.80E-07			5.32E-04				
sub rail fat/km		1.70E-08				1.25E-05			
sub rail inj/km		3.30E-08				2.42E-05			
rural truck fat/km		5.30E-08					1.34E-03		
rural truck inj/km		8.00E-07					2.02E-02		
rural rail fat/km		1.70E-08						2.24E-04	
rural rail inj/km		3.30E-08						4.35E-04	
	TOTAL FATALITIES		1.61E-03						
	TOTAL INJURIES		2.17E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	6.50E+06	8.98E-09	5.84E-02					
	injuries	6.50E+06	7.14E-07	4.64E+00					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		1.61E-03	5.84E-02	6.00E-02				
	INJURIES		2.17E-02	4.64E+00	4.66E+00				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	1.00E+02	=	9.75				
	LWC =	2.45E-02	1.00E+02	=	2.45				
	Fatality =	3.20E-05	1.00E+02	=	0.0032				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.41E+02	=	3.102				
	LWC =	1.10E-02	1.41E+02	=	1.551				
	Fatality =	3.20E-05	1.41E+02	=	0.004512				
TOTALS									
	INJUR	1.75E+01							
	FATAL	6.77E-02							

		VITRIFY WITH TANK WASTE ALTERNATIVE							
ROUTINE									
Construction									
Onsite Truck			trips	km/trip		total			
	borrow		0.00E+00	0.00E+00		0.00E+00			
							Total	0.00E+00	
Offsite Truck			trips	km/trip		total			
	encasement pipe		0.00E+00	0.00E+00		0.00E+00			
	WESF modification		2.00E+02	1.40E+02		2.80E+04			
							Total	2.80E+04	
Capsule Transport									
Onsite Truck			trips	km/trip		total			
	to vitrification plant		1.84E+02	3.20E+01		5.89E+03			
							Total	5.89E+03	
		Onsite Truck (km)		5.89E+03					
		Onsite Rail (km)		0.00E+00					
		Offsite Truck (km)		2.80E+04					
		Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE									
Routine		person-yr	trip/yr	km/trip	car pool	total			
	Const.	1.00E+02	2.60E+02	1.40E+02	7.41E-01	2.70E+06			
	Packaging	5.10E+01	2.60E+02	1.40E+02	7.41E-01	1.38E+06			
	Storage	9.00E+01	2.60E+02	1.40E+02	7.41E-01	2.43E+06			
							Total	6.50E+06	
Distance traveled in population zones									
Urban		Offsite km	zone fraction		Onsite	TOTALS			
	Truck	2.80E+04	5.00E-02			1.40E+03			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Suburban									
	Truck	2.80E+04	5.00E-02		0.00E+00	1.40E+03			
	Rail	0.00E+00	5.00E-02			0.00E+00			
Rural									
	Truck	2.80E+04	9.00E-01			2.52E+04			
	Rail	0.00E+00	9.00E-01			0.00E+00			
Fatalities/Injuries resulting from Truck and Rail transportation accidents									
			urban km		suburban km		rural km		
			truck	rail	truck	rail	truck	rail	

			1.40E+03	0.00E+00	1.40E+03	0.00E+00	2.52E+04	0.00E+00	
urban truck fat/km		7.50E-09	1.05E-05						
urban truck inj/km		3.70E-07	5.18E-04						
urban rail fat/km		1.70E-08		0.00E+00					
urban rail inj/km		3.30E-08		0.00E+00					
sub truck fat.km		1.30E-08			1.82E-05				
sub truck inj/km		3.80E-07			5.32E-04				
sub rail fat/km		1.70E-08				0.00E+00			
sub rail inj/km		3.30E-08				0.00E+00			
rural truck fat/km		5.30E-08					1.34E-03		
rural truck inj/km		8.00E-07					2.02E-02		
rural rail fat/km		1.70E-08						0.00E+00	
rural rail inj/km		3.30E-08						0.00E+00	
	TOTAL FATALITIES		1.36E-03						
	TOTAL INJURIES		2.12E-02						
Fatalities/Injuries resulting from Employee vehicle accidents									
		km	rate/km	TOTAL					
	fatalities	6.50E+06	8.98E-09	5.84E-02					
	injuries	6.50E+06	7.14E-07	4.64E+00					
Cumulative fatalities/injuries from traffic impacts									
			transport	employee	TOTAL				
	FATALITIES		1.36E-03	5.84E-02	5.97E-02				
	INJURIES		2.12E-02	4.64E+00	4.66E+00				
CONSTRUCTION ACCIDENTS									
		rate	person-yr						
	TRC =	9.75E-02	1.00E+02	=	9.75				
	LWC =	2.45E-02	1.00E+02	=	2.45				
	Fatality =	3.20E-05	1.00E+02	=	0.0032				
OPERATION ACCIDENTS									
		rate	person-yr						
	TRC =	2.20E-02	1.41E+02	=	3.102				
	LWC =	1.10E-02	1.41E+02	=	1.551				
	Fatality =	3.20E-05	1.41E+02	=	0.004512				
TOTALS									
	INJUR	1.75E+01							
	FATAL	6.74E-02							

			IN SITU FILL AND CAP					
Construction - (W-314)								
Offsite Truck			trips	km/trip		total		
	steel		5.30E+01	8.00E+02		4.24E+04		
	cement		1.00E+02	1.40E+02		1.40E+04		
	miscellaneous		5.30E+01	1.40E+02		7.42E+03		
							Total	6.38E+04
Onsite Truck			trips	km/trip	yr	total		
	borrow		1.38E+03	1.00E+01		1.38E+04		
							Total	1.38E+04
Grout Fill IMUSTs								
Construction								
Onsite Truck			trips	km/trip		total		
	sand/gravel		2.20E+03	1.00E+01		2.20E+04		
							Total	2.20E+04
Offsite Truck			trips	km/trip		total		
	cement		4.63E+02	1.40E+02		6.48E+04		
	Portland/Seattle		0.00E+00	0.00E+00		0.00E+00		
			trips/yr	km/trip	yr			
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	6.48E+04
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		0.00E+00	0.00E+00		0.00E+00		
							Total	0.00E+00
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.03E+05	1.00E-01	1.00E+01	9.03E+05		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.34E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05		
							Total	5.59E+06
Onsite Truck (km)		5.63E+06						
Onsite Rail (km)		0						
Offsite Truck (km)		1.29E+05						
Offsite Rail (km)		0.00E+00						
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	W-314	1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06		
	Ops/D&D	2.39E+04	2.60E+02	1.40E+02	7.41E-01	6.45E+08		
Fill Tanks with Gravel								
	Const.	9.50E+01	2.60E+02	1.40E+02	7.41E-01	2.56E+06		
	Ops/D&D	1.51E+03	2.60E+02	1.40E+02	7.41E-01	4.07E+07		
Closure		4.67E+02	2.60E+02	1.40E+02	7.41E-01	1.26E+07		
	total	2.61E+04					Total	7.05E+08
Distance traveled in population zones								

Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	1.29E+05	5.00E-02			6.43E+03		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	1.29E+05	5.00E-02		5.63E+06	5.64E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	1.29E+05	9.00E-01			1.16E+05		
	Rail	0.00E+00	9.00E-01			0.00E+00		

Fatalities/Injuries resulting from Truck and Rail transportation accidents

			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			6.43E+03	0.00E+00	5.64E+06	0.00E+00	1.16E+05	0.00E+00
urban truck fat/km		7.50E-09	4.82E-05					
urban truck inj/km		3.70E-07	2.38E-03					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			7.33E-02			
sub truck inj/km		3.80E-07			2.14E+00			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					6.14E-03	
rural truck inj/km		8.00E-07					9.26E-02	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		7.95E-02					
	TOTAL INJURIES		2.24E+00					

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	7.05E+08	8.98E-09	6.33E+00
injuries	7.05E+08	7.14E-07	5.03E+02

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	7.95E-02	6.33E+00	6.41E+00
INJURIES	2.24E+00	5.03E+02	5.06E+02

CONSTRUCTION ACCIDENTS					
		rate	person-yr		
	TRC =	9.75E-02	7.25E+02	=	70.6875
	LWC =	2.45E-02	7.25E+02	=	17.7625
	Fatality =	3.20E-05	7.25E+02	=	0.0232
OPERATION ACCIDENTS					
		rate	person-yr		
	TRC =	2.20E-02	2.54E+04	=	559.02
	LWC =	1.10E-02	2.54E+04	=	279.51
	Fatality =	3.20E-05	2.54E+04	=	0.81312
TOTALS					
	INJUR	1.14E+03			
	FATAL	7.25E+00			

			EX SITU COMBINATION					
RETRIEVAL								
Waste Transport						total		
Onsite Truck						0.00E+00		
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		2.40E+02	1.40E+02	2.00E+01	6.72E+05		
	raw material		2.25E+01	8.00E+02	2.00E+01	3.60E+05		
	equipment		1.25E+01	1.00E+04	2.00E+01	2.50E+06		
	miscellaneous		2.60E+03	1.40E+02	2.00E+01	7.28E+06		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	1.09E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		5.00E+00	8.00E+02	2.00E+01	8.00E+04	Total	8.00E+04
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		8.40E+04	1.00E+01		8.40E+05	Total	8.40E+05
Offsite Truck			trips	km/trip		total		
	concrete		2.30E+04	1.40E+02		3.22E+06		
	steel		9.10E+03	8.00E+02		7.28E+06		
			trips/yr	km/trip	yr			
	miscellaneous		3.15E+03	1.40E+02	1.00E+01	4.41E+06	Total	1.49E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	glassformer/chem		1.30E+03	8.00E+02	1.90E+01	1.98E+07		
	miscellaneous		2.60E+03	1.40E+02	1.90E+01	6.92E+06	Total	2.67E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	glassformer/chem		1.37E+02	8.00E+02	1.90E+01	2.08E+06	Total	2.08E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.18E+02	4.28E+03		1.79E+06	Total	1.79E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.36E+05	1.00E-01	1.00E+01	9.36E+05		
	silt		6.67E+05	1.00E-01	3.00E+01	2.00E+06		
	riprap		1.04E+06	1.00E-01	3.20E+01	3.33E+06		
	ag/sand		7.78E+05	1.00E-01	1.00E+01	7.78E+05	Total	7.04E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truck cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		7.92E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		5.25E+07						
Offsite Rail (km)		3.95E+06						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	6.36E+03	2.60E+02	1.40E+02	7.41E-01	1.72E+08		
	Ops/D&D	2.24E+04	2.60E+02	1.40E+02	7.41E-01	6.04E+08		
Vitrification								
	Const.	1.19E+04	2.60E+02	1.40E+02	7.41E-01	3.21E+08		
	Ops/D&D	1.04E+04	2.60E+02	1.40E+02	7.41E-01	2.81E+08		
Fill tank								
	Const.	5.70E+01	2.60E+02	1.40E+02	7.41E-01	1.54E+06		
	Ops/D&D	9.06E+02	2.60E+02	1.40E+02	7.41E-01	2.44E+07		
Closure		5.74E+02	2.60E+02	1.40E+02	7.41E-01	1.55E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.42E+09

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	5.25E+07	5.00E-02			2.63E+06		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Suburban								
	Truck	5.25E+07	5.00E-02		7.92E+06	1.05E+07		
	Rail	3.95E+06	5.00E-02			1.98E+05		
Rural								
	Truck	5.25E+07	9.00E-01			4.73E+07		
	Rail	3.95E+06	9.00E-01			3.56E+06		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			2.63E+06	1.98E+05	1.05E+07	1.98E+05	4.73E+07	3.56E+06
urban truck fat/km		7.50E-09	1.97E-02					
urban truck inj/km		3.70E-07	9.72E-01					
urban rail fat/km		1.70E-08		3.36E-03				
urban rail inj/km		3.30E-08		6.52E-03				
sub truck fat.km		1.30E-08			1.37E-01			
sub truck inj/km		3.80E-07			4.01E+00			
sub rail fat/km		1.70E-08				3.36E-03		
sub rail inj/km		3.30E-08				6.52E-03		
rural truck fat/km		5.30E-08					2.51E+00	
rural truck inj/km		8.00E-07					3.78E+01	
rural rail fat/km		1.70E-08						6.05E-02
rural rail inj/km		3.30E-08						1.17E-01
	TOTAL FATALITIES		2.73E+00					
	TOTAL INJURIES		4.29E+01					

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.42E+09	8.98E-09	1.28E+01				
	injuries	1.42E+09	7.14E-07	1.02E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		2.73E+00	1.28E+01	1.55E+01			
	INJURIES		4.29E+01	1.02E+03	1.06E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	1.91E+04	=	1.86E+03			
	LWC =	2.45E-02	1.91E+04	=	4.67E+02			
	Fatality =	3.20E-05	1.91E+04	=	6.10E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	3.37E+04	=	7.42E+02			
	LWC =	1.10E-02	3.37E+04	=	3.71E+02			
	Fatality =	3.20E-05	3.37E+04	=	1.08E+00			
TOTALS								
	INJUR	3.66E+03						
	FATAL	1.72E+01						

			LONG-TERM MANAGEMENT ALTERNATIVE					
RETRIEVAL								
Waste Transport								
Onsite Truck						0.00E+00		
							Total	0.00E+00
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	equipment		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	miscellaneous		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		0.00E+00	0.00E+00	0.00E+00	0.00E+00		
							Total	0.00E+00
ROUTINE								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		3.24E+04	1.00E+01		3.24E+05		
							Total	3.24E+05
Offsite Truck			trips/yr	km/trip	yr	total		
	miscellaneous		5.20E+03	1.40E+02	1.90E+01	1.38E+07		
			trips	km/trip				
	Tri-Cities		2.01E+04	1.40E+02		2.81E+06		
	Portland/Seattle		7.75E+03	8.00E+02		6.20E+06		
							Total	2.28E+07
	Onsite Truck (km)		3.24E+05					
	Onsite Rail (km)		0.00E+00					
	Offsite Truck (km)		2.28E+07					
	Offsite Rail (km)		0.00E+00					
EMPLOYEE VEHICLE								
Routine		person-yr	trip/yr	km/trip	car pool	total		
	Const.	3.75E+03	2.60E+02	1.40E+02	7.41E-01	1.01E+08		
	Ops	1.04E+05	2.60E+02	1.40E+02	7.41E-01	2.81E+09		
							Total	2.91E+09
Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	2.28E+07	5.00E-02			1.14E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Suburban								
	Truck	2.28E+07	5.00E-02		3.24E+05	1.47E+06		
	Rail	0.00E+00	5.00E-02			0.00E+00		
Rural								
	Truck	2.28E+07	9.00E-01			2.06E+07		
	Rail	0.00E+00	9.00E-01			0.00E+00		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			1.14E+06	0.00E+00	1.47E+06	0.00E+00	2.06E+07	0.00E+00
urban truck fat/km		7.50E-09	8.57E-03					
urban truck inj/km		3.70E-07	4.23E-01					
urban rail fat/km		1.70E-08		0.00E+00				
urban rail inj/km		3.30E-08		0.00E+00				
sub truck fat.km		1.30E-08			1.91E-02			
sub truck inj/km		3.80E-07			5.57E-01			
sub rail fat/km		1.70E-08				0.00E+00		
sub rail inj/km		3.30E-08				0.00E+00		
rural truck fat/km		5.30E-08					1.09E+00	
rural truck inj/km		8.00E-07					1.64E+01	
rural rail fat/km		1.70E-08						0.00E+00
rural rail inj/km		3.30E-08						0.00E+00
	TOTAL FATALITIES		1.12E+00					
	TOTAL INJURIES		1.74E+01					

Fatalities/Injuries resulting from Employee vehicle accidents				
		km	rate/km	TOTAL
	fatalities	2.91E+09	8.98E-09	2.61E+01
	injuries	2.91E+09	7.14E-07	2.08E+03

Cumulative fatalities/injuries from traffic impacts					
			transport	employee	TOTAL
	FATALITIES		1.12E+00	2.61E+01	2.72E+01
	INJURIES		1.74E+01	2.08E+03	2.09E+03
CONSTRUCTION ACCIDENTS					
		rate	person-yr		
	TRC =	9.75E-02	3.75E+03	=	365.625
	LWC =	2.45E-02	3.75E+03	=	91.875
	Fatality =	3.20E-05	3.75E+03	=	0.12
OPERATION ACCIDENTS					
		rate	person-yr		
	TRC =	2.20E-02	1.04E+05	=	2288
	LWC =	1.10E-02	1.04E+05	=	1144
	Fatality =	3.20E-05	1.04E+05	=	3.328
TOTALS					
	INJUR	4.75E+03			
	FATAL	3.07E+01			

	TOTAL ALTERNATIVE PHASED IMPLEMENTATION 1 AND 2							
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	borrow (W-314)		1.38E+03	1.00E+01		1.38E+04	Total	2.16E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05		
	steel (W-314)		5.30E+01	8.00E+02		4.24E+04		
	cement (W-314)		1.00E+02	1.40E+02		1.40E+04	Total	2.16E+05
VITRIFICATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		1.44E+05	1.00E+01		1.44E+06	Total	1.44E+06
Offsite Truck			trips	km/trip		total		
	concrete		2.61E+04	1.40E+02		3.65E+06		
	steel		9.70E+03	8.00E+02		7.76E+06		
	miscellaneous		3.11E+04	1.40E+02		4.35E+06	Total	1.58E+07
Processing								
Offsite Truck			trips	km/trip		total		
	glassformer/chem		1.65E+04	8.00E+02		1.32E+07		
	miscellaneous		1.03E+05	1.40E+02		1.44E+07		
	process material		3.00E+04	1.40E+02		4.20E+06	Total	3.18E+07
Offsite Rail			trips	km/trip		total		
	glassformer/chem		3.00E+03	8.00E+02		2.40E+06	Total	2.40E+06
VITRIFIED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		8.35E+02	4.28E+03		3.57E+06	Total	3.57E+06
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		8.53E+05	1.00E-01	3.00E+01	2.56E+06		
	riprap		1.22E+06	1.00E-01	3.20E+01	3.90E+06		
	ag/sand		1.00E+06	1.00E-01	1.00E+01	1.00E+06		
	grout fill sand IMUST		2.20E+03	1.00E+01		2.20E+04	Total	8.47E+06
Offsite Truck			trips	km/trip		total		
	groutfill cement IMUS		4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		9.92E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.93E+07						
Offsite Rail (km)		6.19E+06						
EMPLOYEE VEHICLE								
Phase 1		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.16E+04	2.60E+02	1.40E+02	7.41E-01	3.13E+08		
	Ops/D&D	6.77E+03	2.60E+02	1.40E+02	7.41E-01	1.83E+08		
Phase 2								
	Const.	1.98E+04	2.60E+02	1.40E+02	7.41E-01	5.34E+08		
	Ops/D&D	4.91E+04	2.60E+02	1.40E+02	7.41E-01	1.32E+09		
							Total	2.35E+09

Distance traveled in population zones

Urban		Offsite km	zone fraction		Onsite	TOTALS
	Truck	6.93E+07	5.00E-02			3.46E+06
	Rail	6.19E+06	5.00E-02			3.10E+05
Suburban						
	Truck	6.93E+07	5.00E-02		9.92E+06	1.34E+07
	Rail	6.19E+06	5.00E-02			3.10E+05
Rural						
	Truck	6.93E+07	9.00E-01			6.24E+07
	Rail	6.19E+06	9.00E-01			5.57E+06

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		3.46E+06	3.10E+05	1.34E+07	3.10E+05	6.24E+07	5.57E+06
urban truck fat/km	7.50E-09	2.60E-02					
urban truck inj/km	3.70E-07	1.28E+00					
urban rail fat/km	1.70E-08		5.26E-03				
urban rail inj/km	3.30E-08		1.02E-02				
sub truck fat.km	1.30E-08			1.74E-01			
sub truck inj/km	3.80E-07			5.09E+00			
sub rail fat/km	1.70E-08				5.26E-03		
sub rail inj/km	3.30E-08				1.02E-02		
rural truck fat/km	5.30E-08					3.31E+00	
rural truck inj/km	8.00E-07					4.99E+01	
rural rail fat/km	1.70E-08						9.47E-02
rural rail inj/km	3.30E-08						1.84E-01

TOTAL FATALITIES	3.61E+00
TOTAL INJURIES	5.65E+01

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	2.35E+09	8.98E-09	2.11E+01
injuries	2.35E+09	7.14E-07	1.68E+03

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	3.61E+00	2.11E+01	2.47E+01
INJURIES	5.65E+01	1.68E+03	1.74E+03

CONSTRUCTION ACCIDENTS

	rate	person-yr		
TRC =	9.75E-02	3.14E+04	=	3061.5
LWC =	2.45E-02	3.14E+04	=	769.3
Fatality =	3.20E-05	3.14E+04	=	1.0048

OPERATION ACCIDENTS

	rate	person-yr		
TRC =	2.20E-02	5.59E+04	=	1229.14
LWC =	1.10E-02	5.59E+04	=	614.57
Fatality =	3.20E-05	5.59E+04	=	1.78784

TOTALS

INJUR	6.03E+03
FATAL	2.75E+01

	PHASE 1 IMPLEMENTATION SUB-ALTERNATIVE								
RETRIEVAL									
WASTE TRANSFER SYSTEM UPGRADE (W-314)									
	Onsite Truck		trips	km/trip		total			
	borrow		1.38E+03	1.00E+00		1.38E+03	Total	1.38E+03	
	Offsite Truck								
	steel		5.30E+01	8.00E+02		4.24E+04			
	cement		1.00E+02	1.40E+02		1.40E+04	Total	5.64E+04	
VITRIFICATION									
Construction									
	Onsite Truck		trips	km/trip		total			
	borrow		1.96E+03	1.00E+01		1.96E+04	Total	1.96E+04	
	Offsite Truck		trips	km/trip		total			
	concrete		1.20E+03	1.40E+02		1.68E+05			
	steel		7.32E+03	8.00E+02		5.86E+06			
	miscellaneous		3.18E+03	1.40E+02		4.45E+05	Total	6.47E+06	
Processing									
	Offsite Truck		trips	km/trip		total			
	glassformer/chem		3.50E+03	8.00E+02		2.80E+06			
	glassformer/chem		3.57E+03	1.40E+02		5.00E+05			
	miscellaneous		5.20E+04	1.40E+02		7.28E+06	Total	1.06E+07	
	Offsite Rail		trips	km/trip		total			
	glassformer/chem		2.18E+02	8.00E+02		1.74E+05	Total	1.74E+05	
VITRIFIED HLW TRANSPORT									
SITE RESTORATION									
	Onsite Truck		trips	km/trip		total			
	contaminated waste		1.50E+03	1.61E+01		2.42E+04			
	noncont. waste		6.23E+04	1.61E+01		1.00E+06	Total	1.03E+06	
GROUT FILL IMUST									
Onsite Truck (km)		1.05E+06							
Onsite Rail (km)		0.00E+00							
Offsite Truck (km)		1.71E+07							
Offsite Rail (km)		1.74E+05							
EMPLOYEE VEHICLE									
		person-yr	trip/yr	km/trip	car pool	total			
	Const.	1.07E+04	2.60E+02	1.40E+02	7.41E-01	2.89E+08			
	Ops/D&D	6.93E+03	2.60E+02	1.40E+02	7.41E-01	1.87E+08	Total	4.76E+08	

Distance traveled in population zones

		Offsite km	zone fraction		Onsite	TOTALS
Urban						
	Truck	1.71E+07	5.00E-02			8.55E+05
	Rail	1.74E+05	5.00E-02			8.72E+03
Suburban						
	Truck	1.71E+07	5.00E-02		1.05E+06	1.90E+06
	Rail	1.74E+05	5.00E-02			8.72E+03
Rural						
	Truck	1.71E+07	9.00E-01			1.54E+07
	Rail	1.74E+05	9.00E-01			1.57E+05

Fatalities/Injuries resulting from Truck and Rail transportation accidents

		urban km		suburban km		rural km	
		truck	rail	truck	rail	truck	rail
		8.55E+05	8.72E+03	1.90E+06	8.72E+03	1.54E+07	1.57E+05
urban truck fat/km	7.50E-09	6.41E-03					
urban truck inj/km	3.70E-07	3.16E-01					
urban rail fat/km	1.70E-08		1.48E-04				
urban rail inj/km	3.30E-08		2.88E-04				
sub truck fat.km	1.30E-08			2.47E-02			
sub truck inj/km	3.80E-07			7.23E-01			
sub rail fat/km	1.70E-08				1.48E-04		
sub rail inj/km	3.30E-08				2.88E-04		
rural truck fat/km	5.30E-08					8.16E-01	
rural truck inj/km	8.00E-07					1.23E+01	
rural rail fat/km	1.70E-08						2.67E-03
rural rail inj/km	3.30E-08						5.18E-03
TOTAL FATALITIES		8.50E-01					
TOTAL INJURIES		1.34E+01					

Fatalities/Injuries resulting from Employee vehicle accidents

	km	rate/km	TOTAL
fatalities	4.76E+08	8.98E-09	4.27E+00
injuries	4.76E+08	7.14E-07	3.40E+02

Cumulative fatalities/injuries from traffic impacts

	transport	employee	TOTAL
FATALITIES	8.50E-01	4.27E+00	5.12E+00
INJURIES	1.34E+01	3.40E+02	3.53E+02

CONSTRUCTION ACCIDENTS

	rate	person-yr		
TRC =	9.75E-02	1.07E+04	=	1043.25
LWC =	2.45E-02	1.07E+04	=	262.15
Fatality =	3.20E-05	1.07E+04	=	0.3424

OPERATION ACCIDENTS

	rate	person-yr		
TRC =	2.20E-02	6.93E+03	=	152.46
LWC =	1.10E-02	6.93E+03	=	76.23
Fatality =	3.20E-05	6.93E+03	=	0.22176

TOTALS

INJUR	1.55E+03
FATAL	5.68E+00

			EX SITU NO SEPARATIONS ALTERNATIVE					
				CALCINATION				
RETRIEVAL								
Waste Transport						total		
Onsite Truck						1.25E+04	Total	1.25E+04
Construction								
Offsite Truck			trips/yr	km/trip	yr	total		
	concrete		4.80E+02	1.40E+02	2.00E+01	1.34E+06		
	raw material		4.50E+01	8.00E+02	2.00E+01	7.20E+05		
	equipment		2.50E+01	1.00E+04	2.00E+01	5.00E+06		
	miscellaneous		5.20E+03	1.40E+02	2.00E+01	1.46E+07		
	steel W-314		5.30E+01	8.00E+02		4.24E+04		
	cement/misc W-314		1.53E+02	1.40E+02		2.14E+04	Total	2.17E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	raw material		1.00E+01	8.00E+02	2.00E+01	1.60E+05	Total	1.60E+05
Onsite Truck								
	borrow W-314		1.38E+03	1.00E+01		1.38E+04	Total	1.38E+04
CALCINATION								
Construction								
Onsite Truck			trips	km/trip		total		
	borrow		3.30E+04	1.00E+01		3.30E+05	Total	3.30E+05
Offsite Truck			trips	km/trip		total		
	Try Cities		3.40E+04	1.40E+02		4.76E+06		
	Portland/Seattle		1.07E+04	8.00E+02		8.56E+06		
			trips/yr	km/trip	yr			
	miscellaneous		5.20E+03	1.40E+02	5.50E+00	4.00E+06	Total	1.73E+07
Processing								
Offsite Truck			trips/yr	km/trip	yr	total		
	Portand/Seattle		8.87E+02	8.00E+02	1.50E+01	1.06E+07		
	miscellaneous		5.20E+03	1.40E+02	1.50E+01	1.09E+07	Total	2.16E+07
Offsite Rail			trips/yr	km/trip	yr	total		
	Portland/Seattle		1.03E+02	8.00E+02	1.50E+01	1.24E+06	Total	1.24E+06
CALCINED HLW TRANSPORT								
Offsite Rail			trips	km/trip		total		
	Yucca Mountain		4.15E+03	4.28E+03		1.78E+07	Total	1.78E+07
CLOSURE								
Onsite Truck			cu yd	trip/cu yd	km/trip	total		
	fill		9.86E+05	1.00E-01	1.00E+01	9.86E+05		
	silt		4.93E+05	1.00E-01	3.00E+01	1.48E+06		
	riprap		8.35E+05	1.00E-01	3.20E+01	2.67E+06		
	ag/sand		5.43E+05	1.00E-01	1.00E+01	5.43E+05	Total	5.68E+06
GROUT FILL IMUST								
Onsite Truck sand/gravel			2.20E+03	1.00E+01		2.20E+04	Total	2.20E+04
Offsite Truick cement			4.63E+02	1.40E+02		6.48E+04	Total	6.48E+04
Onsite Truck (km)		6.06E+06						
Onsite Rail (km)		0.00E+00						
Offsite Truck (km)		6.06E+07						
Offsite Rail (km)		1.92E+07						
EMPLOYEE VEHICLE								
Retrieval		person-yr	trip/yr	km/trip	car pool	total		
	Const.	1.06E+04	2.60E+02	1.40E+02	7.41E-01	2.86E+08		
	Ops	3.15E+04	2.60E+02	1.40E+02	7.41E-01	8.50E+08		
Vitrification								
	Const.	1.48E+04	2.60E+02	1.40E+02	7.41E-01	3.99E+08		
	Ops	9.78E+03	2.60E+02	1.40E+02	7.41E-01	2.64E+08		
Closure		4.62E+02	2.60E+02	1.40E+02	7.41E-01	1.25E+07		
W-314		1.63E+02	2.60E+02	1.40E+02	7.41E-01	4.40E+06	Total	1.82E+09
	total	6.73E+04						

Distance traveled in population zones								
Urban		Offsite km	zone fraction		Onsite	TOTALS		
	Truck	6.06E+07	5.00E-02			3.03E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Suburban								
	Truck	6.06E+07	5.00E-02		6.06E+06	9.09E+06		
	Rail	1.92E+07	5.00E-02			9.58E+05		
Rural								
	Truck	6.06E+07	9.00E-01			5.46E+07		
	Rail	1.92E+07	9.00E-01			1.72E+07		

Fatalities/Injuries resulting from Truck and Rail transportation accidents								
			urban km		suburban km		rural km	
			truck	rail	truck	rail	truck	rail
			3.03E+06	9.58E+05	9.09E+06	9.58E+05	5.46E+07	1.72E+07
urban truck fat/km		7.50E-09	2.27E-02					
urban truck inj/km		3.70E-07	1.12E+00					
urban rail fat/km		1.70E-08		1.63E-02				
urban rail inj/km		3.30E-08		3.16E-02				
sub truck fat.km		1.30E-08			1.18E-01			
sub truck inj/km		3.80E-07			3.45E+00			
sub rail fat/km		1.70E-08				1.63E-02		
sub rail inj/km		3.30E-08				3.16E-02		
rural truck fat/km		5.30E-08					2.89E+00	
rural truck inj/km		8.00E-07					4.37E+01	
rural rail fat/km		1.70E-08						2.93E-01
rural rail inj/km		3.30E-08						5.69E-01
	TOTAL FATALITIES		3.36E+00					
	TOTAL INJURIES		4.89E+01					

Fatalities/Injuries resulting from Employee vehicle accidents								
		km	rate/km	TOTAL				
	fatalities	1.82E+09	8.98E-09	1.63E+01				
	injuries	1.82E+09	7.14E-07	1.30E+03				

Cumulative fatalities/injuries from traffic impacts								
			transport	employee	TOTAL			
	FATALITIES		3.36E+00	1.63E+01	1.97E+01			
	INJURIES		4.89E+01	1.30E+03	1.35E+03			
CONSTRUCTION ACCIDENTS								
		rate	person-yr					
	TRC =	9.75E-02	2.60E+04	=	2.54E+03			
	LWC =	2.45E-02	2.60E+04	=	6.38E+02			
	Fatality =	3.20E-05	2.60E+04	=	8.33E-01			
OPERATION ACCIDENTS								
		rate	person-yr					
	TRC =	2.20E-02	4.13E+04	=	9.08E+02			
	LWC =	1.10E-02	4.13E+04	=	4.54E+02			
	Fatality =	3.20E-05	4.13E+04	=	1.32E+00			
TOTALS								
	INJUR	4.79E+03						
	FATAL	2.18E+01						

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE RISK ASSESSMENT, SENIOR SCIENTIST/ENGINEER

ORIGINATOR ALEX NAZARALI DATE 4-3-96

REVISION NO. _____

OBJECTIVE CALCULATE TOTAL CANCER INCIDENCE AND CANCER FATALITIES FOR POST-REMEDIATION ALTERNATIVES

METHODOLOGY SEE ATTACHMENT.

ASSUMPTIONS SEE ATTACHMENT.

(Continue on another sheet if necessary)

A. H. Nazarali 4-3-96
SIGNATURE/DATE

C Henderson 4-4-96
CHECKED/DATE

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\CALCVR.SHT

SUMMARY TABLE FOR TOTAL RISK CALCULATION

All the alternative post-remediation total cancer incidence and cancer fatality for 10,000 years from present time

Alternatives	Residential Farmer		Industrial Worker		Recreational user	
	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]
No Action	757	631	276	230	46	39
Long-Term Management	677	565	276	230	50	41
In Situ Fill and Cap	400	333	277	231	29	24
In Situ Vitrification	0	0	0	0	0	0
Ex Situ intermediate Separation	12	10	6	5	0	0
Ex Situ No Separation	12	10	6	5	0	0
Ex Situ Extensive Separation	12	10	6	5	0	0
Ex Situ In Situ Combination	72	60	30	25	1	0
Phased Implementation	12	10	6	5	0	0
Population Density (# of Indv./ km^2)	4.97		2.81		17.75	
Population per Generation (# of Indv)	3900		2200		1950	
Total population in 10,000 yr (# of Indv)	557,143		733,333		650,000	
Area of Land Use (km^2)	785		785		104	

1 Dose to risk conversion factor for cancer incidence used is 6.0E-04 (ICRP 1991).
2 Dose to risk conversion factor for cancer fatality used is 5.0E-04 (ICRP 1991).

Total Post-Remediation Cancer Incidences and Fatality Calculation Methodology and Results Using the Risk Contour Area.

For each alternative (total of 8) and receptor group (total of 4), five risk contours (three isopleth each), corresponded to 300, 500, 2,500, 5,000, and 10,000 years from present time have been calculated and presented in Appendix D, Figures D.5.1.1 through D.5.9.17.

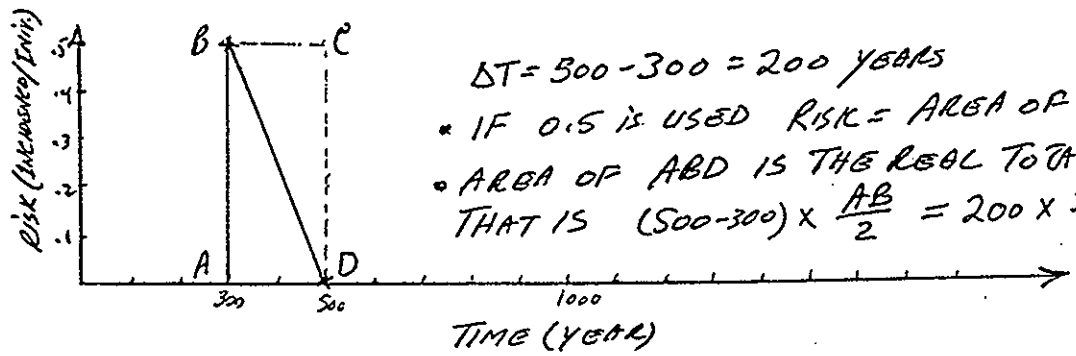
The total risk (cancer incidences) for each isopleth is calculated by multiplying the risk associated with each isopleth by the number of individuals within that isopleth. Then the total risk for the contour, which contains several isopleth, is the sum of the isopleth total risk. The risk in this calculation refers to the incremental lifetime cancer incidence. The cancer incidences are converted to the cancer fatality using the International Commission on Radiation Protection (ICRP) Publication 60 dose to risk conversion factors.

The risk contour presented in Appendix D and Volume One of the TWRS-EIS contains only three isopleths. In this calculation 18 isopleths are used for better estimation of the total risk. These isopleth are produced using the SURFER computer software. The area and corresponding risk print out are tabulated and presented in the attachment.

The data and calculated results for each alternative and receptor are presented in one table. Each table is identified by the alternative's abbreviation (e.g., NA-No Action, ISFC-In Situ Fill and Cap) followed by the receptor type such as residential farmer, industrial worker, and recreational shoreline user. All the tables have the same format and computation method.

The first column of each table presents the risk magnitude, which is the chance of developing cancer. The first risk of 0.5 indicates that 1 out of 2 within the isopleth with this risk has a chance of developing cancer, or an individual has a 50% chance of developing cancer. The next four columns, each containing three subcolumns, have the same format and represent the four time periods of interest, labeled as T1, T2, T3, and T4. The first column within each time period shows the area of each isopleth corresponded to the risk magnitude in square kilometers (km^2). The second column shows the total number of individuals within that area for the duration of that isopleth. The third column present the product of risk magnitude (first column) and the total number of individuals (second column) that is the total cancer incidence per the isopleth.

The area of isopleth with risk of 0.5 at time period T1 is 1.0 km^2 and zero at the time period of T2. This show the risk at the year 200 is 0.5 and at the year 500 is zero. Using the risk of 0.5 for the entire duration of 200 years will over estimate the total risk. For better estimating of the total risk the half value (average) of 0.5 is used for the duration of 200 years. The following graph presents the mathematical logic for this rational.



$\Delta T = 500 - 300 = 200$ YEARS

- IF 0.5 IS USED RISK = AREA OF ABCD
- AREA OF ABD IS THE REAL TOTAL DOSE

THAT IS $(500-300) \times \frac{AB}{2} = 200 \times \frac{0.5}{2} = 200 \times 0.25$

The following demonstrates the calculation for the NA residential farmer for a risk magnitude of 0.5, 0.3, and 0.2 for the time period of T1.

First Column:
Risk of 0.5 has isopleth with area of 1 km^2
Risk of 0.3 has isopleth with area of 3 km^2
Risk of 0.2 has isopleth with area of 50 km^2
.....
.....

Second Column:
The total number of individuals = (Area) x (population density) x (number of generations)

The population density, total population per generation, and number of generations are estimated and assumed based on the current data and anticipated changes. The generation refer to the time duration of a receptor involved in the activity, the industrial worker's generation is assumed 30 years, which means an industrial worker individual would be exposed to the contaminated media for entire duration of his/her occupancy. The same time duration of 30 years is assumed for the recreational shoreline user. This information regarding each receptors is presented in the summary table. For the residential farmer, the population density of 4.97 farming individuals per km^2 is assumed with farming of 70 years per generation. Therefore, for risk of 0.5:

Total number of farming individuals = 1.0 (km^2) x 4.97 (# of Individual per generation per km^2) x (200/70) (years per years per generation) = 14.2 individual0 farmers

Total risk for the 0.5 risk isopleth is
= 14.2 (individuals) x 0.5 (cancer incidence per individual)
= 7.10 cancer incidence for risk of 0.5 over 200 years
= 3..55 cancer incidences for average risk of 2.5 ([0.5 +0.0]/2) over 200 years

For risk of 0.3 the total cancer incidence
= 0.30 (risk/individual) x 3 (km^2) x 4.97 (individuals/km^2-generation) x 200/70 (generations)
= 12.78 cancer Incidences for maximum risk of 0.3
= 6.39 cancer Incidences for average risk of 0.15 ([0.3+0.0]/2)

For risk of 0.2 the total cancer incidence
= 0.2 (risk/individual) x 50 (km^2) x 4.97 (individuals/km^2-generation) x 200/70 (# of generation)
= 142 cancer Incidences for maximum risk of 0.2
= 71.00 cancer Incidences for average risk of 0.1 ([0.2+0.0]/2)

The same is applied to all the calculations.

The cancer incidences are converted to cancer fatalities using the ICRP Publication 60, Table 3. This table presents fatal cancer of 5.0E-04 per rem for exposed population of whole population

and non-fatal cancer of 1.0E-04 per rem. Using the above data, there would be 0.8 fatalities per each incidence (4.0E-04/5.0E-04). Therefore, the cancer incidences of 3.55, 6.39, and 71.00 would be corresponded to 2.84, 5.11, and 56.80 cancer fatalities.

The summary of the calculations is shown in the summary table.

Table D.14.1 All the alternative post-remediation total cancer incidence and cancer fatality for 10,000 years from present time

Alternatives	Residential Farmer		Industrial Worker		Recreational user	
	Cancer Incidence[1]	Cancer Fatality[1]	Cancer Incidence[1]	Cancer Fatality[2]	Cancer Incidence[1]	Cancer Fatality[2]
No Action	757	631	276	230	46	39
Long-Term Management	677	565	276	230	50	41
In Situ Fill and Cap	400	333	277	231	29	24
In Situ Vitrification	0	0	0	0	0	0
Ex Situ intermediate Separation	12	10	6	5	0	0
Ex Situ No Separation	12	10	6	5	0	0
Ex Situ Extensive Separation	12	10	6	5	0	0
Ex Situ In Situ Combination	72	60	30	25	1	0
Phased Implementation	12	10	6	5	0	0
Population Density (# of Indv./ km^2)	4.97		2.81		17.75	
Population per Generation (# of Indv)	3900		2200		1950	
Total population in 10,000 yr (# of Indv)	557,143		733,333		650,000	
Area of Land Use (km^2)	785		785		104	

1 Dose to risk conversion factor for cancer incidence used is 6.0E-04 (ICRP-60)
2 Dose to risk conversion factor for cancer fatality used is 5.0E-04 (ICRP-60)

Table D. All the alternative post-remediation total cancer incidence and cancer fatality for 10,000 years from present time

Alternatives	Residential Farmer		Industrial Worker		Recreational user	
	Cancer Incidence	Cancer Fatality	Cancer Incidence	Cancer Fatality	Cancer Incidence	Cancer Fatality
No Action	757	631	276	230	46	39
Long-Term Management	677	565	276	230	50	41
In Situ Fill and Cap	400	333	277	231	29	24
In Situ Vitrification	0	0	0	0	0	0
Ex Situ intermediate Separation	12	10	6	5	0	0
Ex Situ No Separation	12	10	6	5	0	0
Ex Situ Extensive Separation	12	10	6	5	0	0
Ex Situ In Situ Combination	72	60	30	25	1	0
Phased Implementation	12	10	6	5	0	0
Population Density (# of Indv./ km^2)	4.97		2.81		17.75	
Population per Generation (# of Indv)	3900		2200		1950	
Area of Land Use (km^2)	785		785		104	

Dose to risk conversion factor for cancer incidence is 6.0E-04
Dose to risk conversion factor for cancer fatality is 5.0E-04

NA	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50
0.5	1	14.20	3.55	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.3	3	42.60	6.39	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.2	50	710.00	71.00	10	1420.00	142.00	0	0.00	0.00	0	0.00	0.00
0.1	22	312.40	15.62	4	568.00	28.40	0	0.00	0.00	0	0.00	0.00
0.09	23	326.60	14.70	3	426.00	19.17	0	0.00	0.00	0	0.00	0.00
0.08	17	241.40	9.66	5	710.00	28.40	0	0.00	0.00	0	0.00	0.00
0.07	21	298.20	10.44	3	426.00	14.91	0	0.00	0.00	0	0.00	0.00
0.06	25	355.00	10.65	6	852.00	25.56	0	0.00	0.00	0	0.00	0.00
0.05	21	298.20	7.46	8	1136.00	28.40	0	0.00	0.00	0	0.00	0.00
0.04	52	738.40	14.77	12	1704.00	34.08	0	0.00	0.00	0	0.00	0.00
0.03	46	653.20	9.80	18	2556.00	38.34	0	0.00	0.00	0	0.00	0.00
0.02	35	497.00	4.97	58	8236.00	82.36	0	0.00	0.00	0	0.00	0.00
0.01	35	497.00	2.49	72	10224.00	51.12	0	0.00	0.00	0	0.00	0.00
0.005	63	894.60	2.24	183	25986.00	64.97	0	0.00	0.00	0	0.00	0.00
0.001	70	994.00	0.50	190	26980.00	13.49	1	177.50	0.09	0	0.00	0.00
0.0001	77	1093.40	0.05	82	11644.00	0.58	18	3195.00	0.16	0	0.00	0.00
0.00001	90	1278.00	0.01	37	5254.00	0.03	217	38517.50	0.19	77	27335.00	0.14
0.000001	33	468.60	0.00	30	4260.00	0.00	118	20945.00	0.01	305	108275.00	0.05
0	101	1434.20	0.00	64	9088.00	0.00	431	76502.50	0.00	403	143065.00	0.00
	785		184.27	785		571.81	785		0.45	785		0.19
Total												
756.72												
630.60												

LTM	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.3	1	14.20	2.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.2	4	56.80	5.68	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
0.1	0	0.00	0.00	9	1278.00	63.90	0	0.00	0.00	0	0.00	0.00
0.09	5	71.00	3.20	6	852.00	38.34	0	0.00	0.00	0	0.00	0.00
0.08	16	227.20	9.09	7	994.00	39.76	0	0.00	0.00	0	0.00	0.00
0.07	27	383.40	13.42	8	1136.00	39.76	0	0.00	0.00	0	0.00	0.00
0.06	38	539.60	16.19	12	1704.00	51.12	0	0.00	0.00	0	0.00	0.00
0.05	42	596.40	14.91	10	1420.00	35.50	0	0.00	0.00	0	0.00	0.00
0.04	74	1050.80	21.02	20	2840.00	56.80	0	0.00	0.00	0	0.00	0.00
0.03	44	624.80	9.37	25	3550.00	53.25	0	0.00	0.00	0	0.00	0.00
0.02	80	1136.00	11.36	46	6532.00	65.32	0	0.00	0.00	0	0.00	0.00
0.01	32	454.40	2.27	62	8804.00	44.02	0	0.00	0.00	0	0.00	0.00
0.005	102	1448.40	3.62	175	24850.00	62.13	0	0.00	0.00	0	0.00	0.00
0.001	81	1150.20	0.58	190	26980.00	13.49	1	177.50	0.09	0	0.00	0.00
0.0001	127	1803.40	0.09	83	11786.00	0.59	11	1952.50	0.10	0	0.00	0.00
0.00001	26	369.20	0.00	39	5538.00	0.03	188	33370.00	0.17	77	27335.00	0.14
0.000001	25	355.00	0.00	33	4686.00	0.00	154	27335.00	0.01	305	108275.00	0.05
0	61	866.20		60	8520.00	0.00	431	76502.50	0.00	403	143065.00	0.00
	785		112.92	785		564.00	785		0.37	785		0.19
Total												
677.48												
564.57												

ISFC	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	710.00	7.10					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	95	33725.00	168.63					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	231	82005.00	205.01	14				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	93	33015.00	16.51	311				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	115	40825.00	2.04	169				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	144	51120.00	0.26	143				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	24	8520.00	0.00	45				
0	785	11147.00		785	111470.00	0.00	785	139337.50	0.00	81	28755.00	0.00					
	785		0.00	785		0.00	785		0.00	785		399.55					
Total																	
399.55																	

ISV	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	31	11005.00	0.06	127				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	356	126380.00	0.06	300				
0	785	11147.00		785	111470.00	0.00	785	139337.50	0.00	398	141290.00	0.00	356				
	785		0.00	785		0.00	785		0.00	785		0.12	785				
Total																	
0.12																	

ESIS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	361	128155.00	6.41	242				
0.00001	0	0.00	0.00	0	0.00	0.00	122	21655.00	0.11	119	42245.00	0.21	68				
0.000001	0	0.00	0.00	0	0.00	0.00	233	41357.50	0.02	153	54315.00	0.03	33				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	122	43310.00	0.00	442				
	785		0.00	785		0.00	785		0.13	785		11.97	785				
Total																	
12.10																	

ESNS	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	357	126735.00	6.34					
0.00001	0	0.00	0.00	0	0.00	0.00	122	21655.00	0.11	122	43310.00	0.22					
0.000001	0	0.00	0.00	0	0.00	0.00	233	41357.50	0.02	153	54315.00	0.03					
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	123	43665.00	0.00					
	785		0.00	785		0.00	785		0.13	785		11.91					
Total																	
12.03																	

ESES	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T6			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	357	126735.00	6.34					
0.00001	0	0.00	0.00	0	0.00	0.00	122	21655.00	0.11	122	43310.00	0.22					
0.000001	0	0.00	0.00	0	0.00	0.00	233	41357.50	0.02	153	54315.00	0.03	227				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	123	43665.00	0.00	558				
	785		0.00	785		0.00	785		0.13	785		11.91	785				
Total																	
12.03																	

ESISC	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	12	4260.00	10.65					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	329	116795.00	58.40	11				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	117	41535.00	2.08	361				
0.00001	0	0.00	0.00	0	0.00	0.00	43	7632.50	0.04	191	67805.00	0.34	125				
0.000001	0	0.00	0.00	0	0.00	0.00	277	49167.50	0.02	34	12070.00	0.01	83				
0	785	11147.00		785	111470.00	0.00	465	82537.50	0.00	102	36210.00	0.00	205				
	785		0.00	785		0.00	785		0.06	785		71.47	785				
Total																	
71.53																	

PI	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk	km2	# of Indv.	Risk		T5			
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	30	10650.00	5.33					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	361	128155.00	6.41	242				
0.00001	0	0.00	0.00	0	0.00	0.00	122	21655.00	0.11	119	42245.00	0.21	68				
0.000001	0	0.00	0.00	0	0.00	0.00	233	41357.50	0.02	153	54315.00	0.03	33				
0	785	11147.00		785	111470.00	0.00	430	76325.00	0.00	122	43310.00	0.00	442				
	785		0.00	785		0.00	785		0.13	785		11.97	785				
Total																	
12.10																	

NA	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	1	18.73	1.87	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	1	18.73	0.84	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	2	37.47	1.31	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	1	18.73	0.56	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	1	18.73	0.47	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	22	412.13	8.24	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	67	1255.13	18.83	17	3184.67	47.77	0	0.00	0.00	0	0.00	0.00					
0.02	81	1517.40	15.17	22	4121.33	41.21	0	0.00	0.00	0	0.00	0.00					
0.01	102	1910.80	9.55	32	5994.67	29.97	0	0.00	0.00	0	0.00	0.00					
0.005	78	1461.20	3.65	158	29598.67	74.00	0	0.00	0.00	0	0.00	0.00					
0.001	84	1573.60	0.79	207	38778.00	19.39	0	0.00	0.00	0	0.00	0.00					
0.0001	66	1236.40	0.06	187	35031.33	1.75	8	1873.33	0.09	0	0.00	0.00					
0.00001	106	1985.73	0.01	48	8992.00	0.04	155	36295.83	0.18	28	13113.33	0.07					
0.000001	53	992.87	0.00	31	5807.33	0.00	149	34890.83	0.02	286	133943.33	0.07	2				
0	120	2248.00	0.00	83	15548.67	0.00	473	110760.83	0.00	471	220585.00	0.00	783				
	785		61.37	785		214.14	785		0.29	785		0.13	785				
Total																	
275.93																	
229.95																	

LTM	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50		T5			
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	1	18.73	1.87	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	1	18.73	0.75	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	2	37.47	1.12	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	1	18.73	0.47	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	18	337.20	6.74	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	57	1067.80	16.02	17	3184.67	47.77	0	0.00	0.00	0	0.00	0.00					
0.02	91	1704.73	17.05	22	4121.33	41.21	0	0.00	0.00	0	0.00	0.00					
0.01	102	1910.80	9.55	37	6931.33	34.66	0	0.00	0.00	0	0.00	0.00					
0.005	100	1873.33	4.68	153	28662.00	71.66	0	0.00	0.00	0	0.00	0.00					
0.001	105	1967.00	0.98	207	38778.00	19.39	0	0.00	0.00	0	0.00	0.00					
0.0001	79	1479.93	0.07	188	35218.67	1.76	7	1639.17	0.08	0	0.00	0.00					
0.00001	120	2248.00	0.01	48	8992.00	0.04	128	29973.33	0.15	26	12176.67	0.06					
0.000001	24	449.60	0.00	30	5620.00	0.00	156	36530.00	0.02	286	133943.33	0.07					
0	84	1573.60		83	15548.67	0.00	494	115678.33	0.00	473	221521.67	0.00	2				
	785		59.33	785		216.49	785		0.25	785		0.13					
Total																	
276.20																	
230.17																	

ISFC	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	203	95071.67	237.68					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	157	73528.33	36.76	43				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	108	50580.00	2.53	407				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	182	85236.67	0.43	71				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	40	18733.33	0.01	144				
0	785	14705.67		785	147056.67	0.00	785	183820.83	0.00	95	44491.67	0.00	120				
	785		0.00	785		0.00	785		0.00	785		277.41	785				
Total																	
277.41																	
231.17																	

ISV	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	16	7493.33	0.00	22				
0	785	14705.67		785	147056.67	0.00	785	183820.83	0.00	769	360148.33	0.00	762				
	785		0.00	785		0.00	785		0.00	785		0.00	785				
Total																	
0.00																	
0.00																	

ESIS	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	247	115678.33	5.78					
0.00001	0	0.00	0.00	0	0.00	0.00	5	1170.83	0.01	212	99286.67	0.50	1				
0.000001	0	0.00	0.00	0	0.00	0.00	255	59712.50	0.03	129	60415.00	0.03	283				
0	785	14705.67		785	147056.67	0.00	525	122937.50	0.00	197	92261.67	0.00	501				
	785		0.00	785		0.00	785		0.04	785		6.31	785				
Total																	
6.35																	
5.29																	

ESNS	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	240	112400.00	5.62					
0.00001	0	0.00	0.00	0	0.00	0.00	5	1170.83	0.01	219	102565.00	0.51					
0.000001	0	0.00	0.00	0	0.00	0.00	255	59712.50	0.03	129	60415.00	0.03	0				
0	785	14705.67		785	147056.67	0.00	525	122937.50	0.00	197	92261.67	0.00	785				
	785		0.00	785		0.00	785		0.04	785		6.16	785				
Total																	
6.20																	
5.17																	

ESES	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	240	112400.00	5.62					
0.00001	0	0.00	0.00	0	0.00	0.00	5	1170.83	0.01	219	102565.00	0.51					
0.000001	0	0.00	0.00	0	0.00	0.00	255	59712.50	0.03	129	60415.00	0.03	0				
0	785	14705.67		785	147056.67	0.00	525	122937.50	0.00	197	92261.67	0.00	785				
	785		0.00	785		0.00	785		0.04	785		6.16	785				
Total																	
6.20																	
5.17																	

ESISC	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00					
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	468.33	1.17					
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	91	42618.33	21.31					
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	301	140968.33	7.05	105				
0.00001	0	0.00	0.00	0	0.00	0.00	3	702.50	0.00	133	62288.33	0.31	344				
0.000001	0	0.00	0.00	0	0.00	0.00	192	44960.00	0.02	139	65098.33	0.03	78				
0	785	14705.67		785	147056.67	0.00	590	138158.33	0.00	120	56200.00	0.00	258				
	785		0.00	785		0.00	785		0.03	785		29.87	785				
Total																	
29.90																	
24.92																	

PI	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk	km2	total indv.	risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	247	115678.33	5.78	0				
0.00001	0	0.00	0.00	0	0.00	0.00	5	1170.83	0.01	212	99286.67	0.50	1				
0.000001	0	0.00	0.00	0	0.00	0.00	255	59712.50	0.03	129	60415.00	0.03	283				
0	785	14705.67		785	147056.67	0.00	525	122937.50	0.00	197	92261.67	0.00	501				
	785		0.00	785		0.00	785		0.04	785		6.31	785				
Total																	
6.35																	
5.29																	

NA Recreational shoreline

NA	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of IN	Risk		
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	8	1000.00	2.50	10	12500.00	31.25	0	0.00	0.00	0	0.00	0.00	0				
0.001	13	1625.00	0.81	17	21250.00	10.63	0	0.00	0.00	0	0.00	0.00	0				
0.0001	5	625.00	0.03	14	17500.00	0.88	0	0.00	0.00	0	0.00	0.00	0				
0.00001	8	1000.00	0.01	26	32500.00	0.16	0	0.00	0.00	0	0.00	0.00	0				
0.000001	11	1375.00	0.00	3	3750.00	0.00	6	9375.00	0.00	1	3125.00	0.00	0				
0	59	7375.00	0.00	34	42500.00	0.00	98	153125.00	0.00	103	321875.00	0.00	104				
	104		3.35	104		42.91	104		0.00	104		0.00	104				
Total																	
46.27																	
38.56																	

LTM	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	7	875.00	2.19	11	13750.00	34.38	0	0.00	0.00	0	0.00	0.00	0				
0.001	21	2625.00	1.31	17	21250.00	10.63	0	0.00	0.00	0	0.00	0.00	0				
0.0001	10	1250.00	0.06	13	16250.00	0.81	0	0.00	0.00	0	0.00	0.00	0				
0.00001	20	2500.00	0.01	26	32500.00	0.16	0	0.00	0.00	0	0.00	0.00	0				
0.000001	12	1500.00	0.00	3	3750.00	0.00	0	0.00	0.00	1	3125.00	0.00	0				
0	34	4250.00	0.00	34	42500.00	0.00	104	162500.00	0.00	103	321875.00	0.00	104				
	104		3.58	104		45.98	104		0.00	104		0.00	104				
Total																	
49.55																	
41.30																	

ISFC	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	17	53125.00	26.56	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	14	43750.00	2.19	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	8	25000.00	0.13	32				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	26	81250.00	0.04	11				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	39	121875.00	0.00	61				
	104		0.00	104		0.00	104		0.00	104		28.92	104				
Total																	
28.92																	
24.10																	

ISV	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	104	325000.00	0.00	104				
	104		0.00	104		0.00	104		0.00	104		0.00	104				
Total																	
0.00																	
0.00																	

ESIS	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	8				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	68	212500.00	0.00	96				
	104		0.00	104		0.00	104		0.00	104		0.35	104				
Total																	
0.35																	
0.29																	

ESNS Recreational Shoreline

ESNS	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	0				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	68	212500.00	0.00	104				
	104		0.00	104		0.00	104		0.00	104		0.35	104				
Total																	
0.35																	
0.29																	

ESES	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	8				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	68	212500.00	0.00	96				
	104		0.00	104		0.00	104		0.00	104		0.35	104				
Total																	
0.35																	
0.29																	

ESISC	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	33	103125.00	0.52	5				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	11	34375.00	0.02	27				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	60	187500.00	0.00	72				
	104		0.00	104		0.00	104		0.00	104		0.53	104				
Total																	
0.53																	
0.44																	

IP	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk	km2	# of INDV.	Risk					
	200	T1	0.50	2000	T2	0.50	2500	T3	0.50	5000	T4	0.50					
0.5	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.3	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.2	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.1	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.04	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.02	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.005	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.0001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0				
0.00001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	65625.00	0.33	0				
0.000001	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	15	46875.00	0.02	8				
0	104	13000.00	0.00	104	130000.00	0.00	104	162500.00	0.00	68	212500.00	0.00	96				
	104		0.00	104		0.00	104		0.00	104		0.35	104				
Total																	
0.00																	
0.00																	

S_R_1.CMP (RESIDENTIAL FARMS)

Time Period	Alternative	Risk = 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)
T1	No Action Alternative	0	0	0	0	0	0	1	0	3
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	1
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T2	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T4	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk = 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T5	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .1 Area (km2)	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2)	Risk > .03 Area (km2)	Risk > .02 Area (km2)
T1	No Action Alternative	50	22	23	17	21	25	21	52	46
	Long-Term Management Alternative	4	0	5	16	27	38	42	74	44
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T2	No Action Alternative	10	4	3	5	3	6	8	12	18
	Long-Term Management Alternative	0	9	6	7	8	12	10	20	25
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T4	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .1 Area (km2)	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2)	Risk > .03 Area (km2)	Risk > .02 Area (km2)
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T5	No Action Alternative	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .01 Area (km2)	Risk > .005 Area (km2)	Risk > .001 Area (km2)	Risk > .0001 Area (km2)	Risk > .00001 Area (km2)	Risk > .000001 Area (km2)	Risk > .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
T1	No Action Alternative	35	35	63	70	77	90	33	684	0.471724
	Long-Term Management Alternative	80	32	102	81	127	26	25	724	0.49931
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T2	No Action Alternative	58	72	183	190	82	37	30	721	0.497241
	Long-Term Management Alternative	46	62	175	190	83	39	33	725	0.5
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	0	1	18	217	118	354	0.244138
	Long-Term Management Alternative	0	0	0	1	11	188	154	354	0.244138
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	122	233	355	0.244828
	Ex Situ No Separations Alternative	0	0	0	0	0	122	233	355	0.244828
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	122	233	355	0.244828
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	43	277	320	0.22069
	Phased Implementation Alternative	0	0	0	0	0	122	233	355	0.244828
T4	No Action Alternative	0	0	0	0	0	77	305	382	0.263448
	Long-Term Management Alternative	0	0	0	0	0	77	305	382	0.263448
	In Situ Fill and Cap Alternative	2	95	231	93	115	144	24	704	0.485517
	In Situ Vitrification Alternative	0	0	0	0	0	31	356	387	0.266897

Time Period	Alternative	Risk > .01 Area (km2)	Risk > .005 Area (km2)	Risk > .001 Area (km2)	Risk > .0001 Area (km2)	Risk > .00001 Area (km2)	Risk > .000001 Area (km2)	Risk > .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
	Ex Situ Intermediate Separations Alternative	0	0	0	30	361	119	153	663	0.457241
	Ex Situ No Separations Alternative	0	0	0	30	357	122	153	662	0.456552
	Ex Situ Extensive Separations Alternative	0	0	0	30	357	122	153	662	0.456552
	Ex Situ/In Situ Combination Alternative	0	0	12	329	117	191	34	683	0.471034
	Phased Implementation Alternative	0	0	0	30	361	119	153	663	0.457241
T5	No Action Alternative	0	0	0	0	0	0	5	5	0.003448
	Long-Term Management Alternative	0	0	0	0	0	0	5	5	0.003448
	In Situ Fill and Cap Alternative	0	0	14	311	169	143	45	682	0.470345
	In Situ Vitrification Alternative	0	0	0	1	1	127	300	429	0.295862
	Ex Situ Intermediate Separations Alternative	0	0	0	0	242	68	33	343	0.236552
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	227	227	0.156552
	Ex Situ/In Situ Combination Alternative	0	0	0	11	361	125	83	580	0.4
	Phased Implementation Alternative	0	0	0	0	242	68	33	343	0.236552

S_R_2.CMP (INDSTRIAL WORKER)

Time Period	Alternative	Risk = 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)	Risk > .1 Area (km2)
T1	No Action Alternative	0	0	0	0	0	0	0	0	0	1
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	1
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T2	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T4	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk = 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)	Risk > .1 Area (km2)
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T5	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2)	Risk > .03 Area (km2)	Risk > .02 Area (km2)	Risk > .01 Area (km2)	Risk > .005 Area (km2)
T1	No Action Alternative	0	1	0	2	1	1	22	67	81	102
	Long-Term Management Alternative	0	0	1	0	2	1	18	57	91	102
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T2	No Action Alternative	0	0	0	0	0	0	0	17	22	32
	Long-Term Management Alternative	0	0	0	0	0	0	0	17	22	37
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T4	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2)	Risk > .03 Area (km2)	Risk > .02 Area (km2)	Risk > .01 Area (km2)	Risk > .005 Area (km2)
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0
T5	No Action Alternative	0	0	0	0	0	0	0	0	0	0
	Long-Term Management Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .001 Area (km2)	Risk > .0001 Area (km2)	Risk > .00001 Area (km2)	Risk > .000001 Area (km2)	Risk > .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
T1	No Action Alternative	78	84	66	106	53	665	0.458621
	Long-Term Management Alternative	100	105	79	120	24	701	0.483448
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0
T2	No Action Alternative	158	207	187	48	31	702	0.484138
	Long-Term Management Alternative	153	207	188	48	30	702	0.484138
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	0	0	0	0
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	0	0	0	0	0
	Phased Implementation Alternative	0	0	0	0	0	0	0
T3	No Action Alternative	0	0	8	155	149	312	0.215172
	Long-Term Management Alternative	0	0	7	128	156	291	0.20069
	In Situ Fill and Cap Alternative	0	0	0	0	0	0	0
	In Situ Vitrification Alternative	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations Alternative	0	0	0	5	255	260	0.17931
	Ex Situ No Separations Alternative	0	0	0	5	255	260	0.17931
	Ex Situ Extensive Separations Alternative	0	0	0	5	255	260	0.17931
	Ex Situ/In Situ Combination Alternative	0	0	0	3	192	195	0.134483
	Phased Implementation Alternative	0	0	0	5	255	260	0.17931
T4	No Action Alternative	0	0	0	28	286	314	0.216552
	Long-Term Management Alternative	0	0	0	28	286	314	0.216552
	In Situ Fill and Cap Alternative	203	157	108	182	40	690	0.475862
	In Situ Vitrification Alternative	0	0	0	0	16	16	0.011034

Time Period	Alternative	Risk > .001 Area (km2)	Risk > .0001 Area (km2)	Risk > .00001 Area (km2)	Risk > .000001 Area (km2)	Risk > .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
	Ex Situ Intermediate Separations Alternative	0	0	247	212	129	588	0.405517
	Ex Situ No Separations Alternative	0	0	240	219	129	588	0.405517
	Ex Situ Extensive Separations Alternative	0	0	240	219	129	588	0.405517
	Ex Situ/In Situ Combination Alternative	1	91	301	133	139	665	0.458621
	Phased Implementation Alternative	0	0	247	212	129	588	0.405517
T5	No Action Alternative	0	0	0	0	2	2	0.001379
	Long-Term Management Alternative	0	0	0	0	2	2	0.001379
	In Situ Fill and Cap Alternative	0	43	407	71	144	665	0.458621
	In Situ Vitrification Alternative	0	1	0	0	22	23	0.015862
	Ex Situ Intermediate Separations Alternative	0	0	0	1	283	284	0.195862
	Ex Situ No Separations Alternative	0	0	0	0	0	0	0
	Ex Situ Extensive Separations Alternative	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination Alternative	0	0	105	344	78	527	0.363448
	Phased Implementation Alternative	0	0	0	1	283	284	0.195862

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To	From
Co. Alex	Co. Mitch
Dept.	Phone #
Fax #	Fax #

S_R_4.CMP (RECREATIONAL SHORELINES USERS)

Period	Alternative	= 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)	Risk > .1 Area (km2)
T1	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T2	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T3	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T4	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0

S_R_4.CMP

Time Period	Alternative	Risk = 1 Area (km2)	Risk > .9 Area (km2)	Risk > .8 Area (km2)	Risk > .7 Area (km2)	Risk > .6 Area (km2)	Risk > .5 Area (km2)	Risk > .4 Area (km2)	Risk > .3 Area (km2)	Risk > .2 Area (km2)	Risk > .1 Area (km2)
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T5	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2) *	Risk > .03 Area (km2)	Risk > .02 Area (km2)	Risk > .01 Area (km2)	Risk > .005 Area (km2)
T1	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T2	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T3	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T4	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk > .09 Area (km2)	Risk > .08 Area (km2)	Risk > .07 Area (km2)	Risk > .06 Area (km2)	Risk > .05 Area (km2)	Risk > .04 Area (km2)	Risk > .03 Area (km2)	Risk > .02 Area (km2)	Risk > .01 Area (km2)	Risk > .005 Area (km2)
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0
T5	No Action	0	0	0	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0	0	0	0

Time Period	Alternative	Risk> .001 Area (km2)	Risk> .0001 Area (km2)	Risk> .00001 Area (km2)	Risk> .000001 Area (km2)	Risk> .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
T1	No Action	8	13	5	8	11	45	0.031034
	Long-Term Management	7	21	10	20	12	70	0.048276
	In Situ Fill and Cap	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0
T2	No Action	10	17	14	26	3	70	0.048276
	Long-Term Management	11	17	13	26	3	70	0.048276
	In Situ Fill and Cap	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0
T3	No Action	0	0	0	0	6	6	0.004138
	Long-Term Management	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	0	0	0	0
	In Situ Vitrification	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	0	0	0
	Ex Situ No Separations	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	0	0	0	0
	Phased Implementation	0	0	0	0	0	0	0
T4	No Action	0	0	0	0	1	1	0.00069
	Long-Term Management	0	0	0	0	1	1	0.00069
	In Situ Fill and Cap	0	17	14	8	26	65	0.044828
	In Situ Vitrification	0	0	0	0	0	0	0

S_R_4.CMP

Time Period	Alternative	Risk> .001 Area (km2)	Risk> .0001 Area (km2)	Risk> .00001 Area (km2)	Risk> .000001 Area (km2)	Risk> .0000001 Area (km2)	Total Affected Area (km2)	Percent of Site
	Ex Situ Intermediate Separations	0	0	0	21	15	36	0.024828
	Ex Situ No Separations	0	0	0	21	15	36	0.024828
	Ex Situ Extensive Separations	0	0	0	21	15	36	0.024828
	Ex Situ/In Situ Combination	0	0	0	33	11	44	0.030345
	Phased Implementation	0	0	0	21	15	36	0.024828
T5	No Action	0	0	0	0	0	0	0
	Long-Term Management	0	0	0	0	0	0	0
	In Situ Fill and Cap	0	0	0	32	11	43	0.029655
	In Situ Vitrification	0	0	0	0	0	0	0
	Ex Situ Intermediate Separations	0	0	0	0	8	8	0.005517
	Ex Situ No Separations	0	0	0	0	0	0	0
	Ex Situ Extensive Separations	0	0	0	0	0	0	0
	Ex Situ/In Situ Combination	0	0	0	5	27	32	0.022069
	Phased Implementation	0	0	0	0	8	8	0.005517

TWRS EIS
CALCULATION COVER SHEET

DISCIPLINE & TITLE Safety Consequences for Beyond 100 year Tank Collapse

ORIGINATOR M. Harker DATE 3-26-96

REVISION NO. _____

OBJECTIVE Determine Radiological and Chemical Consequences resulting from all tanks collapsing beyond 100 years for No Action and long-term management

METHODOLOGY Calculate source term for acute release and chronic release; calculate radiological dose and LCFs. calculate chemical exposure and compare with ERPG values.

ASSUMPTIONS 1- nominal Tank inventory is assumed for all tanks. 2. All tanks are assumed to collapse at the same time, 3. 10% of the current Hanford population live on the Hanford site.

(Continue on another sheet if necessary)

3/27/96
SIGNATURE/DATE

David J. Murray 3/28/96
CHECKED/DATE

CALCULATION & RESULTS
ATTACHED

JACOBS\FORMS\CALCVR.SHT

6.1.1

SOURCE TERM CALCULATIONS FOR BEYOND 100 YEAR TANK COLLAPSE									
ACUTE RELEASE PER TANK									
Puff <1h									
head space =		1,000 m3							
SpG =		1.50E+00							
radnuc in head =		100 mg/m3							
MAR =		2,500L							
RRF =		2.00E-03							
Puff release									
	headspac	Spg	concentra	1g per	1 L per	tanks	sourcterm		
	(m3)•		(mg/m3)	1000 mg	1000 g		(L)		
head =	1.00E+03	6.66E-01	1.00E+02	1.00E-03	1.00E-03	1.77E+02	1.18E+01		
	MAR (L)	RRF							
entrain =	2.50E+03	2.00E-03				1.77E+02	8.85E+02		
					Total Puff	=	8.97E+02		
Resuspension 24h									
MAR =	2,500 L								
RRF =	4.0E-05/hr						sourcterm		
	MAR (L)	RRF/hr	hr			tanks	(L)		
resus =	2.50E+03	4.00E-05	2.40E+01			1.77E+02	4.25E+02		
Total Acute Release = puff + 24h resuspension =					8.97E+02	4.25E+02	1.32E+03		
CHRONIC RELEASE PER TANK									
Resuspension 1yr									
MAR =	2,500 L x 10%								
RRF =	4.0E-05/hr								
	MAR (L)	10%reduc	RRF/hr	hr/day	day/yr	tanks	sourcterm		
resus =	2.50E+03	1.00E-01	4.00E-05	2.40E+01	3.64E+02	1.77E+02	1.55E+04		
DOSE CALCULATION FOR BEYOND 100 YEAR TANK COLLAPSE									
ACUTE RELEASE									
	onsite	offsite							
R =	3.30E-04	3.30E-04							
X/Q puff =	4.83E-01	7.29E-02							
X/Q24hr =	2.45E-01	2.52E-02							
ULD =	8.30E+03	8.30E+03	(nominal)						
L puff =	8.97E+02	8.97E+02							
L 24hr =	4.25E+02	4.25E+02							

		R	X/Q	ULD	L	sv to rem	personrem	DtoRCF	LCF
On pop (puff) =		3.30E-04	4.83E-01	8.30E+03	8.97E+02	1.00E+02	1.19E+05	5.00E-04	5.93E+01
On pop (24 hr) =		3.30E-04	2.45E-01	8.30E+03	4.25E+02	1.00E+02	2.85E+04	5.00E-04	1.43E+01
Total On pop							1.47E+05		7.36E+01
Off pop (puff) =		3.30E-04	7.29E-02	8.30E+03	8.97E+02	1.00E+02	1.79E+04	5.00E-04	8.95E+00
Off pop (24hr) =		3.30E-04	2.52E-02	8.30E+03	4.25E+02	1.00E+02	2.93E+03	5.00E-04	1.47E+00
Total Off pop							2.08E+04		1.04E+01
CHRONIC RELEASE (one year)									
		onsite	offsite						
R =		3.30E-04	3.30E-04						
X/Q chronic =		1.60E-04	2.90E-03						
ULD =		8.30E+03	8.30E+03	(nominal)					
L 1 yr =		1.55E+04	1.55E+04						
		R	X/Q	ULD	L	sv to rem	personrem	DtoRCF	LCF
On pop =		3.30E-04	1.60E-04	8.30E+03	1.55E+04	1.00E+02	6.78E+02	5.00E-04	3.39E-01
Off pop =		3.30E-04	2.90E-03	8.30E+03	1.55E+04	1.00E+02	1.23E+04	5.00E-04	6.14E+00

decay source term for 100 yrs.

Sheet2

Source	Bq/L	Lt	Bq (T0)	Bq (T100)	Ci (T0)	Ci (T100)	halflife(yr)	t (yr)	L	Lt	Exp(-Lt)	DCFsv/Bq	Sv/L
C 14	4.90E+04	1	4.90E+04	4.84E+04	1.32E-06	*1.31E-06*	5730	100	0.000121	0.012097	0.987976	5.60E-10	2.71E-05
Co-60	2.60E+06	1	2.60E+06	5.06E+00	7.03E-05	*1.37E-10*	5.271	100	0.131502	13.1502	1.95E-06	5.43E-08	2.75E-07
Se-79	1.70E+04	1	1.70E+04	1.70E+04	4.59E-07	*4.59E-07*	6.50E+04	100	1.07E-05	0.001066	0.998934	2.58E-09	4.38E-05
Sr-90	3.30E+09	1	3.30E+09	3.05E+08	8.92E-02	*8.24E-03*	29.1	100	0.023819	2.381949	0.09237	5.54E-08	1.69E+01
Y-90	3.30E+09	1	3.30E+09	3.05E+08	8.92E-02	*8.24E-03*		100	#VALUE!	#VALUE!	#VALUE!	2.36E-09	7.19E-01
Tc-99	3.30E+06	1	3.30E+06	3.30E+06	8.92E-05	*8.92E-05*	2.13E+05	100	3.25E-06	0.000325	0.999675	2.43E-09	8.02E-03
Ru-106	1.90E+03	1	1.90E+03	5.83E-27	5.14E-08	*0.00E+00*	1.02	100	0.679556	67.95561	3.07E-30	1.27E-07	7.41E-34
Sb-125	2.20E+05	1	2.20E+05	4.63E-07	5.95E-06	*1.25E-17*	2.578	100	0.26887	26.88701	2.1E-12	3.43E-09	1.59E-15
I-129	5.50E+03	1	5.50E+03	5.50E+03	1.49E-07	*1.49E-07*	1.57E+07	100	4.41E-08	4.41E-06	0.999996	4.08E-08	2.24E-04
Cs-134	1.00E+06	1	1.00E+06	2.64E-09	2.70E-05	*7.15E-20*	2.065	100	0.335664	33.56645	2.64E-15	1.15E-08	3.04E-17
Cs-137	5.50E+09	1	5.50E+09	5.53E+08	1.49E-01	*1.49E-02*	30.17	100	0.022975	2.297472	0.100513	8.11E-09	4.48E+00
Ce-144	9.30E+02	1	9.30E+02	2.29E-36	2.51E-08	*6.19E-47*	7.80E-01	100	0.888992	88.89922	2.46E-39	1.01E-07	2.31E-43
Pm-147	0.00E+00	1	0.00E+00	0.00E+00	0.00E+00	*0.00E+00*	2.6234	100	0.264217	26.42171	3.35E-12	1.06E-08	0.00E+00
Eu-154	1.00E+07	1	1.00E+07	3.13E+03	2.70E-04	*8.46E-08*	8.59	100	0.080692	8.069234	0.000313	7.43E-08	2.33E-04
Np-237	3.20E+07	1	3.20E+07	3.20E+07	8.65E-04	*8.65E-04*	2.14E+06	100	3.24E-07	3.24E-05	0.999968	2.25E-04	7.20E+03
Pu-238	1.70E+06	1	1.70E+06	7.71E+05	4.59E-05	*2.08E-05*	87.7	100	0.007904	0.790362	0.453681	1.23E-04	9.49E+01
Pu-239/40	4.00E+06	1	4.00E+06	3.99E+06	1.08E-04	*1.08E-04*	2.41E+04	100	2.88E-05	0.002876	0.997128	1.43E-04	5.70E+02
Pu-241	3.10E+07	1	3.10E+07	2.52E+05	8.38E-04	*6.80E-06*	14.4	100	0.048135	4.813522	0.008119	3.00E-06	7.55E-01
Am-241	3.30E+06	1	3.30E+06	2.81E+06	8.92E-05	*7.60E-05*	432.7	100	0.001602	0.160191	0.851981	1.45E-04	4.08E+02
Cm-242	0.00E+00	1	0.00E+00	0.00E+00	0.00E+00	*0.00E+00*	4.46E-01	100	1.554142	155.4142	3.2E-68	4.68E-06	0.00E+00
Cm-244	0.00E+00	1	0.00E+00	0.00E+00	0.00E+00	*0.00E+00*	18.1	100	0.038295	3.829542	0.02172	7.00E-05	0.00E+00
Eu-155	6.40E+06	1	6.40E+06	2.60E+00	1.73E-04	*7.03E-11*	4.71	100	0.147165	14.7165	4.06E-07	1.11E-08	2.89E-08
			1.22E+10	**1.21E+09**	**3.30E-01**	**3.26E-02**							**8.30E+03**

BEYOND 100 YEAR TANK COLLAPSE DUE TO EARTHQUAKE								
	Bounding							
	100m	290m	1780m	offsite	16,100m			
X/Q puff	9.85E-03	3.57E-05	4.80E-07	3.92E-07	3.54E-08			
		liters		liters				
source term =		5.07E+00	177	897.39				
mg/L =	1,000							
		analyte	bounding	bounding meteorology				
		concent	source	concentration., mg/m3				
analyte		gm/L	mg	100m	290m	1780m	offsite	16,100m
ammonia		1.50E+00	1.35E+06	1.33E+04	4.81E+01	6.46E-01	5.28E-01	0.047651
antimony		1.50E+00	1.35E+06	1.33E+04	4.81E+01	6.46E-01	5.28E-01	0.047651
arsenic		1.20E+00	1.08E+06	1.06E+04	3.84E+01	5.17E-01	4.22E-01	0.038121
barium		4.00E+01	3.59E+07	3.54E+05	1.28E+03	1.72E+01	1.41E+01	1.270704
beryllium		2.60E-02	2.33E+04	2.30E+02	8.33E-01	1.12E-02	9.15E-03	0.000826
cadmium		1.70E+00	1.53E+06	1.50E+04	5.45E+01	7.32E-01	5.98E-01	0.054005
calcium		9.50E+01	8.53E+07	8.40E+05	3.04E+03	4.09E+01	3.34E+01	3.017923
cerium		8.60E-01	7.72E+05	7.60E+03	2.76E+01	3.70E-01	3.03E-01	0.02732
chromium		6.90E+01	6.19E+07	6.10E+05	2.21E+03	2.97E+01	2.43E+01	2.191965
cobalt		5.40E-01	4.85E+05	4.77E+03	1.73E+01	2.33E-01	1.90E-01	0.017155
cyanide		1.60E+01	1.44E+07	1.41E+05	5.13E+02	6.89E+00	5.63E+00	0.508282
dysprosium		6.70E-02	6.01E+04	5.92E+02	2.15E+00	2.89E-02	2.36E-02	0.002128
lanthanum		3.30E+01	2.96E+07	2.92E+05	1.06E+03	1.42E+01	1.16E+01	1.048331
mercury		2.00E+01	1.79E+07	1.77E+05	6.41E+02	8.61E+00	7.04E+00	0.635352
neodymium		1.10E-01	9.87E+04	9.72E+02	3.52E+00	4.74E-02	3.87E-02	0.003494
oxalate		2.80E+02	2.51E+08	2.48E+06	8.97E+03	1.21E+02	9.85E+01	8.89493
selenium		3.50E+00	3.14E+06	3.09E+04	1.12E+02	1.51E+00	1.23E+00	0.111187
sodium hydroxide		2.30E+02	2.06E+08	2.03E+06	7.37E+03	9.91E+01	8.09E+01	7.306549
sodium		4.70E+02	4.22E+08	4.15E+06	1.51E+04	2.02E+02	1.65E+02	14.93077
tellurium		2.00E-01	1.79E+05	1.77E+03	6.41E+00	8.61E-02	7.04E-02	0.006354
thallium		5.00E+00	4.49E+06	4.42E+04	1.60E+02	2.15E+00	1.76E+00	0.158838
organic carbon		7.50E+01	6.73E+07	6.63E+05	2.40E+03	3.23E+01	2.64E+01	2.38257
uranium		2.80E+02	2.51E+08	2.48E+06	8.97E+03	1.21E+02	9.85E+01	8.89493
vanadium		1.30E-01	1.17E+05	1.15E+03	4.16E+00	5.60E-02	4.57E-02	0.00413

Table E.____a

Comparison of Chemical Cocentrations to

Toxic Concentration Limits for Beyond 100 year Accident

Analyte		Exposure	ERPG-1	ERPG-2	ERPG-3
(Threshold values are presented in mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Antimony [1]	Threshold Value		2.00E+00	4.00E+01	7.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.33E+04	6.65E+03	3.33E+02	1.90E+02
	MEI non involved worker at 290m	4.81E+01	2.41E+01	1.20E+00	6.87E-01
	MEI non involved worker at 1780m	6.46E-01	3.23E-01	1.62E-02	9.23E-03
	MEI general public	4.77E-02	2.39E-02	1.19E-03	6.81E-04
Arsenic [2]	Threshold Value		1.00E-01	7.00E+00	1.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.06E+04	1.06E+05	1.51E+03	1.06E+03
	MEI non involved worker at 290m	3.84E+01	3.84E+02	5.49E+00	3.84E+00
	MEI non involved worker at 1780m	5.17E-01	5.17E+00	7.39E-02	5.17E-02
	MEI general public	3.80E-02	3.80E-01	5.43E-03	3.80E-03
Beryllium [3]	Threshold Value		6.00E-03	2.50E-02	1.00E-01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	2.30E+02	3.83E+04	9.20E+03	2.30E+03
	MEI non involved worker at 290m	8.33E-01	1.39E+02	3.33E+01	8.33E+00
	MEI non involved worker at 1780m	1.12E-02	1.87E+00	4.48E-01	1.12E-01
	MEI general public	8.26E-04	1.38E-01	3.30E-02	8.26E-03
Cadmium [4]	Threshold Value		2.00E-01	1.00E+00	1.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.50E+04	7.50E+04	1.50E+04	1.50E+03
	MEI non involved worker at 290m	5.45E+01	2.73E+02	5.45E+01	5.45E+00
	MEI non involved worker at 1780m	7.32E-01	3.66E+00	7.32E-01	7.32E-02
	MEI general public	5.40E-02	2.70E-01	5.40E-02	5.40E-03
Cerium [5]	Threshold Value		7.00E+01	5.00E+02	7.00E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	7.60E+03	1.09E+02	1.52E+01	1.09E+01
	MEI non involved worker at 290m	2.76E+01	3.94E-01	5.52E-02	3.94E-02
	MEI non involved worker at 1780m	3.70E-01	5.29E-03	7.40E-04	5.29E-04
	MEI general public	2.73E-02	3.90E-04	5.46E-05	3.90E-05
Cobalt [6]	Threshold Value		5.00E-02	2.00E-01	8.00E+00
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	4.77E+03	9.54E+04	2.39E+04	5.96E+02
	MEI non involved worker at 290m	1.73E+01	3.46E+02	8.65E+01	2.16E+00
	MEI non involved worker at 1780m	2.33E-01	4.66E+00	1.17E+00	2.91E-02
	MEI general public	1.71E-02	3.42E-01	8.55E-02	2.14E-03

Table E.____a, Cont.

Comparison of Chemical Cocentrations to

Toxic Concentration Limits for Loss of Filtration Accident

Analyte		Exposure	ERPG-1	ERPG-2	ERPG-3
(Threshold values are presented in mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Cyanide [7]	Threshold Value		5.00E+00	4.10E+01	2.00E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.41E+05	2.82E+04	3.44E+03	7.05E+02
	MEI non involved worker at 290m	5.13E+02	1.03E+02	1.25E+01	2.57E+00
	MEI non involved worker at 1780m	6.89E+00	1.38E+00	1.68E-01	3.45E-02
	MEI general public	5.08E-01	1.02E-01	1.24E-02	2.54E-03
Mercury [8]	Threshold Value		7.50E-02	1.00E-01	1.40E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.77E+05	2.36E+06	1.77E+06	1.26E+04
	MEI non involved worker at 290m	6.41E+02	8.55E+03	6.41E+03	4.58E+01
	MEI non involved worker at 1780m	8.61E+00	1.15E+02	8.61E+01	6.15E-01
	MEI general public	6.35E-01	8.47E+00	6.35E+00	4.54E-02
Neodymium [9]	Threshold Value		7.20E+01	5.04E+02	7.20E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	9.72E+02	1.35E+01	1.93E+00	1.35E+00
	MEI non involved worker at 290m	3.52E+00	4.89E-02	6.98E-03	4.89E-03
	MEI non involved worker at 1780m	4.74E-02	6.58E-04	9.40E-05	6.58E-05
	MEI general public	3.49E-03	4.85E-05	6.92E-06	4.85E-06
Oxalate [10]	Threshold Value		4.00E+00	2.00E+01	4.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	2.48E+06	6.20E+05	1.24E+05	6.20E+04
	MEI non involved worker at 290m	8.97E+03	2.24E+03	4.49E+02	2.24E+02
	MEI non involved worker at 1780m	1.21E+02	3.03E+01	6.05E+00	3.03E+00
	MEI general public	8.89E+00	2.22E+00	4.45E-01	2.22E-01
Selenium [11]	Threshold Value		2.00E-01	4.00E-01	2.00E+00
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	3.09E+04	1.55E+05	7.73E+04	1.55E+04
	MEI non involved worker at 290m	1.12E+02	5.60E+02	2.80E+02	5.60E+01
	MEI non involved worker at 1780m	1.51E+00	7.55E+00	3.78E+00	7.55E-01
	MEI general public	1.11E-01	5.55E-01	2.78E-01	5.55E-02
Tellurium [12]	Threshold Value		1.30E-01	3.00E-01	1.40E+00
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.77E+03	1.36E+04	5.90E+03	1.26E+03
	MEI non involved worker at 290m	6.41E+00	4.93E+01	2.14E+01	4.58E+00

	MEI non involved worker at 1780m	8.61E-02	6.62E-01	2.87E-01	6.15E-02
	MEI general public	6.35E-03	4.88E-02	2.12E-02	4.54E-03
	Table E.____a, Cont.				
	Comparison of Chemical Cocentrations to				
	Toxic Concentration Limits for Loss of Filtration Accident				
Analyte		Exposure	ERPG-1	ERPG-2	ERPG-3
(Threshold values are presented in mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Thallium [13]	Threshold Value		3.00E-01	2.00E+00	2.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	4.42E+04	1.47E+05	2.21E+04	2.21E+03
	MEI non involved worker at 290m	1.60E+02	5.33E+02	8.00E+01	8.00E+00
	MEI non involved worker at 1780m	2.15E+00	7.17E+00	1.08E+00	1.08E-01
	MEI general public	1.59E-01	5.30E-01	7.95E-02	7.95E-03
Uranium [14]	Threshold Value		1.00E+00	1.00E+01	2.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	2.48E+06	2.48E+06	2.48E+05	1.24E+05
	MEI non involved worker at 290m	8.97E+03	8.97E+03	8.97E+02	4.49E+02
	MEI non involved worker at 1780m	1.21E+02	1.21E+02	1.21E+01	6.05E+00
	MEI general public	8.89E+00	8.89E+00	8.89E-01	4.45E-01
Vanadium [15]	Threshold Value		1.20E+00	1.10E+01	4.00E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.15E+03	9.58E+02	1.05E+02	2.88E+01
	MEI non involved worker at 290m	4.16E+00	3.47E+00	3.78E-01	1.04E-01
	MEI non involved worker at 1780m	5.60E-02	4.67E-02	5.09E-03	1.40E-03
	MEI general public	4.13E-03	3.44E-03	3.75E-04	1.03E-04
Total Organic Carbon	Threshold Value		3.00E+00	1.50E+01	5.00E+01
(as tributyl phosphate)[16]			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	6.63E+05	2.21E+05	4.42E+04	1.33E+04
	MEI non involved worker at 290m	2.40E+03	8.00E+02	1.60E+02	4.80E+01
	MEI non involved worker at 1780m	3.23E+01	1.08E+01	2.15E+00	6.46E-01
	MEI general public	2.38E+00	7.93E-01	1.59E-01	4.76E-02
	Total MEI worker ratios		N/A	N/A	N/A
	Total MEI non involved worker at 100m ratios		6.35E+06	2.34E+06	2.37E+05
	Total MEI non involved worker at 290m ratios		2.30E+04	8.49E+03	8.58E+02
	Total MEI non involved worker at 1780m ratios		3.09E+02	1.14E+02	1.16E+01
	Total MEI general public ratios		2.28E+01	8.41E+00	8.51E-01
ERPG = Emergency response planning guideline values.					
ERPG-1 = These are maximum airborne concentrations below which it is believed that nearly all individuals could be exposed					
for up to one hour without experiencing other than mild transient adverse effects or perceiving a clearlydefined					

objectionable odor.							
ERPG-2 = Theseare the maximum airborne concentrations below which it is believed that nearly all individuals could be exposed							
for upto one hour without experiencing or developing irreversible or other serious health effects or symptoms that							
could impair their abilities to take protective action.							
ERPG-3 = These are the maximum airborneconcentrations below which it is believed that nearly all individuals could be exposed							
forup to one hourwithout experiencing or developing life-threatening health effects.							
1 Guidelines are based on total antimony content.							
2 Guidelines are based on total arsenic content.							
3 Guidelines are based on total beryllium contentand were developed by PNL.							
4 Guidelines are based on total cadmium content and were developed by HEHF.							
5 ERPGs for cerium were developed by HEHF using data forcerium chloride.							
6 Guidelines are based on total cobalt content and were developed by HEHF.							
7 Guidelines are based on total cyanide content and were developed by HEHF.							
8 Guidelines are based on total mercury content. ERPG-2 is the EPA Level of Concern (LOC). The ERPG-3 is the NIOSH IDLH for							
mercury vapor. •							
9 Guidelines are based on total neodymium content and were based on neodymium chloride.							
10 Guidelines are based on oxalic acidand adjusted by: ERPG(oxalic acid) x mwcompound/mw oxalic acid.							
11 Guidelines are based on the toxicity of sodium selenate.							
12 Guidelines are based on sodium selenate and were developed by HEHF.							
13 ERPGs were developed by HEHF.							
14 ERPGs were based on soluble uraniumcompounds.							
15 ERPGs were based on vanadium pentoxide and were developed by HEHF.							
16 ERPGs were based on the toxicity of tributylphosphate.							

Table E.____b

Comparison of Chemical Cocentrations to

Corrosive/Irritant Concentration Limits for Beyond 100 Year Accident

Analyte		Exposure	ERPG-1	ERPG-2	ERPG-3
(Threshold values are presented in mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Ammonia [17]	Threshold Value		4.60E-01	9.20E+00	2.30E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	1.33E+04	2.89E+04	1.45E+03	5.78E+02
	MEI non involved worker at 290m	4.81E+01	1.05E+02	5.23E+00	2.09E+00
	MEI non involved worker at 1780m	6.46E-01	1.40E+00	7.02E-02	2.81E-02
	MEI general public	4.77E-02	1.04E-01	5.18E-03	2.07E-03
Barium [18]	Threshold Value		6.80E+00	1.38E+02	3.44E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	3.54E+05	5.21E+04	2.57E+03	1.03E+03
	MEI non involved worker at 290m	1.28E+03	1.88E+02	9.28E+00	3.72E+00
	MEI non involved worker at 1780m	1.72E+01	2.53E+00	1.25E-01	5.00E-02
	MEI general public	1.27E+00	1.87E-01	9.20E-03	3.69E-03
Calcium [19]	Threshold Value		1.00E+00	2.20E+01	5.40E+01
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	8.40E+05	8.40E+05	3.82E+04	1.56E+04
	MEI non involved worker at 290m	3.04E+03	3.04E+03	1.38E+02	5.63E+01
	MEI non involved worker at 1780m	4.09E+01	4.09E+01	1.86E+00	7.57E-01
	MEI general public	3.02E+00	3.02E+00	1.37E-01	5.59E-02
Chromium [20]	Threshold Value		2.60E+00	5.15E+01	1.29E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	6.10E+05	2.35E+05	1.18E+04	4.73E+03
	MEI non involved worker at 290m	2.21E+03	8.50E+02	4.29E+01	1.71E+01
	MEI non involved worker at 1780m	2.97E+01	1.14E+01	5.77E-01	2.30E-01
	MEI general public	2.19E+00	8.42E-01	4.25E-02	1.70E-02
Dysprosium [21]	Threshold Value		8.00E+01	6.00E+02	8.00E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	5.92E+02	7.40E+00	9.87E-01	7.40E-01
	MEI non involved worker at 290m	2.15E+00	2.69E-02	3.58E-03	2.69E-03
	MEI non involved worker at 1780m	2.89E-02	3.61E-04	4.82E-05	3.61E-05
	MEI general public	2.13E-03	2.66E-05	3.55E-06	2.66E-06
Lanthanum [22]	Threshold Value		6.90E+00	1.37E+02	3.43E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	2.92E+05	4.23E+04	2.13E+03	8.51E+02
	MEI non involved worker at 290m	1.06E+03	1.54E+02	7.74E+00	3.09E+00
	MEI non involved worker at 1780m	1.42E+01	2.06E+00	1.04E-01	4.14E-02
	MEI general public	1.05E+00	1.52E-01	7.66E-03	3.06E-03

Table E.____b, Cont.

Comparison of Chemical Cocentrations to

Corrosive/Irritant Concentration Limits for Loss of Filtration Accident

Analyte		Exposure	ERPG-1	ERPG-2	ERPG-3
(Threshold values are presented in mg/m^3)		(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Sodium Hydroxide	Threshold Value		2.00E+00	4.00E+01	1.00E+02
			Ratio of Exposure to ERPG		
	MEI worker	N/A			
	MEI non involved worker at 100m	2.03E+06	1.02E+06	5.08E+04	2.03E+04
	MEI non involved worker at 290m	7.37E+03	3.69E+03	1.84E+02	7.37E+01
	MEI non involved worker at 1780m	9.91E+01	4.96E+01	2.48E+00	9.91E-01
	MEI general public	7.31E+00	3.66E+00	1.83E-01	7.31E-02
	Total MEI worker ratios		N/A	N/A	N/A
	Total MEI non involved worker at 100m ratios		2.21E+06	1.07E+05	4.30E+04
	Total MEI non involved worker at 290m ratios		8.02E+03	3.88E+02	1.56E+02
	Total MEI non involved worker at 1780m ratios		1.08E+02	5.21E+00	2.10E+00
	Total MEI general public ratios		7.96E+00	3.85E-01	1.55E-01

17 Guidelines were based on ammonium ydroxide normalized to sodium hydroxide.

18 Guidelines were based on barium hydroxide normalized to sodium hydroxide.

19 ERPGs wee normalized to sodium hydroxide.

20 Guidelines were based on chromium hydroxide normalized to sodium hydroxide.

21 Guidelines were based on cerous hydroxide and were developed by HEHF.

22 Guidelines were based on lanthanum fluoride normalized to sodium hydroxide.

BEYOND 100 YEAR TANK COLLAPSE DUE TO EARTHQUAKE							
	Bounding						
	100m	290m	1780m	offsite			
X/Q puff	9.85E-03	3.57E-05	4.80E-07	3.92E-07			
		liters		liters			
source term =		5.07E+00	177	897.39			
mg/L =	1,000						
		analyte	bounding	bounding meteorology			
		concent	source	concentration., mg/m3			
analyte		gm/L	mg	100m	290m	1780m	offsite
ammonia		1.50E+00	1.35E+06	1.33E+04	4.81E+01	6.46E-01	5.28E-01
antimony		1.50E+00	1.35E+06	1.33E+04	4.81E+01	6.46E-01	5.28E-01
arsenic		1.20E+00	1.08E+06	1.06E+04	3.84E+01	5.17E-01	4.22E-01
barium		4.00E+01	3.59E+07	3.54E+05	1.28E+03	1.72E+01	1.41E+01
beryllium		2.60E-02	2.33E+04	2.30E+02	8.33E-01	1.12E-02	9.15E-03
cadmium		1.70E+00	1.53E+06	1.50E+04	5.45E+01	7.32E-01	5.98E-01
calcium		9.50E+01	8.53E+07	8.40E+05	3.04E+03	4.09E+01	3.34E+01
cerium		8.60E-01	7.72E+05	7.60E+03	2.76E+01	3.70E-01	3.03E-01
chromium		6.90E+01	6.19E+07	6.10E+05	2.21E+03	2.97E+01	2.43E+01
cobalt		5.40E-01	4.85E+05	4.77E+03	1.73E+01	2.33E-01	1.90E-01
cyanide		1.60E+01	1.44E+07	1.41E+05	5.13E+02	6.89E+00	5.63E+00
dysprosium		6.70E-02	6.01E+04	5.92E+02	2.15E+00	2.89E-02	2.36E-02
lanthanum		3.30E+01	2.96E+07	2.92E+05	1.06E+03	1.42E+01	1.16E+01
mercury		2.00E+01	1.79E+07	1.77E+05	6.41E+02	8.61E+00	7.04E+00
neodymium		1.10E-01	9.87E+04	9.72E+02	3.52E+00	4.74E-02	3.87E-02
oxalate		2.80E+02	2.51E+08	2.48E+06	8.97E+03	1.21E+02	9.85E+01
selenium		3.50E+00	3.14E+06	3.09E+04	1.12E+02	1.51E+00	1.23E+00
sodium hydroxide		2.30E+02	2.06E+08	2.03E+06	7.37E+03	9.91E+01	8.09E+01
sodium		4.70E+02	4.22E+08	4.15E+06	1.51E+04	2.02E+02	1.65E+02
tellurium		2.00E-01	1.79E+05	1.77E+03	6.41E+00	8.61E-02	7.04E-02
thallium		5.00E+00	4.49E+06	4.42E+04	1.60E+02	2.15E+00	1.76E+00
organic carbon		7.50E+01	6.73E+07	6.63E+05	2.40E+03	3.23E+01	2.64E+01
uranium		2.80E+02	2.51E+08	2.48E+06	8.97E+03	1.21E+02	9.85E+01
vanadium		1.30E-01	1.17E+05	1.15E+03	4.16E+00	5.60E-02	4.57E-02