This document was too large to scan as a whole document, therefore it required breaking into smaller sections

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Sec 5

II.12.0 Pantex Plant

Pantex currently is custodian of significant volumes of LLMWs and LLW. Each of the waste types is treated independently in the following sections.

II.12.1 Pantex LLMW

Fifteen tables immediately following portray the impacts of LLMW at Pantex. These tables are presented as follows:

Impact Category

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Table II-12.1-1. Pantex—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	1.8E-04	3.8E-03	1.1E-06	2.8E-07	- -	- -
Decentralized	37	16	3.4E-04	3.8E-02	3.5E-05	3.5E-06	3.0E-04	4.8E-03
Regionalized-1	11	12	3.4E-04	3.8E-02	3.5E-05	3.5E-06	3.0E-04	4.8E-03
Regionalized-2	7	6	1.7E-04	1.4E-02	2.3E-06	2.3E-07	- -	- -
Regionalized-3	7	1	1.7E-04	1.4E-02	2.3E-06	2.3E-07	- -	- -
Regionalized-4	4	6	1.7E-04	1.4E-02	2.3E-06	2.3E-07	- -	- -
Centralized	1	1	1.7E-04	1.4E-02	2.3E-06	2.3E-07	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-12.1-2. Pantex—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Worker			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	2.2E-03	3.8E-06	7.0E-08	2.2E-07	5.6E-04	9.5E-07	8.0E-08	5.6E-08	4.4E-01	6.1E-04	7.3E-08	2.6E-05
Decentralized	37	16	6.9E-02	1.2E-04	3.5E-09	6.9E-06	6.9E-03	1.2E-05	4.0E-09	6.9E-07	8.4E-01	1.2E-03	8.2E-07	5.0E-05
Regionalized-1	11	12	6.9E-02	1.2E-04	3.5E-09	6.9E-06	6.9E-03	1.2E-05	4.0E-09	6.9E-07	8.4E-01	1.2E-03	8.2E-07	5.0E-05
Regionalized-2	7	6	4.7E-03	8.0E-06	3.6E-10	4.7E-07	4.7E-04	7.9E-07	4.1E-10	4.7E-08	4.2E-01	5.8E-04	5.5E-08	2.5E-05
Regionalized-3	7	1	4.7E-03	8.0E-06	3.6E-10	4.7E-07	4.7E-04	7.9E-07	4.1E-10	4.7E-08	4.2E-01	5.8E-04	5.5E-08	2.5E-05
Regionalized-4	4	6	4.7E-03	8.0E-06	3.6E-10	4.7E-07	4.7E-04	7.9E-07	4.1E-10	4.7E-08	4.2E-01	5.8E-04	5.5E-08	2.5E-05
Centralized	1	1	4.7E-03	8.0E-06	3.6E-10	4.7E-07	4.7E-04	7.9E-07	4.1E-10	4.7E-08	4.2E-01	5.8E-04	5.5E-08	2.5E-05

Notes:
T = Treatment
D = Disposal

Table II-12.1-3. Pantex—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	7.6E-01	1.1E-03	4.6E-05
Regionalized-1	11	12	7.6E-01	1.1E-03	4.6E-05
Regionalized-2	7	6	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-12.1-4. Pantex—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	9.2E-11	5.2E-10	- -
Decentralized	37	16	2.9E-09	6.6E-09	6.7E-07
Regionalized-1	11	12	2.9E-09	6.6E-09	6.7E-07
Regionalized-2	7	6	2.0E-10	4.4E-10	- -
Regionalized-3	7	1	2.0E-10	4.4E-10	- -
Regionalized-4	4	6	2.0E-10	4.4E-10	- -
Centralized	1	1	2.0E-10	4.4E-10	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-12.1-5. Pantex—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	3	-	1.8E-07	3.1E-10	5.8E-12	1.8E-11	1.1E-06	1.8E-09	1.4E-10	1.1E-10	- -	- -	- -	- -
Decentralized	37	16	5.9E-06	1.0E-08	2.9E-13	5.9E-10	1.3E-05	2.2E-08	6.8E-12	1.3E-09	1.3E-03	2.3E-06	1.2E-06	1.3E-07
Regionalized-1	11	12	5.9E-06	1.0E-08	2.9E-13	5.9E-10	1.3E-05	2.2E-08	6.8E-12	1.3E-09	1.3E-03	2.3E-06	1.23-06	1.3E-07
Regionalized-2	7	6	4.0E-07	6.8E-10	3.0E-14	4.0E-11	8.9E-07	1.5E-09	7.0E-13	8.9E-11	- -	- -	- -	- -
Regionalized-3	7	1	4.0E-07	6.8E-10	3.0E-14	4.0E-11	8.9E-07	1.5E-09	7.0E-13	8.9E-11	- -	- -	- -	- -
Regionalized-4	4	6	4.0E-07	6.8E-10	3.0E-14	4.0E-11	8.9E-07	1.5E-09	7.0E-13	8.9E-11	- -	- -	- -	- -
Centralized	1	1	4.0E-07	6.8E-10	3.0E-14	4.0E-11	8.9E-07	1.5E-09	7.0E-13	8.9E-11	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered for this alternative.

Table II-12.1-6. Pantex—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	8.3E-09	2.0E-07	1.3E-06	- -
Decentralized	37	16	1.3E-09	3.0E-08	4.2E-05	4.0E-03
Regionalized-1	11	12	1.3E-09	3.0E-08	4.2E-05	4.0E-03
Regionalized-2	7	6	7.5E-12	1.8E-10	1.3E-06	- -
Regionalized-3	7	1	7.5E-12	1.8E-10	1.3E-06	- -
Regionalized-4	4	6	7.5E-12	1.8E-10	1.3E-06	- -
Centralized	1	1	7.5E-12	1.8E-10	1.3E-06	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-12.1-7. Pantex—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	2 (0/1)	1 (1/0)	0	0	0	0	1 (0/1)	0	0	0	0	0
Decentralized	37	16	22 (2/20)	9 (5/4)	0	0	0	2 (0/2)	4 (0/4)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-1	11	12	21 (2/19)	9 (5/4)	0	0	0	2 (0/2)	4 (0/4)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-2	7	6	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	2 (0/2)	0	0	0	0	0
Regionalized-3	7	1	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	2 (0/2)	0	0	0	0	0
Regionalized-4	4	6	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	2 (0/2)	0	0	0	0	0
Centralized	1	1	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	2 (0/2)	0	0	0	0	0

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-12.1-8. Pantex—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	--	--	--	--	--	--
Decentralized	37	16	--	--	--	--	--	--
Regionalized-1	11	12	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	0	1	0	0	0	0	--	--	--	--	--	--
Decentralized	37	16	0	1	0	1	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	1	0	1	0	0	0	0	0	0	0	0
Regionalized-2	7	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-3	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Centralized	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) Pantex is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions are assumed to be negligible for all but the Decentralized and Regionalized-1 Alternatives.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-12.1–9. Pantex—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	--	--	0	--	--	0	0	0	0
Decentralized	37	16	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-1	11	12	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-2	7	6	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-3	7	1	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-4	4	6	0	0	0	--	--	0	--	--	0	0	0	0
Centralized	1	1	0	0	0	--	--	0	--	--	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	--	0	0	0	--	0	0	0	--	--
Decentralized	37	16	--	0	0	0	--	0	0	0	--	--
Regionalized-1	11	12	--	0	0	0	--	0	0	0	--	--
Regionalized-2	7	6	--	0	0	0	--	0	0	0	--	--
Regionalized-3	7	1	--	0	0	0	--	0	0	0	--	--
Regionalized-4	4	6	--	0	0	0	--	0	0	0	--	--
Centralized	1	1	--	0	0	0	--	0	0	0	--	--

Notes:
T = Treatment
D = Disposal
-- = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-12.1-10. Pantex—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	711	0.1	- -	305	0.1	- -	- -
Decentralized	37	16	4499	0.8	- -	1457	0.3	- -	- -
Regionalized-1	11	12	4499	0.8	- -	1457	0.3	- -	- -
Regionalized-2	7	6	116	<0.1	- -	387	0.1	- -	- -
Regionalized-3	7	1	116	<0.1	- -	387	0.1	- -	- -
Regionalized-4	4	6	116	<0.1	- -	387	0.1	- -	- -
Centralized	1	1	116	<0.1	- -	387	0.1	- -	- -

Notes:
T = Treatment
D = Disposal
Water supplied by groundwater in the Ogallala Aquifer. Current water use = 548,000 gallons/day.
Wastewater discharged to onsite playas.
- - = Stream Flow and Waste Water Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-12.1-11. Pantex—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)

LLMW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLMW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
- - = No disposal at this site for this alternative.

Table II-12.1-12. Pantex—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)

LLMW Alternatives	T	D	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--

LLMW Alternatives	T	D	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	1	0	0	2	0	0	0
Regionalized-1	11	12	1	0	0	2	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-12.1-13. Pantex—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	33	28	0.03	0.3	0.01	0.02
Decentralized	37	16	169	175	0.17	1.9	0.06	0.07
Regionalized-1	11	12	169	175	0.17	1.9	0.06	0.07
Regionalized-2	7	6	60	62	0.06	0.7	0.02	0.02
Regionalized-3	7	1	60	62	0.06	0.7	0.02	0.02
Regionalized-4	4	6	60	62	0.06	0.7	0.02	0.02
Centralized	1	1	60	62	0.06	0.7	0.02	0.02

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-12.1-14. Pantex—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	3	-	0.66	0.009	711	0.05	305	0.06	0.24	0.02	11	0.4
Decentralized	37	16	3.68	0.048	4499	0.3	1457	0.27	0.45	0.03	158	5
Regionalized-1	11	12	3.68	0.048	4499	0.3	1457	0.27	0.45	0.03	144	5
Regionalized-2	7	6	0.27	0.003	387	0.03	387	0.07	0.16	0.01	39	1
Regionalized-3	7	1	0.27	0.003	387	0.03	387	0.07	0.16	0.01	39	1
Regionalized-4	4	6	0.27	0.003	387	0.03	387	0.07	0.16	0.01	39	1
Centralized	1	1	0.27	0.003	387	0.03	387	0.07	0.16	0.01	39	1

Notes:
T is defined as Treatment, D is defined as Disposal
(1) Based on 1991 site employment

Table II-12.1-15. Pantex—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	38	3	4	21	11	15	23	0
Decentralized	37	16	192	32	68	81	11	152	0	40
Regionalized-1	11	12	192	32	68	81	11	152	0	40
Regionalized-2	7	6	68	8	18	32	11	68	0	0
Regionalized-3	7	1	68	8	18	32	11	68	0	0
Regionalized-4	4	6	68	8	18	32	11	68	0	0
Centralized	1	1	68	8	18	32	11	68	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.12.2 Pantex LLW

Thirteen tables immediately following portray the impacts of LLW at Pantex. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	Pantex—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-12.2-1	12-18
2.	Pantex—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-12.2-2	12-19
3.	Pantex—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-12.2-3	12-20
4.	Pantex—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-12.2-4	12-21
5.	Pantex—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-12.2-5	12-22
7.	Pantex—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-12.2-6	12-23
8.	Pantex—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-12.2-7	12-24
9.	Pantex—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-12.2-8	12-25
10.	Pantex—LLW—Impacts on Water Resources Due to Increased Water Use	II-12.2-9	12-26
11.	Pantex—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-12.2-10	12-27
13.	Pantex—LLW—Socioeconomic Impacts for Treatment and Disposal	II-12.2-11	12-28
14.	Pantex—LLW—Infrastructure Impacts for Treatment and Disposal	II-12.2-12	12-29
15.	Pantex—LLW—Cost	II-12.2-13	12-30

Table II-12.2-1. Pantex—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	9.7E-04	2.9E-02	8.8E-07	8.7E-08	- -	- -
Decentralized		16	7.8E-04	2.5E-02	4.4E-07	4.4E-08	5.8E-04	2.1E-02
Regionalized-1		12	7.8E-04	2.5E-02	4.4E-07	4.4E-08	5.8E-04	2.1E-02
Regionalized-2	11	12	7.8E-04	2.5E-02	4.4E-07	4.4E-08	5.8E-04	2.1E-02
Regionalized-3		6	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Regionalized-4	7	6	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Regionalized-5	4	6	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Regionalized-6		2	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Regionalized-7		2	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Centralized-1		1	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Centralized-2		1	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Centralized-3	7	1	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Centralized-4	7	1	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -
Centralized-5	1	1	7.8E-04	2.5E-02	4.4E-07	4.4E-08	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-12.2–2. Pantex—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	1.8E-03	3.0E-06	1.8E-07	1.7E-04	3.0E-07	1.7E-08	2.4E+00	3.4E-03	1.5E-04
Decentralized		16	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-1		12	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-2	11	12	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-3		6	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-4	7	6	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-5	4	6	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-6		2	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Regionalized-7		2	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Centralized-1		1	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Centralized-2		1	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Centralized-3	7	1	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Centralized-4	7	1	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04
Centralized-5	1	1	8.8E-04	1.5E-06	8.8E-08	8.7E-05	1.5E-07	8.7E-09	1.9E+00	2.7E-03	1.2E-04

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-3. Pantex—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	- -	- -	- -
Decentralized		16	1.5E+00	2.0E-03	8.7E-05
Regionalized-1		12	1.5E+00	2.0E-03	8.7E-05
Regionalized-2	11	12	1.5E+00	2.0E-03	8.7E-05
Regionalized-3		6	- -	- -	- -
Regionalized-4	7	6	- -	- -	- -
Regionalized-5	4	6	- -	- -	- -
Regionalized-6		2	- -	- -	- -
Regionalized-7		2	- -	- -	- -
Centralized-1		1	- -	- -	- -
Centralized-2		1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2–4. Pantex—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	7.5E-11	1.7E-10	- -
Decentralized		16	3.7E-11	8.3E-11	<9.9E-14
Regionalized-1		12	3.7E-11	8.3E-11	<9.9E-14
Regionalized-2	11	12	3.7E-11	8.3E-11	<9.9E-14
Regionalized-3		6	3.7E-11	8.3E-11	- -
Regionalized-4	7	6	3.7E-11	8.3E-11	- -
Regionalized-5	4	6	3.7E-11	8.3E-11	- -
Regionalized-6		2	3.7E-11	8.3E-11	- -
Regionalized-7		2	3.7E-11	8.3E-11	- -
Centralized-1		1	3.7E-11	8.3E-11	- -
Centralized-2		1	3.7E-11	8.3E-11	- -
Centralized-3	7	1	3.7E-11	8.3E-11	- -
Centralized-4	7	1	3.7E-11	8.3E-11	- -
Centralized-5	1	1	3.7E-11	8.3E-11	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-5. Pantex—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	1.5E-07	2.5E-10	1.5E-11	3.3E-07	5.6E-10	3.3E-11	- -	- -	- -
Decentralized		16	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	<9.9E-14	<9.9E-14	<9.9E-14
Regionalized-1		12	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	<9.9E-14	<9.9E-14	<9.9E-14
Regionalized-2	11	12	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	<9.9E-14	<9.9E-14	<9.9E-14
Regionalized-3		6	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Regionalized-4	7	6	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Regionalized-5	4	6	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Regionalized-6		2	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Regionalized-7		2	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Centralized-1		1	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Centralized-2		1	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Centralized-3	7	1	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Centralized-4	7	1	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -
Centralized-5	1	1	7.5E-08	1.3E-10	7.5E-12	1.7E-07	2.8E-10	1.7E-11	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2–6. Pantex—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Decentralized		16	16 (4/12)	13 (11/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-1		12	16 (4/12)	13 (11/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-2	11	12	20 (7/13)	21 (18/3)	0	1 (1/0)	2 (2/0)	4 (2/2)	12 (0/12)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-3		6	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Regionalized-4	7	6	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Regionalized-5	4	6	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Regionalized-6		2	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Regionalzied-7		2	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Centralized-1		1	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Centralized-2		1	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Centralized-3	7	1	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Centralized-4	7	1	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)
Centralized-5	1	1	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	10 (0/10)	3 (0/3)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-7. Pantex—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	0	0	0	0	0	0	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-1		12	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	7	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-5	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-6		2	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-7		2	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-1		1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-2		1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-3	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-4	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-5	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) Pantex is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2–8. Pantex—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Trichloro-fluoro-methane	Vinyl Chloride
No Action	10**	6	--	--	--	--	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T= Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-9. Pantex—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	1977	0.4	- -	671	0.1	- -	- -
Decentralized		16	2960	0.5	- -	933	0.2	- -	- -
Regionalized-1		12	2960	0.5	- -	933	0.2	- -	- -
Regionalized-2	11	12	4600	0.8	- -	3691	0.7	- -	- -
Regionalized-3		6	1977	0.4	- -	671	0.1	- -	- -
Regionalized-4	7	6	1977	0.4	- -	671	0.1	- -	- -
Regionalized-5	4	6	1977	0.4	- -	671	0.1	- -	- -
Regionalized-6		2	1977	0.4	- -	671	0.1	- -	- -
Regionalized-7		2	1977	0.4	- -	671	0.1	- -	- -
Centralized-1		1	1977	0.4	- -	671	0.1	- -	- -
Centralized-2		1	1977	0.4	- -	671	0.1	- -	- -
Centralized-3	7	1	1977	0.4	- -	671	0.1	- -	- -
Centralized-4	7	1	1977	0.4	- -	671	0.1	- -	- -
Centralized-5	1	1	1977	0.4	- -	671	0.1	- -	- -

Notes:
T = Treatment
D = Disposal
Water supplied by groundwater in the Ogallala Aquifer. Current water use = 548,000 gallons/day.
Wastewater discharged to onsite playas.
** Ten sites use existing facilities for Volume Reduction.
- - = Stream Flow is not considered for this site.

Table II-12.2–10. Pantex—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
-- = Disposal is not considered for this Alternative.

Table II-12.2-11. Pantex—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income	% ROI Population Increase (2)
No Action	10**	6	120	124	0.12	1.3	0.04	0.09
Decentralized		16	191	197	0.19	2.1	0.06	0.09
Regionalized-1		12	191	197	0.19	2.1	0.06	0.09
Regionalized-2	11	12	197	203	0.20	2.2	0.07	0.09
Regionalized-3		6	120	124	0.12	1.3	0.04	0.09
Regionalized-4	7	6	120	124	0.12	1.3	0.04	0.09
Regionalized-5		6	120	124	0.12	1.3	0.04	0.09
Regionalized-6		2	120	124	0.12	1.3	0.04	0.09
Regionalized-7		2	120	124	0.12	1.3	0.04	0.09
Centralized-1		1	120	124	0.12	1.3	0.04	0.09
Centralized-2		1	120	124	0.12	1.3	0.04	0.09
Centralized-3	7	1	120	124	0.12	1.3	0.04	0.09
Centralized-4	7	1	120	124	0.12	1.3	0.04	0.09
Centralized-5	1	1	120	124	0.12	1.3	0.04	0.09

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-12. Pantex—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Decentralized		16	1.9	0.025	2960	0.20	932	0.17	0.32	0.02	96	3
Regionalized-1		12	1.9	0.025	2960	0.20	932	0.17	0.32	0.02	96	3
Regionalized-2	11	12	4.5	0.058	4599	0.31	3691	0.68	0.79	0.05	98	3
Regionalized-3		6	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Regionalized-4	7	6	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Regionalized-5	4	6	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Regionalized-6		2	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Regionalized-7		2	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Centralized-1		1	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Centralized-2		1	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Centralized-3	7	1	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Centralized-4	7	1	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5
Centralized-5	1	1	1.7	0.0217	1977	0.13	671	0.12	0.19	0.01	130	5

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
** Ten sites use existing facilities for Volume Reduction.

Table II-12.2-13. Pantex—LLW—Cost

LLW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	135	11	48	69	7	135	0	0
Decentralized		16	216	17	58	124	17	135	0	81
Regionalized-1		12	216	17	58	124	17	135	0	81
Regionalized-2	11	12	222	17	60	127	18	142	0	80
Regionalized-3		6	135	11	48	69	7	135	0	0
Regionalized-4	7	6	135	11	48	69	7	135	0	0
Regionalized-5	4	6	135	11	48	69	7	135	0	0
Regionalized-6		2	135	11	48	69	7	135	0	0
Regionalized-7		2	135	11	48	69	7	135	0	0
Centralized-1		1	135	11	48	69	7	135	0	0
Centralized-2		1	135	11	48	69	7	135	0	0
Centralized-3	7	1	135	11	48	69	7	135	0	0
Centralized-4	7	1	135	11	48	69	7	135	0	0
Centralized-5	1	1	135	11	48	69	7	135	0	0

Notes:
** Ten sites use existing facilities for Volume Reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.13.0 PORTS

Ports currently is custodian of significant volumes of LLMW and LLW. Each of the waste types is treated independently in the following sections.

II.13.1 PORTS LLMW

Fifteen tables immediately following portray the impacts of LLMW at Ports. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	PORTS—LLMW—Treatment and Disposal: Estimated Number of Fatalities	II-13.1-1	13-2
2.	PORTS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-13.1-2	13-3
3.	PORTS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-13.1-3	13-4
4.	PORTS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-13.1-4	13-5
5.	PORTS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-13.1-5	13-6
6.	PORTS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure	II-13.1-6	13-7
7.	PORTS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants	II-13.1-7	13-8
8.	PORTS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants	II-13.1-8	13-9
9.	PORTS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-13.1-9	13-10
10.	PORTS—LLMW—Impacts on Water Resources Due to Increased Water Use	II-13.1-10	13-11
11.	PORTS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)	II-13.1-11	13-12
12.	PORTS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)	II-13.1-12	13-13
13.	PORTS—LLMW—Socioeconomic Impacts for Treatment and Disposal	II-13.1-13	13-14
14.	PORTS—LLMW—Infrastructure Impacts for Treatment and Disposal	II-13.1-14	13-15
15.	PORTS—LLMW—Cost	II-13.1-15	13-16

Table II-13.1-1. PORTS—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	1.3E-03	3.3E-02	3.2E-05	3.3E-06	- -	- -
Decentralized	37	16	1.4E-03	4.8E-01	2.7E-06	2.8E-07	3.6E-02	3.0E-02
Regionalized-1	11	12	5.9E-02	3.4E-01	4.9E-05	2.7E-06	5.8E-02	4.8E-02
Regionalized-2	7	6	7.7E-02	4.7E-01	1.1E-04	8.0E-06	- -	- -
Regionalized-3	7	1	7.7E-02	4.7E-01	1.1E-04	8.0E-06	- -	- -
Regionalized-4	4	6	8.3E-04	1.2E-01	1.8E-08	1.9E-09	- -	- -
Centralized	1	1	8.3E-04	1.2E-01	1.8E-08	1.9E-09	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-13.1-2. PORTS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Workers			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	6.4E-02	1.1E-04	5.9E-05	6.4E-06	6.7E-03	1.1E-05	3.3E-05	6.7E-07	3.2E+00	4.5E-03	1.0E-05	1.9E-04
Decentralized	37	16	5.4E-03	9.1E-06	2.3E-06	5.4E-07	5.7E-04	9.6E-07	1.3E-06	5.7E-08	3.6E+00	5.0E-03	5.9E-04	2.1E-04
Regionalized-1	11	12	9.7E-02	1.7E-04	2.3E-06	9.7E-06	5.4E-03	9.1E-06	1.3E-06	5.4E-07	1.5E+02	2.1E-01	5.8E-04	8.9E-03
Regionalized-2	7	6	2.1E-01	3.6E-04	3.7E-06	2.1E-05	1.6E-02	2.7E-05	2.1E-06	1.6E-06	1.9E+02	2.7E-01	1.0E-03	1.1E-02
Regionalized-3	7	1	2.1E-01	3.6E-04	3.7E-06	2.1E-05	1.6E-02	2.7E-05	2.1E-06	1.6E-06	1.9E+02	2.7E-01	1.0E-03	1.1E-02
Regionalized-4	4	6	3.6E-05	6.1E-08	4.9E-08	3.6E-09	3.7E-06	6.4E-09	2.8E-08	3.7E-10	2.1E+00	2.9E-03	8.1E-06	1.2E-04
Centralized	1	1	3.6E-05	6.1E-08	4.9E-08	3.6E-09	3.7E-06	6.4E-09	2.8E-08	3.7E-10	2.1E+00	2.9E-03	8.1E-06	1.2E-04

Notes:
T = Treatment
D = Disposal

Table II-13.1-3. PORTS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	9.0E+01	1.3E-01	5.4E-03
Regionalized-1	11	12	1.5E+02	2.0E-01	8.7E-03
Regionalized-2	7	6	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-13.1-4. PORTS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	4.0E-09	1.9E-09	- -
Decentralized	37	16	3.4E-10	1.6E-10	7.7E-06
Regionalized-1	11	12	6.0E-09	1.5E-09	2.1E-05
Regionalized-2	7	6	1.3E-08	4.5E-09	- -
Regionalized-3	7	1	1.3E-08	4.5E-09	- -
Regionalized-4	4	6	2.2E-12	1.1E-12	- -
Centralized	1	1	2.2E-12	1.1E-12	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-13.1-5. PORTS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	3	-	8.0E-06	1.4E-08	9.8E-09	8.0E-10	3.8E-06	6.4E-09	1.9E-08	3.8E-10	- -	- -	- -	- -
Decentralized	37	16	6.8E-07	1.2E-09	3.9E-10	6.8E-11	3.2E-07	5.4E-10	7.4E-10	3.2E-11	1.3E-02	2.2E-05	1.6E-05	1.3E-06
Regionalized-1	11	12	1.2E-05	2.0E-08	3.8E-10	1.2E-09	3.0E-06	5.2E-09	7.4E-10	3.0E-10	3.5E-02	6.0E-05	2.8E-05	3.5E-06
Regionalized-2	7	6	2.6E-05	4.5E-08	6.1E-10	2.6E-09	9.1E-06	1.5E-08	1.2E-09	9.1E-10	- -	- -	- -	- -
Regionalized-3	7	1	2.6E-05	4.5E-08	6.1E-10	2.6E-09	9.1E-06	1.5E-08	1.2E-09	9.1E-10	- -	- -	- -	- -
Regionalized-4	4	6	4.5E-09	7.6E-12	8.2E-12	4.5E-13	2.1E-09	3.6E-12	1.6E-11	2.1E-13	- -	-	- -	- -
Centralized	1	1	4.5E-09	7.6E-12	8.2E-12	4.5E-13	2.1E-09	3.6E-12	1.6E-11	2.1E-13	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered for this alternative.

Table II-13.1-6. PORTS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	1.2E-05	2.2E-05	3.0E-05	- -
Decentralized	37	16	7.5E-07	1.4E-06	2.0E-03	1.4E+00
Regionalized-1	11	12	7.6E-07	1.5E-06	2.0E-03	2.1E+00
Regionalized-2	7	6	1.1E-06	2.1E-06	3.2E-03	- -
Regionalized-3	7	1	1.1E-06	2.1E-06	3.2E-03	- -
Regionalized-4	4	6	1.0E-08	1.9E-08	3.6E-05	- -
Centralized	1	1	1.0E-08	1.9E-08	3.6E-05	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-13.1-7. PORTS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	8 (1/7)	3 (2/1)	0	0	0	1 (0/1)	8 (1/7)	2 (1/1)	0	0	0	1 (0/1)
Decentralized	37	16	65 (5/60)	24 (12/12)	0	0	0	8 (1/7)	45 (1/44)	13 (4/9)	0	2 (2/0)	0	5 (0/5)
Regionalized-1	11	12	67 (5/62)	26 (14/12)	0	1 (1/0)	1 (1/0)	8 (1/7)	45 (1/44)	13 (4/9)	0	2 (2/0)	0	5 (0/5)
Regionalized-2	7	6	63 (4/59)	22 (10/12)	0	1 (1/0)	1 (1/0)	8 (1/7)	38 (0/38)	13 (5/8)	0	4 (4/0)	0	5 (0/5)
Regionalized-3	7	1	63 (4/59)	22 (10/12)	0	1 (1/0)	1 (1/0)	8 (1/7)	38 (0/38)	13 (5/8)	0	4 (4/0)	0	5 (0/5)
Regionalized-4	4	6	16 (1/15)	5 (2/3)	0	0	0	2 (0/2)	12 (0/12)	2 (0/2)	0	0	0	1 (0/1)
Centralized	1	1	16 (1/15)	5 (2/3)	0	0	0	2 (0/2)	12 (0/12)	2 (0/2)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-13.1-8. PORTS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	--	--	--	--	--	--
Decentralized	37	16	--	--	--	--	--	--
Regionalized-1	11	12	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	1	3	0	1	0	0	--	--	--	--	--	--
Decentralized	37	16	1	9	0	13	0	0	0	0	0	1	0	0
Regionalized-1	11	12	1	11	0	15	0	0	0	0	0	1	1	0
Regionalized-2	7	6	0	13	0	25	1	0	0	0	0	2	1	0
Regionalized-3	7	1	0	13	0	25	1	0	0	0	0	2	1	0
Regionalized-4	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Centralized	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) Ports is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions are assumed to be negligible for the No Action, Regionalized-4, and Centralized Alternatives.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-13.1-9. PORTS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	--	--	0	--	--	0	0	0	0
Decentralized	37	16	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-1	11	12	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-2	7	6	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-3	7	1	0	0	0	--	--	0	--	--	0	0	0	0
Regionalized-4	4	6	0	0	0	--	--	0	--	--	0	0	0	0
Centralized	1	1	0	0	0	--	--	0	--	--	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	--	0	0	0	--	0	0	0	--	--
Decentralized	37	16	--	0	0	0	--	0	0	0	--	--
Regionalized-1	11	12	--	0	0	0	--	0	0	0	--	--
Regionalized-2	7	6	--	0	0	0	--	0	0	0	--	--
Regionalized-3	7	1	--	0	0	0	--	0	0	0	--	--
Regionalized-4	4	6	--	0	0	0	--	0	0	0	--	--
Centralized	1	1	--	0	0	0	--	0	0	0	--	--

Notes:
T = Treatment
D = Disposal
-- = Emissions of this hazardous or toxic air pollutant are assumed to be negligib
Percentages <1% are shown as zeros.

Table II-13.1-10. PORTS—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	2190	<0.1	- -	1893	<0.1	- -	<0.1
Decentralized	37	16	18018	0.1	- -	6727	<0.1	- -	<0.1
Regionalized-1	11	12	19863	0.1	- -	6787	<0.1	- -	<0.1
Regionalized-2	7	6	16024	0.1	- -	6709	<0.1	- -	<0.1
Regionalized-3	7	1	16024	0.1	- -	6709	<0.1	- -	<0.1
Regionalized-4	4	6	3664	<0.1	- -	1888	<0.1	- -	<0.1
Centralized	1	1	3664	<0.1	- -	1888	<0.1	- -	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by groundwater in the Alluvial Aquifer. Current water use = 14,000,000 gallons/day.
Wastewater discharged to the Scioto River. Average flow rate of the Scioto River = 3,036,000,000 gallons/day.
- - = Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-13.1-11. PORTS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)

LLMW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLMW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-13.1-12. PORTS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)

LLMW Alternatives	T	D	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	2	0	20	0	8	0	0
Regionalized-1	11	12	0	3	0	30	0	10	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--

LLMW Alternatives	T	D	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	80	0	0	100	10	0	0
Regionalized-1	11	12	100	0	0	200	20	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-13.1-13. PORTS—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	186	153	0.20	1.6	0.06	0.09
Decentralized	37	16	726	751	0.96	8.0	0.31	0.35
Regionalized-1	11	12	741	765	0.98	8.2	0.31	0.36
Regionalized-2	7	6	662	685	0.88	7.3	0.28	0.32
Regionalized-3	7	1	662	685	0.88	7.3	0.28	0.30
Regionalized-4	4	6	211	218	0.28	2.3	0.09	0.09
Centralized	1	1	211	218	0.28	2.3	0.09	0.09

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-13.1-14. PORTS—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Construction Employment	% of Current Employment
No Action	3	-	1.3	0.04	2190	0.01	1893	0.16	0.81	0.04	55	2
Decentralized	37	16	10.6	0.33	18018	0.05	6727	0.56	1.62	0.08	467	20
Regionalized 1	11	12	12.2	0.38	19863	0.05	6787	0.57	1.84	0.10	484	20
Regionalized 2	7	6	10.3	0.32	16024	0.04	6709	0.56	1.31	0.07	457	19
Regionalized 3	7	1	10.3	0.32	16024	0.04	6709	0.56	1.31	0.07	451	19
Regionalized 4	4	6	2.6	0.08	3664	0.01	1888	0.16	0.37	0.02	113	5
Centralized	1	1	2.6	0.08	3664	0.01	1888	0.16	0.37	0.02	116	5

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts
(1) Based on 1991 Site Employment

Table II-13.1-15. PORTS—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	210	8	28	154	19	95	115	0
Decentralized	37	16	822	76	236	465	45	685	0	137
Regionalized-1	11	12	838	82	240	468	48	672	0	166
Regionalized-2	7	6	749	80	224	411	34	749	0	0
Regionalized-3	7	1	749	80	224	411	34	749	0	0
Regionalized-4	4	6	240	18	58	153	10	240	0	0
Centralized	1	1	240	18	58	153	10	240	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.13.2 PORTS LLW

Thirteen tables immediately following portray the impacts of LLW at Ports. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	PORTS—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-13.2-1	13-18
2.	PORTS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-13.2-2	13-19
3.	PORTS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-13.2-3	13-20
4.	PORTS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-13.2-4	13-21
5.	PORTS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-13.2-5	13-22
7.	PORTS—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-13.2-6	13-23
8.	PORTS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-13.2-7	13-24
9.	PORTS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-13.2-8	13-25
10.	PORTS—LLW—Impacts on Water Resources Due to Increased Water Use	II-13.2-9	13-26
11.	PORTS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-13.2-10	13-27
13.	PORTS—LLW—Socioeconomic Impacts for Treatment and Disposal	II-13.2-11	13-28
14.	PORTS—LLW—Infrastructure Impacts for Treatment and Disposal	II-13.2-12	13-29
15.	PORTS—LLW—Cost	II-13.2-13	13-30

Table II-13.2-1. PORTS—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	5.6E-03	2.4E-01	1.7E-09	1.8E-10	- -	- -
Decentralized		16	4.6E-03	1.5E-01	2.4E-10	2.6E-11	1.3E-02	4.3E-01
Regionalized-1		12	4.6E-03	1.5E-01	2.4E-10	2.6E-11	3.1E-02	4.9E-01
Regionalized-2	11	12	2.8E-02	7.1E-01	5.3E-05	5.4E-06	2.7E-02	2.9E-01
Regionalized-3		6	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Regionalized-4	7	6	3.7E-02	7.2E-01	1.9E-02	5.9E-04	- -	- -
Regionalized-5	4	6	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Regionalized-6		2	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Regionalized-7		2	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Centralized-1		1	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Centralized-2		1	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -
Centralized-3	7	1	3.7E-02	7.2E-01	1.9E-02	5.9E-04	- -	- -
Centralized-4	7	1	3.7E-02	7.2E-01	1.9E-02	5.9E-04	- -	- -
Centralized-5	1	1	4.6E-03	2.3E-01	1.8E-09	1.8E-10	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-13.2–2. PORTS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	3.3E-06	5.7E-09	3.3E-10	3.5E-07	6.0E-10	3.5E-11	1.4E+01	2.0E-02	8.4E-04
Decentralized		16	4.9E-07	8.3E-10	4.9E-11	5.1E-08	8.7E-11	5.1E-12	1.1E+01	1.6E-02	6.8E-04
Regionalized-1		12	4.9E-07	8.3E-10	4.9E-11	5.1E-08	8.7E-11	5.1E-12	1.1E+01	1.6E-02	6.8E-04
Regionalized-2	11	12	1.1E-01	1.8E-04	1.1E-05	1.1E-02	1.8E-05	1.1E-06	6.9E+01	9.6E-02	4.1E-03
Regionalized-3		6	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.3E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Regionalized-4	7	6	3.8E+01	6.4E-02	3.8E-03	1.2E+00	2.0E-03	1.2E-04	9.2E+01	1.3E-01	5.5E-03
Regionalized-5	4	6	3.5E-06	5.9E-09	3.5E-10	3.7E-07	6.2E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Regionalized-6		2	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.3E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Regionalized-7		2	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.3E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Centralized-1		1	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.3E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Centralized-2		1	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.3E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04
Centralized-3	7	1	3.8E+01	6.4E-02	3.8E-03	1.2E+00	2.0E-03	1.2E-04	9.2E+01	1.3E-01	5.5E-03
Centralized-4	7	1	3.8E+01	6.4E-02	3.8E-03	1.2E+00	2.0E-03	1.2E-04	9.2E+01	1.3E-01	5.5E-03
Centralized-5	1	1	3.5E-06	6.0E-09	3.5E-10	3.7E-07	6.2E-10	3.7E-11	1.1E+01	1.6E-02	6.8E-04

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-3. PORTS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	- -	- -	- -
Decentralized		16	3.3E+01	4.6E-02	2.0E-03
Regionalized-1		12	7.8E+01	1.1E-01	4.7E-03
Regionalized-2	11	12	6.6E+01	9.3E-02	4.0E-03
Regionalized-3		6	- -	- -	- -
Regionalized-4	7	6	- -	- -	- -
Regionalized-5	4	6	- -	- -	- -
Regionalized-6		2	- -	- -	- -
Regionalized-7		2	- -	- -	- -
Centralized-1		1	- -	- -	- -
Centralized-2		1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2–4. PORTS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	2.1E-13	9.9E-14	- -
Decentralized		16	3.1E-14	1.4E-14	6.1E-08
Regionalized-1		12	3.1E-14	1.4E-14	5.0E-07
Regionalized-2	11	12	6.6E-09	3.1E-09	8.8E-07
Regionalized-3		6	2.2E-13	1.0E-13	- -
Regionalized-4	7	6	2.3E-06	3.4E-07	- -
Regionalized-5	4	6	2.2E-13	1.0E-13	- -
Regionalized-6		2	2.2E-13	1.0E-13	- -
Regionalized-7		2	2.2E-13	1.0E-13	- -
Centralized-1		1	2.2E-13	1.0E-13	- -
Centralized-2		1	2.2E-13	1.0E-13	- -
Centralized-3	7	1	2.3E-06	3.4E-07	- -
Centralized-4	7	1	2.3E-06	3.4E-07	- -
Centralized-5	1	1	2.2E-13	1.0E-13	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-5. PORTS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	4.2E-10	7.2E-13	4.2E-14	2.0E-10	3.4E-13	2.0E-14	- -	- -	- -
Decentralized		16	6.2E-11	1.1E-13	<9.9E-14	2.9E-11	4.9E-14	<9.9E-14	1.2E-04	2.1E-07	1.2E-08
Regionalized-1		12	6.2E-11	1.1E-13	<9.9E-14	2.9E-11	4.9E-14	<9.9E-14	1.0E-03	1.7E-06	1.0E-07
Regionalized-2	11	12	1.3E-05	2.2E-08	1.3E-09	6.1E-06	1.0E-08	6.1E-10	1.7E-03	2.9E-06	1.7E-07
Regionalized-3		6	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Regionalized-4	7	6	4.6E-03	7.9E-06	4.6E-07	6.8E-04	1.2E-06	6.8E-08	- -	- -	- -
Regionalized-5	4	6	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Regionalized-6		2	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Regionalized-7		2	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Centralized-1		1	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Centralized-2		1	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -
Centralized-3	7	1	4.6E-03	7.9E-06	4.6E-07	6.8E-04	1.2E-06	6.8E-08	- -	- -	- -
Centralized-4	7	1	4.6E-03	7.9E-06	4.6E-07	6.8E-04	1.2E-06	6.8E-08	- -	- -	- -
Centralized-5	1	1	4.4E-10	7.5E-13	4.4E-14	2.1E-10	3.5E-13	2.1E-14	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-6. PORTS—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	32 (11/21)	32 (28/4)	0	2 (2/0)	3 (3/0)	6 (3/3)	17 (1/16)	6 (2/4)	0	0	0	2 (0/2)
Decentralized		16	174 (124/50)	335 (325/10)	0	26 (26/0)	31 (31/0)	37 (31/6)	43 (2/41)	15 (5/10)	0	1 (1/0)	0	5 (0/5)
Regionalized-1		12	219 (169/50)	451 (441/10)	0	35 (35/0)	42 (42/0)	49 (43/6)	32 (3/29)	13 (6/7)	0	1 (1/0)	0	4 (0/4)
Regionalized-2	11	12	245 (155/90)	422 (404/18)	0	32 (32/0)	38 (38/0)	50 (39/11)	86 (3/83)	24 (6/18)	0	2 (2/0)	0	10 (0/10)
Regionalized-3		6	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Regionalized-4	7	6	89 (27/62)	83 (71/12)	0	6 (6/0)	7 (7/0)	14 (7/7)	58 (0/58)	17 (2/15)	0	1 (1/0)	0	7 (0/7)
Regionalized-5	4	6	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Regionalized-6		2	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Regionalzied-7		2	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Centralized-1		1	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Centralized-2		1	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)
Centralized-3	7	1	89 (27/62)	83 (71/12)	0	6 (6/0)	7 (7/0)	14 (7/7)	58 (0/58)	17 (2/15)	0	1	0	7 (0/7)
Centralized-4	7	1	89 (27/62)	83 (71/12)	0	6 (6/0)	7 (7/0)	14 (7/7)	58 (0/58)	17 (2/15)	0	1	0	7 (0/7)
Centralized-5	1	1	17 (6/11)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	12 (0/12)	5 (0/5)	0	0	0	2 (0/2)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-7. PORTS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	1	4	0	2	0	0	--	--	--	--	--	--
Decentralized		16	2	11	0	5	0	1	--	--	--	--	--	--
Regionalized-1		12	3	16	0	7	0	1	--	--	--	--	--	--
Regionalized-2	11	12	3	16	0	10	0	1	0	0	0	0	0	0
Regionalized-3		6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	7	6	0	4	0	6	0	0	0	0	0	0	0	0
Regionalized-5	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-6		2	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-7		2	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-1		1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-2		1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-3	7	1	0	4	0	6	0	0	0	0	0	0	0	0
Centralized-4	7	1	0	4	0	6	0	0	0	0	0	0	0	0
Centralized-5	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) Ports is in an attainment area for all criteria pollutants, therefore the GCR do not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for all but the Regionalized-2 and -4, and Centralized-3 and -4 Alternatives are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-8. PORTS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	5	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	5	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	5	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	10**	6	--	--	--	--	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T= Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-9. PORTS—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	8079	0.1	- -	22144	0.2	- -	<0.1
Decentralized		16	130210	0.9	- -	4659	<0.1	- -	<0.1
Regionalized-1		12	178908	1.3	- -	4780	<0.1	- -	<0.1
Regionalized-2	11	12	157092	1.1	- -	11265	0.1	- -	<0.1
Regionalized-3		6	3997	<0.1	- -	1094	<0.1	- -	<0.1
Regionalized-4	7	6	20383	0.1	- -	7814	0.1	- -	<0.1
Regionalized-5	4	6	3997	<0.1	- -	1094	<0.1	- -	<0.1
Regionalized-6		2	3997	<0.1	- -	1094	<0.1	- -	<0.1
Regionalized-7		2	3997	<0.1	- -	1094	<0.1	- -	<0.1
Centralized-1		1	3997	<0.1	- -	1094	<0.1	- -	<0.1
Centralized-2		1	3997	<0.1	- -	1094	<0.1	- -	<0.1
Centralized-3	7	1	20383	0.1	- -	7814	0.1	- -	<0.1
Centralized-4	7	1	20383	0.1	- -	7814	0.1	- -	<0.1
Centralized-5	1	1	3997	<0.1	- -	1094	<0.1	- -	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by groundwater in the Alluvial Aquifer. Current water use = 14,000,000 gallons/day.
Wastewater discharged to the Scioto River. Average flow rate of the Scioto River = 3,036,000,000 gallons/day.
** Ten sites use existing facilities for Volume Reduction.
- - = Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-13.2-10. PORTS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
- - = Disposal is not considered for this Alternative.

Table II-13.2-11. PORTS—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	10**	6	474	392	0.50	4.2	0.16	0.20
Decentralized		16	1079	1115	1.43	11.9	0.46	0.24
Regionalized-1		12	1228	1269	1.63	13.5	0.52	0.23
Regionalized-2	11	12	1269	1312	1.69	14.0	0.54	0.62
Regionalized-3		6	149	154	0.20	1.6	0.06	0.08
Regionalized-4	7	6	860	888	1.14	9.5	0.37	0.42
Regionalized-5		6	149	154	0.20	1.6	0.06	0.08
Regionalized-6		2	149	154	0.20	1.6	0.06	0.08
Regionalized-7		2	149	154	0.20	1.6	0.06	0.08
Centralized-1		1	149	154	0.20	1.6	0.06	0.08
Centralized-2		1	149	154	0.20	1.6	0.06	0.08
Centralized-3	7	1	860	888	1.14	9.5	0.37	0.42
Centralized-4	7	1	860	888	1.14	9.5	0.37	0.42
Centralized-5	1	1	149	154	0.20	1.6	0.06	0.08

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2–12. PORTS—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	23.0	0.72	22144	0.06	22144	1.85	5.31	0.28	164	7
Decentralized		16	16.6	0.52	130210	0.35	4659	0.39	19.48	1.01	387	16
Regionalized-1		12	43.5	1.40	178908	0.48	4780	0.40	26.84	1.39	387	16
Regionalized-2	11	12	44.7	1.40	157092	0.42	11265	0.94	23.02	1.19	696	29
Regionalized-3		6	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Regionalized-4	7	6	10.1	0.32	20383	0.06	7814	0.66	2.82	0.15	483	20
Regionalized-5	4	6	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Regionalized-6		2	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Regionalized-7		2	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Centralized-1		1	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Centralized-2		1	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4
Centralized-3	7	1	10.1	0.32	20383	0.06	7814	0.66	2.82	0.15	482	20
Centralized-4	7	1	10.1	0.32	20383	0.06	7814	0.66	2.82	0.15	482	20
Centralized-5	1	1	2.0	0.06	3997	0.01	1094	0.09	0.44	0.02	85	4

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1990 Site Employment.
** Ten sites use existing facilities for Volume Reduction.

Table II-13.2-13. PORTS—LLW—Cost

LLW Alternatives	T	D	Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
				Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	536	26	79	403	28	536	0	0
Decentralized		16	1221	77	491	513	141	169	0	1052
Regionalized-1		12	1389	119	533	555	183	169	0	1221
Regionalized-2	11	12	1436	130	307	873	125	914	0	522
Regionalized-3		6	169	15	38	106	11	169	0	0
Regionalized-4	7	6	973	98	204	610	60	973	0	0
Regionalized-5	4	6	169	15	38	106	11	169	0	0
Regionalized-6		2	169	15	38	106	11	169	0	0
Regionalized-7		2	169	15	38	106	11	169	0	0
Centralized-1		1	169	15	38	106	11	169	0	0
Centralized-2		1	169	15	38	106	11	169	0	0
Centralized-3	7	1	973	98	204	610	60	973	0	0
Centralized-4	7	1	973	98	204	610	60	973	0	0
Centralized-5	1	1	169	15	38	106	11	169	0	0

Notes:
** Ten sites use existing facilities for Volume Reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.14.0 RFETS

RFETS currently is custodian of significant volumes of LLMW, LLW, and TRUW. Each of the waste types is treated independently in the following sections.

14.1 RFETS LLMW

Fifteen tables immediately following portray the impacts of LLMW at RFETS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	RFETS—LLMW—Treatment and Disposal: Estimated Number of Fatalities	II-14.1-1	14-2
2.	RFETS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-14.1-2	14-3
3.	RFETS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-14.1-3	14-4
4.	RFETS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-14.1-4	14-5
5.	RFETS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-14.1-5	14-6
6.	RFETS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure	II-14.1-6	14-7
7.	RFETS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants	II-14.1-7	14-8
8.	RFETS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants	II-14.1-8	14-9
9.	RFETS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-14.1-9	14-10
10.	RFETS—LLMW—Impacts on Water Resources Due to Increased Water Use	II-14.1-10	14-11
11.	RFETS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)	II-14.1-11	14-12
12.	RFETS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)	II-14.1-12	14-13
13.	RFETS—LLMW—Socioeconomic Impacts for Treatment and Disposal	II-14.1-13	14-14
14.	RFETS—LLMW—Infrastructure Impacts for Treatment and Disposal	II-14.1-14	14-15
15.	RFETS—LLMW—Cost	II-14.1-15	14-16

Table II-14.1-1. RFETS—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	1.8E-03	2.3E-01	1.3E-02	6.7E-04	- -	- -
Decentralized	37	16	1.0E-03	6.2E-01	8.8E-05	4.5E-06	2.3E-03	6.9E-02
Regionalized-1	11	12	1.0E-03	6.2E-01	8.8E-05	4.5E-06	2.3E-03	6.9E-02
Regionalized-2	7	6	1.2E-03	6.2E-01	8.9E-05	4.5E-06	- -	- -
Regionalized-3	7	1	1.2E-03	6.2E-01	8.9E-05	4.5E-06	- -	- -
Regionalized-4	4	6	9.9E-04	2.1E-01	6.3E-06	3.2E-07	- -	- -
Centralized	1	1	9.9E-04	2.1E-01	6.3E-06	3.2E-07	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-14.1-2. RFETS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Worker			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	2.6E+01	4.5E-02	1.0E-03	2.6E-03	7.3E+00	1.2E-04	2.0E-04	7.3E-04	4.5E+00	6.3E-03	3.6E-05	2.7E-04
Decentralized	37	16	1.8E-01	3.0E-04	5.0E-05	1.8E-05	9.0E-03	1.5E-05	1.0E-05	9.0E-07	2.5E+00	3.6E-03	5.6E-04	1.5E-04
Regionalized-1	11	12	1.8E-01	3.0E-04	5.0E-05	1.8E-05	9.0E-03	1.5E-05	1.0E-05	9.0E-07	2.5E+00	3.6E-03	5.6E-04	1.5E-04
Regionalized-2	7	6	1.8E-01	3.0E-04	2.6E-05	1.8E-05	9.1E-03	1.5E-05	5.3E-06	9.1E-07	2.9E+00	4.1E-03	5.6E-04	1.7E-04
Regionalized-3	7	1	1.8E-01	3.0E-04	2.6E-05	1.8E-05	9.1E-03	1.5E-05	5.3E-06	9.1E-07	2.9E+00	4.1E-03	5.6E-04	1.7E-04
Regionalized-4	4	6	1.3E-02	2.1E-05	2.4E-06	1.3E-06	6.4E-04	1.1E-06	4.8E-07	6.4E-08	2.5E+00	3.5E-03	2.5E-05	1.5E-04
Centralized	1	1	1.3E-02	2.1E-05	2.4E-06	1.3E-06	6.4E-04	1.1E-06	4.8E-07	6.4E-08	2.5E+00	3.5E-03	2.5E-05	1.5E-04

Notes:
T = Treatment
D = Disposal

Table II-14.1-3. RFETS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	5.8E+00	8.2E-03	3.5E-04
Regionalized-1	11	12	5.8E+00	8.2E-03	3.5E-04
Regionalized-2	7	6	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-14.1-4. RFETS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	1.8E-07	4.0E-07	- -
Decentralized	37	16	1.2E-09	2.7E-09	3.9E-07
Regionalized-1	11	12	1.2E-09	2.7E-09	3.9E-07
Regionalized-2	7	6	1.2E-09	2.7E-09	- -
Regionalized-3	7	1	1.2E-09	2.7E-09	- -
Regionalized-4	4	6	8.5E-11	1.9E-10	- -
Centralized	1	1	8.5E-11	1.9E-10	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-14.1-5. RFETS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	3	-	3.6E-04	6.1E-07	8.0E-09	3.6E-08	8.0E-04	1.4E-06	1.0E-07	8.0E-08	- -	- -	- -	- -
Decentralized	37	16	2.4E-06	4.0E-09	4.0E-10	2.4E-10	5.4E-06	9.1E-09	5.1E-09	5.4E-10	7.8E-04	1.3E-06	2.8E-04	7.8E-08
Regionalized-1	11	12	2.4E-06	4.0E-09	4.0E-10	2.4E-10	5.4E-06	9.1E-09	5.1E-09	5.4E-10	7.8E-04	1.3E-06	2.8E-04	7.8E-08
Regionalized-2	7	6	2.4E-06	4.1E-09	2.1E-10	2.4E-10	5.4E-06	9.2E-09	2.7E-09	5.4E-10	- -	- -	- -	- -
Regionalized-3	7	1	2.4E-06	4.1E-09	2.1E-10	2.4E-10	5.4E-06	9.2E-09	2.7E-09	5.4E-10	- -	- -	- -	- -
Regionalized-4	4	6	1.7E-07	2.9E-10	1.9E-11	1.7E-11	3.8E-07	6.5E-10	2.4E-10	3.8E-11	- -	- -	- -	- -
Centralized	1	1	1.7E-07	2.9E-10	1.9E-11	1.7E-11	3.8E-07	6.5E-10	2.4E-10	3.8E-11	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered for this alternative.

Table II-14.1-6. RFETS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	9.1E-07	1.2E-05	1.7E-05	- -
Decentralized	37	16	1.2E-07	1.5E-06	3.4E-04	3.0E+00
Regionalized-1	11	12	1.2E-07	1.5E-06	3.4E-04	3.0E+00
Regionalized-2	7	6	7.4E-08	9.5E-07	3.4E-04	- -
Regionalized-3	7	1	7.4E-08	9.5E-07	3.4E-04	- -
Regionalized-4	4	6	4.0E-09	5.1E-08	2.7E-05	- -
Centralized	1	1	4.0E-09	5.1E-08	2.7E-05	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-14.1-7. RFETS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	95 (31/64)	94 (81/13)	0	6 (6/0)	8 (8/0)	16 (8/8)	23 (1/22)	6 (2/4)	0	0	0	3 (0/3)
Decentralized	37	16	169 (33/136)	114 (87/27)	0	7 (7/0)	8 (8/0)	24 (8/16)	82 (2/80)	25 (9/16)	0	5 (5/0)	0	10 (0/10)
Regionalized-1	11	12	169 (33/136)	114 (87/27)	0	7 (7/0)	8 (8/0)	24 (8/16)	82 (2/80)	25 (9/16)	0	5 (5/0)	0	10 (0/10)
Regionalized-2	7	6	107 (5/102)	32 (12/20)	0	1 (1/0)	1 (1/0)	13 (1/12)	53 (1/52)	17 (6/11)	0	5 (5/0)	0	6 (0/6)
Regionalized-3	7	1	107 (5/102)	32 (12/20)	0	1 (1/0)	1 (1/0)	13 (1/12)	53 (1/52)	17 (6/11)	0	5 (5/0)	0	6 (0/6)
Regionalized-4	4	6	47 (2/45)	16 (7/9)	0	1 (1/0)	1 (1/0)	6 (1/5)	24 (0/24)	5 (0/5)	0	0	0	3 (0/3)
Centralized	1	1	47 (2/45)	16 (7/9)	0	1 (1/0)	1 (1/0)	6 (1/5)	24 (0/24)	5 (0/5)	0	0	0	3 (0/3)

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-14.1–8. RFETS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	95 (31/64)	94 (81/13)	- -	7 (7/0)	- -	31 (16/15)
Decentralized	37	16	169 (33/136)	114 (87/27)	- -	7 (7/0)	- -	50 (17/33)
Regionalized-1	11	12	169 (33/136)	114 (87/27)	- -	7 (7/0)	- -	50 (17/33)
Regionalized-2	7	6	107 (5/102)	32 (12/20)	- -	1 (1/0)	- -	27 (2/25)
Regionalized-3	7	1	107 (5/102)	32 (12/20)	- -	1 (1/0)	- -	27 (2/25)
Regionalized-4	4	6	48 (3/45)	16 (7/9)	- -	1 (1/0)	- -	12 (1/11)
Centralized	1	1	48 (3/45)	16 (7/9)	- -	1 (1/0)	- -	12 (1/11)

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (6)	NO2 (5)	Pb (4)	PM10 (6)	SO2 (4)	VOC (5)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	23 (1/22)	7 (3/4)	0	0	0	6 (1/5)	- -	- -	- -	- -	- -	- -
Decentralized	37	16	81 (1/80)	25 (9/16)	0	5 (5/0)	1	20 (1/19)	0	0	0	0	5	0
Regionalized-1	11	12	81 (1/80)	25 (9/16)	0	5 (5/0)	1	20 (1/19)	0	0	0	0	5	0
Regionalized-2	7	6	53 (1/52)	17 (6/11)	0	5 (5/0)	1	13 (0/13)	0	0	0	0	5	0
Regionalized-3	7	1	53 (1/52)	17 (6/11)	0	5 (5/0)	1	13 (0/13)	0	0	0	0	5	0
Regionalized-4	4	6	24 (0/24)	5 (0/5)	0	0	0	6 (0/6)	- -	- -	- -	- -	- -	- -
Centralized	1	1	24 (0/24)	5 (0/5)	0	0	0	6 (0/6)	- -	- -	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) GCR de minimus levels are applied, since PSD regulations are not applicable to construction activities. Values = % of total emissions (% of equipment emissions / % of worker vehicles emission).
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions are assumed to be negligible for the No Action, Regionalized-4, and Centralized Alternatives.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
(5) Nonattainment area for ozone. Pollutant is an ozone precursor, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
(6) Nonattainment area for this pollutant, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emission / % of transportation emission).

Table II-14.1-9. RFETS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Decentralized	37	16	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-1	11	12	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-2	7	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-3	7	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-4	4	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Centralized	1	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	- -	0	0	0	- -	0	0	0	- -	- -
Decentralized	37	16	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-1	11	12	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-2	7	6	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-3	7	1	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-4	4	6	- -	0	0	0	- -	0	0	0	- -	- -
Centralized	1	1	- -	0	0	0	- -	0	0	0	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-14.1-10. RFETS—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	75070	27.6	- -	5199	1.9	- -	<0.1
Decentralized	37	16	89025	32.7	- -	11099	4.1	- -	<0.1
Regionalized-1	11	12	89025	32.7	- -	11099	4.1	- -	<0.1
Regionalized-2	7	6	20720	7.6	- -	9238	3.4	- -	<0.1
Regionalized-3	7	1	20720	7.6	- -	9238	3.4	- -	<0.1
Regionalized-4	4	6	7271	2.7	- -	3478	1.3	- -	<0.1
Centralized	1	1	7271	2.7	- -	3478	1.3	- -	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by municipal water from the Denver Water Board.
Current water use = 272,000 gallons/day
Wastewater discharged to Walnut Creek. Average flow rate of Walnut Creek = 142,000,000 gallons/day.
- - = Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-14.1-11. RFETS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)

LLMW Alternatives	Number of Sites		Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
	T	D																					
No Action	3	-	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Centralized	1	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

LLMW Alternatives	Number of Sites		Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
	T	D																						
No Action	3	-	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Centralized	1	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = No disposal at this site for this alternative.

Table II-14.1-12. RFETS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)

LLMW Alternatives	T	D	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	3	0	20	0	100	0	0
Regionalized-1	11	12	0	3	0	20	0	100	0	0
Regionalized-2	7	6	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--

LLMW Alternatives	T	D	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	200	0	0	400	10	1	0
Regionalized-1	11	12	200	0	0	400	10	1	0
Regionalized-2	7	6	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-14.1-13. RFETS—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	912	765	0.06	8.6	0.02	0.04
Decentralized	37	16	1614	1693	0.14	19.0	0.05	0.07
Regionalized-1	11	12	1614	1693	0.14	19.0	0.05	0.07
Regionalized-2	7	6	1091	1144	0.10	12.9	0.03	0.05
Regionalized-3	7	1	1091	1144	0.10	12.9	0.03	0.05
Regionalized-4	4	6	554	581	0.05	6.5	0.02	0.02
Centralized	1	1	554	581	0.05	6.5	0.02	0.02

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-14.1-14. RFETS—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Construction Employment	% of Current Employment
No Action	3	-	25.9	0.45	75070	7.51	5199	1.04	10.75	31.17	497	7
Decentralized	37	16	32.9	0.57	89025	8.90	11099	2.22	11.49	33.31	1055	14
Regionalized 1	11	12	32.9	0.57	89025	8.90	11099	2.22	11.49	33.31	1055	14
Regionalized 2	7	6	13.1	0.23	20720	2.07	9238	1.85	1.60	4.65	778	11
Regionalized 3	7	1	13.1	0.23	20720	2.07	9238	1.85	1.60	4.65	778	11
Regionalized 4	4	6	6.2	0.11	7271	0.73	3478	0.70	0.86	2.50	347	5
Centralized	1	1	6.2	0.11	7271	0.73	3478	0.70	0.86	2.50	347	5

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts
(1) Based on 1991 Site Employment

Table II-14.1-15. RFETS—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	1032	56	271	467	238	537	494	0
Decentralized	37	16	1826	117	587	808	314	1234	0	591
Regionalized-1	11	12	1826	117	587	808	314	1234	0	591
Regionalized-2	7	6	1236	99	434	661	42	1236	0	0
Regionalized-3	7	1	1236	99	434	661	42	1236	0	0
Regionalized-4	4	6	627	43	190	368	26	627	0	0
Centralized	1	1	627	43	190	368	26	627	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.14.2 RFETS LLW

Thirteen tables immediately following portray the impacts of LLW at RFETS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	RFETS—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-14.2-1	14-18
2.	RFETS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-14.2-2	14-19
3.	RFETS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-14.2-3	14-20
4.	RFETS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-14.2-4	14-21
5.	RFETS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-14.2-5	14-22
7.	RFETS—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-14.2-6	14-23
8.	RFETS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-14.2-7	14-24
9.	RFETS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-14.2-8	14-25
10.	RFETS—LLW—Impacts on Water Resources Due to Increased Water Use	II-14.2-9	14-26
11.	RFETS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-14.2-10	14-27
13.	RFETS—LLW—Socioeconomic Impacts for Treatment and Disposal	II-14.2-11	14-28
14.	RFETS—LLW—Infrastructure Impacts for Treatment and Disposal	II-14.2-12	14-29
15.	RFETS—LLW—Cost	II-14.2-13	14-30

Table II-14.2-1. RFETS—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	1.9E-03	1.2E-01	1.2E-07	6.2E-09	- -	- -
Decentralized		16	1.1E-03	7.0E-02	3.6E-07	1.8E-08	2.8E-03	1.4E-01
Regionalized-1		12	1.1E-03	7.0E-02	3.6E-07	1.8E-08	2.8E-03	1.4E-01
Regionalized-2	11	12	1.1E-03	2.2E-01	1.9E-04	9.5E-06	1.6E-03	6.6E-02
Regionalized-3		6	1.2E-03	8.0E-02	4.0E-07	2.0E-08	- -	- -
Regionalized-4	7	6	1.1E-03	2.2E-01	1.9E-04	9.5E-06	- -	- -
Regionalized-5	4	6	1.2E-03	7.9E-02	4.0E-07	2.0E-08	- -	- -
Regionalized-6		2	1.2E-03	8.0E-02	4.0E-07	2.0E-08	- -	- -
Regionalized-7		2	1.2E-03	8.0E-02	4.0E-07	2.0E-08	- -	- -
Centralized-1		1	1.2E-03	8.0E-02	4.0E-07	2.0E-08	- -	- -
Centralized-2		1	1.2E-03	8.0E-02	4.0E-07	2.0E-08	- -	- -
Centralized-3	7	1	1.1E-03	2.2E-01	1.9E-04	9.5E-06	- -	- -
Centralized-4	7	1	1.1E-03	2.2E-01	1.9E-04	9.5E-06	- -	- -
Centralized-5	1	1	1.2E-03	7.9E-02	4.0E-07	2.0E-08	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-14.2–2. RFETS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	2.4E-04	4.1E-07	2.4E-08	1.2E-05	2.1E-08	1.2E-09	4.6E+00	6.5E-03	2.8E-04
Decentralized		16	7.1E-04	1.2E-06	7.1E-08	3.7E-05	6.2E-08	3.7E-09	2.9E+00	4.0E-03	1.7E-04
Regionalized-1		12	7.1E-04	1.2E-06	7.1E-08	3.7E-05	6.2E-08	3.7E-09	2.9E+00	4.0E-03	1.7E-04
Regionalized-2	11	12	3.7E-01	6.3E-04	3.7E-05	1.9E-02	3.2E-05	1.9E-06	2.9E+00	4.0E-03	1.7E-04
Regionalized-3		6	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Regionalized-4	7	6	3.7E-01	6.3E-04	3.7E-05	1.9E-02	3.2E-05	1.9E-06	2.9E+00	4.0E-03	1.7E-04
Regionalized-5	4	6	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Regionalized-6		2	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Regionalized-7		2	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Centralized-1		1	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Centralized-2		1	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04
Centralized-3	7	1	3.7E-01	6.3E-04	3.7E-05	1.9E-02	3.2E-05	1.9E-06	2.9E+00	4.0E-03	1.7E-04
Centralized-4	7	1	3.7E-01	6.3E-04	3.7E-05	1.9E-02	3.2E-05	1.9E-06	2.9E+00	4.0E-03	1.7E-04
Centralized-5	1	1	8.0E-04	1.4E-06	8.0E-08	4.1E-05	6.9E-08	4.1E-09	2.9E+00	4.0E-03	1.7E-04

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-3. RFETS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	- -	- -	- -
Decentralized		16	7.1E+00	9.9E-03	4.3E-04
Regionalized-1		12	7.1E+00	9.9E-03	4.3E-04
Regionalized-2	11	12	4.0E+00	5.6E-03	2.4E-04
Regionalized-3		6	- -	- -	- -
Regionalized-4	7	6	- -	- -	- -
Regionalized-5	4	6	- -	- -	- -
Regionalized-6		2	- -	- -	- -
Regionalized-7		2	- -	- -	- -
Centralized-1		1	- -	- -	- -
Centralized-2		1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2–4. RFETS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	1.6E-12	3.7E-12	- -
Decentralized		16	4.9E-12	1.1E-11	2.7E-08
Regionalized-1		12	4.9E-12	1.1E-11	2.7E-08
Regionalized-2	11	12	2.5E-09	5.7E-09	8.1E-08
Regionalized-3		6	5.4E-12	1.2E-11	- -
Regionalized-4	7	6	2.5E-09	5.7E-09	- -
Regionalized-5	4	6	5.4E-12	1.2E-11	- -
Regionalized-6		2	5.4E-12	1.2E-11	- -
Regionalized-7		2	5.4E-12	1.2E-11	- -
Centralized-1		1	5.4E-12	1.2E-11	- -
Centralized-2		1	5.4E-12	1.2E-11	- -
Centralized-3	7	1	2.5E-09	5.7E-09	- -
Centralized-4	7	1	2.5E-09	5.7E-09	- -
Centralized-5	1	1	5.4E-12	1.2E-11	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-5. RFETS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	3.3E-09	5.6E-12	3.3E-13	7.4E-09	1.3E-11	7.4E-13	- -	- -	- -
Decentralized		16	9.7E-09	1.7E-11	9.7E-13	2.2E-08	3.7E-11	2.2E-12	5.4E-05	9.2E-08	5.4E-09
Regionalized-1		12	9.7E-09	1.7E-11	9.7E-13	2.2E-08	3.7E-11	2.2E-12	5.4E-05	9.2E-08	5.4E-09
Regionalized-2	11	12	5.1E-06	8.6E-09	5.1E-10	1.1E-05	1.9E-08	1.1E-09	1.6E-04	2.8E-07	1.6E-08
Regionalized-3		6	1.1E-08	1.8E-11	1.1E-12	2.4E-08	4.2E-11	2.5E-12	- -	- -	- -
Regionalized-4	7	6	5.1E-06	8.6E-09	5.1E-10	1.1E-05	1.9E-08	1.1E-09	- -	- -	- -
Regionalized-5	4	6	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -
Regionalized-6		2	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -
Regionalized-7		2	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -
Centralized-1		1	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -
Centralized-2		1	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -
Centralized-3	7	1	5.1E-06	8.6E-09	5.1E-10	1.1E-05	1.9E-08	1.1E-09	- -	- -	- -
Centralized-4	7	1	5.1E-06	8.6E-09	5.1E-10	1.1E-05	1.9E-08	1.1E-09	- -	- -	- -
Centralized-5	1	1	1.1E-08	1.8E-11	1.1E-12	2.5E-08	4.2E-11	2.5E-12	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-6. RFETS—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	12 (4/8)	12 (10/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	7 (0/7)	2 (0/2)	0	0	0	1 (0/1)
Decentralized		16	28 (16/12)	45 (43/2)	0	3 (3/0)	4 (4/0)	5 (4/1)	39 (0/39)	8 (0/8)	0	0	0	5 (0/5)
Regionalized-1		12	28 (16/12)	45 (43/2)	0	3 (3/0)	4 (4/0)	5 (4/1)	39 (0/39)	8 (0/8)	0	0	0	5 (0/5)
Regionalized-2	11	12	38 (28/10)	76 (74/2)	0	6 (6/0)	7 (7/0)	8 (7/1)	56 (0/55)	13 (2/11)	0	1 (1/0)	0	7 (0/7)
Regionalized-3		6	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-4	7	6	26 (21/5)	55 (54/1)	0	4 (4/0)	5 (5/0)	6 (5/1)	33 (0/33)	8 (1/7)	0	1 (1/0)	0	4 (0/4)
Regionalized-5	4	6	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-6		2	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Regionalzied-7		2	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Centralized-1		1	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Centralized-2		1	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)
Centralized-3	7	1	26 (21/5)	55 (54/1)	0	4 (4/0)	5 (5/0)	6 (5/1)	33 (0/33)	8 (1/7)	0	1 (1/0)	0	4 (0/4)
Centralized-4	7	1	26 (21/5)	55 (54/1)	0	4 (4/0)	5 (5/0)	6 (5/1)	33 (0/33)	8 (1/7)	0	1 (1/0)	0	4 (0/4)
Centralized-5	1	1	15 (1/14)	6 (3/3)	0	0	0	2 (0/2)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-7. RFETS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	12 (4/8)	12 (10/2)	--	1 (1/0)	--	4 (2/2)
Decentralized		16	28 (16/12)	45 (43/2)	--	3 (3/0)	--	11 (8/3)
Regionalized-1		12	28 (16/12)	45 (43/2)	--	3 (3/0)	--	11 (8/3)
Regionalized-2	11	12	38 (28/10)	76 (74/2)	--	6 (6/0)	--	16 (14/2)
Regionalized-3		6	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Regionalized-4	7	6	26 (21/5)	55 (54/1)	--	4 (4/0)	--	11 (10/1)
Regionalized-5	4	6	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Regionalized-6		2	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Regionalized-7		2	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Centralized-1		1	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Centralized-2		1	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)
Centralized-3	7	1	26 (21/5)	55 (54/1)	--	4 (4/0)	--	11 (10/1)
Centralized-4	7	1	26 (21/5)	55 (54/1)	--	4 (4/0)	--	11 (10/1)
Centralized-5	1	1	15 (1/14)	6 (3/3)	--	0	--	4 (1/3)

LLW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (6)	NO2 (5)	Pb (4)	PM10 (6)	SO2 (4)	VOC (5)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	7 (0/7)	2 (0/2)	0	0	0	2 (0/2)	--	--	--	--	--	--
Decentralized		16	39 (0/39)	8 (0/8)	0	0	0	9 (0/9)	--	--	--	--	--	--
Regionalized-1		12	39 (0/39)	8 (0/8)	0	0	0	9 (0/9)	--	--	--	--	--	--
Regionalized-2	11	12	55 (0/55)	12 (1/11)	0	1 (1/0)	0	13 (0/13)	0	0	0	0	0	0
Regionalized-3		6	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Regionalized-4	7	6	33 (0/33)	8 (1/7)	0	1 (1/0)	0	8 (0/8)	0	0	0	0	0	0
Regionalized-5	4	6	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Regionalized-6		2	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Regionalized-7		2	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Centralized-1		1	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Centralized-2		1	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--
Centralized-3	7	1	33 (0/33)	8 (1/7)	0	1 (1/0)	0	8 (0/8)	0	0	0	0	0	0
Centralized-4	7	1	33 (0/33)	8 (1/7)	0	1 (1/0)	0	8 (0/8)	0	0	0	0	0	0
Centralized-5	1	1	11 (0/11)	2 (0/2)	0	0	0	3 (0/3)	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) GCR de minimus levels are applied, since PSD regulations are not applicable to construction activities. Values = % of total emissions (% of equipment emissions / % of worker vehicle emissions)
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for all but the Regionalized-2 and -4, and Centralized-3 and -4 Alternatives are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
(5) Nonattainment area for ozone. Pollutant is an ozone precursor, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
(6) Nonattainment area for this pollutant, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2–8. RFETS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	10**	6	--	--	--	--	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T= Treatment
D = Disposal
-- = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-9. RFETS—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	2490	0.9	- -	914	0.3	- -	<0.1
Decentralized		16	12497	4.6	- -	5080	1.9	- -	<0.1
Regionalized-1		12	12497	4.6	- -	5080	1.9	- -	<0.1
Regionalized-2	11	12	17980	6.6	- -	11997	4.4	- -	<0.1
Regionalized-3		6	4025	1.5	- -	1478	0.5	- -	<0.1
Regionalized-4	7	6	11527	4.2	- -	9106	3.3	- -	<0.1
Regionalized-5	4	6	4025	1.5	- -	1478	0.5	- -	<0.1
Regionalized-6		2	4025	1.5	- -	1478	0.5	- -	<0.1
Regionalized-7		2	4025	1.5	- -	1478	0.5	- -	<0.1
Centralized-1		1	4025	1.5	- -	1478	0.5	- -	<0.1
Centralized-2		1	4025	1.5	- -	1478	0.5	- -	<0.1
Centralized-3	7	1	11527	4.2	- -	9106	3.3	- -	<0.1
Centralized-4	7	1	11527	4.2	- -	9106	3.3	- -	<0.1
Centralized-5	1	1	4025	1.5	- -	1478	0.5	- -	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by municipal water from the Denver Water Board. Current water use = 272,000 gallons/day.
Wastewater discharged to Walnut Creek. Average flow rate of Walnut Creek = 142,000,000 gallons/day.
** Ten sites use existing facilities for Volume Reduction.
- - = Wastewater discharged to evaporation ponds.
<0.1 indicates that the percentage is less than 0.1%.

Table II-14.2-10. RFETS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
- - = Disposal is not considered for this Alternative.

Table II-14.2-11. RFETS—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	10**	6	219	184	0.02	2.1	0.01	0.01
Decentralized		16	623	654	0.05	7.4	0.02	0.03
Regionalized-1		12	623	654	0.05	7.4	0.02	0.03
Regionalized-2	11	12	923	968	0.08	10.9	0.03	0.05
Regionalized-3		6	201	211	0.02	2.4	0.01	0.01
Regionalized-4	7	6	610	640	0.05	7.2	0.02	0.03
Regionalized-5		6	201	211	0.02	2.4	0.01	0.01
Regionalized-6		2	201	211	0.02	2.4	0.01	0.01
Regionalized-7		2	201	211	0.02	2.4	0.01	0.01
Centralized-1		1	201	211	0.02	2.4	0.01	0.01
Centralized-2		1	201	211	0.02	2.4	0.01	0.01
Centralized-3	7	1	610	640	0.05	7.2	0.02	0.03
Centralized-4	7	1	610	640	0.05	7.2	0.02	0.03
Centralized-5	1	1	201	211	0.02	2.4	0.01	0.01

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-12. RFETS—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	1.1	0.02	2490	0.25	914	0.18	0.20	0.58	64	1
Decentralized		16	7.1	0.12	12496	1.25	5080	1.02	1.43	4.16	258	4
Regionalized-1		12	7.1	0.12	12496	1.25	5080	1.02	1.43	4.16	258	4
Regionalized-2	11	12	11.4	0.20	17980	1.84	11997	1.63	1.67	4.85	558	8
Regionalized-3		6	2.9	0.05	4025	0.40	1478	0.30	0.41	1.19	110	1
Regionalized-4	7	6	2.5	0.04	11527	1.15	9106	1.82	1.00	2.88	442	6
Regionalized-5	4	6	2.9	0.04	4025	0.33	1478	0.30	0.41	0.96	110	1
Regionalized-6		2	2.9	0.05	4025	0.40	1478	0.30	0.41	1.19	110	1
Regionalized-7		2	2.9	0.05	4025	0.40	1478	0.30	0.41	1.19	110	1
Centralized-1		1	2.9	0.05	4025	0.40	1478	0.30	0.41	1.19	110	1
Centralized-2		1	2.9	0.05	4025	0.40	1478	0.30	0.41	1.19	110	1
Centralized-3	7	1	2.5	0.04	11527	1.15	9106	1.82	1.00	2.88	442	7
Centralized-4	7	1	2.5	0.04	11527	1.15	9106	1.82	1.00	2.88	442	7
Centralized-5	1	1	2.9	0.04	4025	0.33	1478	0.30	0.41	0.96	110	1

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1990 Site Employment.
** Ten sites use existing facilities for Volume Reduction.

Table II-14.2-13. RFETS—LLW—Cost

LLW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	248	10	32	194	12	248	0	0
Decentralized		16	705	61	96	452	96	190	0	515
Regionalized-1		12	705	61	96	452	96	190	0	515
Regionalized-2	11	12	1044	100	260	588	96	690	0	354
Regionalized-3		6	228	18	54	141	15	228	0	0
Regionalized-4	7	6	690	67	225	361	37	690	0	0
Regionalized-5	4	6	228	18	54	141	15	228	0	0
Regionalized-6		2	228	18	54	141	15	228	0	0
Regionalized-7		2	228	18	54	141	15	228	0	0
Centralized-1		1	228	18	54	141	15	228	0	0
Centralized-2		1	228	18	54	141	15	228	0	0
Centralized-3	7	1	690	67	225	361	37	690	0	0
Centralized-4	7	1	690	67	225	361	37	690	0	0
Centralized-5	1	1	228	18	54	141	15	228	0	0

Notes:
** Ten sites use existing facilities for Volume Reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.14.3 RFETS TRUW

Twelve tables immediately following portray the impacts of TRUW at RFETS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	RFETS—TRUW—Treatment: Estimated Number of Fatalities	II-14.3-1	14-32
2.	RFETS—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-14.3-2	14-33
4.	RFETS—TRUW—Treatment: MEI Probability of Cancer Fatality	II-14.3-3	14-34
5.	RFETS—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects	II-14.3-4	14-35
6.	RFETS—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure	II-14.3-5	14-36
7.	RFETS—TRUW—Emissions in Tons per Year of Criteria Air Pollutants	II-14.3-6	14-37
8.	RFETS—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants	II-14.3-7	14-38
9.	RFETS—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-14.3-8	14-39
10.	RFETS—TRUW—Impacts on Water Resources Due to Increased Water Use	II-14.3-9	14-40
13.	RFETS—TRUW—Socioeconomic Impacts for Treatment	II-14.3-10	14-41
14.	RFETS—TRUW—Infrastructure Impacts for Treatment	II-14.3-11	14-42
15.	RFETS—TRUW—Cost	II-14.3-12	14-43

Table II-14.3-1. RFETS—TRUW—Treatment: Estimated Number of Fatalities

TRUW Alternatives	Treatment						
	Number of Sites		Treatment Standard	WM Worker		Offsite Population Radiation Exposure	Noninvolved Workers Radiation Exposure
	CH Treat	RH Treat		Radiation Exposure	Physical Hazards		
No Action **	16	5	WIPP WAC	8.2E-05	7.3E-02	3.0E-06	1.5E-07
Decentralized ***	16	5	WIPP WAC	7.7E-03	2.1E-01	9.3E-06	4.7E-07
Regionalized-1	5	2	Reduce Gas	7.7E-03	3.3E-01	1.5E-05	7.6E-07
Regionalized-2	5	2	LDR	7.3E-03	5.6E-01	1.1E-01	5.6E-03
Regionalized-3	3	2	LDR	3.0E-02	1.3E-01	1.2E-05	6.1E-07
Centralized	WIPP	2	LDR	3.0E-02	1.3E-01	1.2E-05	6.1E-07

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at 16 sites, then transfered to interim storage at 10 sites, then to WIPP.

Table II-14.3-2. RFETS—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treatment Standard	Offsite Population				Noninvolved Workers				WM Workers			
	CH Treat	RH Treat		Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action**	16	5	WIPP WAC	6.0E-03	1.0E-05	1.0E-10	6.0E-07	3.1E-04	5.2E-07	2.1E-11	3.1E-08	2.1E-01	2.9E-04	4.0E-09	1.2E-05
Decentralized***	16	5	WIPP WAC	1.9E-02	3.1E-05	4.8E-10	1.9E-06	9.4E-04	1.6E-06	9.6E-11	9.4E-08	1.9E+01	2.7E-02	6.8E-09	1.2E-03
Regionalized-1	5	2	Reduce Gas	3.0E-02	5.1E-05	6.3E-10	3.0E-06	1.5E-03	2.6E-06	1.3E-10	1.5E-07	1.9E+01	2.7E-02	2.1E-08	1.2E-03
Regionalized-2	5	2	LDR	2.2E+02	3.7E-01	8.4E-10	2.2E-02	1.1E+01	1.9E-02	1.7E-10	1.1E-03	1.8E+01	2.5E-02	6.2E-08	1.1E-03
Regionalized-3	3	2	LDR	2.4E-02	4.1E-05	1.1E-09	2.4E-06	1.2E-03	2.1E-06	2.3E-10	1.2E-07	7.4E+01	1.0E-01	2.6E-08	4.4E-03
Centralized	WIPP	2	LDR	2.4E-02	4.1E-05	1.1E-09	2.4E-06	1.2E-03	2.1E-06	2.3E-10	1.2E-07	7.4E+01	1.0E-01	2.6E-08	4.4E-03

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
T = Treatment
D = Disposal

Table II-14.3-3. RFETS—TRUW—Treatment: MEI Probability of Cancer Fatality

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment	
	CH Treat	RH Treat		Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability
No Action**	16	5	WIPP WAC	4.1E-11	9.2E-11
Decentralized***	16	5	WIPP WAC	1.3E-10	2.8E-10
Regionalized-1	5	2	Reduce Gas	2.0E-10	4.6E-10
Regionalized-2	5	2	LDR	1.5E-06	3.3E-06
Regionalized-3	3	2	LDR	1.6E-10	3.7E-10
Centralized	WIPP	2	LDR	1.6E-10	3.7E-10

Notes:
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives disposal at WIPP is assumed.
***In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-14.3–4. RFETS—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment							
				Offsite Population MEI				Noninvolved Worker MEI			
	CH Treat	RH Treat		Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action **	16	5	WIPP WAC	8.2E-08	1.4E-10	<9.9E-14	8.2E-12	1.8E-07	3.1E-10	1.1E-14	1.8E-11
Decentralized ***	16	5	WIPP WAC	2.5E-07	4.3E-10	<9.9E-14	2.5E-11	5.7E-07	9.6E-10	4.9E-14	5.7E-11
Regionalized-1	5	2	Reduce Gas	4.0E-07	6.9E-10	<9.9E-14	4.0E-11	9.1E-07	1.6E-09	6.5E-14	9.1E-11
Regionalized-2	5	2	LDR	3.0E-03	5.0E-06	<9.9E-14	3.0E-07	6.7E-03	1.1E-05	8.5E-14	6.7E-07
Regionalized-3	3	2	LDR	3.3E-07	5.6E-10	<9.9E-14	3.3E-11	7.4E-07	1.3E-09	1.2E-13	7.4E-11
Centralized	WIPP	2	LDR	3.3E-07	5.6E-10	<9.9E-14	3.3E-11	7.4E-07	1.3E-09	1.2E-13	7.4E-11

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
MEI = Maximally Exposed Individual

Table II-14.3-5. RFETS—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment		
	CH Treat	RH Treat		Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index
No Action**	16	5	WIPP WAC	2.1E-11	2.7E-10	5.3E-07
Decentralized***	16	5	WIPP WAC	1.1E-10	1.4E-09	1.2E-06
Regionalized-1	5	2	Reduce Gas	2.0E-10	2.5E-09	1.2E-06
Regionalized-2	5	2	LDR	1.2E-09	1.5E-08	2.6E-05
Regionalized-3	3	2	LDR	1.5E-10	1.9E-09	2.3E-06
Centralized	WIPP	2	LDR	1.5E-10	1.9E-09	2.3E-06

Notes:
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The Hazard Quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-14.3-6. RFETS—TRUW—Emissions in Tons per Year of Criteria Air Pollutants

TRUW Alternatives	Number of Sites: CH Treat	Number of Sites: RH Treat	Treatment Standard	Construction Emissions in Tons/Year (1): CO	NO2	Pb	PM10	SO2	VOC	Operations & Maintenance Emissions in Tons/Year (2): CO	NO2	Pb	PM10	SO2	VOC
No Action**	16	5	WIPP WAC	--	--	--	--	--	--	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Decentralized***	16	5	WIPP WAC	19 (3/16)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	17 (0/17)	3 (0/3)	0	0	0	2 (0/2)
Regionalized-1	5	2	Reduce Gas	20 (3/17)	11 (8/3)	0	1 (1/0)	1 (1/0)	3 (1/2)	20 (0/20)	4 (0/4)	0	0	0	2 (0/2)
Regionalized-2	5	2	LDR	29 (4/25)	15 (10/5)	0	1 (1/0)	1 (1/0)	4 (/13)	24 (0/24)	5 (0/5)	0	0	0	3 (0/3)
Regionalized-3	3	2	LDR	7 (1/6)	4 (3/1)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized	WIPP	2	LDR	7 (1/6)	4 (3/1)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)

Notes:
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission)
(2) Values = total emissions (stationary-source emissions / mobile-source emission)
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-14.3–7. RFETS—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants

TRUW Alternatives	Number of Sites		Treat STD	Construction					
				Percent of Tons/Year General Conformity Rule (1)					
	CH Treat	RH Treat		CO	NO2	Pb	PM10	SO2	VOC
No Action	16	5	WIPP WAC	--	--	--	--	--	--
Decentralized	16	5	WIPP WAC	19 (3/16)	11 (3/3)	--	1 (1/0)	--	6 (2/4)
Regionalized-1	5	2	Reduce Gas	20 (3/17)	11 (8/3)	--	1 (1/0)	--	6 (2/4)
Regionalized-2	5	2	LDR	29 (4/25)	15 (10/5)	--	1 (1/0)	--	8 (2/6)
Regionalized-3	3	2	LDR	7 (1/6)	4 (3/1)	--	0	--	2 (1/1)
Centralized	WIPP	2	LDR	7 (1/6)	4 (3/1)	--	0	--	2 (1/1)

TRUW Alternatives	Number of Sites		Treat STD	Operations & Maintenance											
				Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	CH Treat	RH Treat		CO (6)	NO2 (5)	Pb (4)	PM10 (6)	SO2 (4)	VOC (5)	CO	NO2	Pb	PM10	SO2	VOC
No Action	16	5	WIPP WAC	8 (0/8)	2 (0/2)	0	0	0	2 (0/2)	--	--	--	--	--	--
Decentralized	16	5	WIPP WAC	17 (0/17)	3 (0/3)	0	0	0	4 (0/4)	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	20 (0/20)	4 (0/4)	0	0	0	5 (0/5)	--	--	--	--	--	--
Regionalized-2	5	2	LDR	24 (0/24)	5 (0/5)	0	0	1	6 (0/6)	0	0	0	0	0	0
Regionalized-3	3	2	LDR	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	--	--	--	--	--	--
Centralized	WIPP	2	LDR	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)	--	--	--	--	--	--

Notes:
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) GCR only applies to pollutants in nonattainment.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for alternatives that do not involve treatment to LDR (incineration) are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
(5) Nonattainment area for ozone. Pollutant is an ozone precursor, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
(6) Nonattainment area for this pollutant, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.

Table II-14.3-8. RFETS—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance											
	CH Treat	RH Treat		Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action**	16	5	WIPP - WAC	0	--	--	--	0	0	--	--	--	--	--	--
Decentralized***	16	5	WIPP - WAC	0	--	--	--	0	0	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	0	--	--	--	0	0	--	--	--	--	--	--
Regionalized-2	5	2	LDR	3	--	--	--	0	0	--	--	--	--	--	--
Regionalized-3	3	2	LDR	0	--	--	--	0	0	--	--	--	--	--	--
Centralized	WIPP	2	LDR	0	--	--	--	0	0	--	--	--	--	--	--

TRUW Alternatives	Number of Sites		Treat STD	Operations & Maintenance									
	CH Treat	RH Treat		Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action**	16	5	WIPP - WAC	0	0	--	--	--	0	0	--	--	--
Decentralized***	16	5	WIPP - WAC	0	0	--	--	--	0	0	--	--	--
Regionalized-1	5	2	Reduce Gas	0	0	--	--	--	0	0	--	--	--
Regionalized-2	5	2	LDR	0	0	--	--	--	0	0	--	--	--
Regionalized-3	3	2	LDR	0	0	--	--	--	0	0	--	--	--
Centralized	WIPP	2	LDR	0	0	--	--	--	0	0	--	--	--

Notes:

** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.

*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.

Percentages <1% are shown as zeros. CH = contact handled. RH = remote handled.

Table II-14.3-9. RFETS—TRUW—Impacts on Water Resources Due to Increased Water Use

TRUW Alternatives	Number of Sites		Treatment Standard	Construction			Operations			
	CH Treat	RH Treat		Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action**	16	5	WIPP WAC	- -	- -	- -	2342	0.9	- -	<0.1
Decentralized***	16	5	WIPP WAC	5827	2.1	- -	3229	1.2	- -	<0.1
Regionalized-1	5	2	Reduce Gas	6029	2.2	- -	3985	1.5	- -	<0.1
Regionalized-2	5	2	LDR	8223	3.0	- -	4866	1.8	- -	<0.1
Regionalized-3	3	2	LDR	2173	0.8	- -	708	0.3	- -	<0.1
Centralized	WIPP	2	LDR	2173	0.8	- -	708	0.3	- -	<0.1

Notes:
Water supplied by municipal water from the Denver Water Board. Current water use = 272,000 gallons/day.
Wastewater discharged to Walnut Creek. Average flow rate of Walnut Creek = 142,000,000 gallons/day.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
- - = Stream Flow is not considered for this site.
<0.1 indiicates that the percentage is less than 0.1%.

Table II-14.3-10. RFETS—TRUW—Socioeconomic Impacts for Treatment

TRUW Alternatives	Number of Sites		Effect of Implementation of Alternatives						
					Jobs		Income		
	CH Treat	RH Treat	Treatment Standard	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action**	16	5	WIPP WAC	246	206	0.02	2.3	0.01	0.01
Decentralized***	16	5	WIPP WAC	333	349	0.03	3.9	0.01	0.01
Regionalized-1	5	2	Reduce Gas	372	391	0.03	4.4	0.01	0.02
Regionalized-2	5	2	LDR	470	493	0.04	5.5	0.01	0.02
Regionalized-3	3	2	LDR	112	117	0.01	1.3	0.00	0.00
Centralized	WIPP	2	LDR	112	117	0.01	1.3	0.00	0.00

Notes:
(1) In current 1990 dollars.
(2) Compared to 1990 baseline.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-14.3-11. RFETS—TRUW—Infrastructure Impacts for Treatment

TRUW Alternatives	Number of Sites		Treatment Standard	Effect of Implementation of Alternatives									
				Land Use		Water		Waste Water		Power		Employment (FTE)	
	CH Treat	RH Treat		Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action**	16	5	WIPP WAC	0	0.00	2342	0.23	2342	0.47	0.12	0.35	0	0.00
Decentralized***	16	5	WIPP WAC	2.5	0.04	5827	0.59	3229	0.65	0.52	1.1	173	2.30
Regionalized-1	5	2	Reduce Gas	2.6	0.04	6029	0.61	3985	0.8	0.54	1.57	178	2.40
Regionalized-2	5	2	LDR	2.8	0.05	8223	0.82	4866	0.97	0.87	2.53	266	3.60
Regionalized-3	3	2	LDR	1.2	0.02	2173	0.22	708	0.14	0.45	1.31	62	0.80
Centralized	WIPP	2	LDR	1.2	0.02	2173	0.22	708	0.14	0.45	1.31	62	0.80

Notes:
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1990 Site Employment.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-14.3-12. RFETS—TRUW—Cost

TRUW Alternatives	Number of Sites		Treatment Standard (2)	Total Cost (Millions) (1)	Life-Cycle Component				Functional Area		
	CH Treat	RH Treat			Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Retrieval Characterization (Millions)	Treatment (Millions)	Storage (Millions)
No Action**	11	5	WIPP - WAC	278	0	0	257	21	0	262	16
Decentralized***	16	5	WIPP - WAC	377	21	95	227	34	46	311	20
Regionalized-1	5	2	Reduce Gas	421	22	98	257	45	46	346	30
Regionalized-2	5	2	LDR	531	34	145	303	49	46	457	29
Regionalized-3	3	2	LDR	127	8	34	68	16	46	81	0
Centralized	WIPP	2	LDR	127	8	34	68	16	46	81	0

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.
(2) Treatment standard (STD) applied: treat to WIPP Waste Acceptance Criteria (WIPP WAC), treat for reduced gas generation (Reduce Gas), treat to Land Disposal Restrictions (LDR).

II.15.0 SNL-NM

SNL-NM currently is custodian of significant volumes of LLMW and LLW. Each of the waste types is treated independently in the following sections.

II.15.1 SNL-NM LLMW

Fifteen tables immediately following portray the impacts of LLMW at SNL-NM. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	SNL-NM—LLMW—Treatment and Disposal: Estimated Number of Fatalities	II-15.1-1	15-2
2.	SNL-NM—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-15.1-2	15-3
3.	SNL-NM—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-15.1-3	15-4
4.	SNL-NM—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-15.1-4	15-5
5.	SNL-NM—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-15.1-5	15-6
6.	SNL-NM—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure	II-15.1-6	15-7
7.	SNL-NM—LLMW—Emissions in Tons per Year of Criteria Air Pollutants	II-15.1-7	15-8
8.	SNL-NM—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants	II-15.1-8	15-9
9.	SNL-NM—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-15.1-9	15-10
10.	SNL-NM—LLMW—Impacts on Water Resources Due to Increased Water Use	II-15.1-10	15-11
11.	SNL-NM—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)	II-15.1-11	15-12
12.	SNL-NM—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)	II-15.1-12	15-13
13.	SNL-NM—LLMW—Socioeconomic Impacts for Treatment and Disposal	II-15.1-13	15-14
14.	SNL-NM—LLMW—Infrastructure Impacts for Treatment and Disposal	II-15.1-14	15-15
15.	SNL-NM—LLMW—Cost	II-15.1-15	15-16

Table II-15.1-1. SNL-NM—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	2.4E-05	6.3E-04	3.8E-05	7.4E-07	- -	- -
Decentralized	37	16	3.3E-04	5.1E-03	1.4E-04	7.8E-07	3.4E-05	7.4E-04
Regionalized-1	11	12	1.7E-05	1.2E-03	1.8E-08	3.5E-10	- -	- -
Regionalized-2	7	6	1.7E-05	1.2E-03	1.8E-08	3.5E-10	- -	- -
Regionalized-3	7	1	1.7E-05	1.2E-03	1.8E-08	3.5E-10	- -	- -
Regionalized-4	4	6	1.7E-05	1.2E-03	1.8E-08	3.5E-10	- -	- -
Centralized	1	1	1.7E-05	1.2E-03	1.8E-08	3.5E-10	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-15.1-2. SNL-NM—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Worker			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	7.7E-02	1.3E-04	7.3E-07	7.7E-06	1.5E-03	2.5E-06	8.1E-08	1.5E-07	6.0E-02	8.4E-05	4.2E-10	3.6E-06
Decentralized	37	16	2.8E-01	4.7E-04	2.1E-08	2.8E-05	1.6E-03	2.7E-06	2.4E-09	1.6E-07	8.2E-01	1.2E-03	1.7E-08	4.9E-05
Regionalized-1	11	12	3.6E-05	6.1E-08	5.4E-10	3.6E-09	6.9E-07	1.2E-09	6.0E-11	6.9E-11	4.3E-02	6.1E-05	3.4E-10	2.6E-06
Regionalized-2	7	6	3.6E-05	6.1E-08	5.4E-10	3.6E-09	6.9E-07	1.2E-09	6.0E-11	6.9E-11	4.3E-02	6.1E-05	3.4E-10	2.6E-06
Regionalized-3	7	1	3.6E-05	6.1E-08	5.4E-10	3.6E-09	6.9E-07	1.2E-09	6.0E-11	6.9E-11	4.3E-02	6.1E-05	3.4E-10	2.6E-06
Regionalized-4	4	6	3.6E-05	6.1E-08	5.4E-10	3.6E-09	6.9E-07	1.2E-09	6.0E-11	6.9E-11	4.3E-02	6.1E-05	3.4E-10	2.6E-06
Centralized	1	1	3.6E-05	6.1E-08	5.4E-10	3.6E-09	6.9E-07	1.2E-09	6.0E-11	6.9E-11	4.3E-02	6.1E-05	3.4E-10	2.6E-06

Notes:
T = Treatment
D = Disposal

Table II-15.1-3. SNL-NM—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	8.6E-02	1.2E-04	5.2E-06
Regionalized-1	11	12	- -	- -	- -
Regionalized-2	7	6	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-15.1–4. SNL-NM—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	1.5E-09	3.1E-10	- -
Decentralized	37	16	5.4E-09	3.2E-10	4.5E-05
Regionalized-1	11	12	7.1E-13	1.4E-13	- -
Regionalized-2	7	6	7.1E-13	1.4E-13	- -
Regionalized-3	7	1	7.1E-13	1.4E-13	- -
Regionalized-4	4	6	7.1E-13	1.4E-13	- -
Centralized	1	1	7.1E-13	1.4E-13	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-15.1-5. SNL-NM—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	3	-	3.0E-06	5.2E-09	3.1E-11	3.0E-10	6.2E-07	1.1E-09	3.1E-11	6.2E-11	- -	- -	- -	- -
Decentralized	37	16	1.1E-05	1.9E-08	9.1E-13	1.1E-09	6.4E-07	1.1E-09	9.1E-13	6.4E-11	9.0E-02	1.5E-04	8.9E-07	9.0E-06
Regionalized-1	11	12	1.4E-09	2.4E-12	2.3E-14	1.4E-13	2.9E-10	4.9E-13	2.3E-14	2.9E-14	- -	- -	- -	- -
Regionalized-2	7	6	1.4E-09	2.4E-12	2.3E-14	1.4E-13	2.9E-10	4.9E-13	2.3E-14	2.9E-14	- -	- -	- -	- -
Regionalized-3	7	1	1.4E-09	2.4E-12	2.3E-14	1.4E-13	2.9E-10	4.9E-13	2.3E-14	2.9E-14	- -	- -	- -	- -
Regionalized-4	4	6	1.4E-09	2.4E-12	2.3E-14	1.4E-13	2.9E-10	4.9E-13	2.3E-14	2.9E-14	- -	- -	- -	- -
Centralized	1	1	1.4E-09	2.4E-12	2.3E-14	1.4E-13	2.9E-10	4.9E-13	2.3E-14	2.9E-14	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered for this alternative.

Table II-15.1-6. SNL-NM—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	3.9E-08	3.9E-08	4.9E-08	- -
Decentralized	37	16	3.3E-09	3.3E-09	2.8E-06	2.3E-02
Regionalized-1	11	12	3.4E-11	3.4E-11	4.9E-08	- -
Regionalized-2	7	6	3.4E-11	3.4E-11	4.9E-08	- -
Regionalized-3	7	1	3.4E-11	3.4E-11	4.9E-08	- -
Regionalized-4	4	6	3.4E-11	3.4E-11	4.9E-08	- -
Centralized	1	1	3.4E-11	3.4E-11	4.9E-08	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-15.1-7. SNL-NM—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	3 (0/3)	1 (0/1)	0	0	0	0	1 (0/1)	0	0	0	0	0
Decentralized	37	16	8 (0/8)	3 (1/2)	0	0	0	1 (0/1)	2 (0/2)	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3	7	1	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-4	4	6	0	0	0	0	0	0	0	0	0	0	0	0
Centralized	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-15.1-8. SNL-NM—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	3 (0/3)	- -	- -	- -	- -	- -
Decentralized	37	16	9 (0/9)	- -	- -	- -	- -	- -
Regionalized-1	11	12	0	- -	- -	- -	- -	- -
Regionalized-2	7	6	0	- -	- -	- -	- -	- -
Regionalized-3	7	1	0	- -	- -	- -	- -	- -
Regionalized-4	4	6	0	- -	- -	- -	- -	- -
Centralized	1	1	0	- -	- -	- -	- -	- -

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (5)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	1 (0/1)	0	0	0	0	0	- -	- -	- -	- -	- -	- -
Decentralized	37	16	2 (0/2)	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	- -	- -	- -	- -	- -	- -
Regionalized-2	7	6	0	0	0	0	0	0	- -	- -	- -	- -	- -	- -
Regionalized-3	7	1	0	0	0	0	0	0	- -	- -	- -	- -	- -	- -
Regionalized-4	4	6	0	0	0	0	0	0	- -	- -	- -	- -	- -	- -
Centralized	1	1	0	0	0	0	0	0	- -	- -	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) GCR de minimus levels are applied, since PSD regulations are not applicable to construction activities. Values = % of total emissions (% of equipment emissions / % of worker vehicles emission)
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions are assumed to be negligible for all but the Decentralized Alternative.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
(5) Nonattainment area for this pollutant, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions)

Table II-15.1-9. SNL-NM—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Decentralized	37	16	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-1	11	12	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-2	7	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-3	7	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-4	4	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Centralized	1	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	- -	0	0	0	- -	0	0	0	- -	- -
Decentralized	37	16	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized 1	11	12	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized 2	7	6	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized 3	7	1	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized 4	4	6	- -	0	0	0	- -	0	0	0	- -	- -
Centralized	1	1	- -	0	0	0	- -	0	0	0	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-15.1-10. SNL-NM—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	- -	- -	- -	18	<0.1	- -	- -
Decentralized	37	16	2079	0.2	- -	289	<0.1	- -	- -
Regionalized-1	11	12	- -	- -	- -	18	<0.1	- -	- -
Regionalized-2	7	6	- -	- -	- -	18	<0.1	- -	- -
Regionalized-3	7	1	- -	- -	- -	18	<0.1	- -	- -
Regionalized-4	4	6	- -	- -	- -	18	<0.1	- -	- -
Centralized	1	1	- -	- -	- -	18	<0.1	- -	- -

Notes:
T = Treatment
D = Disposal
Notes: Water supplied by the City of Albuquerque and Kirtland AFB. Current water use = 1,000,000 gallons/day. Wastewater discharged to the City of Albuquerque WWTP.
- - = Construction is not considered for this site except for the Decentralized Alternative, and for operations waste water as a percent of stream flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-15.1-11. SNL-NM—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)

LLMW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	900	0
Regionalized-1	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLMW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Regionalized-1	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
- - = No disposal at this site for this alternative.

Table II-15.1-12. SNL-NM—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)

LLMW Alternatives	T	D	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0
Regionalized-1	11	12	--	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--

LLMW Alternatives	T	D	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	1	0	0	1	0	0	0
Regionalized-1	11	12	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-15.1-13. SNL-NM—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	28	23	0.01	0.3	0.00	0.00
Decentralized	37	16	65	67	0.02	0.7	0.01	0.07
Regionalized-1	11	12	6	6	0.00	0.1	0.00	0.00
Regionalized-2	7	6	6	6	0.00	0.1	0.00	0.00
Regionalized-3	7	1	6	6	0.00	0.1	0.00	0.00
Regionalized-4	4	6	6	6	0.00	0.1	0.00	0.00
Centralized	1	1	6	6	0.00	0.1	0.00	0.00

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-15.1-14. SNL-NM—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment FTE	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment
No Action	3	-	0.0	0.00	18	0.00	18	0.00	0.01	0.01	7	0.1
Decentralized	37	16	1.7	0.83	2079	0.05	289	0.05	0.15	0.31	66	1
Regionalized-1	11	12	0.0	0.00	18	0.00	18	0.00	0.01	0.01	0	0
Regionalized-2	7	6	0.0	0.00	18	0.00	18	0.00	0.01	0.01	0	0
Regionalized-3	7	1	0.0	0.00	18	0.00	18	0.00	0.01	0.01	0	0
Regionalized-4	4	6	0.0	0.00	18	0.00	18	0.00	0.01	0.01	0	0
Centralized	1	1	0.0	0.00	18	0.00	18	0.00	0.01	0.01	0	0

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts
(1) Based on 1991 Site Employment

Table II-15.1-15. SNL-NM—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	32	4	8	9	12	19	12	0
Decentralized	37	16	73	14	28	28	3	73	0	0 (2)
Regionalized-1	11	12	6	0	0	2	5	6	0	0
Regionalized-2	7	6	6	0	0	2	5	6	0	0
Regionalized-3	7	1	6	0	0	2	5	6	0	0
Regionalized-4	4	6	6	0	0	2	5	6	0	0
Centralized	1	1	6	0	0	2	5	6	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.
(2) Disposal occurs at SNL-NM, but throughput is below de minimis value for costing.

II.15.2 SNL-NM LLW

Thirteen tables immediately following portray the impacts of LLW at SNL-NM. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	SNL-NM—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-15.2-1	15-18
2.	SNL-NM—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-15.2-2	15-19
3.	SNL-NM—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-15.2-3	15-20
4.	SNL-NM—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-15.2-4	15-21
5.	SNL-NM—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-15.2-5	15-22
7.	SNL-NM—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-15.2-6	15-23
8.	SNL-NM—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-15.2-7	15-24
9.	SNL-NM—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-15.2-8	15-25
10.	SNL-NM—LLW—Impacts on Water Resources Due to Increased Water Use	II-15.2-9	15-26
11.	SNL-NM—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-15.2-10	15-27
13.	SNL-NM—LLW—Socioeconomic Impacts for Treatment and Disposal	II-15.2-11	15-28
14.	SNL-NM—LLW—Infrastructure Impacts for Treatment and Disposal	II-15.2-12	15-29
15.	SNL-NM—LLW—Cost	II-15.2-13	15-30

Table II-15.2-1. SNL-NM—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	5.1E-04	5.0E-02	1.7E-06	2.9E-08	- -	- -
Decentralized		16	2.2E-02	4.3E-02	1.8E-06	3.0E-08	6.3E-02	3.2E-02
Regionalized-1		12	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-2	11	12	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-3		6	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-4	7	6	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-5	4	6	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-6		2	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Regionalized-7		2	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Centralized-1		1	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Centralized-2		1	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -
Centralized-3	7	1	2.2E-02	5.5E-02	1.8E-06	3.0E-08	- -	- -
Centralized-4	7	1	2.2E-02	5.5E-02	1.8E-06	3.0E-08	- -	- -
Centralized-5	1	1	4.1E-04	5.1E-02	1.8E-06	3.0E-08	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-15.2-2. SNL-NM—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	3.4E-03	5.8E-06	3.4E-07	5.8E-05	9.9E-08	5.8E-09	1.3E+00	1.8E-03	7.6E-05
Decentralized		16	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	5.4E+01	7.6E-02	3.3E-03
Regionalized-1		12	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-2	11	12	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-3		6	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-4	7	6	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-5	4	6	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-6		2	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Regionalized-7		2	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Centralized-1		1	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Centralized-2		1	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05
Centralized-3	7	1	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	5.4E+01	7.6E-02	3.3E-03
Centralized-4	7	1	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	5.4E+01	7.6E-02	3.3E-03
Centralized-5	1	1	3.6E-03	6.2E-06	3.6E-07	6.1E-05	1.0E-07	6.1E-09	1.0E+00	1.5E-03	6.2E-05

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-3. SNL-NM—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	- -	- -	- -
Decentralized		16	1.6E+02	2.2E-01	9.4E-03
Regionalized-1		12	- -	- -	- -
Regionalized-2	11	12	- -	- -	- -
Regionalized-3		6	- -	- -	- -
Regionalized-4	7	6	- -	- -	- -
Regionalized-5	4	6	- -	- -	- -
Regionalized-6		2	- -	- -	- -
Regionalized-7		2	- -	- -	- -
Centralized-1		1	- -	- -	- -
Centralized-2		1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2–4. SNL-NM—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	6.8E-11	1.2E-11	- -
Decentralized		16	7.1E-11	1.3E-11	1.6E-02
Regionalized-1		12	7.2E-11	1.3E-11	- -
Regionalized-2	11	12	7.2E-11	1.3E-11	- -
Regionalized-3		6	7.2E-11	1.3E-11	- -
Regionalized-4	7	6	7.2E-11	1.3E-11	- -
Regionalized-5	4	6	7.2E-11	1.3E-11	- -
Regionalized-6		2	7.2E-11	1.3E-11	- -
Regionalized-7		2	7.2E-11	1.3E-11	- -
Centralized-1		1	7.2E-11	1.3E-11	- -
Centralized-2		1	7.2E-11	1.3E-11	- -
Centralized-3	7	1	7.2E-11	1.3E-11	- -
Centralized-4	7	1	7.2E-11	1.3E-11	- -
Centralized-5	1	1	7.2E-11	1.3E-11	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-5. SNL-NM—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	1.4E-07	2.3E-10	1.4E-11	2.4E-08	4.2E-11	2.4E-12	- -	- -	- -
Decentralized		16	1.4E-07	2.4E-10	1.4E-11	2.5E-08	4.3E-11	2.5E-12	3.2E+01	5.3E-02	3.2E-03
Regionalized-1		12	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-2	11	12	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-3		6	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-4	7	6	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-5	4	6	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-6		2	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Regionalized-7		2	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Centralized-1		1	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Centralized-2		1	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Centralized-3	7	1	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Centralized-4	7	1	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -
Centralized-5	1	1	1.4E-07	2.4E-10	1.4E-11	2.6E-08	4.3E-11	2.6E-12	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-6. SNL-NM—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	9 (2/7)	5 (4/1)	0	0	0	1 (0/1)	3 (0/3)	1 (0/1)	0	0	0	0
Decentralized		16	10 (1/9)	5 (3/2)	0	0	0	1 (0/1)	13 (0/13)	3 (0/3)	0	0	0	2 (0/2)
Regionalized-1		12	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-2	11	12	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-3		6	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-4	7	6	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-5	4	6	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-6		2	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Regionalized-7		2	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized-1		1	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized-2		1	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized-3	7	1	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized-4	7	1	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)
Centralized-5	1	1	10 (1/9)	4 (2/2)	0	0	0	1 (0/1)	5 (0/5)	1 (0/1)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-7. SNL-NM—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	9 (2/7)	--	--	--	--	--
Decentralized		16	10 (1/9)	--	--	--	--	--
Regionalized-1		12	10 (1/9)	--	--	--	--	--
Regionalized-2	11	12	10 (1/9)	--	--	--	--	--
Regionalized-3		6	10 (1/9)	--	--	--	--	--
Regionalized-4	7	6	10 (1/9)	--	--	--	--	--
Regionalized-5	4	6	10 (1/9)	--	--	--	--	--
Regionalized-6		2	10 (1/9)	--	--	--	--	--
Regionalized-7		2	10 (1/9)	--	--	--	--	--
Centralized-1		1	10 (1/9)	--	--	--	--	--
Centralized-2		1	10 (1/9)	--	--	--	--	--
Centralized-3	7	1	10 (1/9)	--	--	--	--	--
Centralized-4	7	1	10 (1/9)	--	--	--	--	--
Centralized-5	1	1	10 (1/9)	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (5)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	3 (0/3)	0	0	0	0	0	--	--	--	--	--	--
Decentralized		16	13 (0/13)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-1		12	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-2	11	12	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-3		6	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	7	6	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-5	4	6	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-6		2	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Regionalized-7		2	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Centralized-1		1	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Centralized-2		1	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Centralized-3	7	1	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Centralized-4	7	1	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--
Centralized-5	1	1	5 (0/5)	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) GCR de minimus levels are applied, since PSD regulations are not applicable to construction activities. Values = % of total emissions (% of equipment emissions / % of worker vehicle emissions)
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for all alternatives are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
(5) Nonattainment area for this pollutant, therefore GCR de minimus levels are applied. Values = % of total emissions (% of stationary-source emissions / % of mobile-source emissions).
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-8. SNL-NM—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action			--	--	--	--	--	--	--	--	--	--
Decentralized	10**	6	--	--	--	--	--	--	--	--	--	--
Regionalized-1		16	--	--	--	--	--	--	--	--	--	--
Regionalized-2		12	--	--	--	--	--	--	--	--	--	--
Regionalized-3	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-4		6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--
Centralized-1		2	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--
Centralized-3		1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	7	1	--	--	--	--	--	--	--	--	--	--
Centralized - 5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T= Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-15.2-9. SNL-NM—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	1077	0.1	- -	622	0.1	- -	- -
Decentralized		16	3675	0.4	- -	1146	0.1	- -	- -
Regionalized-1		12	2499	0.2	- -	627	0.1	- -	- -
Regionalized-2	11	12	2499	0.2	- -	627	0.1	- -	- -
Regionalized-3		6	2499	0.2	- -	627	0.1	- -	- -
Regionalized-4	7	6	2499	0.2	- -	627	0.1	- -	- -
Regionalized-5	4	6	2499	0.2	- -	627	0.1	- -	- -
Regionalized-6		2	2499	0.2	- -	627	0.1	- -	- -
Regionalized-7		2	2499	0.2	- -	627	0.1	- -	- -
Centralized-1		1	2499	0.2	- -	627	0.1	- -	- -
Centralized-2		1	2499	0.2	- -	627	0.1	- -	- -
Centralized-3	7	1	2499	0.2	- -	627	0.1	- -	- -
Centralized-4	7	1	2499	0.2	- -	627	0.1	- -	- -
Centralized-5	1	1	2499	0.2	- -	627	0.1	- -	- -

Notes:
T = Treatment
D = Disposal
Water supplied by the City of Albuquerque and Kirtland AFB. Current water use = 1,000,000 gallons/day.
Wastewater discharged to the City of Albuquerque WWTP.
** Ten sites use existing facilities for Volume Reduction.
- - = Stream Flow is not considered for this site.

Table II-15.2-10. SNL-NM—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	900	2000	0
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	0	0	0	0	0	0	0	200	0	0	0	2	0	0	0	100	1	0	30000	0	
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
-- = Disposal is not considered for this Alternative.

Table II-15.2-11. SNL-NM—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	10**	6	100	83	0.02	0.9	0.01	0.01
Decentralized		16	215	223	0.06	2.4	0.02	0.03
Regionalized-1		12	96	99	0.03	1.1	0.01	0.01
Regionalized-2	11	12	96	99	0.03	1.1	0.01	0.01
Regionalized-3		6	96	99	0.03	1.1	0.01	0.01
Regionalized-4	7	6	96	99	0.03	1.1	0.01	0.01
Regionalized-5		6	96	99	0.03	1.1	0.01	0.01
Regionalized-6		2	96	99	0.03	1.1	0.01	0.01
Regionalized-7		2	96	99	0.03	1.1	0.01	0.01
Centralized-1		1	96	99	0.03	1.1	0.01	0.01
Centralized-2		1	96	99	0.03	1.1	0.01	0.01
Centralized-3	7	1	96	99	0.03	1.1	0.01	0.01
Centralized-4	7	1	96	99	0.03	1.1	0.01	0.01
Centralized-5	1	1	96	99	0.03	1.1	0.01	0.01

Notes:
T = Treatment
D = Disposal
(1) In constant 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-12. SNL-NM—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	0.9	0.44	1077	0.03	622	0.11	0.12	0.24	51	1
Decentralized		16	3.0	0.97	3675	0.09	1146	0.21	0.39	0.77	110	1
Regionalized-1		12	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-2	11	12	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-3		6	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-4	7	6	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-5	4	6	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-6		2	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Regionalized-7		2	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Centralized-1		1	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Centralized-2		1	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Centralized-3	7	1	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Centralized-4	7	1	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1
Centralized-5	1	1	1.9	0.92	2499	0.06	627	0.11	0.24	0.46	69	1

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
** Ten sites use existing facilities for Volume Reduction.

Table II-15.2-13. SNL-NM—LLW—Cost

LLW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	113	8	25	75	4	113	0	0
Decentralized		16	243	22	47	105	69	108	0	135
Regionalized-1		12	108	10	37	52	10	108	0	0
Regionalized-2	11	12	108	10	37	52	10	108	0	0
Regionalized-3		6	108	10	37	52	10	108	0	0
Regionalized-4	7	6	108	10	37	52	10	108	0	0
Regionalized-5	4	6	108	10	37	52	10	108	0	0
Regionalized-6		2	108	10	37	52	10	108	0	0
Regionalized-7		2	108	10	37	52	10	108	0	0
Centralized-1		1	108	10	37	52	10	108	0	0
Centralized-2		1	108	10	37	52	10	108	0	0
Centralized-3	7	1	108	10	37	52	10	108	0	0
Centralized-4	7	1	108	10	37	52	10	108	0	0
Centralized-5	1	1	108	10	37	52	10	108	0	0

Notes:
** Ten sites use existing facilities for Volume Reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.15.3 SNL-NM TRUW

SNL-NM has a small amount of TRUW that factored into the transportation analysis but did not warrant analysis of impacts onsite. Therefore, Section 15.3 has been intentionally left blank.

II.16.0 SRS

SRS currently is custodian of significant volumes of LLMW, LLW, and TRUW. Each of the waste types is treated independently in the following sections.

II.16.1 SRS LLMW

Seventeen tables immediately following portray the impacts of LLMW at SRS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	SRS—LLMW—Treatment and Disposal: Estimated Number of Fatalities	II-16.1-1	16-3
2.	SRS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-16.1-2	16-4
3.	SRS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-16.1-3	16-5
4.	SRS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-16.1-4	16-6
5.	SRS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-16.1-5	16-7
6.	SRS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure	II-16.1-6	16-8
7.	SRS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants	II-16.1-7	16-9
8.	SRS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants	II-16.1-8	16-10
9.	SRS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-16.1-9	16-11
10.	SRS—LLMW—Impacts on Water Resources Due to Increased Water Use	II-16.1-10	16-12
11.	SRS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)	II-16.1-11	16-13
11.	SRS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) from Disposal (Remote-Handled)	II-16.1-12	16-14
12.	SRS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)	II-16.1-13	16-15
12.	SRS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Remote-Handled)	II-16.1-14	16-16

13.	SRS—LLMW—Socioeconomic Impacts for Treatment and Disposal	II-16.1-15	16-17
14.	SRS—LLMW—Infrastructure Impacts for Treatment and Disposal	II-16.1-16	16-18
15.	SRS—LLMW—Cost	II-16.1-17	16-19

Table II-16.1-1. SRS—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	1.4E-01	6.9E-02	1.6E-03	6.5E-05	- -	- -
Decentralized	37	16	1.1E-01	3.3E-01	1.7E-03	6.1E-05	3.9E-02	1.0E-01
Regionalized-1	11	12	1.1E-01	3.3E-01	1.8E-03	6.1E-05	3.9E-02	1.0E-01
Regionalized-2	7	6	1.1E-01	3.3E-01	1.8E-03	6.1E-05	3.9E-02	1.0E-01
Regionalized-3	7	1	1.1E-01	3.3E-01	1.8E-03	6.1E-05	- -	- -
Regionalized-4	4	6	1.1E-01	3.3E-01	1.8E-03	6.1E-05	3.9E-02	1.0E-01
Centralized	1	1	3.3E-02	4.9E-02	1.3E-06	6.5E-08	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-16.1-2. SRS—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Worker			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	3.1E+00	5.3E-03	2.9E-06	3.1E-04	1.3E-01	2.2E-04	1.4E-06	1.3E-05	3.4E+02	4.8E-01	1.1E-03	2.0E-02
Decentralized	37	16	3.5E+00	5.9E-03	9.8E-07	3.5E-04	1.2E-01	2.1E-04	4.9E-07	1.2E-05	2.6E+02	3.7E-01	7.0E-04	1.6E-02
Regionalized -1	11	12	3.5E+00	6.0E-03	9.8E-07	3.5E-04	1.2E-01	2.1E-04	4.9E-07	1.2E-05	2.7E+02	3.8E-01	7.0E-04	1.6E-02
Regionalized-2	7	6	3.5E+00	6.0E-03	9.8E-07	3.5E-04	1.2E-01	2.1E-04	4.9E-07	1.2E-05	2.7E+02	3.8E-01	7.0E-04	1.6E-02
Regionalized-3	7	1	3.5E+00	6.0E-03	9.4E-07	3.5E-04	1.2E-01	2.1E-04	4.7E-07	1.2E-05	2.7E+02	3.8E-01	7.0E-04	1.6E-02
Regionalized-4	4	6	3.5E+00	6.0E-03	9.8E-07	3.5E-04	1.2E-01	2.1E-04	4.9E-07	1.2E-05	2.7E+02	3.8E-01	7.0E-04	1.6E-02
Centralized	1	1	2.7E-03	4.6E-06	6.1E-08	2.7E-07	1.3E-04	2.2E-07	3.1E-08	1.3E-08	8.2E+01	1.1E-01	3.8E-05	4.9E-03

Notes:
T = Treatment
D = Disposal

Table II-16.1-3. SRS—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	9.7E+01	1.4E-01	5.8E-03
Regionalized-1	11	12	9.7E+01	1.4E-01	5.8E-03
Regionalized-2	7	6	9.7E+01	1.4E-01	5.8E-03
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	9.7E+01	1.4E-01	5.8E-03
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-16.1–4. SRS—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	1.5E-08	5.7E-08	- -
Decentralized	37	16	1.7E-08	5.3E-08	2.4E-05
Regionalized-1	11	12	1.7E-08	5.3E-08	2.4E-05
Regionalized-2	7	6	1.7E-08	5.3E-08	2.4E-05
Regionalized-3	7	1	1.7E-08	5.3E-08	- -
Regionalized-4	4	6	1.7E-08	5.3E-08	2.4E-05
Centralized	1	1	1.3E-11	5.7E-11	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-16.1-5. SRS—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probabhlity	Radiation Genetic Effects Probability
No Action	3	-	2.9E-05	5.0E-08	3.7E-11	2.9E-09	1.1E-04	1.9E-07	1.6E-09	1.1E-08	- -	- -	- -	- -
Decentralized	37	16	3.3E-05	5.6E-08	1.3E-11	3.3E-09	1.1E-04	1.8E-07	5.6E-10	1.1E-08	4.9E-02	8.2E-05	2.5E-04	4.9E-06
Regionalized-1	11	12	3.3E-05	5.7E-08	1.3E-11	3.3E-09	1.1E-04	1.8E-07	5.6E-10	1.1E-08	4.9E-02	8.2E-05	2.5E-04	4.9E-06
Regionalized-2	7	6	3.3E-05	5.7E-08	1.3E-11	3.3E-09	1.1E-04	1.8E-07	5.6E-10	1.1E-08	4.9E-02	8.2E-05	2.5E-04	4.9E-06
Regionalized-3	7	1	3.3E-05	5.7E-08	1.2E-11	3.3E-09	1.1E-04	1.8E-07	5.4E-10	1.1E-08	- -	- -	- -	- -
Regionalized-4	4	6	3.3E-05	5.7E-08	1.3E-11	3.3E-09	1.1E-04	1.8E-07	5.6E-10	1.1E-08	4.9E-02	8.2E-05	2.5E-04	4.9E-06
Centralized	1	1	2.5E-08	4.3E-11	7.9E-13	2.5E-12	1.1E-07	1.9E-10	3.5E-11	1.1E-11	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.

Table II-16.1-6. SRS—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	3.8E-08	1.7E-06	5.8E-03	- -
Decentralized	37	16	1.6E-08	6.9E-07	5.8E-03	2.7E+00
Regionalized-1	11	12	1.6E-08	6.9E-07	5.8E-03	2.7E+00
Regionalized-2	7	6	1.6E-08	6.9E-07	5.8E-03	2.7E+00
Regionalized-3	7	1	1.4E-08	6.3E-07	5.8E-03	- -
Regionalized-4	4	6	1.6E-08	6.9E-07	5.8E-03	2.7E+00
Centralized	1	1	1.6E-10	7.0E-09	1.0E-04	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-16.1-7. SRS—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	82 (30/52)	89 (79/10)	0	6 (6/0)	8 (8/0)	14 (8/6)	23 (2/21)	9 (5/4)	0	1 (1/0)	0	2 (0/2)
Decentralized	37	16	123 (19/104)	70 (49/21)	0	4 (4/0)	5 (5/0)	17 (5/12)	60 (1/59)	15 (3/12)	0	2 (0/2)	0	7 (0/7)
Regionalized-1	11	12	128 (19/109)	71 (49/22)	0	4 (4/0)	5 (5/0)	18 (5/13)	62 (1/61)	15 (3/12)	0	2 (0/2)	0	7 (0/7)
Regionalized-2	7	6	128 (19/109)	71 (49/22)	0	4 (4/0)	5 (5/0)	18 (5/13)	62 (1/61)	15 (3/12)	0	2 (0/2)	0	7 (0/7)
Regionalized-3	7	1	99 (4/95)	29 (10/19)	0	1 (1/0)	1 (1/0)	12 (1/11)	47 (0/47)	11 (2/9)	0	1 (1/0)	0	6 (0/6)
Regionalized-4	4	6	128 (19/109)	71 (49/22)	0	4 (4/0)	5 (5/0)	18 (5/13)	62 (1/61)	15 (3/12)	0	2 (0/2)	0	7 (0/7)
Centralized	1	1	39 (1/38)	10 (2/8)	0	0	0	5 (0/5)	11 (0/11)	2 (0/2)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-16.1-8. SRS—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	--	--	--	--	--	--
Decentralized	37	16	--	--	--	--	--	--
Regionalized-1	11	12	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	2	13	0	10	0	1	0	0	0	0	0	0
Decentralized	37	16	1	8	0	10	0	0	0	0	0	0	0	0
Regionalized-1	11	12	1	8	0	10	0	0	0	0	0	0	0	0
Regionalized-2	7	6	1	8	0	10	0	0	0	0	0	0	0	0
Regionalized-3	7	1	0	6	0	9	0	0	0	0	0	0	0	0
Regionalized-4	4	6	1	8	0	10	0	0	0	0	0	0	0	0
Centralized	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) SRS is in an attainment area for all criteria pollutants, therefore the GCR doe not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for the No Action and minimum treatment (no incineration) alternatives are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-16.1-9. SRS—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Decentralized	37	16	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-1	11	12	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-2	7	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-3	7	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-4	4	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Centralized	1	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	- -	0	0	0	- -	0	0	0	- -	- -
Decentralized	37	16	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-1	11	12	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-2	7	6	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-3	7	1	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-4	4	6	- -	0	0	0	- -	0	0	0	- -	- -
Centralized	1	1	- -	0	0	0	- -	0	0	0	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-16.1-10. SRS—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	74593	4.7	- -	7487	0.5	- -	<0.1
Decentralized	37	16	34974	2.2	- -	8956	0.6	- -	<0.1
Regionalized-1	11	12	35688	2.2	- -	8980	0.6	- -	<0.1
Regionalized-2	7	6	35688	2.2	- -	8980	0.6	- -	<0.1
Regionalized-3	7	1	16697	1.0	- -	7577	0.5	- -	<0.1
Regionalized-4	4	6	35717	2.2	- -	8968	0.6	- -	<0.1
Centralized	1	1	2832	0.2	- -	1053	0.1	- -	<0.1

Notes:
T = Treatment
D = Disposal
Notes: Water supplied by groundwater. Current water use = 1,600,000 gallons/day.
Wastewater discharged to the Savannah River. Average flow rate of the Savannah River = 6,463,000,000 gallons/day.
- - = Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-16.1-11. SRS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal (Contact-Handled)

LLMW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107
No Action	3	-	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Regionalized-2	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Regionalized-3	7	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-4	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Centralized	1	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

LLMW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234
No Action	3	-	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	37	16	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	4
Regionalized-1	11	12	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	4
Regionalized-2	7	6	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	4
Regionalized-3	7	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-4	4	6	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	4
Centralized	1	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = No disposal of CH-LLMW at this site for this alternative.

Table II-16.1-12. SRS—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) from Disposal (Remote-Handled)

LLMW Alternatives	T	D *	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-4	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centralized	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LLMW Alternatives	T	D *	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	3	-	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Regionalized-1	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Regionalized-2	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Regionalized-3	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Regionalized-4	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Centralized	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0

Notes:

T = Treatment

D = Disposal

* = In addition to the CH-LLMW disposal sites indicated below, disposal of RH-LLMW occurs at four sites (Hanford, INEL, ORR and SRS) for all alternatives except No Action.

- - = No disposal at this site for this alternative.

Table II-16.1-13. SRS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Contact-Handled)

LLMW Alternatives	T	D	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	3	0	300	0	100	40	0
Regionalized-1	11	12	0	3	0	300	0	100	40	0
Regionalized-2	7	6	0	3	0	300	0	100	40	0
Regionalized-3	7	1	--	--	--	--	--	--	--	--
Regionalized-4	4	6	0	3	0	300	0	100	40	0
Centralized	1	1	--	--	--	--	--	--	--	--

LLMW Alternatives	T	D	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	200	0	0	500	30	10	0
Regionalized-1	11	12	200	0	0	500	30	10	0
Regionalized-2	7	6	200	0	0	500	30	10	0
Regionalized-3	7	1	--	--	--	--	--	--	--
Regionalized-4	4	6	200	0	0	500	30	10	0
Centralized	1	1	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
"--" = No disposal at this site for this alternative.

Table II-16.1-14. SRS—LLMW—Percent of Drinking Water Standards for Hazardous Constituents in Groundwater from Disposal (Remote-Handled)

LLMW Alternatives	T	D *	Acetone	Arsenic	Barium	Benzene	Cadmium	Carbon Tetrachloride	Chromium	Cyanide
No Action	3	-	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	1	0	0
Regionalized-1	11	12	0	0	0	0	0	1	0	0
Regionalized-2	7	6	0	0	0	0	0	1	0	0
Regionalized-3	7	1	0	0	0	0	0	1	0	0
Regionalized-4	4	6	0	0	0	0	0	1	0	0
Centralized	1	1	0	0	0	0	0	1	0	0

LLMW Alternatives	T	D *	1,2-dichloro-ethane	Lead	Mercury	Methylene Chloride	Selenium	Silver	1,2,2-trichloro-1,1-trifluoroethane
No Action	3	-	--	--	--	--	--	--	--
Decentralized	37	16	1	0	0	3	0	0	0
Regionalized-1	11	12	1	0	0	3	0	0	0
Regionalized-2	7	6	1	0	0	3	0	0	0
Regionalized-3	7	1	1	0	0	3	0	0	0
Regionalized-4	4	6	1	0	0	3	0	0	0
Centralized	1	1	1	0	0	3	0	0	0

Notes:
T = Treatment
D = Disposal
* = In addition to the CH-LLMW disposal sites indicated below, disposal of RH-LLMW occurs at four sites (Hanford, INEL, ORR and SRS) for all alternatives except No Action.
"--" = No disposal at this site for this alternative.

Table II-16.1-15. SRS—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	506	436	0.17	4.7	0.06	0.11
Decentralized	37	16	1058	1139	0.45	12.3	0.17	0.31
Regionalized-1	11	12	1100	1184	0.46	12.8	0.18	0.32
Regionalized-2	7	6	1100	1184	0.46	12.8	0.18	0.32
Regionalized-3	7	1	844	909	0.36	9.8	0.13	0.21
Regionalized-4	4	6	1100	1184	0.46	12.8	0.18	0.32
Centralized	1	1	222	239	0.09	2.6	0.04	0.04

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-16.1-16. SRS—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment
No Action	3	-	24.9	0.02	74593	1.49	7487	1.00	10.46	5.98	232	1
Decentralized	37	16	22.6	0.02	34974	0.70	8956	1.19	2.51	1.44	727	4
Regionalized-1	11	12	22.6	0.02	35688	0.71	8980	1.20	2.51	1.44	760	4
Regionalized-2	7	6	22.6	0.02	35688	0.71	8980	1.20	2.55	1.46	649	4
Regionalized-3	7	1	12.8	0.01	16697	0.33	7577	1.01	1.41	0.80	760	4
Regionalized-4	4	6	22.6	0.02	35717	0.71	8968	1.20	2.51	1.44	788	5
Centralized	1	1	12.8	0.00	2832	0.06	1053	0.14	1.41	0.81	207	1

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts
(1) Based on 1991 Site Employment

Table II-16.1-17. SRS—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	572	37	111	389	36	339	234	0
Decentralized	37	16	1198	133	331	603	122	908	0	289
Regionalized-1	11	12	1245	142	349	628	125	955	0	289
Regionalized-2	7	6	1245	142	349	628	125	955	0	289
Regionalized-3	7	1	955	116	308	483	46	955	0	0
Regionalized-4	4	6	1245	142	349	628	125	955	0	289
Centralized	1	1	253	37	96	104	14	253	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.16.2 SRS LLW

Thirteen tables immediately following portray the impacts of LLW at SRS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	SRS—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-16.2-1	16-21
2.	SRS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-16.2-2	16-22
3.	SRS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-16.2-3	16-23
4.	SRS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-16.2-4	16-24
5.	SRS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-16.2-5	16-25
7.	SRS—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-16.2-6	16-26
8.	SRS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-16.2-7	16-27
9.	SRS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-16.2-8	16-28
10.	SRS—LLW—Impacts on Water Resources Due to Increased Water Use	II-16.2-9	16-29
11	SRS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-16.2-10	16-30
13.	SRS—LLW—Socioeconomic Impacts for Treatment and Disposal	II-16.2-11	16-31
14.	SRS—LLW—Infrastructure Impacts for Treatment and Disposal	II-16.2-12	16-32
15.	SRS—LLW—Cost	II-16.2-13	16-33

Table II-16.2-1. SRS—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	3.3E-01	5.2E-01	5.9E-04	3.2E-05	7.3E-01	2.1E+00
Decentralized		16	2.3E-01	4.4E-01	1.9E-05	1.3E-06	5.8E-01	3.5E+00
Regionalized-1		12	2.3E-01	4.4E-01	1.9E-05	1.3E-06	5.8E-01	3.5E+00
Regionalized-2	11	12	2.8E-01	5.6E-01	6.1E-04	3.3E-05	5.7E-01	3.0E+00
Regionalized-3		6	2.3E-01	4.4E-01	1.9E-05	1.3E-06	5.8E-01	3.5E+00
Regionalized-4	7	6	2.8E-01	5.6E-01	6.1E-04	3.3E-05	5.7E-01	3.0E+00
Regionalized-5	4	6	2.8E-01	5.6E-01	6.1E-04	3.3E-05	5.7E-01	3.0E+00
Regionalized-6		2	2.3E-01	4.4E-01	1.9E-05	1.3E-06	6.1E-01	5.8E+00
Regionalized-7		2	2.3E-01	4.4E-01	1.9E-05	1.3E-06	6.1E-01	5.8E+00
Centralized-1		1	2.3E-01	4.4E-01	1.9E-05	1.3E-06	- -	- -
Centralized-2		1	2.3E-01	4.4E-01	1.9E-05	1.3E-06	- -	- -
Centralized-3	7	1	2.8E-01	5.6E-01	6.1E-04	3.3E-05	- -	- -
Centralized-4	7	1	2.8E-01	5.6E-01	6.1E-04	3.3E-05	- -	- -
Centralized-5	1	1	2.3E-01	4.4E-01	1.2E-05	1.1E-06	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-16.2-2. SRS—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	1.2E+00	2.0E-03	1.2E-04	6.4E-02	1.1E-04	6.4E-06	8.3E+02	1.2E+00	5.0E-02
Decentralized		16	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	7.9E-01	3.4E-02
Regionalized-1		12	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	7.9E-01	3.4E-02
Regionalized-2	11	12	1.2E+00	2.1E-03	1.2E-04	6.6E-02	1.1E-04	6.6E-06	6.9E+02	9.6E-01	4.1E-02
Regionalized-3		6	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	7.9E-01	3.4E-02
Regionalized-4	7	6	1.2E+00	2.1E-03	1.2E-04	6.6E-02	1.1E-04	6.6E-06	6.9E+02	9.6E-01	4.1E-02
Regionalized-5	4	6	1.2E+00	2.1E-03	1.2E-04	6.6E-02	1.1E-04	6.6E-06	6.9E+02	9.6E-01	4.1E-02
Regionalized-6		2	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	7.9E-01	3.4E-02
Regionalized-7		2	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	7.9E-01	3.4E-02
Centralized-1		1	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	8.0E-01	3.4E-02
Centralized-2		1	3.7E-02	6.3E-05	3.7E-06	2.6E-03	4.4E-06	2.6E-07	5.7E+02	8.0E-01	3.4E-02
Centralized-3	7	1	1.2E+00	2.1E-03	1.2E-04	6.7E-02	1.1E-04	6.7E-06	6.9E+02	9.6E-01	4.1E-02
Centralized-4	7	1	1.2E+00	2.1E-03	1.2E-04	6.7E-02	1.1E-04	6.7E-06	6.9E+02	9.6E-01	4.1E-02
Centralized-5	1	1	2.5E-02	4.2E-05	2.5E-06	2.2E-03	3.7E-06	2.2E-06	5.7E+02	7.9E-01	3.4E-02

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2-3. SRS—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	1.8E+03	2.5E+00	1.1E-01
Decentralized		16	1.5E+03	2.0E+00	8.7E-02
Regionalized-1		12	1.5E+03	2.0E+00	8.7E-02
Regionalized-2	11	12	1.4E+03	2.0E+00	8.5E-02
Regionalized-3		6	1.5E+03	2.0E+00	8.7E-02
Regionalized-4	7	6	1.4E+03	2.0E+00	8.5E-02
Regionalized-5	4	6	1.4E+03	2.0E+00	8.5E-02
Regionalized-6		2	1.5E+03	2.1E+00	9.1E-02
Regionalized-7		2	1.5E+03	2.1E+00	9.1E-02
Centralized-1		1	- -	- -	- -
Centralized-2		1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2–4. SRS—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	5.6E-09	2.9E-08	3.7E-05
Decentralized		16	1.7E-10	1.1E-09	2.8E-05
Regionalized-1		12	1.7E-10	1.1E-09	3.0E-05
Regionalized-2	11	12	5.7E-09	3.0E-08	3.6E-05
Regionalized-3		6	1.7E-10	1.1E-09	3.0E-05
Regionalized-4	7	6	5.7E-09	3.0E-08	3.6E-05
Regionalized-5	4	6	5.7E-09	3.0E-08	3.6E-05
Regionalized-6		2	1.7E-10	1.1E-09	4.3E-05
Regionalized-7		2	1.7E-10	1.1E-09	4.3E-05
Centralized-1		1	1.8E-10	1.1E-09	- -
Centralized-2		1	1.8E-10	1.1E-09	- -
Centralized-3	7	1	5.7E-09	3.0E-08	- -
Centralized-4	7	1	5.7E-09	3.0E-08	- -
Centralized-5	1	1	1.2E-10	9.5E-10	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2–5. SRS—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	1.1E-05	1.9E-08	1.1E-09	5.7E-05	9.7E-08	5.7E-09	7.4E-02	1.3E-04	7.4E-06
Decentralized		16	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.8E-09	2.3E-10	5.7E-02	9.6E-05	5.7E-06
Regionalized-1		12	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.8E-09	2.3E-10	6.0E-02	1.0E-04	6.0E-06
Regionalized-2	11	12	1.1E-05	1.9E-08	1.1E-09	5.9E-05	1.0E-07	5.9E-09	7.2E-02	1.2E-04	7.2E-06
Regionalized-3		6	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.8E-09	2.3E-10	6.0E-02	1.0E-04	6.0E-06
Regionalized-4	7	6	1.1E-05	1.9E-08	1.1E-09	5.9E-05	1.0E-07	5.9E-09	7.2E-02	1.2E-04	7.2E-06
Regionalized-5	4	6	1.1E-05	1.9E-08	1.1E-09	5.9E-05	1.0E-07	5.9E-09	7.2E-02	1.2E-04	7.2E-06
Regionalized-6		2	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.8E-09	2.3E-10	8.6E-02	1.5E-04	8.6E-06
Regionalized-7		2	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.8E-09	2.3E-10	8.6E-02	1.5E-04	8.6E-06
Centralized-1		1	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.9E-09	2.3E-10	- -	- -	- -
Centralized-2		1	3.5E-07	5.9E-10	3.5E-11	2.3E-06	3.9E-09	2.3E-10	- -	- -	- -
Centralized-3	7	1	1.2E-05	2.0E-08	1.2E-09	5.9E-05	1.0E-07	5.9E-09	- -	- -	- -
Centralized-4	7	1	1.2E-05	2.0E-08	1.2E-09	5.9E-05	1.0E-07	5.9E-09	- -	- -	- -
Centralized-5	1	1	2.3E-07	3.9E-10	2.3E-11	1.9E-06	3.2E-09	1.9E-10	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2–6. SRS—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	48 (19/29)	56 (50/6)	0	4 (4/0)	5 (5/0)	8 (5/3)	213 (2/211)	46 (4/42)	0	1 (1/0)	0	25 (0/25)
Decentralized		16	83 (23/60)	73 (61/12)	0	5 (5/0)	6 (6/0)	13 (6/7)	197 (1/196)	40 (1/39)	0	0	0	24 (0/24)
Regionalized-1		12	259 (199/60)	529 (517/12)	0	41 (41/0)	49 (49/0)	57 (50/7)	197 (1/196)	40 (1/39)	0	0	0	24 (0/24)
Regionalized-2	11	12	107 (22/85)	75 (58/17)	0	5 (5/0)	6 (6/0)	16 (6/10)	198 (1/197)	41 (2/39)	0	1 (1/0)	0	24 (0/24)
Regionalized-3		6	83 (23/60)	73 (61/12)	0	5 (5/0)	6 (6/0)	13 (6/7)	198 (1/197)	40 (1/39)	0	0	0	24 (0/24)
Regionalized-4	7	6	107 (22/85)	75 (58/17)	0	5 (5/0)	6 (6/0)	16 (6/10)	198 (1/197)	41 (2/39)	0	1 (1/0)	0	24 (0/24)
Regionalized-5	4	6	119 (35/84)	109 (92/17)	0	7 (7/0)	9 (9/0)	19 (9/10)	198 (1/197)	41 (2/39)	0	1 (1/0)	0	24 (0/24)
Regionalized-6		2	97 (37/60)	107 (95/12)	0	8 (8/0)	9 (9/0)	16 (9/7)	324 (1/323)	76 (2/74)	0	1 (0/1)	0	39 (0/39)
Regionalized-7		2	97 (37/60)	107 (95/12)	0	8 (8/0)	9 (9/0)	16 (9/7)	324 (1/323)	76 (2/74)	0	1 (0/1)	0	39 (0/39)
Centralized-1		1	87 (7/80)	35 (19/16)	0	1 (1/0)	2 (2/0)	12 (2/10)	76 (0/76)	21 (1/20)	0	0	0	9 (0/9)
Centralized-2		1	87 (7/80)	35 (19/16)	0	1 (1/0)	2 (2/0)	12 (2/10)	76 (0/76)	21 (1/20)	0	0	0	9 (0/9)
Centralized-3	7	1	94 (9/85)	35 (19/16)	0	2 (2/0)	2 (2/0)	12 (2/10)	91 (0/91)	24 (1/23)	0	1 (1/0)	0	11 (0/11)
Centralized-4	7	1	94 (9/85)	40 (23/17)	0	2 (2/0)	2 (2/0)	12 (2/10)	91 (0/91)	24 (1/23)	0	1 (1/0)	0	11 (0/11)
Centralized-5	1	1	66 (7/59)	35 (19/16)	0	2 (1/0)	2 (2/0)	11 (2/10)	66 (0/66)	19 (1/18)	0	0	0	8 (0/8)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2–7. SRS—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	2	11	0	6	0	1	0	0	0	0	0	0
Decentralized		16	1	3	0	2	0	0	--	--	--	--	--	--
Regionalized-1		12	1	3	0	2	0	0	--	--	--	--	--	--
Regionalized-2	11	12	1	6	0	5	0	0	0	0	0	0	0	0
Regionalized-3		6	1	3	0	2	0	0	--	--	--	--	--	--
Regionalized-4	7	6	1	6	0	5	0	0	0	0	0	0	0	0
Regionalized-5	4	6	1	6	0	5	0	0	0	0	0	0	0	0
Regionalized-6		2	1	5	0	2	0	0	--	--	--	--	--	--
Regionalized-7		2	1	5	0	2	0	0	--	--	--	--	--	--
Centralized-1		1	0	2	0	1	0	0	--	--	--	--	--	--
Centralized-2		1	0	2	0	1	0	0	--	--	--	--	--	--
Centralized-3	7	1	0	4	0	4	0	0	0	0	0	0	0	0
Centralized-4	7	1	0	4	0	4	0	0	0	0	0	0	0	0
Centralized-5	1	1	0	2	0	1	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) SRS is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for the minimum treatment (no incineration) alternatives, and the Centralized - 5 Alternative are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2-8. SRS—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized		16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	10**	6	--	--	--	--	--	--	--	--	--	--
Decentralized		16	--	--	--	--	--	--	--	--	--	--
Regionalized-1		12	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-3		6	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6		2	--	--	--	--	--	--	--	--	--	--
Regionalized-7		2	--	--	--	--	--	--	--	--	--	--
Centralized-1		1	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T= Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2-9. SRS—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	13690	0.9	- -	21968	1.4	- -	<0.1
Decentralized		16	105325	6.6	- -	25298	1.6	- -	<0.1
Regionalized-1		12	105325	6.6	- -	25298	1.6	- -	<0.1
Regionalized-2	11	12	99729	6.2	- -	25682	1.6	- -	<0.1
Regionalized-3		6	105325	6.6	- -	25298	1.6	- -	<0.1
Regionalized-4	7	6	99729	6.2	- -	25682	1.6	- -	<0.1
Regionalized-5	4	6	99729	6.2	- -	25682	1.6	- -	<0.1
Regionalized-6		2	174220	10.9	- -	40247	2.5	- -	<0.1
Regionalized-7		2	174220	10.9	- -	40247	2.5	- -	<0.1
Centralized-1		1	24652	1.5	- -	7911	0.5	- -	<0.1
Centralized-2		1	24652	1.5	- -	7911	0.5	- -	<0.1
Centralized-3	7	1	27709	1.7	- -	10438	0.7	- -	<0.1
Centralized-4	7	1	27709	1.7	- -	10438	0.7	- -	<0.1
Centralized-5	1	1	24652	1.5	- -	7911	0.5	- -	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by groundwater. Current water use = 1,600,000 gallons/day.
Wastewater discharged to the Savannah River. Average flow rate of the Savannah River = 6,463,000,000 gallons/day.
** Ten sites use existing facilities for Volume Reduction.
- - = Streamflow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-16.2-10. SRS—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Decentralized		16	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-2	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-3		6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-4	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-5	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Regionalized-6		2	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0
Regionalized-7		2	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 229	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	10**	6	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	5	0	0	900	0	0
Decentralized		16	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	4	0	0	700	0	0
Regionalized-1		12	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	4	0	0	700	0	0
Regionalized-2	11	12	0	0	8	0	0	0	0	0	3	0	0	0	1	0	0	0	5	0	0	900	0	0
Regionalized-3		6	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	4	0	0	700	0	0
Regionalized-4	7	6	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	5	0	0	900	0	0
Regionalized-5	4	6	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	5	0	0	900	0	0
Regionalized-6		2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	500	0	0
Regionalized-7		2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	500	0	0
Centralized-1		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2		1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
-- = Disposal is not considered for this Alternative.

Table II-16.2-11. SRS—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	10**	6	4128	3555	1.40	38.4	0.53	0.48
Decentralized		16	4365	4699	1.84	50.7	0.69	0.82
Regionalized-1		12	4365	4699	1.84	50.7	0.69	0.82
Regionalized-2	11	12	4136	4452	1.75	48.1	0.69	0.77
Regionalized-3		6	4365	4699	1.84	50.7	0.69	0.82
Regionalized-4	7	6	4136	4452	1.75	48.1	0.69	0.77
Regionalized-5		6	4136	4452	1.75	48.1	0.69	0.77
Regionalized-6		2	5860	6308	2.48	68.1	0.93	1.33
Regionalized-7		2	5860	6308	2.48	68.1	0.93	1.33
Centralized-1		1	942	1014	0.40	10.9	0.15	0.19
Centralized-2		1	942	1014	0.40	10.9	0.15	0.19
Centralized-3	7	1	1125	1211	0.48	13.1	0.18	0.23
Centralized-4	7	1	1125	1211	0.48	13.1	0.18	0.23
Centralized-5	1	1	942	1014	0.40	10.9	0.15	0.19

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2–12. SRS—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	23.0	0.02	13690	0.27	21968	2.95	5.31	3.03	224	1
Decentralized		16	49.8	0.03	105325	2.11	25298	3.37	6.46	3.69	3818	22
Regionalized-1		12	49.8	0.03	105325	2.11	25298	3.37	6.46	3.69	3818	22
Regionalized-2	11	12	46.6	0.02	99729	1.99	25682	3.42	6.52	3.73	3289	19
Regionalized-3		6	49.8	0.03	105325	2.11	25298	3.37	6.46	3.69	3818	22
Regionalized-4	7	6	46.6	0.02	99729	1.99	25682	3.42	6.52	3.73	3290	19
Regionalized-5	4	6	46.6	0.03	99729	1.99	25478	3.42	6.52	3.73	3290	19
Regionalized-6		2	82.5	0.06	174220	3.48	40247	5.37	9.77	5.58	6213	36
Regionalized-7		2	82.5	0.06	174220	3.48	40247	5.37	9.77	5.58	6213	36
Centralized-1		1	12.5	0.01	24652	0.49	7911	1.05	6.46	3.69	618	4
Centralized-2		1	12.5	0.01	24652	0.49	7911	1.05	6.46	3.69	618	4
Centralized-3	7	1	13.4	0.01	27709	0.55	10438	1.39	6.36	3.63	660	4
Centralized-4	7	1	13.4	0.01	27709	0.55	10438	1.39	6.36	3.63	660	4
Centralized-5		1	12.5	0.01	24652	0.49	7911	1.05	6.46	3.69	618	4

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
** Ten sites use existing facilities for Volume Reduction.

Table II-16.2-13. SRS—LLW—Cost

LLW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	4670	35	1658	2761	216	947	0	3723
Decentralized		16	4939	322	1969	2438	210	904	0	4035
Regionalized-1		12	4939	322	1969	2438	210	904	0	4035
Regionalized-2	11	12	4679	327	1758	2369	225	1267	0	3412
Regionalized-3		6	4939	322	1969	2437	210	904	0	4035
Regionalized-4	7	6	4679	327	1758	2369	225	1267	0	3412
Regionalized-5	4	6	4679	327	1758	2369	225	1267	0	3412
Regionalized-6		2	6630	439	2682	3300	210	904	0	5726
Regionalized-7		2	6630	439	2682	3300	210	904	0	5726
Centralized-1		1	1066	79	321	622	44	1066	0	0
Centralized-2		1	1066	79	321	622	44	1066	0	0
Centralized-3	7	1	1272	116	299	801	56	1272	0	0
Centralized-4	7	1	1272	116	299	801	56	1272	0	0
Centralized-5	1	1	1066	79	321	622	44	1066	0	0

Notes:
** Ten sites use existing facilities for Volume Reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.16.3 SRS TRUW

Twelve tables immediately following portray the impacts of TRUW at SRS. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	SRS—TRUW—Treatment: Estimated Number of Fatalities	II-16.3-1	16-35
2.	SRS—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-16.3-2	16-36
4.	SRS—TRUW—Treatment: MEI Probability of Cancer Fatality	II-16.3-3	16-37
5.	SRS—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects	II-16.3-4	16-38
6.	SRS—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure	II-16.3-5	16-39
7.	SRS—TRUW—Emissions in Tons per Year of Criteria Air Pollutants	II-16.3-6	16-40
8.	SRS—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants	II-16.3-7	16-41
9.	SRS—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-16.3-8	16-42
10.	SRS—TRUW—Impacts on Water Resources Due to Increased Water Use	II-16.3-9	16-43
13.	SRS—TRUW—Socioeconomic Impacts for Treatment	II-16.3-10	16-44
14.	SRS—TRUW—Infrastructure Impacts for Treatment	II-16.3-11	16-45
15.	SRS—TRUW—Cost	II-16.3-12	16-46

Table II-16.3-1. SRS—TRUW—Treatment: Estimated Number of Fatalities

TRUW Alternatives	Treatment						
	Number of Sites		Treat STD	WM Worker		Offsite Population Radiation Exposure	Noninvolved Workers Radiation Exposure
	CH Treat	RH Treat		Radiation Exposure	Physical Hazards		
No Action **	16	5	WIPP WAC	3.8E-02	2.6E-02	2.2E-05	2.3E-06
Decentralized ***	16	5	WIPP WAC	6.9E-02	8.8E-02	7.2E-05	7.8E-06
Regionalized-1	5	2	Reduce Gas	7.7E-02	1.5E-01	1.4E-04	1.5E-05
Regionalized-2	5	2	LDR	7.4E-02	1.8E-01	2.3E-03	2.4E-04
Regionalized-3	3	2	LDR	7.4E-02	1.8E-01	2.3E-03	2.4E-04
Centralized	WIPP	2	LDR	1.0E-01	7.3E-02	3.4E-05	3.7E-06

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at 16 sites, then transfered to interim storage at 10 sites, then to WIPP.

Table II-16.3-2. SRS—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treat STD	Offsite Population				Noninvolved Workers				WM Workers			
	CH Treat	RH Treat		Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action**	16	5	WIPP WAC	4.3E-02	7.4E-05	7.2E-13	4.3E-06	4.7E-03	8.0E-06	3.6E-13	4.7E-07	9.4E+01	1.3E-01	4.1E-10	5.7E-03
Decentralized***	16	5	WIPP WAC	1.5E-01	2.5E-04	1.9E-11	1.5E-05	1.6E-02	2.7E-05	9.5E-12	1.6E-06	1.7E+02	2.4E-01	4.2E-09	1.0E-02
Regionalized-1	5	2	Reduce Gas	2.7E-01	4.6E-04	3.1E-11	2.7E-05	2.9E-01	4.9E-05	1.5E-11	2.9E-06	1.9E+02	2.7E-01	2.2E-08	1.2E-02
Regionalized-2	5	2	LDR	4.5E+00	7.7E-03	2.9E-11	4.5E-04	4.8E-01	8.2E-04	1.5E-11	4.8E-05	1.9E+02	2.6E-01	3.7E-08	1.1E-02
Regionalized-3	3	2	LDR	4.5E+00	7.7E-03	2.9E-11	4.5E-04	4.8E-01	8.2E-04	1.5E-11	4.8E-05	1.9E+02	2.6E-01	3.7E-08	1.1E-02
Centralized	WIPP	2	LDR	6.80E-02	1.2E-04	1.4E-11	6.8E-06	7.3E-03	1.3E-05	6.8E-12	7.3E-07	2.6E+02	3.6E-01	4.0E-09	1.5E-02

Notes:

** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.

*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

T = Treatment

D = Disposal

Table II-16.3-3. SRS—TRUW—Treatment: MEI Probability of Cancer Fatality

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment	
	CH Treat	RH Treat		Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability
No Action**	16	5	WIPP WAC	2.0E-10	2.0E-09
Decentralized***	16	5	WIPP WAC	6.8E-10	6.8E-09
Regionalized-1	5	2	Reduce Gas	1.3E-09	1.3E-08
Regionalized-2	5	2	LDR	2.1E-08	2.1E-07
Regionalized-3	3	2	LDR	2.1E-08	2.1E-07
Centralized	WIPP	2	LDR	3.2E-10	3.2E-09

Notes:
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives disposal at WIPP is assumed.
***In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-16.3-4. SRS—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment							
				Offsite Population MEI				Noninvolved Worker MEI			
	CH Treat	RH Treat		Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action **	16	5	WIPP WAC	4.1E-07	6.9E-10	<9.9E-14	4.1E-11	4.1E-06	6.9E-09	<9.9E-14	4.1E-10
Decentralized ***	16	5	WIPP WAC	1.4E-06	2.3E-09	<9.9E-14	1.4E-10	1.4E-05	2.3E-08	1.1E-14	1.4E-09
Regionalized-1	5	2	Reduce Gas	2.5E-06	4.3E-09	<9.9E-14	2.5E-10	2.5E-05	4.3E-08	1.8E-14	2.5E-09
Regionalized-2	5	2	LDR	4.2E-05	7.2E-08	<9.9E-14	4.2E-09	4.2E-04	7.1E-07	1.7E-14	4.2E-08
Regionalized-3	3	2	LDR	4.2E-05	7.2E-08	<9.9E-14	4.2E-09	4.2E-04	7.1E-07	1.7E-14	4.2E-08
Centralized	WIPP	2	LDR	6.4E-07	1.1E-09	<9.9E-14	6.4E-11	6.4E-06	1.1E-08	<9.9E-14	6.4E-10

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
MEI = Maximally Exposed Individual

Table II-16.3-5. SRS—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment		
	CH Treat	RH Treat		Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index
No Action**	16	5	WIPP WAC	<9.9E-14	2.5E-13	5.2E-09
Decentralized***	16	5	WIPP WAC	2.8E-13	1.2E-11	6.7E-08
Regionalized-1	5	2	Reduce Gas	4.5E-13	2.0E-11	7.9E-08
Regionalized-2	5	2	LDR	4.5E-13	2.0E-11	1.3E-07
Regionalized-3	3	2	LDR	4.5E-13	2.0E-11	1.3E-07
Centralized	WIPP	2	LDR	2.0E-13	8.9E-12	6.7E-08

Notes:
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The Hazard Quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-16.3-6. SRS—TRUW—Emissions in Tons per Year of Criteria Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year					
	CH Treat	RH Treat		CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action**	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -	7 (0/7)	1 (0/1)	0	0	0	1 (0/1)
Decentralized***	16	5	WIPP WAC	31 (8/23)	25 (20/5)	0	2 (2/0)	2 (2/0)	5 (2/3)	23 (0/23)	5 (0/5)	0	0	0	3 (3/0)
Regionalized-1	5	2	Reduce Gas	53 (10/43)	34 (25/9)	0	2 (2/0)	2 (2/0)	7 (2/5)	39 (0/39)	8 (1/8)	0	0	0	5 (0/5)
Regionalized-2	5	2	LDR	68 (11/57)	40 (29/11)	0	2 (2/0)	3 (3/0)	10 (3/7)	40 (0/40)	8 (1/8)	0	0	0	5 (0/5)
Regionalized-3	3	2	LDR	68 (11/57)	40 (29/11)	0	2 (2/0)	3 (3/0)	10 (3/7)	40 (0/40)	8 (1/8)	0	0	0	5 (0/5)
Centralized	WIPP	2	LDR	14 (5/9)	16 (14/2)	0	1 (1/0)	1 (1/0)	2 (1/1)	9 (0/9)	2 (0/2)	0	0	0	1 (0/1)

Notes:
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission)
(2) Values = total emissions (stationary-source emissions / mobile-source emission)
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-16.3-7. SRS—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Construction					
				Percent of Tons/Year General Conformity Rule (1)					
	CH Treat	RH Treat		CO	NO2	Pb	PM10	SO2	VOC
No Action**	16	5	WIPP WAC	--	--	--	--	--	--
Decentralized***	16	5	WIPP WAC	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--
Centralized	WIPP	2	LDR	--	--	--	--	--	--

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance											
				Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	CH Treat	RH Treat		CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action**	16	5	WIPP WAC	0	0	0	0	0	0	--	--	--	--	--	--
Decentralized***	16	5	WIPP WAC	0	1	0	0	0	0	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	0	1	0	1	0	0	--	--	--	--	--	--
Regionalized-2	5	2	LDR	0	2	0	9	4	0	0	0	0	0	0	0
Regionalized-3	3	2	LDR	0	2	0	9	4	0	0	0	0	0	0	0
Centralized	WIPP	2	LDR	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) SRS is in an attainment area for all criteria pollutants, therfore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for all alternatives are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-16.3-8. SRS—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

Number of TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance											
	CH Treat	RH Treat		Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action**	16	5	WIPP - WAC	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -
Decentralized**	16	5	WIPP - WAC	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -
Regionalized-2	5	2	LDR	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -
Regionalized-3	3	2	LDR	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -
Centralized	WIPP	2	LDR	0	- -	- -	- -	0	0	- -	- -	- -	- -	- -	- -

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance									
	CH Treat	RH Treat		Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action**	16	5	WIPP - WAC	0	0	- -	- -	- -	0	0	- -	- -	- -
Decentralized***	16	5	WIPP - WAC	0	0	- -	- -	- -	0	0	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	0	0	- -	- -	- -	0	0	- -	- -	- -
Regionalized-2	5	2	LDR	0	0	- -	- -	- -	0	0	- -	- -	- -
Regionalized-3	3	2	LDR	0	0	- -	- -	- -	0	0	- -	- -	- -
Centralized	WIPP	2	LDR	0	0	- -	- -	- -	0	0	- -	- -	- -

Notes:

** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.

*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.

Percentages <1% are shown as zeros. CH = contact handled. RH = remote handled.

Table II-16.3-9. SRS—TRUW—Impacts on Water Resources Due to Increased Water Use

TRUW Alternatives	Number of Sites		Treatment Standard	Construction			Operations			
	CH Treat	RH Treat		Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action**	16	5	WIPP WAC	- -	- -	- -	1973	0.1	- -	<0.1
Decentralized***	16	5	WIPP WAC	13231	0.8	- -	4116	0.3	- -	<0.1
Regionalized-1	5	2	Reduce Gas	18457	1.2	- -	7185	0.4	- -	<0.1
Regionalized-2	5	2	LDR	22118	1.4	- -	7366	0.5	- -	<0.1
Regionalized-3	3	2	LDR	22118	1.4	- -	7366	0.5	- -	<0.1
Centralized	WIPP	2	LDR	8530	0.5	- -	847	0.1	- -	<0.1

Notes:
Water supplied by groundwater. Current water use = 1,600,000 gallons/day.
Wastewater discharged to the Savannah River. Average flow rate of the Savannah River = 6,463,000,000 gallons/day.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
- - = Stream Flow is not considered for this site.

Table II-16.3-10. SRS—TRUW—Socioeconomic Impacts for Treatment

TRUW Alternatives	Number of Sites		Effect of Implementation of Alternatives						
					Jobs		Income		
	CH Treat	RH Treat	Treatment Standard	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action**	16	5	WIPP WAC	142	123	0.05	1.3	0.02	0.02
Decentralized***	16	5	WIPP WAC	446	480	0.19	5.2	0.07	0.08
Regionalized-1	5	2	Reduce Gas	757	814	0.32	8.8	0.12	0.14
Regionalized-2	5	2	LDR	905	975	0.38	10.5	0.14	0.16
Regionalized-3	3	2	LDR	905	975	0.38	10.5	0.14	0.16
Centralized	WIPP	2	LDR	164	176	0.07	1.9	0.03	0.03

Notes:
(1) In current 1990 dollars.
(2) Compared to 1990 baseline.
** For No Action Alternative, storage is indefinite: no disposal at WIPP to assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-16.3-11. SRS—TRUW—Infrastructure Impacts for Treatment

TRUW Alternatives	Number of Sites		Treatment Standard	Effect of Implementation of Alternatives									
				Land Use		Water		Waste Water		Power		Employment (FTE)	
	CH Treat	RH Treat		Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action**	16	5	WIPP WAC	0	0.00	1973	0.04	1973	0.26	0.07	0.04	0	0.00
Decentralized***	16	5	WIPP WAC	6.3	0.00	13231	0.26	4116	0.55	0.58	0.33	244	1.40
Regionalized-1	5	2	Reduce Gas	7.8	0.01	18457	0.37	7185	0.96	0.94	0.54	475	2.80
Regionalized-2	5	2	LDR	8.2	0.01	22118	0.44	7366	0.98	1.17	0.67	625	3.60
Regionalized-3	3	2	LDR	8.2	0.01	22118	0.44	7366	0.98	1.17	0.67	625	3.60
Centralized	WIPP	2	LDR	4.3	0.00	8530	0.17	847	0.11	0.19	0.11	86	0.50

Notes:
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-16.3-12. SRS—TRUW—Cost

TRUW Alternatives	Number of Sites		Treatment Standard (2)	Total Cost (Millions) (1)	Life-Cycle Component				Functional Area		
	CH Treat	RH Treat			Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Retrieval Characterization (Millions)	Treatment (Millions)	Storage (Millions)
No Action**	11	5	WIPP - WAC	161	0	0	144	17	0	144	17
Decentralized***	16	5	WIPP - WAC	505	30	134	251	90	15	457	33
Regionalized-1	5	2	Reduce Gas	856	68	246	421	120	15	780	61
Regionalized-2	5	2	LDR	1024	87	327	509	100	15	982	28
Regionalized-3	3	2	LDR	1024	87	327	509	100	15	982	28
Centralized	WIPP	2	LDR	186	8	51	71	55	15	170	0

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In Current 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.
(2) Treatment standard (STD) applied: treat to WIPP Waste Acceptance Criteria (WIPP WAC), treat for reduced gas generation (Reduce Gas), treat to Land Disposal Restrictions (LDR).

II.16.4 SRS HLW

Nine of the 14 impact categories apply to HLW at SRS. These impacts are presented in the following tables.

Impact Category

No.	Description	Table No.	Page No.
1.	SRS—HLW—Storage: Estimated Number of Fatalities	II-16.4-1	16-48
2.	SRS—HLW—Storage: Estimated Number of Cancer Incidences and Genetic Effects	II-16.4-2	16-49
7.	SRS—HLW—Emissions in Tons per Year of Criteria Air Pollutants	II-16.4-3	16-50
8.	SRS—HLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-16.4-4	16-51
9.	SRS—HLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-16.4-5	16-52
10.	SRS—HLW—Impacts on Water Resources Due to Increased Water Use	II-16.4-6	16-53
13.	SRS—HLW—Socioeconomic Impacts for Storage	II-16.4-7	16-54
14.	SRS—HLW—Infrastructure Impacts for Storage	II-16.4-8	16-55
15.	SRS—HLW—Cost	II-16.4-9	16-56

Table II-16.4–1. SRS—HLW—Storage: Estimated Number of Fatalities

HLW Alternatives	Number of Storage Sites	WM Workers	
		Radiation Exposure	Physical Hazards
No Action	4	9.8E-01	3.6E-01
Decentralized	4	9.3E-01	3.3E-01
Regionalized-1	3	9.8E-01	3.5E-01
Regionalized-2	3	9.3E-01	3.3E-01
Centralized	1	7.8E-01	2.8E-01

Table II-16.4-2. SRS—HLW—Storage: Estimated Number of Cancer Incidences and Genetic Effects

HLW Alternatives	Number of Storage Sites	WM Workers		
		Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	4	2.5E+03	3.4E+00	1.5E-01
Decentralized	4	2.3E+03	3.3E+00	1.4E-01
Regionalized-1	3	2.5E+03	3.4E+00	1.5E-01
Regionalized-2	3	2.3E+03	3.3E+00	1.4E-01
Centralized	1	1.9E+03	2.7E+00	1.2E-01

Table II-16.4–3. SRS—HLW—Emissions in Tons per Year of Criteria Air Pollutants

HLW Alternatives	Number of Storage Sites	Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
		CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	4	4 (2/2)	5 (5/0)	0	0	0	0	7 (0/7)	2 (0/2)	0	0	0	1 (0/1)
Decentralized	4	4 (2/2)	5 (5/0)	0	0	0	0	7 (0/7)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-1	3	4 (2/2)	5 (5/0)	0	0	1 (1/0)	1 (1/0)	7 (0/7)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-2	3	4 (2/2)	5 (5/0)	0	0	0	0	6 (0/6)	2 (0/2)	0	0	0	1 (0/1)
Centralized	1	4 (2/2)	5 (5/0)	0	0	0	0	7 (0/7)	1 (0/1)	0	0	0	1 (0/1)

Notes:
S = Storage
Data is based on repository beginning to accept HLW canisters in 2015.
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission)
(2) Values = total emissions (stationary-source emissions / mobile-source emission)

Table II-16.4–4. SRS—HLW—Percent of Standard/Guideline for Criteria Air Pollutants

HLW Alternatives	Number of Storage Sites	Construction					
		Percent of Tons/Year General Conformity Rule (1)					
		CO	NO2	Pb	PM10	SO2	VOC
No Action	4	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--
Regionalized-1	3	--	--	--	--	--	--
Regionalized-2	3	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--

HLW Alternatives	Number of Storage Sites	Operations & Maintenance										
		Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)				
		CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2
No Action	4	--	--	--	--	--	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	3	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	3	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--	--	--	--	--	--

Notes:
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) SRS is in an attainment area for all criteria pollutants, therfore the GCR does not apply.
(2) Stationary-source emissions from HLW storage facilities are assumed to be negligible.
(3) Stationary-source emissions from HLW storage facilities are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-16.4-5. SRS—HLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

HLW Alternatives	Number of Storage Sites	Operations & Maintenance											
		Total Radio-nuclides	Other Hazardous and Toxic Air Pollutants	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-1	3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-2	3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Centralized	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

HLW Alternatives	Number of Storage Sites	Operations & Maintenance									
		Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-1	3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-2	3	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Centralized	1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

Notes:
- - = Emissions of hazardous and toxic air pollutants, including radionuclides, from HLW storage facilities are assumed to be negligible.

Table II-16.4–6. SRS—HLW—Impacts on Water Resources Due to Increased Water Use

HLW Alternatives	Number of Storage Sites	Construction			Operations			
		Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	4	28	<0.1	- -	1,900	0.1	- -	<0.1
Decentralized	4	28	<0.1	- -	1,900	0.1	- -	<0.1
Regionalized-1	3	28	<0.1	- -	1,900	0.1	- -	<0.1
Regionalized-2	3	28	<0.1	- -	1,900	0.1	- -	<0.1
Centralized	1	28	<0.1	- -	1,900	0.1	- -	<0.1

Notes:
Water supplied by groundwater. Current water use = 1,600,000 gallons/day.
Wastewater discharged to the Savannah River. Average flow rate of the Savannah River = 6,463,000,000 gallons/d
Data is based on repository beginning to accept HLW canisters in 2015.
- - = Stream Flow is not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-16.4-7. SRS—HLW—Socioeconomic Impacts for Storage

HLW Alternatives	Number of Storage Sites	Effect of Implementation of Alternatives					
		Cost (Millions) (1)	Jobs		Income		% ROI Population Increase (2)
			Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	
No Action	4	257	265	0.10	2.9	0.04	0.03
Decentralized	4	311	321	0.13	3.5	0.05	0.03
Regionalized-1	3	309	319	0.13	3.4	0.05	0.03
Regionalized-2	3	311	321	0.13	3.5	0.05	0.03
Centralized	1	146	151	0.06	1.6	0.02	0.03

Notes:
(1) In 1990 dollars. The economic multiplies analysis only was applied to costs through 2015.
(2) Compared to 1990 baseline.

Table II-16.4–8. SRS—HLW—Infrastructure Impacts for Storage

HLW Alternatives	Number of Storage Sites	Effect of Implementation of Alternatives									
		Land Use		Water		Waste Water		Power		Employment (FTE)	
		Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Construction Employment	% of Current Employment (1)
No Action	4	2	0.00	1,900	0.04	1,900	0.3	0.05	0.03	16	0
Decentralized	4	2	0.00	1,900	0.04	1,900	0.3	0.05	0.03	16	0
Regionalized-1	3	4	0.00	1,900	0.04	1,900	0.3	0.05	0.03	17	0
Regionalized-2	3	2	0.00	1,900	0.04	1,900	0.3	0.05	0.03	16	0
Centralized	1	0	0.00	1,900	0.04	1,900	0.3	0.05	0.03	16	0

Notes:
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.

Table II-16.4–9. SRS—HLW—Cost

HLW Alternatives	Number of Storage Sites	Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)		Cost by Functional Area (1)	
			Construction (Millions) (2)	Operations & Maintenance (3) (Millions)	Storage (Millions)	Handling (Millions)
No Action	4	490	40	451	159	332
Decentralized	4	567	40	527	91	476
Regionalized-1	3	594	40	554	94	500
Regionalized-2	3	567	40	527	91	476
Centralized	1	283	0	283	17	266
Centralized Delayed Acceptance	1	401	0	401	17	384

Notes:
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of Life Cycle Components = Sum of Functional Areas.
(2) Construction costs are for the interim storage facilities.
(3) Operations and maintenance costs include operation and maintenance of the interim storage facilities, and the handling of canisters (unloading/loading of canisters into or out of the interim storage facilities).

II.16.5 SRS HW

Eleven of the 14 impact categories apply to HW at SRS. These impacts are presented in the following tables.

Impact Category

No.	Description	Table No.	Page No.
1.	SRS—HW—Treatment: Estimated Number of Fatalities	II-16.5-1	16-58
2.	SRS—HW—Treatment: Estimated Number of Cancer Incidences	II-16.5-2	16-59
5.	SRS—HW—Treatment: MEI Probability of Cancer Incidences	II-16.5-3	16-60
6.	SRS—HW—Treatment: Noncancer Health Risk From Chemical Exposure	II-16.5-4	16-61
7.	SRS—HW—Emissions in Tons per Year of Criteria Air Pollutants	II-16.5-5	16-62
8.	SRS—HW—Percent of Standard/Guideline for Criteria Air Pollutants	II-16.5-6	16-63
9.	SRS—HW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-16.5-7	16-64
10.	SRS—HW—Impacts on Water Resources Due to Increased Water Use	II-16.5-8	16-65
13.	SRS—HW—Socioeconomic Impacts for Treatment	II-16.5-9	16-66
14.	SRS—HW—Infrastructure Impacts for Treatment	II-16.5-10	16-67
15.	SRS—HW—Cost	II-16.5-11	16-68

Table II-16.5-1. SRS—HW—Treatment: Estimated Number of Fatalities

HW Alternatives	Number of Treatment Sites	WM Workers Physical Hazards
No Action	2	- -
Decentralized	3	8.4E-03
Regionalized-1	5	7.9E-03
Regionalized-2	2	- -

Notes:
- - = Treatment is not considered for this alternative

Table II-16.5-2. SRS—HW—Treatment: Estimated Number of Cancer Incidences

HW Alternatives	Number of Treatment Sites	Treatment		
		Offsite Population Chemical Cancer Incidence	Noninvolved Workers Chemical Cancer Incidence	WM Workers Chemical Cancer Incidence
No Action	2	- -	- -	- -
Decentralized	3	1.3E-03	6.5E-04	1.0E-01
Regionalized-1	5	1.2E-03	5.9E-04	9.3E-02
Regionalized-2	2	- -	- -	- -

Notes:
- - = Treatment is not considered for this alternative.

Table II-16.5-3. SRS—HW—Treatment: MEI Probability of Cancer Incidences

HW Alternatives	Number of Treatment Sites	Treatment	
		Offsite MEI Cancer Incidence Probability	Noninvolved MEI Cancer Incidence Probability
No Action	2	- -	- -
Decentralized	3	1.7E-08	7.4E-07
Regionalized-1	5	1.5E-08	6.7E-07
Regionalized-2	2	- -	- -

Notes:
MEI = Maximally Exposed Individual
- - = Treatment is not considered for this alternative.

Table II-16.5–4. SRS—HW—Treatment: Noncancer Health Risk From Chemical Exposure

HW Alternatives	Number of Treatment Sites	Treatment		
		Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index
No Action	2	- -	- -	- -
Decentralized	3	2.2E-04	9.9E-03	5.3E+00
Regionalized-1	5	2.0E-04	9.0E-03	5.2E+00
Regionalized-2	2	- -	- -	- -

Notes:
MEI = Maximally Exposed Individual
- - = Treatment is not considered for this alternative.
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The Hazard Quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-16.5-5. SRS—HW—Emissions in Tons per Year of Criteria Air Pollutants

HW Alternatives	Number of Treatment Sites	Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
		CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	2	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized	3	3 (2/1)	5 (5/0)	0	0	0	1 (0/0)	0	0	0	0	1 (1/0)	0
Regionalized - 1	5	3 (2/1)	5 (5/0)	0	0	0	1 (0/0)	0	0	0	0	1 (1/0)	0
Regionalized - 2	2	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

Notes:
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission)
(2) Values = total emissions (stationary-source emissions / mobile-source emission)

Table II-16.5–6. SRS—HW—Percent of Standard/Guideline for Criteria Air Pollutants

HW Alternatives	Number of Treatment Sites	Construction					
		Percent of Tons/Year General Conformity Rule (1)					
		CO	NO2	Pb	PM10	SO2	VOC
No Action	2	--	--	--	--	--	--
Decentralized	3	--	--	--	--	--	--
Regionalized-1	5	--	--	--	--	--	--
Regionalized-2	2	--	--	--	--	--	--

HW Alternatives	Number of Treatment Sites	Operations & Maintenance											
		Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
		CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	2	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	3	0	0	0	3	1	0	0	0	0	0	0	0
Regionalized-1	5	0	0	0	3	1	0	0	0	0	0	0	0
Regionalized-2	2	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) SRS is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for the Regionalized-2 Alternative are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-16.5-7. SRS—HW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

HW Alternatives	Number of Treatment Sites	Operations & Maintenance											
		Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	2	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	3	--	--	--	0	--	--	0	0	--	--	--	--
Regionalized - 1	5	--	--	--	0	--	--	0	0	--	--	--	--
Regionalized - 2	2	--	--	--	--	--	--	--	--	--	--	--	--

HW Alternatives	Number of Treatment Sites	Operations & Maintenance									
		Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	2	--	--	--	--	--	--	--	--	--	--
Decentralized	3	--	0	--	--	0	--	0	0	0	1
Regionalized - 1	5	--	0	--	--	0	--	0	0	0	1
Regionalized - 2	2	--	--	--	--	--	--	--	--	--	--

Notes:
Percentages <1% are shown as zeros.
-- = Emissions of certain hazardous or toxic air pollutants, including radionuclides, from HW treatment facilities are assumed to be negligible.

Table II-16.5-8. SRS—HW—Impacts on Water Resources Due to Increased Water Use

HW Alternatives	Number of Treatment Sites	Construction			Operations			
		Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	2	- -	- -	- -	- -	- -	- -	- -
Decentralized	3	516	<0.1	- -	358	<0.1	- -	<0.1
Regionalized-1	5	593	<0.1	- -	371	<0.1	- -	<0.1
Regionalized-2	2	- -	- -	- -	- -	- -	- -	- -

Notes:
Water supplied by groundwater. Current water use = 1,600,000 gallons/day.
Wastewater discharged to the Savannah River. Average flow rate of the Savannah River = 6,463,000,000 gallons/day.
- - = Not considered for this site.
<0.1 indicates that the percentage is less than 0.1%.

Table II-16.5-9. SRS—HW—Socioeconomic Impacts for Treatment

HW Alternatives	Number of Treatment Sites	Effect of Implementation of Alternatives					
		Cost (Millions) (1)	Jobs		Income		% ROI Population Increase (2)
			Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	
No Action	2	- -	- -	- -	- -	- -	- -
Decentralized	3	24	30	0.01	0.3	0.00	0.00
Regionalized 1	5	25	31	0.01	0.3	0.00	0.00
Regionalized 2	2	- -	- -	- -	- -	- -	- -

Notes:
- - = Treatment is not considered for this alternative.
(1) In 1990 dollars.
(2) Compared to 1990 baseline.

Table II-16.5-10. SRS—HW—Infrastructure Impacts for Treatment

HW Alternatives	Number of Treatment Sites	Effect of Implementation of Alternatives									
		Land Use		Water		Waste Water		Power		Employment (FTE)	
		Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Construction Employment	% of Current Employment (1)
No Action	2	--	--	--	--	--	--	--	--	--	--
Decentralized	3	1	0.000	516	0.01	358	0.05	0.13	0.07	8	0
Regionalized-1	5	1	0.001	593	0.01	371	0.05	0.13	0.07	10	0
Regionalized-2	2	--	--	--	--	--	--	--	--	--	--

Notes:
GPD = Gallons per Day
MW = Megawatts Electric
-- = Treatment is not considered for this alternative
(1) Based on 1991 Site Employment.

Table II-16.5-11. SRS—HW—Cost

HW Alternatives	Number of Treatment Sites	Total Cost (Millions) (1)	Government Cost by Life-Cycle Component (1)				Cost by Functional Area (1)	
			Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment & Disposal	
							Government (2) (Millions)	Commercial (Millions)
No Action	2	3	0	0	3	0	0	3
Decentralized	3	31	2	10	15	1	28	3
Regionalized-1	5	32	2	10	16	1	29	3
Regionalized-2	2	- -	- -	- -	- -	- -	- -	- -

Notes:
- - = Not considered for this site.
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Functional Areas.
(2) Government costs equal to the sum of the life-cycle components.

II.17.0 WIPP

II.17.1 WIPP LLMW

WIPP is not one of the sites considered for management of LLMW. Therefore, Section 17.1 has been intentionally left blank.

II.17.2 WIPP LLW

WIPP is not considered for the management of LLW. Therefore, Section 17.2 has been intentionally left blank.

II.17.3 WIPP TRUW

Twelve tables immediately following portray the impacts of TRUW at WIPP. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	WIPP—TRUW—Treatment: Estimated Number of Fatalities	II-17.3-1	17-3
2.	WIPP—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-17.3-2	17-4
4.	WIPP—TRUW—Treatment: MEI Probability of Cancer Fatality	II-17.3-3	17-5
5.	WIPP—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects	II-17.3-4	17-6
6.	WIPP—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure	II-17.3-5	17-7
7.	WIPP—TRUW—Emissions in Tons per Year of Criteria Air Pollutants	II-17.3-6	17-8
8.	WIPP—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants	II-17.3-7	17-9
9.	WIPP—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-17.3-8	17-10
10.	WIPP—TRUW—Impacts on Water Resources Due to Increased Water Use	II-17.3-9	17-11
13.	WIPP—TRUW—Socioeconomic Impacts for Treatment	II-17.3-10	17-12
14.	WIPP—TRUW—Infrastructure Impacts for Treatment	II-17.3-11	17-13
15.	WIPP—TRUW—Cost	II-17.3-12	17-14

Table II-17.3-1. WIPP—TRUW—Treatment: Estimated Number of Fatalities

TRUW Alternatives	Treatment						
	Number of Sites		Treatment Standard	WM Worker		Offsite Population Radiation Exposure	Noninvolved Workers Radiation Exposure
	CH Treat	RH Treat		Radiation Exposure	Physical Hazards		
No Action **	16	5	WIPP WAC	- -	- -	- -	- -
Decentralized ***	16	5	WIPP WAC	- -	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -	- -	- -
Regionalized-2	5	2	LDR	- -	- -	- -	- -
Regionalized-3	3	2	LDR	- -	- -	- -	- -
Centralized	WIPP	2	LDR	1.6E-02	4.4E-01	2.6E-01	2.1E-02

Notes:
- - = WIPP is only considered under the Centralized Alternative.
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at 16 sites, then transfered to interim storage at 10 sites, then to WIPP.

Table II-17.3-2. WIPP—TRUW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treatment Standard	Offsite Population				Noninvolved Workers				WM Workers			
	CH Treat	RH Treat		Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action**	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	5.2E+02	8.9E-01	5.5E-10	5.2E-02	4.2E+01	7.2E-02	2.8E-10	4.2E-03	4.1E+01	5.7E-02	4.6E-06	2.4E-03

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
T = Treatment
D = Disposal

Table II-17.3-3. WIPP—TRUW—Treatment: MEI Probability of Cancer Fatality

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment	
	CH Treat	RH Treat		Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability
No Action**	16	5	WIPP WAC	- -	- -
Decentralized***	16	5	WIPP WAC	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -
Regionalized-2	5	2	LDR	- -	- -
Regionalized-3	3	2	LDR	- -	- -
Centralized	WIPP	2	LDR	6.9E-05	8.2E-05

Notes:
- - = Treatment is not considered under this alternative
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives disposal at WIPP is assumed.
***In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP

Table II-17.3–4. WIPP—TRUW—Treatment: MEI Probability of Cancer Incidences and Genetic Effects

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment							
				Offsite Population MEI				Noninvolved Worker MEI			
	CH Treat	RH Treat		Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action **	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -	- -	- -
Decentralized ***	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-2	5	2	LDR	- -	- -	- -	- -	- -	- -	- -	- -
Regionalized-3	3	2	LDR	- -	- -	- -	- -	- -	- -	- -	- -
Centralized	WIPP	2	LDR	1.4E-01	2.3E-04	2.1E-13	1.4E-05	1.6E-01	2.8E-04	1.3E-12	1.6E-05

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
- - = WIPP is only considered under the Centralized Alternative.

Table II-17.3-5. WIPP—TRUW—Treatment: Noncancer Health Risk From Chemical Exposure

TRUW Alternatives	Number of Sites		Treatment Standard	Treatment		
	CH Treat	RH Treat		Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index
No Action**	16	5	WIPP WAC	- -	- -	- -
Decentralized***	16	5	WIPP WAC	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -	- -
Regionalized-2	5	2	LDR	- -	- -	- -
Regionalized-3	3	2	LDR	- -	- -	- -
Centralized	WIPP	2	LDR	4.9E-11	3.0E-10	5.2E-04

Notes:
MEI = Maximally Exposed Individual
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
- - = Treatment is not considered under this alternative.
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The Hazard Quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-17.3–6. WIPP—TRUW—Emissions in Tons per Year of Criteria Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	CH Treat	RH Treat		CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action**	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP WAC	--	--	--	--	--	--	1 (0/1)	2 (0/2)	0	0	0	0
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	1 (0/1)	2 (0/2)	0	0	0	0
Regionalized-2	5	2	LDR	--	--	--	--	--	--	0	1 (0/1)	0	0	0	0
Regionalized-3	3	2	LDR	--	--	--	--	--	--	0	1 (0/1)	0	0	0	0
Centralized	WIPP	2	LDR	104 (55/49)	153 (143/10)	0	11 (11/0)	14 (14/0)	20 (14/6)	8 (1/7)	9 (6/3)	0	4 (4/0)	0	1 (0/1)

Notes:

Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.

CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.

(1) Values = total emissions (equipment emissions / worker vehicles emission)

(2) Values = total emissions (stationary-source emissions / mobile-source emission)

** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.

*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-17.3-7. WIPP—TRUW—Percent of Standard/Guideline for Criteria Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Construction					
				Percent of Tons/Year General Conformity Rule (1)					
	CH Treat	RH Treat		CO	NO2	Pb	PM10	SO2	VOC
No Action	16	5	WIPP WAC	--	--	--	--	--	--
Decentralized	16	5	WIPP WAC	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--
Centralized	WIPP	2	LDR	--	--	--	--	--	--

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance											
				Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	CH Treat	RH Treat		CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	1	15	0	25	1	0	0	0	0	2	0	0

Notes:
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) WIPP is in an attainment area for all criteria pollutants, therfore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for alternatives that do not involve treatment to LDR (incineration) are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-17.3-8. WIPP—TRUW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance											
	CH Treat	RH Treat		Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action**	16	5	WIPP - WAC	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP - WAC	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	137	--	--	--	0	0	--	--	--	--	--	--

TRUW Alternatives	Number of Sites		Treatment Standard	Operations & Maintenance									
	CH Treat	RH Treat		Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action**	16	5	WIPP - WAC	--	--	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP - WAC	--	--	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	0	0	--	--	--	0	0	--	--	--

Notes:
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
-- = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros. CH = contact handled. RH = remote handled.

Table II-17.3-9. WIPP—TRUW—Impacts on Water Resources Due to Increased Water Use

TRUW Alternatives	Number of Sites		Treatment Standard	Construction			Operations			
	CH Treat	RH Treat		Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action**	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -	- -
Decentralized***	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -	- -	- -	- -	- -	- -
Regionalized-2	5	2	LDR	- -	- -	- -	- -	- -	- -	- -
Regionalized-3	3	2	LDR	- -	- -	- -	- -	- -	- -	- -
Centralized	WIPP	2	LDR	41429	287.7	- -	15204	105.6	- -	- -

Notes:
Water supplied by municipal system from City of Carlsbad. Current water use = 14,400 gallons/day.
Wastewater discharged to onsite evaporation ponds.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
- - = WIPP is only considered under the Centralized Alternative, and Stream Flow and Waste Water Stream Flow are not considered for WIPP.

Table II-17.3-10. WIPP—TRUW—Socioeconomic Impacts for Treatment

TRUW Alternatives	Number of Sites		Effect of Implementation of Alternatives						
					Jobs		Income		
	CH Treat	RH Treat	Treatment Standard	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action**	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -
Decentralized***	16	5	WIPP WAC	- -	- -	- -	- -	- -	- -
Regionalized-1	5	2	Reduce Gas	- -	- -	- -	- -	- -	- -
Regionalized-2	5	2	LDR	- -	- -	- -	- -	- -	- -
Regionalized-3	3	2	LDR	- -	- -	- -	- -	- -	- -
Centralized	WIPP	2	LDR	2074	2046	2.05	22.1	0.75	0.64

Notes:
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
- - = WIPP is only considered under the Centralized Alternative.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.

Table II-17.3-11. WIPP—TRUW—Infrastructure Impacts for Treatment

TRUW Alternatives	Number of Sites		Treatment Standard	Effect of Implementation of Alternatives									
				Land Use		Water		Waste Water		Power		Employment (FTE)	
	CH Treat	RH Treat		Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action**	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP WAC	--	--	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	8.8	0.09	41429	7.7	15204	82.18	3.5	49.96	1512	162.20

Notes:
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
** For No Action Alternative, storage is indefinite: no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
-- = WIPP is only considered under the Centralized Alternative.

Table II-17.3-12. WIPP—TRUW—Cost

TRUW Alternatives	Number of Sites		Treatment Standard (2)	Total Cost (Millions) (1)	Life-Cycle Component				Functional Area		
	CH Treat	RH Treat			Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Retrieval Characterization (Millions)	Treatment (Millions)	Storage (Millions)
No Action**	11	5	WIPP - WAC	--	--	--	--	--	--	--	--
Decentralized***	16	5	WIPP - WAC	--	--	--	--	--	--	--	--
Regionalized-1	5	2	Reduce Gas	--	--	--	--	--	--	--	--
Regionalized-2	5	2	LDR	--	--	--	--	--	--	--	--
Regionalized-3	3	2	LDR	--	--	--	--	--	--	--	--
Centralized	WIPP	2	LDR	2346	185	832	1243	86	0	2346	0

Notes:
** For No Action Alternative, storage is indefinite; no disposal at WIPP is assumed, for all other alternatives, disposal at WIPP is assumed.
*** In Decentralized Alternative, TRUW is processed at all 16 sites, then transferred to interim storage at 10 sites, then to WIPP.
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.
(2) Treatment standard (STD) applied: treat to WIPP Waste Acceptance Criteria (WIPP WAC), treat for reduced gas generation (Reduce Gas), treat to Land Disposal Restrictions (LDR).

II.18.0 WVDP

WVDP currently is the custodian of significant volumes of LLMW, LLW, TRUW, and HLW. Each of the waste types is treated independently in the following sections.

II.18.1 WVDP LLMW

Fourteen tables immediately following portray the impacts of LLMW at WVDP. These tables are presented as follows:

Impact Category

No.	Description	Table No.	Page No.
1.	WVDP—LLMW—Treatment and Disposal: Estimated Number of Fatalities	II-18.1-1	18-2
2.	WVDP—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-18.1-2	18-3
3.	WVDP—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-18.1-3	18-4
4.	WVDP—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-18.1-4	18-5
5.	WVDP—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-18.1-5	18-6
6.	WVDP—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure	II-18.1-6	18-7
7.	WVDP—LLMW—Emissions in Tons per Year of Criteria Air Pollutants	II-18.1-7	18-8
8.	WVDP—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants	II-18.1-8	18-9
9.	WVDP—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-18.1-9	18-10
10.	WVDP—LLMW—Impacts on Water Resources Due to Increased Water Use	II-18.1-10	18-11
11.	WVDP—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-18.1-11	18-12
13.	WVDP—LLMW—Socioeconomic Impacts for Treatment and Disposal	II-18.1-12	18-13
14.	WVDP—LLMW—Infrastructure Impacts for Treatment and Disposal	II-18.1-13	18-14
15.	WVDP—LLMW—Cost	II-18.1-14	18-15

Table II-18.1-1. WVDP—LLMW—Treatment and Disposal: Estimated Number of Fatalities

LLMW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	3	-	3.1E-05	7.6E-04	1.4E-04	3.4E-07	- -	- -
Decentralized	37	16	2.5E-03	4.8E-03	2.5E-07	4.2E-10	- -	- -
Regionalized-1	11	12	2.8E-05	3.2E-03	1.7E-07	2.2E-10	- -	- -
Regionalized-2	7	6	2.8E-05	3.2E-03	1.7E-07	2.2E-10	- -	- -
Regionalized-3	7	1	2.8E-05	3.2E-03	1.7E-07	2.2E-10	- -	- -
Regionalized-4	4	6	2.9E-05	3.3E-03	1.7E-07	2.3E-10	- -	- -
Centralized	1	1	2.9E-05	3.3E-03	1.7E-07	2.3E-10	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-18.1-2. WVDP—LLMW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Offsite Population				Noninvolved Workers				WM Worker			
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Chemical Cancer Incidence	Radiation Genetic Effects
No Action	3	-	2.7E-01	4.7E-04	1.5E-07	2.7E-05	6.7E-04	1.1E-06	3.0E-09	6.7E-08	7.7E-02	1.1E-04	1.4E-09	4.6E-06
Decentralized	37	16	5.0E-04	8.6E-07	5.1E-09	5.0E-08	8.4E-07	1.4E-09	1.0E-10	8.4E-11	6.2E+00	8.6E-03	1.2E-09	3.7E-04
Regionalized-1	11	12	3.4E-04	5.8E-07	4.5E-09	3.4E-08	4.4E-07	7.5E-10	8.9E-11	4.4E-11	6.9E-02	9.6E-05	1.1E-09	4.1E-06
Regionalized-2	7	6	3.4E-04	5.8E-07	4.5E-09	3.4E-08	4.4E-07	7.5E-10	8.9E-11	4.4E-11	6.9E-02	9.6E-05	1.1E-09	4.1E-06
Regionalized-3	7	1	3.4E-04	5.8E-07	4.5E-09	3.4E-08	4.4E-07	7.5E-10	8.9E-11	4.4E-11	6.9E-02	9.6E-05	1.1E-09	4.1E-06
Regionalized-4	4	6	3.5E-04	5.9E-07	4.5E-09	3.5E-08	4.6E-07	7.8E-10	9.0E-11	4.6E-11	7.3E-02	1.0E-04	1.2E-09	4.4E-06
Centralized	1	1	3.5E-04	5.9E-07	4.5E-09	3.5E-08	4.6E-07	7.8E-10	9.0E-11	4.6E-11	7.3E-02	1.0E-04	1.2E-09	4.4E-06

Notes:
T = Treatment
D = Disposal

Table II-18.1-3. WVDP—LLMW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	3	-	- -	- -	- -
Decentralized	37	16	- -	- -	- -
Regionalized-1	11	12	- -	- -	- -
Regionalized-2	7	6	- -	- -	- -
Regionalized-3	7	1	- -	- -	- -
Regionalized-4	4	6	- -	- -	- -
Centralized	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this Alternative.

Table II-18.1–4. WVDP—LLMW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLMW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	3	-	2.1E-09	1.9E-09	- -
Decentralized	37	16	3.8E-12	2.4E-12	- -
Regionalized-1	11	12	2.6E-12	1.3E-12	- -
Regionalized-2	7	6	2.6E-12	1.3E-12	- -
Regionalized-3	7	1	2.6E-12	1.3E-12	- -
Regionalized-4	4	6	2.6E-12	1.3E-12	- -
Centralized	1	1	2.6E-12	1.3E-12	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative

Table II-18.1-5. WVDP—LLMW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLMW Alternatives	Number of Sites		Treatment								Disposal			
			Offsite Population MEI				Noninvolved Worker MEI				Hypothetical Farm Family Most Exposed Lifetime MEI			
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Chemical Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	3	-	4.1E-08	7.0E-09	5.0E-12	4.1E-10	3.6E-08	6.4E-09	1.6E-11	3.8E-10	- -	- -	- -	- -
Decentralized	37	16	7.6E-09	1.3E-11	1.7E-13	7.6E-13	4.8E-09	8.1E-12	5.1E-13	4.8E-13	- -	- -	- -	- -
Regionalized-1	11	12	5.2E-09	8.8E-12	1.5E-13	5.2E-13	2.5E-09	4.3E-12	4.5E-13	2.5E-13	- -	- -	- -	- -
Regionalized-2	7	6	5.2E-09	8.8E-12	1.5E-13	5.2E-13	2.5E-09	4.3E-12	4.5E-13	2.5E-13	- -	- -	- -	- -
Regionalized-3	7	1	5.2E-09	8.8E-12	1.5E-13	5.2E-13	2.5E-09	4.3E-12	4.5E-13	2.5E-13	- -	- -	- -	- -
Regionalized-4	4	6	5.2E-09	8.9E-12	1.5E-13	5.2E-13	2.6E-09	4.4E-12	4.5E-13	2.6E-13	- -	- -	- -	- -
Centralized	1	1	5.2E-09	8.9E-12	1.5E-13	5.2E-13	2.6E-09	4.4E-12	4.5E-13	2.6E-13	- -	- -	- -	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered for this alternative.

Table II-18.1-6. WVDP—LLMW—Treatment and Disposal: Noncancer Health Risk from Chemical Exposure

LLMW Alternatives	Number of Sites		Treatment			Disposal
	T	D	Offsite MEI Hazard Index	Noninvolved Worker MEI Hazard Index	WM Worker Exposure Index	Hypothetical Farm Family Most Exposed Lifetime Hazard Index
No Action	3	-	4.8E-09	1.4E-08	8.7E-08	- -
Decentralized	37	16	7.1E-11	2.1E-10	9.9E-08	- -
Regionalized-1	11	12	2.1E-11	6.2E-11	8.7E-08	- -
Regionalized-2	7	6	2.1E-11	6.2E-11	8.7E-08	- -
Regionalized-3	7	1	2.1E-11	6.2E-11	8.7E-08	- -
Regionalized-4	4	6	2.4E-11	6.9E-11	9.9E-08	- -
Centralized	1	1	2.4E-11	6.9E-11	9.9E-08	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered for this alternative.
MEI = Maximally Exposed Individual
Hazard Index = Sum of hazard quotient values for all noncarcinogenic chemicals. The hazard quotient is the chemical-specific ratio of media exposure concentrations to concentrations believed to have no appreciable adverse effects.
Exposure Index = Ratio of exposure concentration to chemical-specific occupational threshold limits.

Table II-18.1-7. WVDP—LLMW—Emissions in Tons per Year of Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	4 (0/4)	1 (0/1)	0	0	0	1 (0/1)	0	0	0	0	0	0
Decentralized	37	16	3 (1/2)	2 (2/0)	0	0	0	0	1 (0/1)	0	0	0	0	0
Regionalized-1	11	12	1 (0/1)	0	0	0	0	0	0	0	0	0	0	0
Regionalized-2	7	6	1 (0/1)	0	0	0	0	0	0	0	0	0	0	0
Regionalized-3	7	1	1 (0/1)	0	0	0	0	0	0	0	0	0	0	0
Regionalized-4	4	6	1 (0/1)	0	0	0	0	0	0	0	0	0	0	0
Centralized	1	1	1 (0/1)	0	0	0	0	0	0	0	0	0	0	0

Notes:
T = Treatment
D = Disposal
Emissions <1 tons per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission).
(2) Values = total emissions (stationary-source emissions / mobile-source emission).

Table II-18.1-8. WVDP—LLMW—Percent of Standard/Guideline for Criteria Air Pollutants

LLMW Alternatives	Number of Sites		Construction					
			Percent of Tons/Year General Conformity Rule (1)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	--	--	--	--	--	--
Decentralized	37	16	--	--	--	--	--	--
Regionalized-1	11	12	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--

LLMW Alternatives	Number of Sites		Operations & Maintenance											
			Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
	T	D	CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	3	-	0	0	0	0	0	0	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-2	7	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-3	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Centralized	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) WVDP is in an attainment area for all criteria pollutants, therefore the GCR does not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions are assumed to be negligible for all but the Decentralized Alternative.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-18.1-9. WVDP—LLMW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLMW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	3	-	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Decentralized	37	16	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-1	11	12	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-2	7	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-3	7	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Regionalized-4	4	6	0	0	0	- -	- -	0	- -	- -	0	0	0	0
Centralized	1	1	0	0	0	- -	- -	0	- -	- -	0	0	0	0

LLMW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	3	-	- -	0	0	0	- -	0	0	0	- -	- -
Decentralized	37	16	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-1	11	12	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-2	7	6	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-3	7	1	- -	0	0	0	- -	0	0	0	- -	- -
Regionalized-4	4	6	- -	0	0	0	- -	0	0	0	- -	- -
Centralized	1	1	- -	0	0	0	- -	0	0	0	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.

Table II-18.1-10. WVDP—LLMW—Impacts on Water Resources Due to Increased Water Use

LLMW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	3	-	229	0.3	<0.1	18	<0.1	<0.1	<0.1
Decentralized	37	16	1925	2.8	<0.1	240	0.3	<0.1	<0.1
Regionalized-1	11	12	365	0.5	<0.1	173	0.2	<0.1	<0.1
Regionalized-2	7	6	365	0.5	<0.1	173	0.2	<0.1	<0.1
Regionalized-3	7	1	365	0.5	<0.1	173	0.2	<0.1	<0.1
Regionalized-4	4	6	365	0.5	<0.1	173	0.2	<0.1	<0.1
Centralized	1	1	365	0.5	<0.1	173	0.2	<0.1	<0.1

Notes:
T = Treatment
D = Disposal
Notes: Water supplied by surface water from 2 onsite reservoirs. Current water use = 70,000 gallons/day. Wastewater discharged to Buttermilk Creek. Average flow rate of Buttermilk Creek = 41,000,000 gallons/day.
<0.1 indicates that the percentage is less than 0.1%.

Table II-18.1-11. WVDP—LLMW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLMW Alternatives	Number of Sites T	Number of Sites D	Ac 225	Ac 227	Am 241	Am 242	Am 243	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Pb 210	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLMW Alternatives	Number of Sites T	Number of Sites D	Po 210	K 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 228	Th 229	Th 230	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90	Zr 93
No Action	3	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	37	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
- - = No disposal at this site for this alternative.

Table II-18.1-12. WVDP—LLMW—Socioeconomic Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	3	-	23	21	0.00	0.2	0.00	0.00
Decentralized	37	16	15	17	0.00	0.2	0.00	0.00
Regionalized-1	11	12	6	7	0.00	0.1	0.00	0.00
Regionalized-2	7	6	6	7	0.00	0.1	0.00	0.00
Regionalized-3	7	1	6	7	0.00	0.1	0.00	0.00
Regionalized-4	4	6	6	7	0.00	0.1	0.00	0.00
Centralized	1	1	6	7	0.00	0.1	0.00	0.00

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline

Table II-18.1-13. WVDP—LLMW—Infrastructure Impacts for Treatment and Disposal

LLMW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	3	-	0.36	0.221	229	0.21	18	0.03	0.02	0.31	34	5
Decentralized	37	16	1.5	0.908	1925	1.75	240	0.34	0.26	4.03	14	2
Regionalized-1	11	12	0.65	0.393	365	0.33	173	0.25	0.03	0.54	8	1
Regionalized-2	7	6	0.65	0.393	365	0.33	173	0.25	0.03	0.54	8	1
Regionalized-3	7	1	0.65	0.393	365	0.33	173	0.25	0.03	0.54	8	1
Regionalized-4	4	6	0.65	0.393	365	0.33	173	0.25	0.03	0.55	8	1
Centralized	1	1	0.65	0.393	365	0.33	173	0.25	0.03	0.55	8	1

Notes:
T = Treatment
D = Disposal
GPD = Gallons per Day
MW = Megawatts
(1) Based on 1991 Site Employment

Table II-18.1-14. WVDP—LLMW—Cost

LLMW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	3	-	26	9	11	5	1	7	19	0
Decentralized	37	16	17	2	7	6	2	7	0	10
Regionalized-1	11	12	7	2	4	1	1	7	0	0
Regionalized-2	7	6	7	2	4	1	1	7	0	0
Regionalized-3	7	1	7	2	4	1	1	7	0	0
Regionalized-4	4	6	7	2	4	1	1	7	0	0
Centralized	1	1	7	2	4	1	1	7	0	0

Notes:
T = Treatment
D = Disposal
The Life-Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum of these may not reflect the true total cost.
(1) In 1994 dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.18.2 WVDP LLW

Impact Category

No.	Description	Table No.	Page No.
1.	WVDP—LLW—Treatment and Disposal: Estimated Number of Fatalities	II-18.2-1	18-17
2.	WVDP—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects	II-18.2-2	18-18
3.	WVDP—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects	II-18.2-3	18-19
4.	WVDP—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality	II-18.2-4	18-20
5.	WVDP—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects	II-18.2-5	18-21
7.	WVDP—LLW—Emissions in Tons per Year of Criteria Air Pollutants	II-18.2-6	18-22
8.	WVDP—LLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-18.2-7	18-23
9.	WVDP—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-18.2-8	18-24
10.	WVDP—LLW—Impacts on Water Resources Due to Increased Water Use	II-18.2-9	18-25
11.	WVDP—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal	II-18.2-10	18-26
13.	WVDP—LLW—Socioeconomic Impacts for Treatment and Disposal	II-18.2-11	18-27
14.	WVDP—LLW—Infrastructure Impacts for Treatment and Disposal	II-18.2-12	18-28
15.	WVDP—LLW—Cost	II-18.2-13	18-29

Table II-18.2-1. WVDP—LLW—Treatment and Disposal: Estimated Number of Fatalities

LLW Alternatives	Number of Sites		Treatment				Disposal	
			WM Worker		Offsite Population	Noninvolved Workers	WM Worker	
	T	D	Radiation Exposure	Physical Hazards	Radiation Exposure	Radiation Exposure	Radiation Exposure	Physical Hazards
No Action	10**	6	1.9E-02	3.8E-02	3.5E-06	7.5E-09	- -	- -
Decentralized	- -	16	1.3E-02	4.9E-02	1.2E-06	1.5E-11	2.5E-02	6.8E-02
Regionalized-1	- -	12	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Regionalized-2	11	12	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -
Regionalized-3	- -	6	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Regionalized-4	7	6	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -
Regionalized-5	4	6	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -
Regionalized-6	- -	2	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Regionalized-7	- -	2	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Centralized-1	- -	1	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Centralized-2	- -	1	1.3E-02	5.3E-02	2.1E-06	4.3E-09	- -	- -
Centralized-3	7	1	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -
Centralized-4	7	1	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -
Centralized-5	1	1	1.3E-02	5.3E-02	2.1E-06	4.4E-09	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative
** Ten sites use existing facilities for Volume Reduction

Table II-18.2-2. WVDP—LLW—Treatment: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Offsite Population			Noninvolved Workers			WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	7.1E-03	1.2E-05	7.1E-07	1.5E-05	2.5E-08	1.5E-09	4.6E+01	6.5E-02	2.8E-03
Decentralized	- -	16	2.5E-03	4.2E-06	2.5E-07	5.1E-06	8.7E-09	5.1E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-1	- -	12	4.1E-03	7.0E-06	4.1E-07	8.6E-06	4.3E-09	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-2	11	12	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-3	- -	6	4.1E-03	7.0E-06	4.1E-07	8.6E-06	1.5E-08	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-4	7	6	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-5	4	6	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-6	- -	2	4.1E-03	7.0E-06	4.1E-07	8.6E-06	1.5E-08	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Regionalized-7	- -	2	4.1E-03	7.0E-06	4.1E-07	8.6E-06	1.5E-08	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Centralized-1	- -	1	4.1E-03	7.0E-06	4.1E-07	8.6E-06	1.5E-08	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Centralized-2	- -	1	4.1E-03	7.0E-06	4.1E-07	8.6E-06	1.5E-08	8.6E-10	3.2E+01	4.5E-02	1.9E-03
Centralized-3	7	1	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03
Centralized-4	7	1	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03
Centralized-5	1	1	4.2E-03	7.2E-06	4.2E-07	8.8E-06	1.5E-08	8.8E-10	3.2E+01	4.5E-02	1.9E-03

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction.

Table II-18.2-3. WVDP—LLW—Disposal: Estimated Number of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		WM Workers		
	T	D	Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	10**	6	- -	- -	- -
Decentralized	- -	16	6.2E+01	8.7E-02	3.7E-03
Regionalized-1	- -	12	- -	- -	- -
Regionalized-2	11	12	- -	- -	- -
Regionalized-3	- -	6	- -	- -	- -
Regionalized-4	7	6	- -	- -	- -
Regionalized-5	4	6	- -	- -	- -
Regionalized-6	- -	2	- -	- -	- -
Regionalized-7	- -	2	- -	- -	- -
Centralized-1	- -	1	- -	- -	- -
Centralized-2	- -	1	- -	- -	- -
Centralized-3	7	1	- -	- -	- -
Centralized-4	7	1	- -	- -	- -
Centralized-5	1	1	- -	- -	- -

Notes:
T = Treatment
D = Disposal
- - = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-18.2–4. WVDP—LLW—Treatment and Disposal: MEI Probability of Cancer Fatality

LLW Alternatives	Number of Sites		Treatment		Disposal
	T	D	Offsite MEI Cancer Fatality Probability	Noninvolved Worker MEI Cancer Fatality Probability	Hypothetical Farm Family - Most Exposed Lifetime MEI Cancer Fatality Probability
No Action	10**	6	5.3E-11	4.2E-11	- -
Decentralized	- -	16	1.9E-11	1.5E-11	1.3E-04
Regionalized-1	- -	12	3.1E-11	2.4E-11	- -
Regionalized-2	11	12	3.1E-11	2.5E-11	- -
Regionalized-3	- -	6	3.1E-11	2.4E-11	- -
Regionalized-4	7	6	3.1E-11	2.5E-11	- -
Regionalized-5	4	6	3.1E-11	2.5E-11	- -
Regionalized-6	- -	2	3.1E-11	2.4E-11	- -
Regionalized-7	- -	2	3.1E-11	2.4E-11	- -
Centralized 1	- -	1	3.1E-11	2.4E-11	- -
Centralized 2	- -	1	3.1E-11	2.4E-11	- -
Centralized 3	7	1	3.1E-11	2.5E-11	- -
Centralized 4	7	1	3.1E-11	2.5E-11	- -
Centralized 5	1	1	3.1E-11	2.5E-11	- -

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
- - = Disposal is not considered under the Alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-18.2-5. WVDP—LLW—Treatment and Disposal: MEI Probability of Cancer Incidences and Genetic Effects

LLW Alternatives	Number of Sites		Treatment						Disposal		
			Offsite Population MEI			Noninvolved Worker MEI			Hypothetical Farm Family Most Exposed Lifetime MEI		
	T	D	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability	Dose (rem)	Radiation Cancer Incidence Probability	Radiation Genetic Effects Probability
No Action	10**	6	1.1E-07	1.8E-10	1.1E-11	8.5E-08	1.4E-10	8.5E-12	--	--	--
Decentralized	--	16	3.7E-08	6.3E-11	3.7E-12	2.9E-08	4.9E-11	2.9E-12	2.7E-01	4.5E-04	2.7E-05
Regionalized-1	--	12	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Regionalized-2	11	12	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--
Regionalized-3	--	6	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Regionalized-4	7	6	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--
Regionalized-5	4	6	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--
Regionalized-6	--	2	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Regionalized-7	--	2	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Centralized-1	--	1	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Centralized-2	--	1	6.1E-08	1.0E-10	6.1E-12	4.8E-08	8.2E-11	4.8E-12	--	--	--
Centralized-3	7	1	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--
Centralized-4	7	1	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--
Centralized-5	1	1	6.3E-08	1.1E-10	6.3E-12	5.0E-08	8.4E-11	5.0E-12	--	--	--

Notes:
T = Treatment
D = Disposal
MEI = Maximally Exposed Individual
-- = Disposal is not considered under the alternative.
** Ten sites use existing facilities for Volume Reduction.

Table II-18.2–6. WVDP—LLW—Emissions in Tons per Year of Criteria Air Pollutants

LLW Alternatives	Number of Sites		Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
	T	D	CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Decentralized	- -	16	93 (59/34)	161 (155/7)	0	12 (12/0)	15 (15/0)	19 (15/4)	18 (1/17)	5 (2/3)	0	0	0	2 (0/2)
Regionalized-1	- -	12	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-2	11	12	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-3	- -	6	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-4	7	6	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-5	4	6	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalized-6	- -	2	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Regionalzied-7	- -	2	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Centralized-1	- -	1	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Centralized-2	- -	1	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Centralized-3	7	1	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Centralized-4	7	1	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)
Centralized-5	1	1	27 (9/18)	28 (24/4)	0	2 (2/0)	2 (2/0)	4 (2/2)	8 (0/8)	2 (0/2)	0	0	0	1 (0/1)

Notes:
T = Treatment
D = Disposal
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions / worker vehicles emission)
(2) Values = total emissions (stationary-source emissions / mobile-source emission)
** Ten sites use existing facilities for volume reduction.

Table II-18.2-7. WVDP—LLW—Percent of Standard/Guideline for Criteria Air Pollutants

LLW Alternatives	T	D	Construction: Percent of Tons/Year General Conformity Rule (1)					
			CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	--	--	--	--	--	--
Decentralized	--	16	--	--	--	--	--	--
Regionalized-1	--	12	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--
Regionalized-3	--	6	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--
Regionalized-6	--	2	--	--	--	--	--	--
Regionalzied-7	--	2	--	--	--	--	--	--
Centralized-1	--	1	--	--	--	--	--	--
Centralized-2	--	1	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--

LLW Alternatives	T	D	Operations & Maintenance: Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)					
			CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2	VOC
No Action	10**	6	0	0	0	0	0	0	--	--	--	--	--	--
Decentralized	--	16	1	5	0	2	0	0	--	--	--	--	--	--
Regionalized-1	--	12	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-2	11	12	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-3	--	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-4	7	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-5	4	6	0	0	0	0	0	0	--	--	--	--	--	--
Regionalized-6	--	2	0	0	0	0	0	0	--	--	--	--	--	--
Regionalzied-7	--	2	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-1	--	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-2	--	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-3	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-4	7	1	0	0	0	0	0	0	--	--	--	--	--	--
Centralized-5	1	1	0	0	0	0	0	0	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide. VOC = volatile organic compounds.
NAAQS = National Ambient Air Quality Standard.
(1) WIPP is in an attainment area for all criteria pollutants, therefore the GCR do not apply.
(2) Percent of either PSD or GCR tons per year (tpy) limit as indicated by pollutant footnote.
(3) The value presented is the highest of all NAAQS averaging periods for that pollutant. Stationary-source emissions for the minimum treatment (no incineration) alternatives, and the Centralized-5 Alternatives, are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.
** Ten sites use existing facilities for volume reduction.

Table II-18.2-8. WVDP—LLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

LLW Alternatives	Number of Sites		Operations & Maintenance											
	T	D	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	10**	6	0	--	--	--	--	--	--	--	--	--	--	--
Decentralized	--	16	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	--	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	--	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6	--	2	0	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7	--	2	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-1	--	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-2	--	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	0	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	0	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites		Operations & Maintenance									
	T	D	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	10**	6	--	--	--	--	--	--	--	--	--	--
Decentralized	--	16	--	--	--	--	--	--	--	--	--	--
Regionalized-1	--	12	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--
Regionalized-3	--	6	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--
Regionalized-6	--	2	--	--	--	--	--	--	--	--	--	--
Regionalized-7	--	2	--	--	--	--	--	--	--	--	--	--
Centralized-1	--	1	--	--	--	--	--	--	--	--	--	--
Centralized-2	--	1	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
- - = Emissions of this hazardous or toxic air pollutant are assumed to be negligible.
Percentages <1% are shown as zeros.
** Ten sites use existing facilities for Volume Reduction.

Table II-18.2-9. WVDP—LLW—Impacts on Water Resources Due to Increased Water Use

LLW Alternatives	Number of Sites		Construction			Operations			
	T	D	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	10**	6	6447	9.2	--	2588	3.7	--	<0.1
Decentralized	--	16	58800	84.0	--	5618	8.0	--	<0.1
Regionalized-1	--	12	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-2	11	12	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-3	--	6	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-4	7	6	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-5	4	6	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-6	--	2	6447	9.2	--	2588	3.7	--	<0.1
Regionalized-7	--	2	6447	9.2	--	2588	3.7	--	<0.1
Centralized-1	--	1	6447	9.2	--	2588	3.7	--	<0.1
Centralized-2	--	1	6447	9.2	--	2588	3.7	--	<0.1
Centralized-3	7	1	6447	9.2	--	2588	3.7	--	<0.1
Centralized-4	7	1	6447	9.2	--	2588	3.7	--	<0.1
Centralized-5	1	1	6447	9.2	--	2588	3.7	--	<0.1

Notes:
T = Treatment
D = Disposal
Water supplied by surface water in two onsite reservoirs. Current water use = 70,000 gallons/day.
Wastewater discharged to Buttermilk Creek. Average flow rate of the creek = 41,000,000 gallons/day.
** Ten sites use existing facilities for volume reduction.
<0.1 indicates that the percentage is less than 0.1%.

Table II-18.2-10. WVDP—LLW—Radionuclide Concentrations in Groundwater (Percent of Comparison Criteria) for Disposal

LLW Alternatives	Number of Sites T	Number of Sites D	Am 228	Am 237	Am 241	Am 242	Am 245	C 14	Cs 135	Cs 137	Cm 242	Cm 244	Cm 245	I 129	Np 237	Ni 59	Ni 63	Pd 107	Pu 238	Pu 239	Pu 240	Pu 241
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	--	16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Regionalized-1	--	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	--	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LLW Alternatives	Number of Sites T	Number of Sites D	Po 210	Ra 40	Pa 231	Ra 223	Ra 226	Sm 151	Se 79	Sr 90	Tc 99	Th 227	Th 229	Th 230	Th 232	Th 232	Sn 126	U 233	U 234	U 235	U 236	U 238	Y 90
No Action	10**	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	--	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionalized-1	--	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	11	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-3	--	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-4	7	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-5	4	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-6	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-7	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-2	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-3	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-4	7	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Centralized-5	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
T = Treatment
D = Disposal
** Ten sites use existing facilities for Volume Reduction
- - = Disposal is not considered for this Alternative.

Table II-18.2-11. WVDP—LLW—Socioeconomic Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives					
				Jobs		Income		
	T	D	Cost (Millions) (1)	Jobs	% Change in ROI (2)	Annual Income (Millions)	% Change in Annual Income	% ROI Population Increase (2)
No Action	10**	6	291	337	0.06	3.85	0.02	0.02
Decentralized	- -	16	542	628	0.11	7.16	0.04	0.05
Regionalized-1	- -	12	291	337	0.06	3.85	0.02	0.02
Regionalized-2	11	12	291	337	0.06	3.85	0.02	0.02
Regionalized-3	- -	6	291	337	0.06	3.85	0.02	0.02
Regionalized-4	7	6	291	337	0.06	3.85	0.02	0.02
Regionalized-5	4	6	291	337	0.06	3.85	0.02	0.02
Regionalized-6	- -	2	291	337	0.06	3.85	0.02	0.02
Regionalized-7	- -	2	291	337	0.06	3.85	0.02	0.02
Centralized-1	- -	1	291	337	0.06	3.85	0.02	0.02
Centralized-2	- -	1	291	337	0.06	3.85	0.02	0.02
Centralized-3	7	1	291	337	0.06	3.85	0.02	0.02
Centralized-4	7	1	291	337	0.06	3.85	0.02	0.02
Centralized-5	1	1	291	337	0.06	3.85	0.02	0.02

Notes:
T = Treatment
D = Disposal
(1) In 1990 dollars.
(2) Compared to 1990 baseline.
** Ten sites use existing facilities for volume reduction.

Table II-18.2–12. WVDP—LLW—Infrastructure Impacts for Treatment and Disposal

LLW Alternatives	Number of Sites		Effect of Implementation of Alternatives									
			Land Use		Water		Waste Water		Power		Employment (FTE)	
	T	D	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Peak Construction Employment	% of Current Employment (1)
No Action	10**	6	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Decentralized	- -	16	18	10.9	58800	53.45	5618	8.03	8.49	130	643	41
Regionalized-1	- -	12	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-2	11	12	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-3	- -	6	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-4	7	6	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-5	4	6	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-6	- -	2	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Regionalized-7	- -	2	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Centralized-1	- -	1	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Centralized-2	- -	1	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Centralized-3	7	1	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Centralized-4	7	1	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13
Centralized-5	1	1	4.0	2.40	6447	5.86	2588	3.70	0.70	10.75	139	13

Notes:
T = Treatment
D = Disposal
** = Ten sites use existing facilities for volume reduction.
GPD = Gallons per Day
MW = Megawatts Electric

Table II-18.2-13. WVDP—LLW—Cost

LLW Alternatives	Number of Sites		Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)				Cost by Functional Area (1)		
	T	D		Pre-Operations (Millions)	Construction (Millions)	Operations & Maintenance (Millions)	Decontamination & Decommissioning (Millions)	Treatment (Millions)	Storage (Millions)	Disposal (Millions)
No Action	10**	6	330	27	80	210	13	330	0	0
Decentralized	- -	16	614	49	152	385	28	306	0	308
Regionalized-1	- -	12	330	27	80	210	13	330	0	0
Regionalized-2	11	12	330	27	80	210	13	330	0	0
Regionalized-3	- -	6	330	27	80	210	13	330	0	0
Regionalized-4	7	6	330	27	80	210	13	330	0	0
Regionalized-5	4	6	330	27	80	210	13	330	0	0
Regionalized-6	- -	2	330	27	80	210	13	330	0	0
Regionalized-7	- -	2	330	27	80	210	13	330	0	0
Centralized-1	- -	1	330	27	80	210	13	330	0	0
Centralized-2	- -	1	330	27	80	210	13	330	0	0
Centralized-3	7	1	330	27	80	210	13	330	0	0
Centralized-4	7	1	330	27	80	210	13	330	0	0
Centralized-5	1	1	330	27	80	210	13	330	0	0

Notes:
** Ten sites use existing facilities for volume reduction
T = Treatment
D = Disposal
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of the Life Cycle Components = Sum of the Functional Areas.

II.18.3 WVDP TRUW

WVDP has a small amount of TRUW which factored into the transportation analysis but did not warrant analysis of impacts onsite. Therefore, Section 18.3 has been intentionally left blank.

II.18.4 WVDP HLW

Nine of the 15 impact categories apply to HLW at WVDP. These impacts are presented in the following tables.

Impact Category No.	Description	Table No.	Page No.
1.	WVDP—HLW—Storage: Estimated Number of Fatalities	II-18.4–1	18–32
2.	WVDP—HLW—Storage: Estimated Number of Cancer Incidences and Genetic Effects	II-18.4–2	18–33
7.	WVDP—HLW—Emissions in Tons per Year of Criteria Air Pollutants	II-18.4–3	18–34
8.	WVDP—HLW—Percent of Standard/Guideline for Criteria Air Pollutants	II-18.4–4	18–35
9.	WVDP—HLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants	II-18.4–5	18–36
10.	WVDP—HLW—Impacts on Water Resources Due to Increased Water Use	II-18.4–6	18–37
13.	WVDP—HLW—Socioeconomic Impacts for Storage	II-18.4–7	18–38
14.	WVDP—HLW—Infrastructure Impacts for Storage	II-18.4–8	18–39
15.	WVDP—HLW—Cost	II-18.4–9	18–40

Table II-18.4–1. WVDP—HLW—Storage: Estimated Number of Fatalities

HLW Alternatives	Number of Storage Sites	WM Workers	
		Radiation Exposure	Physical Hazards
No Action	4	5.3E-02	2.3E-02
Decentralized	4	5.3E-02	2.3E-02
Regionalized-1	3	3.2E-02	1.4E-02
Regionalized-2	3	4.5E-02	1.9E-02
Centralized	1	4.5E-02	1.9E-02

Table II-18.4–2. WVDP—HLW—Storage: Estimated Number of Cancer Incidences and Genetic Effects

HLW Alternatives	Number of Storage Sites	WM Workers		
		Dose (person-rem)	Radiation Cancer Incidence	Radiation Genetic Effects
No Action	4	2.0E+02	2.8E-01	1.2E-02
Decentralized	4	1.9E+02	2.7E-01	1.2E-02
Regionalized-1	3	1.2E+02	1.7E-01	7.4E-03
Regionalized-2	3	1.7E+02	2.3E-01	1.0E-02
Centralized	1	1.7E+02	2.3E-01	1.0E-02

Table II-18.4–3. WVDP—HLW—Emissions in Tons per Year of Criteria Air Pollutants

HLW Alternatives	Number of Sites S	Construction Emissions in Tons/Year (1)						Operations & Maintenance Emissions in Tons/Year (2)					
		CO	NO2	Pb	PM10	SO2	VOC	CO	NO2	Pb	PM10	SO2	VOC
No Action	4	0	0	0	0	0	0	2 (0/2)	0	0	0	0	0
Decentralized	4	0	0	0	0	0	0	2 (0/2)	0	0	0	0	0
Regionalized-1	3	0	0	0	0	0	0	2 (0/2)	0	0	0	0	0
Regionalized-2	3	0	0	0	0	0	0	2 (0/2)	0	0	0	0	0
Centralized	1	0	0	0	0	0	0	2 (0/2)	0	0	0	0	0

Notes:
S = Storage
Data is based on repository beginning to accept HLW canisters in 2015.
Emissions <1 ton per year are shown as zeros. VOC = Volatile Organic Compounds.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
(1) Values = total emissions (equipment emissions/worker vehicles emission)
(2) Values = total emissions (stationary-source emissions/mobile-source emission)

Table II-18.4–4. WVDP—HLW—Percent of Standard/Guideline for Criteria Air Pollutants

HLW Alternatives	Number of Sites S	Construction					
		Percent of Tons/Year General Conformity Rule (1)					
		CO	NO2	Pb	PM10	SO2	VOC
No Action	4	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--
Regionalized - 1	3	--	--	--	--	--	--
Regionalized - 2	3	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--

HLW Alternatives	Number of Sites S	Operations & Maintenance										
		Percent of Tons/Year Standard or Guideline (2)						Percent of NAAQS Concentration (3)				
		CO (4)	NO2 (4)	Pb (4)	PM10 (4)	SO2 (4)	VOC (4)	CO	NO2	Pb	PM10	SO2
No Action	4	--	--	--	--	--	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--	--	--	--	--	--
Regionalized - 1	3	--	--	--	--	--	--	--	--	--	--	--
Regionalized - 2	3	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--	--	--	--	--	--

Notes:
S = Storage
Percentages <1% are shown as zeros. PSD = Prevention of Significant Deterioration. GCR = General Conformity Rule.
CO = carbon monoxide. NO2 = nitrogen dioxide. Pb = lead. PM10 = particulate matter less than 10 microns in diameter. SO2 = sulfur dioxide.
VOC = volatile organic compounds. NAAQS = National Ambient Air Quality Standard.
(1) WVDP is in an attainment area for all criteria pollutants, therfore the GCR does not apply.
(2) Stationary-source emissions from HLW storage facilities are assumed to be negligible.
(3) Stationary-source emissions from HLW storage facilities are assumed to be negligible.
(4) Attainment area for this pollutant, therefore PSD increment levels are applied. Values are for stationary-source emissions only.

Table II-18.4–5. WVDP—HLW—Percent of Standard/Guideline for Hazardous Air Pollutants and Toxic Air Pollutants

HLW Alternatives	Number of Sites	Operations & Maintenance											
	S	Total Radio-nuclides	Acetone	Benzene	Bromo-dichloro-methane	Butyl Alcohol	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Chromium VI	Cyanide	1,2-Dichloro-ethane	Lead
No Action	4	--	--	--	--	--	--	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-1	3	--	--	--	--	--	--	--	--	--	--	--	--
Regionalized-2	3	--	--	--	--	--	--	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--	--	--	--	--	--	--

HLW Alternatives	Number of Sites	Operations & Maintenance									
	S	Methanol	Methylene Chloride	Selenium	Silver	1,1,2,2-Tetrachloro-ethane	1,2,2-Trichloro, 1,1-Trifluoro-ethane	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Triochloro-fluoro-methane	Vinyl Chloride
No Action	4	--	--	--	--	--	--	--	--	--	--
Decentralized	4	--	--	--	--	--	--	--	--	--	--
Regionalized-1	3	--	--	--	--	--	--	--	--	--	--
Regionalized-2	3	--	--	--	--	--	--	--	--	--	--
Centralized	1	--	--	--	--	--	--	--	--	--	--

Notes:
S = Storage
-- = Emissions of hazardous and toxic air pollutants, including radionuclides, from HLW storage facilities are assumed to be negligible.

Table II-18.4–6. WVDP—HLW—Impacts on Water Resources Due to Increased Water Use

HLW Alternatives	Number of Sites	Construction			Operations			
	S	Water Use GPD	% Current Use	% Stream Flow	Water Use GPD	% Current Use	% Stream Flow	Waste Water % Stream Flow
No Action	4	- -	- -	- -	1,000	1.4	<0.1	<0.1
Decentralized	4	- -	- -	- -	1,000	1.4	<0.1	<0.1
Regionalized-1	3	- -	- -	- -	1,000	1.4	<0.1	<0.1
Regionalized-2	3	- -	- -	- -	1,000	1.4	<0.1	<0.1
Centralized	1	- -	- -	- -	1,000	1.4	<0.1	<0.1

Notes:
S = Storage
Water supplied by surface water from 2 onsite reservoirs. Current water use = 70,000 gallons/day.
Wastewater discharged to Buttermilk Creek. Average flow rate of Buttermilk Creek = 41,000,000 gallons/day.
Data is based on repository beginning to accept HLW canisters in 2015.
- - = Construction is not considered at WVDP.
<0.1 indicates that the percentage is less than 0.1%.

Table II-18.4–7. WVDP—HLW—Socioeconomic Impacts for Storage

HLW Alternatives	S	Effect of Implementation of Alternatives					
			Jobs		Income		
		Cost (Millions) (1)	Annual Jobs	% Annual Change in ROI (2)	ROI Annual Income (Millions) (1)	% Change in Annual Income (Millions) (1)	% ROI Population Increase (2)
No Action	4	19	21	0.00	0.2	0.00	0.00
Decentralized	4	19	21	0.00	0.2	0.00	0.00
Regionalized-1	3	27	30	0.01	0.3	0.00	0.00
Regionalized-2	3	27	30	0.01	0.3	0.00	0.00
Centralized	1	27	30	0.01	0.3	0.00	0.00

Notes:
S = Storage
(1) In 1990 dollars. The economic multiplies analysis only was applied to costs through 2015.
(2) Compared to 1990 baseline.

Table II-18.4–8. WVDP—HLW—Infrastructure Impacts for Storage

HLW Alternatives	Number of Sites	Effect of Implementation of Alternatives									
		Land Use		Water		Waste Water		Power		Employment (FTE)	
	S	Acres Required	% of Designated or Suitable Land Area	Demand (GPD)	% Current Capacity	Demand (GPD)	% Current Capacity	Power Required (MW)	% Current Capacity	Construction Employment	% of Current Employment (1)
No Action	4	- -	- -	1,000	0.9	1,000	1.4	0.04	0.54	- -	- -
Decentralized	4	- -	- -	1,000	0.9	1,000	1.4	0.04	0.54	- -	- -
Regionalized-1	3	- -	- -	1,000	0.9	1,000	1.4	0.04	0.54	- -	- -
Regionalized-2	3	- -	- -	1,000	0.9	1,000	1.4	0.04	0.54	- -	- -
Centralized	1	- -	- -	1,000	0.9	1,000	1.4	0.04	0.54	- -	- -

Notes:
S = Storage
GPD = Gallons per Day
MW = Megawatts Electric
FTE = Full Time Equivalent
(1) Based on 1991 Site Employment.
- - = Construction is not considered at WVDP.

Table II-18.4–9. WVDP—HLW—Cost

HLW Alternatives	Number of Sites	Total Cost (Millions) (1)	Cost by Life-Cycle Component (1)		Cost by Functional Area (1)	
	S		Construction (Millions) (2)	Operations & Maintenance (3) (Millions)	Storage (Millions)	Handling (Millions)
No Action	4	30	10	20	12	18
Decentralized	4	29	10	19	11	18
Regionalized-1	3	29	10	19	11	18
Regionalized-2	3	29	10	19	11	18
Centralized	1	29	10	19	11	18
Centralized Delayed Acceptance	1	29	10	19	11	18

Notes:
S = Storage
The Life Cycle Components and the Functional Area have been rounded to the nearest million, and therefore the sum may not reflect the true total cost.
(1) In 1994 Dollars; Total Cost = Sum of Life Cycle Components = Sum of Functional Areas.
(2) Construction costs are for the interim storage facilities.
(3) Operations and maintenance costs include operation and maintenance of the interim storage facilities, and the handling of canisters (unloading/loading of canisters into or out of the interim storage facilities).

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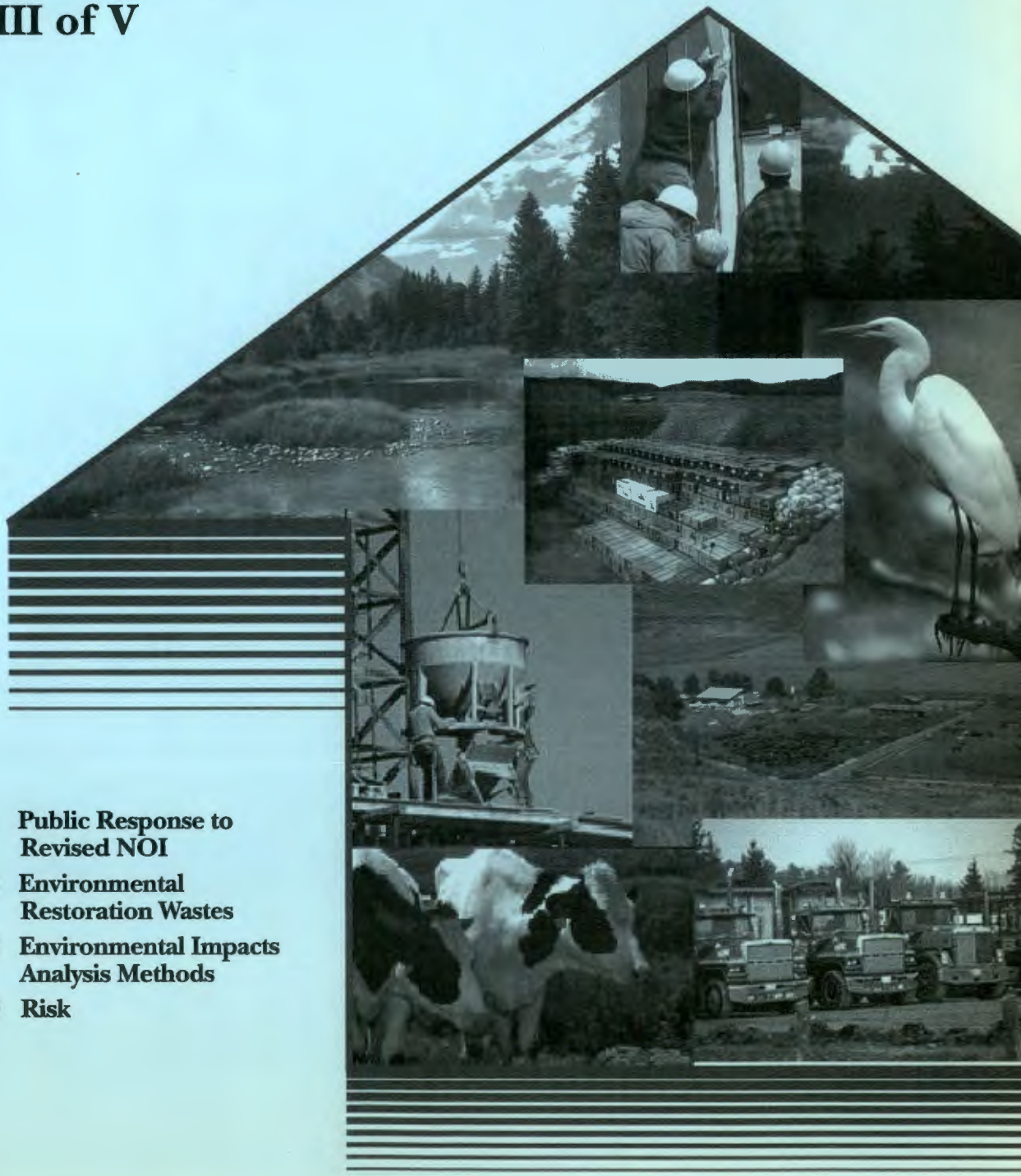
U.S. Department of Energy
Office of Environmental Management

Final Waste Management Programmatic Environmental Impact Statement

For Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste

DOE/EIS-0200-F

Volume III of V



Appendix A Public Response to Revised NOI

Appendix B Environmental Restoration Wastes

Appendix C Environmental Impacts Analysis Methods

Appendix D Risk

DOE/EIS-0200-F

FINAL
WASTE MANAGEMENT
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT
for
Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste

Volume III of V

Appendices A–D

U.S. Department of Energy
Office of Environmental Management
1000 Independence Ave.
Washington, DC 20585

Appendix A

Public Comments to DOE's Proposed Revisions to the Scope of the WM PEIS

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Attachment 1 Federal Register Notice, October 22, 1990 (55 FR 42633) A1–1
Attachment 2 Federal Register Notice, January 24, 1995 (60 FR 4607) A2–1
Attachment 3 Federal Register Notice, March 16, 1995 (60 FR 14275) A3–1
Attachment 4 Natural Resources Defense Council's Comments on the Department of Energy's Proposed Modification in Scope of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement A4–1

Acronyms

The following is a list of acronyms used in this appendix.

BEMR	Baseline Environmental Management Report
CERCLA	Comprehensive Environmental Response; Compensation and Liability Act
DOE	U.S. Department of Energy
NEPA	National Environmental Policy Act
NOI	Notice of Intent
PEIS	programmatic environmental impact statement
WM	Waste Management

APPENDIX A
Public Comments to DOE's Proposed Revisions to the Scope of the WM PEIS

On June 27, 1989, twenty-two citizens' groups, led by the Natural Resources Defense Council, filed suit to compel the U.S. Department of Energy (DOE) to prepare a programmatic environmental impact statement (PEIS) on proposals for the cleanup and modernization of the nuclear weapons production complex. Consequently, on January 12, 1990, the Secretary of Energy decided to prepare two programmatic environmental impact statements, one on the modernization of the nuclear weapons complex and the other on the Five-year Environmental Restoration and Waste Management Plan. Accordingly, on October 22, 1990, DOE issued a Notice of Intent (NOI) (55 FR 42633) to prepare the Environmental Restoration (ER) and Waste Management (WM) Programmatic Environmental Impact Statement (see Attachment 1). In the NOI, the Department identified the proposed action as follows: "to formulate and implement an integrated environmental restoration and waste management program in a safe and environmentally sound manner and in compliance with applicable laws, regulations and standards." The NOI identified two separate sets of alternatives to be evaluated, one for environmental restoration and one for waste management.

The public scoping period on the PEIS extended from October 22, 1990, to February 19, 1991. Beginning on December 3, 1990, the Department held 23 scoping meetings at various locations across the country to ensure adequate opportunity for participation by the public and other government agencies. During the public comment period, over 1,200 people provided approximately 7,000 comments, either by participating in the meetings or by submitting materials and letters. Most concerns were related to the public perception of the Department and to environmental, health, and safety issues.

To record the results of the public scoping meetings and to serve as a plan for preparing the PEIS, a Draft Implementation Plan was prepared and made publicly available on February 4, 1992 (57 FR 4193). The Draft Implementation Plan summarized the comments received during the public scoping meetings and identified those issues, as suggested by the comments, that would be considered in preparing the PEIS. A public comment period on the Draft Implementation Plan extended from February 4, 1992, until April 24, 1992. During this time, six regional public workshops were held.

The Final Implementation Plan was completed in January 1994 and made available to the public (59 FR 7990, February 17, 1994). It addressed comments received during the public scoping meetings and those received on the Draft Implementation Plan as well.

Subsequently, the Department attempted to meaningfully analyze the environmental restoration alternatives that it originally defined in the Final Implementation Plan but concluded, after considerable effort, that it would not be appropriate to make programmatic decisions regarding cleanup strategies that would be applicable to all of the Department's sites.

Accordingly, the Department announced on January 24, 1995 (60 FR 4607), an opportunity for public comment on its proposal to shift the focus and change the title of the PEIS (see Attachment 2). The proposed modification would eliminate the environmental restoration alternatives and modify the proposed action. On March 16, 1995, (60 FR 14275) in response to a request from the public, the Department announced an extension of the public comment period on the proposed scope to April 10, 1995 (see Attachment 3). In both announcements, the Department stated that the draft PEIS would contain an appendix summarizing comments received during the resulting public comment period.

On April 10, 1995, the Natural Resources Defense Council (NRDC) filed a public comment in response to the notices of opportunity on the proposed modification to the scope and title of the PEIS. The NRDC's comments were the only ones DOE received.

The NRDC's letter (see Attachment 4) referred to the prior litigation between the Natural Resources Defense Council and the Department of Energy and stated that the Department indicated that its cleanup and waste management activities constituted actions that fall within the meaning of the National Environmental Policy Act (NEPA) and are thus subject to review. The letter also stated that the Department, during the course of litigation, committed to preparing a PEIS that included environmental restoration.

The NRDC cited several issues that it believes warrant full analysis and public participation, including those pertaining to standards; the scope and pace of the cleanup program; land use restrictions in setting cleanup levels; inter- and intra-facility priorities in light of budget constraints; and public participation in the decision process for cleanup. Further, NRDC noted that as a matter of policy, the Department does not perform reviews under NEPA for actions taken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The Department agrees that there are issues with regard to the cleanup program for which a national perspective and public discussion are appropriate. DOE is considering some enhanced public participation to obtain input on such national environmental restoration issues. The Department believes that there are suitable analytical tools and venues available other than the PEIS, to address the issues raised in the Council's letter. These are discussed below.

As the Department noted in the *Federal Register*, the fundamental reasoning behind its decision to refocus the scope of the EIS was that cleanup decisions must reflect site-specific cleanup conditions commensurate with the regulatory framework under CERCLA and the Resource Conservation and Recovery Act. The site-specific nature of cleanup is inconsistent with programmatic initiatives that would be implemented nationwide. In other words, for environmental restoration, there is not a proposed program that requires evaluation of programmatic alternatives. Consequently, a PEIS is not an appropriate vehicle for analysis.

Arriving at cleanup decisions on a site-specific basis does not preclude public involvement in such decisions, nor does it alter the Department's commitments and requirements to complete appropriate reviews under NEPA. On the contrary, this permits the necessary specific reviews, considerations, and deliberations for cleanup actions, including considerations of land use issues, to be reached properly with the approval of state and federal regulators and with the direct involvement of the local community.

In addition, with regard to using land use restrictions in setting cleanup levels, the Department has embarked on an extensive initiative to gain an understanding of the long-term future site uses, which is essential to effective planning and decision making for a myriad of Departmental activities. Specifically, this initiative will provide a basis for decision making and for site development and comprehensive planning. Each of the Department's major sites is developing future land use preferences with significant involvement of interested and affected stakeholders.

The Department's Office of Environmental Management (EM) actively seeks the involvement of regulators and other stakeholders in establishing priorities and developing budgets. EM designed a process to give regulators and stakeholders a meaningful voice in developing site priorities, which are then used to develop a budget. The goal of this collaborative effort is to plan what could and could not be done with available resources to try to achieve an optimum balance among priorities within a site, and to some extent, among sites. This process results in a reprioritizing of activities and modification of schedules to ensure that the program will be as effective and cost-efficient as possible. As part of this open decision-making process, national meetings are held with regulators and stakeholders to discuss national priorities and cross-cutting

issues as well as any changes to field budget submissions. The pace as well as the scope of the program, therefore, is taken into consideration and reflected in the priorities and the budget.

The role of site-specific advisory boards and other means of public participation in the decision-making process for cleanup is of critical concern to the Department. The Department has established several advisory boards at its major sites. The boards, which are one means for involving the public, have negotiated their roles and responsibilities. Moreover, agendas are left to the boards to determine in conjunction with the regulators and the Department. The boards are informed of ongoing cleanup activities and issues, including land use planning, budget planning and development, and priority setting, and are invited into the decision-making process.

In the Fiscal Year 1994 National Defense Authorization Acts, Congress directed the Department to provide a life-cycle cost estimate for the program, delineated by specific projects and activities. The *Baseline Environmental Management Report* (BEMR), first issued in 1995 and updated in 1996, systematically analyzed potential life-cycle costs of meeting legal commitments as well as addressing other issues related to the management of hazardous and radioactive materials and waste within DOE The report provided cost estimates associated with various programwide alternatives given differing land use assumptions, residual contamination standards funding and schedule changes, waste treatment, storage and disposal options, and potential technology improvements. This report is a valuable analytical tool for exploring cost consequences of potential options.

In addition, the document *Risks and the Risk Debate: Searching for Common Ground "The First Step"* (DOE, 1995a), when considered with the *Baseline Environmental Management Report* (DOE, 1996) as well as other analyses, helps to provide a foundation of technical, environmental, financial, and social analysis needed to inform the national debate on a number of issues, including those raised in the Council's letter. The purpose of the analysis, prepared in response to direction from the Energy and Water Subcommittee of the Committee on Appropriations, was to help the Department develop a mechanism for establishing priorities among competing cleanup requirements.

After careful consideration of the NRDC's comments, and given these various opportunities for discussion and the analytical tools available for informed debate on national issues, the Department determined that these activities and processes are useful to the public and should continue. Consequently, DOE has begun a "National Dialogue" initiative to provide a means for continuing comprehensive discussions with government officials, regulatory authorities, and other interested organizations and publics regarding the

major materials, waste, and cleanup decisions DOE needs to make. This dialogue includes public participation and input into environmental restoration issues. Nonetheless, the Department decided that the scope of the PEIS should be modified as proposed to consider management of the Department's radiological and hazardous wastes and sites at which the wastes could be managed in the future. This approach is consistent with the alternatives outlined for waste management in the Final Implementation Plan.

Appendix A
References

U.S. Department of Energy. 1995a. *Risks and the Risk Debate: Searching for Common Ground "The First Step," Volumes I and II*. June draft. Washington, DC: Office of Environmental Management.

U.S. Department of Energy. 1996. *The 1996 Baseline Environmental Management Report [BEMR]*. DOE/EM-0290. June. Washington, DC: Office of Environmental Management.

Attachment 1
(to WM PEIS Appendix A)

Federal Register Notice
(Volume 55, Number 204, Monday October 22, 1990)
[55 FR 42633]

Department of Energy
"Intent to Prepare a Programmatic Environmental Impact Statement on the Department of Energy's Proposed Integrated Environmental Restoration and Waste Management Program, and to Conduct Public Scoping Meetings"

Federal Register / Vol. 55, No. 204 / Monday, October 22, 1990 / Notices 42633

DEPARTMENT OF ENERGY

Intent To Prepare a Programmatic Environmental Impact Statement on the Department of Energy's Proposed Integrated Environmental Restoration and Waste Management Program, and To Conduct Public Scoping Meetings

AGENCY: U.S. Department of Energy (DOE).

ACTION: Notice of intent (NOI) to prepare a programmatic environmental impact statement (PEIS).

SUMMARY: The Department of Energy announces its intent to prepare a PEIS pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321, *et seq.*), as amended, and to conduct a series of public scoping meetings nationwide. The PEIS will assess the potential environmental consequences of alternatives for implementing an integrated environmental restoration and waste management program

The purpose of DOE's proposed integrated environmental restoration and waste management program is to provide a broad, systematic approach to addressing cleanup activities and waste management practices. The Department is committed to ensuring that potential risks to human health and the environment from the cleanup of contamination resulting from past operations and from future waste management activities are at safe levels. DOE is further committed to full compliance with environmental regulations and to a goal of completing environmental restoration by 2019.

INVITATION TO COMMENT: To ensure that the full range of issues related to this proposal are addressed, comments on the proposed scope of the PEIS are invited from all interested parties. Written comments to assist DOE in identifying significant environmental issues and defining the appropriate scope of the PEIS should be directed to Mr. Wisenbaker at the address indicated below. Agencies, organizations, and the general public also are invited to present oral comments pertinent to the preparation of the PEIS at the public scoping meetings to be held nationwide, as described below. Written and oral comments will be given equal weight.

Following the completion of the public scoping process, a PEIS Implementation Plan will be issued for public comment. The Implementation Plan will record the results of the scoping process and define the alternatives and issues to be evaluated in the PEIS. DOE intends to

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complete the draft PEIS in early 1992. Its availability will be announced in the Federal Register, and public comments again will be solicited. Comments on the draft PEIS will be considered in preparing the final PEIS, scheduled for 1993.

DATES: The public scoping period will continue until February 19, 1991. Written comments should be postmarked by February 19, 1991 to assure consideration. Comments received after that date will be considered to the extent practicable. The public scoping meetings will begin in December 1990. The dates and locations of the meetings will be announced in a subsequent Federal Register notice and in local public notices in advance of the planned meetings.

ADDRESSES AND FURTHER INFORMATION: Written comments on the scope of the PEIS, questions concerning the program, and requests for copies of the draft PEIS should be directed to: Mr. W. E. Wisenbaker, Acting Director, Division of Program Support, Office of Environmental Restoration (EM-43), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585, (202) 353-2950.

For further information on the DOE NEPA process please contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Oversight (EH-25), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585, (202) 586-4600.

PUBLIC SCOPING MEETINGS: Public scoping meetings will be held in the following cities beginning in December 1990. The dates and locations of these meetings will be published in a subsequent Federal Register notice. This information will also be announced in local public notices before the planned meetings.

Oakland, California
Denver, Colorado
Washington, DC
Tampa, Florida
Atlanta, Georgia
Boise, Idaho
Idaho Falls, Idaho
Chicago, Illinois
Paducah, Kentucky
St. Louis, Missouri
Las Vegas, Nevada
Princeton, New Jersey
Albuquerque, New Mexico
Newburgh, New York
Cincinnati, Ohio
Columbus, Ohio
Portland, Oregon
Columbia, South Carolina
Oak Ridge, Tennessee
Amarillo, Texas
Richland, Washington
Seattle, Washington
Spokane, Washington

SUPPLEMENTARY INFORMATION: *Background.* In November 1989, the Secretary of Energy established the DOE Office of Environmental Restoration and Waste Management (EM) for the purpose of consolidating the Department's environmental restoration and waste management activities. In January 1990, the Secretary determined that DOE will prepare an Environmental Impact Statement on a newly proposed integrated environmental restoration and waste management program.

Some of the waste management practices that DOE and its predecessor agencies once considered safe and prudent under then existing requirements and guidelines have resulted in the need for remediation under applicable current Federal and state requirements and guidelines. DOE's environmental restoration activities include the assessment and physical cleanup of contamination at DOE installations and other properties. Environmental restoration activities also include the decontamination and decommissioning (D&D) of DOE's surplus facilities. These facilities and properties may have contamination from radioactive, hazardous, or mixed (radioactive and hazardous) waste. As decisions are made for the handling of contamination at various sites and facilities, new wastes will be generated that will require management.

DOE's waste management operations include the treatment, storage, transportation, and disposal of wastes generated by ongoing nuclear energy, energy research, and defense activities; by environmental restoration activities; and by other sources. These wastes include: high-level radioactive waste (HLW); low-level radioactive waste (LLW); transuranic waste (TRU); mixed waste (MW); greater-than-Class C waste (GTCC) waste; and hazardous waste.

The Affected Installations. DOE's environmental restoration and waste management activities occur throughout the U.S. The largest number of facilities that require environmental restoration or that generate or store the largest volumes of radioactive, hazardous, and mixed waste are located at these installations: Hanford Reservation (Washington); Savannah River Site (South Carolina); Oak Ridge Reservation (Tennessee); Rocky Flats Plant (Colorado); Feed Materials Production Center, Mound Plant and Portsmouth Gaseous Diffusion Plant (Ohio); Idaho National Engineering Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Argonne National Laboratory (Illinois); Paducah Gaseous Diffusion Plant (Kentucky); Nevada Test Site (Nevada); Los Alamos National Laboratory and Sandia National Laboratory (New Mexico); and Pantex Plant (Texas). The Appendix contains a listing of DOE locations where current environmental restoration and waste management activities occur that DOE believes are within the scope of this PEIS. Additional sites may be added in the course of the development of the PEIS.

The Regulatory Framework. Federal laws of major importance to DOE's environmental restoration and waste management activities include, among others, the Atomic Energy Act of 1954 (42 U.S.C. 2011, *et seq.*), as amended; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. 9601, *et seq.*), as amended; and the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901, *et seq.*), as amended. The Atomic Energy Act requires the management, processing, and utilization of radioactive materials in a manner that protects the public health and the environment. CERCLA requires responses to releases or threatened releases of hazardous substances into the environment and establishes a process to clean up abandoned or uncontrolled hazardous waste sites which may endanger public health or the environment. RCRA requires management of waste currently being generated, including the treatment, storage, transportation, and disposal of hazardous waste, and cleanup of hazardous waste releases from past and present operations that pose a threat to human health and the environment. It is DOE's policy to apply NEPA to its waste management and cleanup activities. To minimize delay and duplication of effort in meeting these responsibilities, DOE is supplementing, where necessary, and integrating the procedural documentation and public participation requirements for CERCLA and RCRA to facilitate compliance with NEPA requirements (DOE Order 5400.4, Comprehensive Environmental Response, Compensation, and Liability Act Requirements).

DOE environmental restoration and waste management activities are subject to other applicable Federal and state requirements and to enforceable agreements. Additionally, certain Federal statutes require DOE to undertake specific environmental restoration and waste management activities. For example, under Title I of the Uranium Mill Tailings Radiation Control Act, DOE must remediate inactive uranium milling sites in accordance with Environmental

Protection Agency standards (40 CFR part 192) established for that purpose.

Wastes are categorized in accordance with Federal statutes and regulations and DOE Orders. High-level waste is defined in the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101(12)). Low-level, transuranic, and radioactive mixed wastes are defined in DOE Order 5820.2A (Radioactive Waste Management). Hazardous wastes are those wastes that are defined as hazardous by U.S. Environmental Protection Agency regulations implementing RCRA (40 CFR Part 261) and by applicable state regulations.

Current Practices for Waste Management. To date, DOE's waste management operations have focused on site-by-site treatment, storage, transportation, and disposal of waste. Transuranic, low-level, hazardous, and radioactive mixed waste are generated at many DOE installations; only a few installations generate high-level waste.

DOE generates or stores high-level waste at four installations: the Savannah River Site, the Hanford Reservation, the Idaho National Engineering Laboratory, and the West Valley Demonstration Project. To date, high-level waste has undergone only limited treatment. DOE intends to immobilize the waste in a stable, solid form acceptable for disposal in a geologic repository. Under current law, only one potential repository site (at Yucca Mountain, Nevada) for this waste is currently being characterized.

Most TRU waste has been generated at DOE's Rocky Flats Plant in Golden, Colorado. Transuranic waste is currently stored at several facilities including the Rocky Flats Plant, the Idaho National Engineering Laboratory, the Hanford Reservation, the Oak Ridge Reservation, the Nevada Test Site, Los Alamos National Laboratory, and the Savannah River Site. The Idaho National Engineering Laboratory has the largest management program for this waste. The Department is currently evaluating the Waste Isolation Pilot Plant in Carlsbad, New Mexico, as a potential disposal site for TRU waste.

Low-level waste requires relatively minimal treatment. Although in some instances other methods may be used, DOE currently disposes of the majority of its LLW in near-surface facilities, including installations at the Savannah River Site, the Oak Ridge Reservation, the Nevada Test Site, the Hanford Reservation, Los Alamos National Laboratory, and the Idaho National Engineering Laboratory.

DOE Order 5820.2A (Radioactive Waste Management) requires that the DOE waste equivalent to commercially generated Greater-than-Class C (GTCC) waste be handled as a special case by each site. The Department is also responsible for disposal of commercially generated GTCC waste. DOE has developed a three-part strategy for managing this waste. The first phase would provide a storage facility for those generators that cannot continue to store the waste. The second phase would provide a central storage facility for all commercially generated GTCC waste.

The final phase would transfer the stored waste to a high-level waste repository or provide for the development of a separate GTCC disposal facility.

For hazardous waste, DOE's near-term objective is to treat the waste as it is generated, thereby minimizing the need for storage capacity. DOE disposes of treated hazardous waste in permitted DOE or commercial facilities.

Mixed wastes are generated at many DOE installations. Mixed waste may include high-level waste, transuranic waste, and low-level waste. DOE stores these wastes until they can be treated and disposed of in permitted facilities. The Department currently treats a small amount of MW by thermal destruction to eliminate some hazardous components. In addition, DOE treats some low-level MW by solidification.

The PEIS will address these practices and any reasonable alternatives that are amenable to environmental analysis. (See Scope of PEIS, below)

Current Practices for Environmental Restoration. DOE will continue to seek, to the extent possible, to negotiate a comprehensive Federal Facilities Agreement with the Environmental Protection Agency (EPA) and the involved state to cover its remediation activities at an installation. Such agreements establish technical requirements and schedules for characterization, feasibility assessment and cleanup at each of the affected sites, and delineate the roles and responsibilities of each party to the agreement, to comply with the requirements of Section 120 of CERCLA. DOE is in the early stages of site assessment and characterization at many facilities. These initial activities are being reviewed in compliance with NEPA. DOE has determined that these early remediation activities are normally categorically excluded under its NEPA guidelines (55 FR 37174, September 7, 1990).

Decontamination and decommissioning activities have several objectives: (1) To maintain facilities awaiting additional D&D activities in a manner that protects workers, the public, and the environment; (2) to decontaminate facilities intended for reuse; and (3) decommission other facilities in accordance with requirements set forth in an approved environmental compliance plan. Currently, D&D activities are planned and executed on a site-by-site basis.

The PEIS will address these practices and any reasonable alternatives amenable to environmental analysis.

Need for an Integrated Environmental Restoration and Waste Management Program. The fundamental goal of DOE's Office of Environmental Restoration and Waste Management is to ensure that potential risks to human health and to the environment posed by wastes under its jurisdiction are at safe levels. To help achieve this goal, DOE proposes to conduct an integrated environmental restoration and waste management program.

Historically, DOE environmental restoration and waste management operations have been conducted on a site-by-site basis. This practice has led to differing approaches to cleanup and waste management among DOE sites. DOE's recent consolidation of waste program responsibilities (environmental restoration and waste management) provides the opportunity to establish a systematic approach to programmatic requirements and practices.

Remediation and D & D activities result in large amounts of waste that will require management, in addition to the wastes generated from production, research, and other activities. Because environmental restoration activities will be a significant source of waste, cleanup and waste management activities are closely related. The resolution of certain key issues, such as future land-usability objectives, will determine the amount, type, and timing of environmental restoration waste being introduced into the waste management part of the system. Land-usability policy relates to cleanup standards and the degree of reliance on institutional controls for long-term health and environmental protection.

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT: On January 12, 1990, the Secretary of Energy determined that a PEIS should be prepared for DOE's newly proposed integrated environmental restoration and waste management program. The Secretary stated that preparation of this PEIS will ensure that a comprehensive and cumulative environmental analysis of waste management proposals and alternatives will be available to DOE decisionmakers and the public.

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The PEIS will assess broad programmatic issues and integrated approaches to DOE's environmental restoration and waste management activities. DOE aims, to the extent this is feasible, for the PEIS to provide the primary environmental basis for selecting waste management methods and technologies and the locations at which they would be implemented. However, DOE does not intend the PEIS to assess impacts related to alternative choices of locations within a site. Such detailed decisions would be based on site-specific NEPA documents tiered to this PEIS.

PRELIMINARY DESCRIPTION OF ALTERNATIVES: *Scope of PEIS.* DOE solicits public input on all aspects of the proposed program described in this notice. DOE plans to structure this PEIS in two sections to facilitate public review and comments. One section of the PEIS will focus on key environmental restoration issues. The second section will analyze reasonably foreseeable potential impacts associated with various waste management alternatives within the integrated program.

As discussed previously, current environmental restoration and waste management practices for which reasonable alternatives that are amenable to environmental analysis can be identified are within the scope of the PEIS. Under the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101, *et seq.*), as amended, DOE currently plans to dispose of high-level waste resulting from Departmental activities in a repository to be developed for spent fuel from commercial nuclear utilities. In addition, under section 213(a) of the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (42 U.S.C. 7272, *et seq.*), as amended, the Department plans to demonstrate the disposal of defense transuranic waste at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. These decisions will not be revisited in the programmatic EIS. In addition, there is a national program, under Congressional direction, to address the management of commercial nuclear reactor spent fuel. The activities associated with that program will be considered in separate NEPA documentation and not in this PEIS. Commercial LLW is not the Department's responsibility and therefore is outside the scope of the PEIS. Uranium Mill Tailings Remedial Action Program (UMTRAP) tailings cleanup and disposal activities are within DOE's purview, but are expected to be close to completion prior to the issuance of the Record of Decision and will not be considered in the PEIS. The groundwater remediation activities associated with UMTRAP are just beginning, however, and therefore are within the scope of this PEIS.

Proposed action. The proposed action is to formulate and implement an integrated Environmental Restoration and Waste Management Program in a safe and environmentally sound manner, and in compliance with applicable laws, regulations and standards. Alternative approaches are discussed below.

Environmental Restoration Analysis: NEPA requires DOE to analyze reasonable alternatives to its proposed actions. DOE realizes that in the current environmental restoration decisionmaking framework for remediation activities there are statutory and regulatory requirements that must be fulfilled. DOE will continue to follow established processes in conducting ongoing environmental restoration activities.

For example, the framework Congress established under CERCLA for remedial actions imposes a strong preference for permanent remedies that comply with all applicable and appropriate requirements established under environmental laws. Consequently, DOE's overall environmental restoration efforts have focused on cleaning up sites adequately for unrestricted future use. The framework also requires that cleanup requirements and remedies be selected site-specifically. This produces final decisions made both discretely and diversely.

DOE believes, however, that there are important national issues that it should analyze in carrying out its responsibilities. These issues include, but are not limited to, (1) the degree to which DOE should rely on proven technologies in contrast to making strong resource commitments to developing innovative technologies; (2) the manner in which DOE should manage wastes until adequate treatment and disposal capacity is available; (3) whether DOE's installations should invariably be cleaned up for unrestricted use; and (4) the environmental basis for deciding cleanup priorities.

DOE seeks to develop and analyze programmatic alternatives that bear on these issues. DOE believes that important information on the costs and benefits of alternative program management strategies could thereby be obtained. DOE is especially interested in receiving public comments on these issues.

Decontamination and decommissioning activities are not subject to the decisionmaking framework that governs remediation activities. DOE proposes, therefore, to approach all D&D activities in an integrated, systematic fashion.

Waste Management Analysis: Waste treatment, storage, transportation, and disposal alternatives primarily depend on the waste category (such as radioactive, hazardous, or radioactive mixed waste). Alternatives will reflect centralized, regional, or installation-specific strategies. The analysis would provide environmental information for deciding which waste management capabilities should be established centrally, regionally, or at each site. Transportation of waste and the potential associated impacts will also be evaluated.

No Action. This alternative would continue present practices. DOE would not adopt and integrated environmental restoration and waste management program. DOE would continue to operate its environmental restoration activities and its waste operations as discrete site-specific actions. If site requirements dictate the need for offsite or new facilities, management decisions would be made on a project specific basis.

DOE would maintain existing facilities for waste management operations. New waste management activities, projects, and technological development would be considered case-by-case.

IDENTIFICATION OF ENVIRONMENTAL ISSUES: The following environmental issues have been identified for analysis in the PEIS. This list is presented to facilitate discussion on the scope of the PEIS and is not intended to be all-inclusive or to predetermine the scope. Therefore, DOE invites comments on these and additional issues relevant to this PEIS.

(1) The potential impacts (both beneficial and adverse) to worker health, public health, and the environment under various alternatives for environmental restoration and waste management.

(2) The potential impacts to workers, public health, and the environment under various alternatives from routine transportation of wastes and potential transportation accidents.

(3) The development of needed technologies and methods for environmental restoration and waste management and the potential impacts (both beneficial and adverse) from their implementation.

(4) Any obstacles to achieving full compliance with all applicable federal, state, and local environmental statutes, regulations, and requirements.

(5) The socioeconomic impacts of alternatives for dispersed, regional, and centralized waste management.

(6) The potential impacts of applying various land-usability strategies to the cleanup of DOE installations and sites.

RELATIONSHIP TO OTHER ACTIONS: *Five-Year Plan.* DOE issued a Five-Year Plan for Environmental Restoration and Waste Management (DOE/S-0070) in August 1989 that was subsequently revised, updated, and reissued (DOE/S-0078P) in June 1990. The Plan summarizes current DOE practices and identifies short- and long-term goals. The activities described are for the near-term (e.g., remediation of seepage basins at the Savannah River Site, and radioactive storage upgrades at the Kansas City Plant). Only general objectives, criteria, and guidance, in addition to those set in applicable environmental regulations and statutes, are specified for implementing environmental restoration and waste management activities on a long-term basis. For example, the Plan states that the majority of solid low-level waste generally will continue to be disposed of using shallow land burial, but recognizes that this may not be suitable for all locations. The Plan also states DOE's general intent that facilities and sites be returned to a condition suitable for unrestricted use, but recognizes that in-place remedies may sometimes be preferred.

The Five-Year Plan is not a proposal within the context of NEPA. Rather, it is preliminary to the Environmental Restoration and Waste Management PEIS in which DOE will evaluate integrating its long-term environmental restoration and waste management activities. The PEIS will specifically address the long-term goals and issues generally summarized in the Five-Year Plan.

As the Plan states, completion of the PEIS process may result in changes in specific programs, which would be reflected in future editions of the Plan.

Environmental Restoration and Waste Management Configuration Study. The Environmental Restoration and Waste Management Configuration Study is a strategic planning study for the long-term (the next 25 years). The study will support the definition of waste system configuration alternatives in this PEIS. DOE intends to issue the draft configuration study concurrently with the draft PEIS for public information and use in reviewing the draft PEIS.

Many factors influence the configuration and updating of DOE's waste management operations, including: (1) Increasingly strict environmental, safety, and health standards and requirements; (2) facilities dating from the late 1940s to the middle 1960s becoming obsolete; (3) increasing costs to maintain and upgrade these facilities; (4) difficulties in managing widely dispersed waste storage facilities in different environmental settings; (5) potential changes in the locations, volumes, and types of waste to be managed, after consideration of a PEIS on reconfiguring (modernizing) the nuclear weapons complex; (6) availability of improved technologies; (7) population growth near once-remote facilities such as areas near Rocky Flats, Colorado, Fernald, Ohio, Oak Ridge, Tennessee, and Livermore, California, which has led to local demands for restricting DOE operations; and (8) transition from waste accumulation and storage to waste treatment and disposal.

PEIS for the Nuclear Weapons Complex (NWC). In concert with the decision to prepare this PEIS, the Secretary decided that a separate PEIS on DOE's proposal to modernize (reconfigure) the nuclear weapons complex will also be prepared. The reconfiguration of the nuclear weapons complex would affect DOE's program for environmental restoration and waste management because it would change the locations, volumes, and types of waste to be managed. The environmental restoration and waste management PEIS, therefore, will take into account, to the extent practical, the materials generated in the preparation of the NWC PEIS. Separate statements are being prepared, however, because the programs are driven by distinct missions, requirements, and schedules. If the PEIS on the NWC is not issued first, DOE will prepare a supplement to the Environmental Restoration and waste management PEIS, if appropriate.

PUBLIC SCOPING MEETINGS AND INVITATION TO COMMENT: DOE is committed to providing opportunities for the involvement of interested individuals and groups in this and other DOE planning activities.

DOE will conduct a series of public scoping meetings nationwide and invites all interested people to attend and to present oral comments concerning: (1) the scope of the PEIS, (2) the issues that should be addressed, and (3) the alternative integrated approaches to be analyzed in the PEIS. DOE also invites written comments.

Oral and written comments will be given equal consideration. Instructions for submitting written comments are given above. People desiring to speak at the public scoping meetings should submit their requests to do so to the contact persons to be designated in a subsequent **Federal Register** notice. Oral presentation requests for each meeting should be received by DOE at least two days before the meeting.

The meetings will be chaired by a presiding officer. They will not be conducted as evidentiary hearings. Speakers will not be cross-examined, although the DOE representatives present may ask them clarifying questions.

To ensure everyone an adequate opportunity to speak, five minutes will be allotted for each speaker. Depending on the number of persons requesting to speak, the presiding officer may allow more time for speakers representing multiple parties or organizations. Persons wishing to speak on behalf of organizations should identify the organization in their request. Persons who have not submitted a timely request to speak may register at the meetings, and will be called on to speak if time permits. Written comments also will be accepted at the meetings, and speakers are encouraged to provide written versions of their oral comments for the record.

The public scoping meetings will begin in December 1990. Detailed information on the meetings will be provided in a subsequent **Federal Register** notice. This information will also be announced in local public notices before the planned meetings.

DOE will make a transcript of each meeting. Copies will be made available for inspection at the DOE Freedom of Information Reading Room (Room 1E-190), Forrestal Building, 1000 Independence Avenue SW., Washington, DC 20585, during business hours, Monday through Friday and in local DOE reading rooms. Locations of local reading rooms will be provided in the subsequent **Federal Register** notice regarding the scoping meetings.

RELATED NEPA DOCUMENTATION: DOE expects to prepare additional NEPA documents for implementing programmatic and facility-specific decisions based upon this PEIS. These generally site-specific documents will analyze future technology and siting alternatives for implementing DOE's environmetnal restoration and waste management activities. Their analyses will address such local concerns as floodplains and wetlands, historic and archaeological sites, land use, and threatened and endangered species. The PEIS will examine these issues only to the degree necessary for selection of an integrated program.

Interim Actions. DOE may need to conduct many diverse and discrete site-

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specific environmental restoration and waste management activities while the PEIS is being prepared. Many of these activities are required by Federal and state regulatory agencies under environmental compliance agreements and some are required by court decrees. DOE will have to determine case-by-case whether site-specific actions may proceed before the PEIS is completed. This will be done in accordance with all applicable requirements, including the test for interim actions found in Council on Environmental Quality's NEPA Regulations (40 CFR 1506.1(c)).

Other. DOE has prepared, or is currently preparing, NEPA documents for many of DOE's site-specific actions. Examples of some major relevant waste management NEPA documents are listed below:

1. Final Environmental Impact Statement, Disposal of Hanford Defense High-level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington. DOE/EIS-0113, December 1987. U.S. Department of Energy, Washington, DC.
2. Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina. DOE/EIS-0120, December 1987. U.S. Department of Energy, Washington, DC.
3. Final Supplemental Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026-FS, January 1990. U.S. Department of Energy, Washington, DC.
4. Draft Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington, DOE/EIS-0119d, March 1989. U.S. Department of Energy, Washington, DC.

These documents, the Five-Year Plan (DOE/S-0078P), transcripts from the public scoping meetings (when they become available), and other related documents will be available for inspection at DOE Freedom of Information Reading Rooms.

Issued in Washington, DC, this 15th day of October 1990.

Peter N. Brush,

Acting Assistant Secretary, Environment, Safety and Health.

Appendix: Locations of Activities Embraced by the PEIS

Name	Location
Amchitka Island	Amchitka Island, AK.
Lawrence Berkeley Laboratory.	Berkeley, CA.
University of California	Berkeley, CA.
Atomics International	Canoga Park, CA.
Laboratory for Energy-Related Health Research.	Davis, CA.
Sandia National Laboratory-Livermore.	Livermore, CA.
Lawrence Livermore Laboratory	Livermore, CA.
Bayo Canyon	Los Alamos, CA.
Stanford Linear Accelerator Center.	Palo Alto, CA.
General Atomics	San Diego, CA.
Energy Technology Engineering Center.	Santa Susana, CA.
General Electric Vallecitos Nuclear Center.	Vallecitos, CA.
Rocky Flats Plant	Golden, CO.
Grand Junction Project Office.	Grand Junction, CO.
Project Rulison Site	Grand Valley, CO.
Project RioBlanco Site	Rifle, CO.
Seymour Speciality Wire	Seymour, CT.
Pinellas Plant	St. Petersburg, FL.
Kauai Test Facility	Kauai, HI.
Ames Laboratory	Ames, IA.
Idaho National Engineering Laboratory	Idaho Falls, ID.
Argonne National Laboratory—West.	Idaho Falls, ID.
Argonne National Laboratory—East.	Chicago, IL.
National Guard Armory	Chicago, IL.
Palos Forest	Chicago, IL.
Fermi National Accelerator Laboratory.	Batavia, IL.
University of Chicago	Chicago, IL.
Johnston Atoll	Johnston Atoll.
Paducah Gaseous Diffusion Plant.	Paducah, KY
Ventron, Beverly	Beverly, MA.
Shpack Landfill	Norton, MA.
W.R. Grace & Co.	Curtis Bay, MD.
General Motors	Adrian, MI.
Hazelwood (Latty Avenue)	Hazelwood, MO.
Kansas City Plant	Kansas City, MO.
St. Louis Airport Storage Site	St. Louis, MO.
Mallinckrodt, Inc.	St. Louis, MO.
St. Louis Airport Storage Site Vicinity Properties.	St. Louis, MO.
Weldon Spring Site Remedial Action Project.	St. Charles, MO.
Tatum Dome	Tatum Dome, MS.
Component Development & Integration Facility	Butte, MT
Hallam Nuclear Power Facility	Lincoln, NE.
Du Pont & Company	Deepwater, NJ.
Kellex/Pierpont	Jersey City, NJ.
Maywood	Maywood, NJ.
Middlesex Landfill	Middlesex, NJ.
Middlesex Sampling Plant	Middlesex, NJ.
New Brunswick Laboratory	New Brunswick, NJ.
Princeton Plasma Physics Laboratory.	Princeton, NJ.
Wayne/Pequannock	Wayne/Pequannock, NJ.
Inhalation Toxicology Research Institute.	Albuquerque, NM.
Sandia National Laboratory—Albuquerque.	Albuquerque, NM.
Ross Aviation	Albuquerque, NM.
Project GNOME Site	Carlsbad, NM.
Waste Isolation Pilot Plant	Carlsbad, NM.
Project GASSBUGGY Site	Farmington, NM.
Los Alamos National Laboratory.	Los Alamos, NM.
Acid/Pueblo Canyon	Los Alamos, NM.
Chupadera Mesa	White Sands Missile Range, NM.
Central Nevada Test Area	Central Nevada Test Area, NV.
Project Shoal Site	Fallon, NV.
Nevada Test Site	Los Vegas, NV
Tonopah Test Range	Nellis Air Force Base, NV.
Colonie	Colonia, NY.
Niagara Falls Storage Site Vicinity Properties.	Lewiston, NY
Niagara Falls Storage Site	Niagara Falls, NY
Ashland Oil Co. #2	Tonawanda, NY
Linde Air Products	Tonawanda, NY.
Seaway Industrial Park	Tonawanda, NY.
Ashland Oil Co. #1	Tonawanda, NY.
Brookhaven National Laboratory.	Upton, Long Island, NY.
West Valley Demonstration Project.	West Valley, NY.
Reactive Metals Inc	Ashtabula, OH.
Battelle Columbus Laboratories.	Columbus, OH.
Feed Materials Production Center.	Fernald, OH.
Mound Laboratory	Miamisburg, OH.
Piqua Nuclear Power Facility	Piqua, OH.
Portsmouth Gaseous Diffusion Plant.	Portsmouth, OH.
Albany Metallurgical Research Center.	Albany, OR.
Universal Cyclops	Allquippa, PA.
Center for Energy and Environmental Research.	Mayaguez, PR.
Savannah River Site	Aiken, SC.
Oak Ridge National Laboratory	Oak Ridge, TN.
Oak Ridge Gaseous Diffusion Plant.	Oak Ridge, TN.
Y-12 Plant	Oak Ridge, TN.
Pantex Plant	Amarillo, TX.
Hanford Reservation	Richland, WA.
24 Site Covered under Title I of the Uranium Mill Tailings Radiation Control Act.	Various Locations.

Attachment 2
(to WM PEIS Appendix A)

Federal Register Notice
(Volume 60, Number 15, Tuesday January 24, 1995)
[60 FR 4607]

Department of Energy
"Environmental Restoration and Waste Management; Programmatic Environmental Impact Statement"

Federal Register / Vol. 60, No. 15 / Tuesday, January 24, 1995 / Notices 4607

DEPARTMENT OF ENERGY

Environmental Restoration and Waste Management; Programmatic Environmental Impact Statement

AGENCY: U.S. Department of Energy

ACTION: Notice of opportunity for public comment.

SUMMARY: The Department of Energy is giving the public the opportunity to comment on proposed modifications to the title and scope of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. The Department proposes to modify the scope and name of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement (PEIS).

The proposed action would focus primarily on the evaluation and analysis of waste management issues confronting the Department and would be renamed the Waste Management Programmatic Environmental Impact Statement.

DATES: To ensure that the public's concerns and views are fully considered, DOE is providing a 45-day written comment period that will extend until March 10, 1995, to comment on the proposed modification to the Programmatic Environmental Impact Statement.

ADDRESSES AND FURTHER INFORMATION: Written comments and requests for further information on the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement should be directed to: James A. Turi, Office of Waste Management (EM-33), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585-0002, (301) 903-7147.

For information on the Department's National Environmental Policy Act process, contact: Carol M. Borgstrom, Director, Office of NEPA Oversight (EH-25), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585, (202) 586-4600 or leave a message at 1-800-472-2756.

SUPPLEMENTARY INFORMATION: On October 22, 1990, the Department of Energy issued a Notice of Intent to prepare the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement (PEIS) (55 FR 42633). In the Notice of Intent and in an Implementation Plan issued in January 1994, the Department identified the proposed action as follows: "to formulate and implement an integrated environmental restoration and waste management program in a safe and environmentally sound manner and in compliance with applicable laws, regulations and standards." The Notice of Intent and the Implementation Plan identified two separate sets of alternatives to be evaluated, for environmental restoration and for waste management.

The Department attempted to meaningfully analyze the environmental restoration alternatives that it originally defined as part of the "proposed action." After considerable effort, the Department has concluded that it would not be appropriate to make programmatic decisions regarding cleanup strategies that would be applicable to all of the Department's sites. The fundamental reasoning behind the Department's conclusion is that cleanup decisions should reflect site-specific conditions, and, in any event, can only be reached with the approval of state and federal regulators and the involvement of the public. It would be inconsistent with the site-specific nature of cleanup decisions, therefore, to make these decisions under this PEIS that would be implemented nationwide.

Accordingly, the Department proposes to eliminate the analysis of environmental restoration alternatives and to modify the proposed action. As modified, the PEIS would consider how to manage the subject wastes and analyze alternative sites at which the wastes could be managed in the future. The PEIS would focus its programmatic evaluations on waste management facilities, and would henceforth be known as the "Waste Management Programmatic Environmental Impact Statement." As previously set forth in the Implementation Plan, the PEIS would evaluate decentralized, regional, and centralized approaches for storage of high-level waste; treatment and storage of transuranic waste; treatment and disposal of low-level and low level mixed waste; and treatment of hazardous waste. Waste generated by restoration activities in the future that must be managed as part of the Department's program to manage all of its wastes would be considered in the PEIS's projected waste inventories. The draft PEIS is currently scheduled for publication in late spring of 1995.

In the October 22, 1990, Notice of Intent in the Federal Register, the Department of Energy discussed the preparation of a Programmatic Environmental Impact Statement based on formulating and implementing an integrated environmental restoration and waste management program in a safe and environmentally sound manner and in compliance with applicable requirements. The Notice of Intent stated that the purpose of the integrated environmental restoration and waste management program was to provide a broad, systematic approach to addressing site cleanup and waste management. Although the proposed action was defined in terms of integrating environmental restoration and waste management, the description of the alternatives in the Implementation Plan set forth separate sets of alternatives for environmental restoration and waste management.

When the Department published the Notice of Intent in 1990, there were important national issues regarding the direction of its environmental restoration program that could be meaningfully evaluated in the PEIS. These issues focused primarily on the level and extent of cleanup of the Department's facilities. The Department continues to believe that cleanup of its sites involves important issues such as land use, public health, worker risks, and cleanup standards. The Department has concluded, however, that programmatic decisions regarding environmental restoration cannot be made because these decisions should reflect the particular conditions at each site, and require the approval of state regulators and the involvement of stakeholders. The Department believes that the proposed action originally considered in the PEIS should be modified by eliminating the analysis of environmental restoration alternatives. In view of this modification the PEIS would be renamed the "Waste Management Programmatic Environmental Impact Statement."

The modified proposed action would focus on the evaluation and analysis of waste management issues confronting the Department and would incorporate potential impacts of environmental restoration on the management of wastes. The Department believes the proposed action as modified will identify and analyze waste management issues and activities for which the Department is responsible. A summary of the comments received in response to this notice will be contained in an appendix to the draft Waste Management Programmatic Environmental Impact Statement. Comments previously received during the public comment process on the scope of the PEIS that are still relevant in light of the proposed modification to the PEIS, and the issues raised by such comments, would be evaluated as discussed in the Implementation Plan. Comments on the scope of the PEIS that are relevant to other analyses being conducted in connection with site-specific environmental restoration at DOE's sites will be considered in the preparation of those analyses.

Issued in Washington, D.C., on January 18, 1995.

Thomas P. Grumbly,
Assistant Secretary for Environmental Management.

[FR Doc. 95-1754 Filed 1-23-95; 8:45 am]

BILLING CODE 6450-01-P

Attachment 3
(to WM PEIS Appendix A)

Federal Register Notice
(Volume 60, Thursday March 16, 1995)
[60 FR 14275]

Department of Energy
"Extension of Public Comment Period for The Environmental Management Programmatic Environmental Impact Statement"

Federal Register / Vol. 60, No. 51 / Thursday, March 16, 1995 / Notices 14275

DEPARTMENT OF ENERGY

Extension of Public Comment Period for the Environmental Management Programmatic Environmental Impact Statement

AGENCY: U.S. Department of Energy.

ACTION: Extension of public comment period.

SUMMARY: On October 22, 1990, the Department of Energy issued a Notice of Intent to prepare the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement (PEIS). (55 FR 42633). In the Notice of Intent and in an Implementation Plan issued in January 1994, the Department identified the proposed action as follows: "to formulate and implement an integrated environmental restoration and waste management program in a safe and environmentally sound manner and in compliance with applicable laws, regulations and standards." A notice was issued on January 24, 1995, inviting the public to provide written comments on a proposed modification to the scope and name of the PEIS. (60 FR 4607). In the notice, the Department proposed to modify the proposed action to eliminate the analysis of environmental restoration alternatives. As modified, the PEIS would consider how to manage certain types of radioactive and hazardous waste, and analyze alternative sites at which the wastes could be managed in the future. The PEIS would focus its programmatic evaluations on waste management facilities, and would henceforth be known as the "Waste Management Programmatic Environmental Impact Statement."

INVITATION TO COMMENT: In response to a request from the public, the Department is extending for 30 days, until April 10, 1995, the written comment period for the proposed modification to the Programmatic Environmental Impact Statement. A summary of the comments received in response to this notice will be contained in an appendix to the draft Waste Management Programmatic Environmental Impact Statement.

ADDRESSES AND FURTHER INFORMATION: Written comments and requests for further information on the Programmatic Environmental Impact Statement should be directed to: James A. Turi, Office of Waste Management (EM-33), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585-0002, (301) 903-7147.

For information on the Department's National Environmental Policy Act process, contact: Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance (EH-42), U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585, (202) 586-4600 or leave a message at 1-800-472-2756.

Issued in Washington, D.C., this 10th day of March 1995.

Thomas P. Grumbly,
Assistant Secretary for Environmental Management.

[FR Doc. 95-6520 Filed 3-15-95; 8:45 am]

BILLING CODE 6450-01-P

Attachment 4
(to WM PEIS Appendix A)

Natural Resources Defense Council's (NRDC's) Comments on the Department of Energy's (DOE's) Proposed Modification in Scope of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement (Letter: Andrew P. Caputo [NRDC] to James A. Turi [DOE], April 10, 1995)

Natural Resources Defense Council

1350 New York Ave., N.W.
Washington, DC 20005
202 783-7800
Fax 202 783-5917

April 10, 1995

James A. Turi
Office of Waste Management (EM-33)
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585-0002

Dear Mr. Turi:

The Natural Resources Defense Council ("NRDC"), lead plaintiff in NRDC v. Watkins, Civ. No. 89-1835-SS (D.D.C.) (stipulation filed Oct. 22, 1990), files the following comments on the Department of Energy's proposed modification in scope of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. Notice of the proposed modification was published in the Federal Register at 60 Fed. Reg. 4,607 (Jan. 24, 1995), and the comment period was extended to today pursuant to a notice published at 60 Fed. Reg. 14,275 (March 16, 1995).

NRDC opposes the proposed modification for both legal and policy reasons. As a legal matter, the National Environmental Policy Act ("NEPA") requires the Energy Department to prepare a programmatic environmental impact statement ("EIS") on its program of environmental restoration activities, for all of the reasons explained in the submissions by NRDC leading up to and during the above-cited litigation. Moreover, during this litigation the Department specifically conceded that its program of environmental restoration and waste management constitutes "'a group of concerted actions' within the meaning of NEPA,"[1] which triggers a duty to prepare a programmatic EIS pursuant to 40 C.F.R. § 1508.18(b)(3). Finally, the Department committed to prepare such a document in the course of the NRDC v. Watkins litigation.

The case for a programmatic EIS on the environmental restoration program is just as strong from a policy perspective as it is from a legal perspective. While it is certainly true that "cleanup decisions should reflect site-specific conditions," 60 Fed. Reg. at 4,608, it is

[1] Memorandum from James D. Watkins, Secretary, DOE, to Leo P. Duffy, Director, Office of Environmental Restoration and Waste Management, DOE, Jan. 12, 1990.

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James A. Turi
April 10, 1995
Page 2

equally true that there are a number of important program-level issues relating to the environmental restoration program that demand a full, prospective, program-level analysis with full public participation. These issues include the scope and pace of the environmental restoration program in light of budgetary and other constraints; the choice between using uniform cleanup standards or site-specific cleanup standards as part of the program; the programmatic implications of using land-use restrictions in setting cleanup levels; issues of inter- and intra-facility priority setting, particularly in a situation of budget scarcity; and the programmatic role of site-specific advisory boards and other avenues for public participation in making cleanup decisions. A programmatic analysis of these and other important issues in the environmental restoration program has become even more important in recent months and years, in light of such developments as departmental discussions concerning land-use considerations in the cleanup process, the findings of the Baseline Environmental Management Report, and budget developments.

The need for a program-level analysis of the environmental restoration program is enhanced by the fact that the Department, as a matter of policy, does not perform NEPA compliance on site-specific environmental restoration actions taken pursuant to the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"). Thus, a program-level EIS seems the only NEPA analysis available to citizens on many of the important issues facing the environmental restoration program. Moreover, no alternative to the NEPA process currently exists for analyzing these issues in a programmatic, prospective manner with full public participation.

Sincerely,

Andrew Caputo

Andrew P. Caputo
Attorney

cc: Assistant Secretary Thomas P. Grumbly

Appendix B

Environmental Restoration Wastes

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Acronyms and Abbreviations

The following is a list of the acronyms and abbreviations (including units of measure) used in this appendix.

Ames	Ames Laboratory
ANL-E	Argonne National Laboratory-East
BCL	Battelle Columbus Laboratories
BEMR	*Baseline Environmental Management Report*
BNL	Brookhaven National Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ERDF	Environmental Restoration Disposal Facility
FEMP	Fernald Environmental Management Project
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	fiscal year
GA	General Atomics
GE	General Electric Vallecitos Nuclear Center
Hanford	Hanford Site
INEL	Idaho National Engineering Laboratory
ITRI	Inhalation Toxicology Research Institute
LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LEHR	Laboratory for Energy-Related Health Research
LLMW	low-level mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
m^3	cubic meter(s)
Mound	Mound Plant
NEPA	National Environmental Policy Act
NTS	Nevada Test Site

ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OU	operable unit
Pantex	Pantex Plant
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Gaseous Diffusion Plant
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RMI	Reactive Metals, Inc.
SNL-NM	Sandia National Laboratories, New Mexico
SPRU	Separations Process Research Unit
SRS	Savannah River Site
TRUW	transuranic waste
WIPP	Waste Isolation Pilot Plant
WM	waste management
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WVDP	West Valley Demonstration Project
Y-12	Y-12 Plant

APPENDIX B
Environmental Restoration Wastes

Certain wastes generated during environmental restoration (ER) activities will be transferred to the Waste Management (WM) Program. The current information available about the ER transferred waste is limited to volumetric estimates by site and waste type (i.e., low-level waste, low-level mixed waste, and transuranic waste. The radiological profiles, chemical contaminant concentrations, and the treatment categories of the individual ER transferred waste streams have not yet been determined to the extent necessary to allow for an evaluation of the potential environmental and human health impacts that would result from management of these ER transferred wastes. Therefore, in this appendix, the assessment as to how the addition of ER transferred wastes may affect WM PEIS alternatives is limited to a qualitative discussion about the potential for affecting WM facility capacities. This discussion is based on the comparison between the expected volumes of ER transferred waste and the volumes of the WM waste at each site. Such analysis, while not of the same scope as the impacts assessment done for WM wastes, is useful to identify those sites and alternatives that could be affected by the addition of ER transferred wastes. When the radiological and chemical contaminant concentration and the treatment categories of ER transferred waste are better known, DOE may be required to assess the impacts of managing ER transferred waste on a site-specific or project basis.

B.1 Introduction

The term "environmental restoration" (ER) refers to the remediation of contaminated media at U.S. Department of Energy (DOE) sites in order to reduce risks and allow sites to be used for other purposes. Depending on the particular site and contaminated media, remediation can occur in place without removal, or the contaminated media may be removed from the environment, generating wastes that would require further treatment or disposal. The majority of the wastes generated during remediation will be managed outside of the alternatives evaluated in the Waste Management Programmatic Environmental Impact Statement (WM PEIS). However, a certain subset of the remediation wastes will be sent for treatment or disposal at waste management (WM) facilities.

This appendix provides estimates of the total amounts of low-level waste (LLW), low-level mixed waste (LLMW), and transuranic waste (TRUW) that are expected to be generated during remediation, as well as estimates of the amounts of these wastes that may be managed by the WM Program. In this appendix, the term "ER transferred wastes" is used to designate those wastes generated by ER that will be transferred to the WM Program. This appendix compares the estimated volumes of ER transferred waste to the volumes of WM wastes analyzed in the WM PEIS and also discusses how the ER transferred wastes may affect the

treatment and disposal capacities of WM facilities. The purpose of the analysis is to identify those WM PEIS alternatives, if any, that could be affected by the addition of ER transferred wastes. This appendix also identifies possible strategies that can be used to accommodate the increased loading of the ER transferred wastes to the WM Program.

Finally, this appendix discusses the assumptions and uncertainties involved in (1) estimating the amount of ER transferred wastes and (2) estimating the effects that ER transferred waste would have on the alternatives in the WM PEIS.

B.2 DOE Environmental Restoration Program

One legacy of the Nuclear Weapons Program is environmental contamination at the sites where research, development, testing, and production of nuclear weapons took place. The Environmental Restoration Program was established to address contaminated media at these sites. The ER Program performs a wide range of activities such as stabilizing contaminated soil, treating groundwater, decommissioning process buildings (including nuclear reactors and chemical separations plants), and exhuming buried drums of waste.

The extent to which a site is "cleaned up" will depend largely on regulatory requirements and decisions regarding future land use. For many sites, the process of evaluating possible uses in the future has just begun. The general process concerning site cleanup actions is laid out by statutes, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC Section 9601 *et seq.*) and the Resource Conservation and Recovery Act (RCRA) (42 USC Section 6905 *et seq.*). The process involves discussions among DOE, regulatory agencies, and local stakeholders. Decisions are implemented at specific sites through formal agreements among DOE, the U.S. Environmental Protection Agency (EPA), and the host state. The process involves several steps. First, a site or portion of a site is characterized to identify contaminants, determine the nature and extent of contamination, and assess potential threats to public health and the environment. Concurrent with characterization, a detailed analysis is performed to quantify risk and evaluate remedial alternatives. A remedy can be implemented quickly, as expedited response actions designed to mitigate conditions that present immediate and significant risks to the environment or human health, or can be performed as part of long-term cleanup.

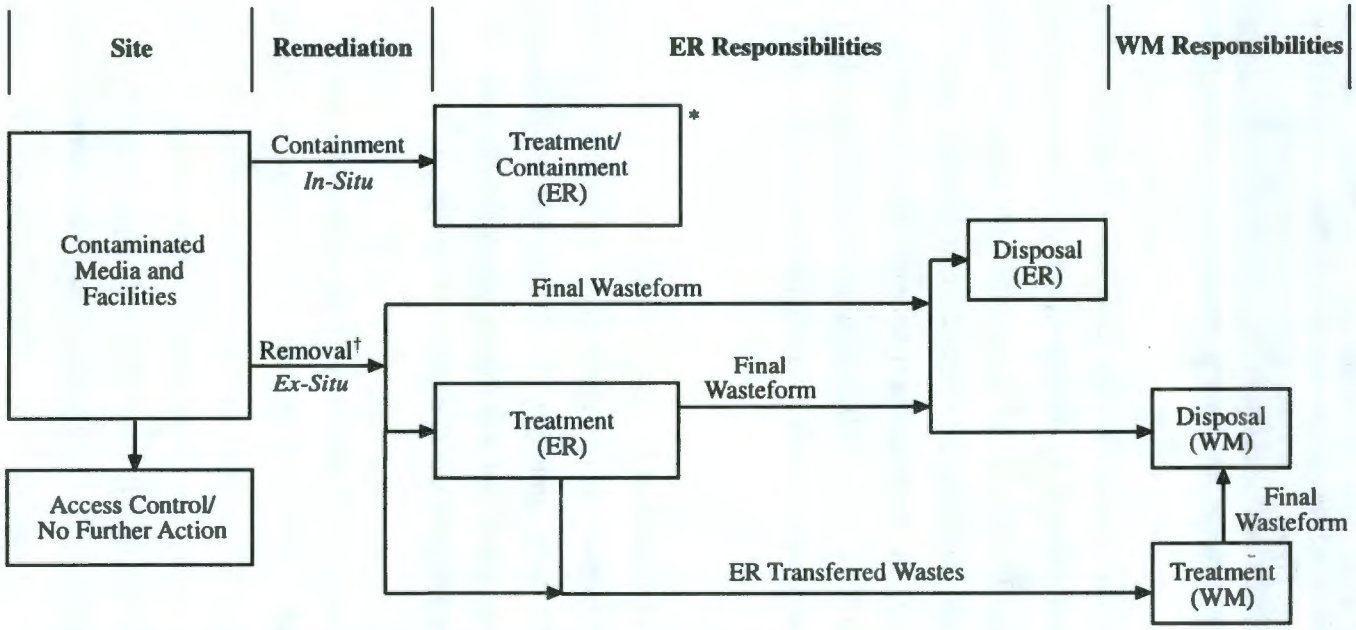
B.3 Remediation Alternatives and ER Transferred Wastes

The treatment and disposition of wastes generated from site restoration activities can be done under either the DOE ER or WM Programs. Environmental restoration wastes transferred to the responsibility of the DOE WM Program for treatment and disposal are called "ER transferred wastes." The highlighted areas in Figure B.3–1 indicate the ER transferred wastes that are analyzed in this appendix.

Remediation activities are dependent on proposed land uses for each site and can be grouped into two general categories: containment or removal. In the first category, containment, *in situ* remediation and access control serve to reduce the risks by managing contaminated media in their current locations. The second category, *ex situ* remediation, involves removal of the contaminated media, which are then treated and sent for disposal (Figure B.3–1). *In situ* containment remedies (such as capping a landfill or entombing buildings) generate relatively small volumes of ER transferred waste. Typically, remedies using *in situ* technologies, where the contaminated media would remain in place, are coupled with decisions that restrict future site land use.

At those sites where future land-use plans call for less restricted access, it is more likely that remediation would involve removal of contaminated media. Typically, contaminated media that are excavated or facilities that are dismantled will undergo some type of treatment that would generate either a final waste form ready for disposal or a waste stream that will require additional treatment before disposal. In some cases, contaminated media can be removed and sent directly for disposal.

The extent to which ER transferred wastes will use WM facilities is site-specific and depends on such factors as the particular remediation activities at each site and on decisions regarding ER at the site. For example, at the Hanford Site (Hanford), the vast majority of wastes generated during remediation activities are destined for disposal in the Environmental Restoration Disposal Facility (ERDF) (DOE, 1996b). The ERDF is a dedicated disposal facility for ER wastes. Accordingly, Hanford is unlikely to transfer large amounts of ER waste to WM facilities. At sites without dedicated ER facilities, much (or all) of the wastes generated during remediation might become ER transferred waste and would be managed under the alternatives evaluated in the WM PEIS.



* Note: Minor transferred waste streams from *in-situ* treatment are not shown.

† Note: Some *ex-situ* waste streams and ER transferred wastes may be sent to commercial facilities for treatment and/or disposal.

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Figure B.3–1. General Remediation Scheme for Contaminated Media and ER Wastes.

B.4 Need to Proceed With Waste Management Decisions Without Assessment of Impacts From ER Transferred Waste

DOE believes that decisions about which sites should host WM treatment, storage, or disposal activities must be made now to make rapid progress toward improving DOE's management of its wastes. Although some ER waste could be transferred for treatment or disposal in WM facilities, possibly influencing the size or siting for these facilities, it was not possible to analyze the potential impacts of managing ER transferred waste in the WM PEIS because there are large uncertainties about ER waste (see Section B.9). DOE believes, however, that the sites for WM facilities must be selected soon. There is a minimum requirement for the siting and sizing of WM facilities based wholly on the locations and quantities of WM wastes and that would remain valid regardless of future ER waste treatment or disposal requirements. When there is better knowledge about the volumes and composition of ER wastes, it is possible that additional WM treatment or disposal capabilities may be needed, which may necessitate further site-specific National Environmental Policy Act (NEPA) analyses. However, these site-specific evaluations would not change the need for the initial set of sites identified to host WM treatment, storage, or disposal activities.

As DOE conducted its analyses of both the ER and WM Programs, it became evident that analyses leading to nationwide programmatic proposals for the ER Program were not appropriate. The Department felt that decisions related to ER were not suited to a national-level analysis but instead should be focused at the site level and reflect site-specific conditions. The ER activities at each site would be best developed on the basis of factors such as the proposed land use, the nature of the contaminated media, the technical solutions available, and local regulatory priorities. Evaluations conducted at the site and local level would be more effective in considering these elements and developing appropriate remediative responses. In contrast, many WM Program decisions are more appropriately addressed at the national level. The nature of WM waste and the requirements for its treatment and disposal are more certain; wastes are either already in storage or will be generated from ongoing processes that are well understood. It is possible and appropriate to develop treatment or disposal capabilities at one or more sites to handle these wastes because the nature and timing of treatment and disposal requirements across many sites are better known. A national-level analysis and programmatic decisions would therefore provide better solutions for the WM Program (see Section 1.7.1).

Consequently, in the *Federal Register* of January 24, 1995, DOE announced that the scope of the WM PEIS would be limited to a programmatic analysis regarding how and where DOE would treat, store, and dispose of its WM waste. The 1995 announcement and the response by the public are contained in Appendix A.

In making decisions about sites that will host WM treatment, storage, or disposal facilities, DOE will consider many criteria. For example, the WM PEIS shows that there is a tradeoff between the impacts resulting from the transport of wastes and the impacts (e.g., health risks and costs) that result from site-specific waste management actions under each alternative. The Decentralized Alternatives minimize transportation risks and associated impacts (such as physical trauma from accidents) but increase the site-specific impacts associated with construction and operation of WM facilities at many sites. The Centralized Alternatives have the greatest transportation impacts and increase the impacts at the chosen central site but decrease the nationwide site-specific impacts and decrease overall costs. The transportation and site-specific impacts associated with the Regionalized Alternatives fall in between those of the Decentralized and Centralized Alternatives. Decisions on which sites will host WM facilities will consider such transportation and site-specific tradeoffs. Sites may be selected to host WM facilities on the basis of a variety of factors, including (1) minimizing the transportation of large quantities of waste, (2) effectively using existing management capabilities, or (3) taking advantage of site-specific conditions (e.g., favorable geology).

When there is sufficient information to evaluate ER transferred wastes, DOE will need to further assess its options. For example, if ER transferred waste is located at a site that already is selected to have certain WM facility capabilities, DOE would have to determine whether the site facilities should manage the additional waste and whether additional NEPA analysis would be required to examine the impacts resulting from the addition of the ER transferred wastes. If the ER transferred waste is present at a site not selected for a WM facility, DOE would evaluate whether new WM capabilities should be added to the site or whether the wastes should be transported to a site with the capability to manage the waste. Any additional NEPA evaluations are likely to be project- or site-specific and would consider how the ER activities and ER transferred waste at one site should be managed, given the existence of a set of WM facilities with varying capacities and capabilities, as well as commercial waste treatment and disposal capabilities. The future evaluation of options for managing ER transferred wastes will be facilitated by having more operating experience at the WM facilities and improved knowledge of costs, effectiveness, and environmental effects.

The following sections of Appendix B provide general information on the estimated volumes of ER wastes.

B.5 Estimated Volumes of Contaminated Media and ER Transferred Wastes

DOE has prepared projections of the volumes of contaminated media and the waste that may be generated by remedial activities. The information on ER waste volume presented in this appendix is updated from data in *The Current and Planned Low-Level Waste Disposal Capacity Report, Revision 0* (DOE, 1996a). Additional information about the amounts of contaminated media and facilities at DOE sites is contained in *The 1996 Baseline Environmental Management Report* (BEMR) (DOE, 1996b). The BEMR looked at more than 10,000 contaminated sites and facilities and applied generic "base case" (the base case is detailed in the Summary and Volume 1 of the BEMR) criteria, such as potential site land use and the technical feasibility of processing certain media, to identify possible remedial actions and to estimate the volume of waste that might be generated.

For DOE sites addressed in this appendix, the total volume of radioactively contaminated media is approximately 58 million cubic meters (m^3). Tables B.5–1 through B.5–3 present the anticipated disposition and volumes of LLW, LLMW, and TRUW, respectively, from ER.

DOE does not expect to generate any high-level waste by remedial activities. Hazardous waste generated during remediation would be sent to offsite commercial facilities for final disposition and thus is not analyzed in this section.

Environmental restoration activities are site-specific. Of the total volume of contaminated media, approximately 36,000,000 cubic meters would be managed without physically removing or excavating the media, either through access controls or *in situ* treatment or both. Of this volume, approximately 11,000,000 cubic meters are media for which an appropriate response may be access control alone (where public access to the area is restricted either through land deeds or a barrier such as a fence and posted warnings). At some sites (e.g., LANL), some of the contaminated media may require no further action. The other 25,000,000 cubic meters would be managed by *in situ* treatment and containment technologies such as capping.

Approximately 8,500,000 cubic meters would be removed and managed in planned ER facilities that would only handle LLW and LLMW generated by onsite remediation. An additional 1,600,000 cubic meters of LLW and LLMW would be removed and sent to commercial facilities for disposal (e.g., DOE currently sends some waste to the Envirocare facility in Utah; other commercial disposal facilities will be considered

Table B.5–1. Planned Disposition of LLW From Environmental Restoration Actions

DOE Sites Analyzed in the WM PEIS		Estimated Volume for Each Type of Response Action[a] (m^3)						TOTAL by Site
		Ex Situ, Managed by ER	*Ex Situ*, Transferred to WM	*Ex Situ*, Commercial Disposal	*In Situ* Treatment or Containment	Access Controls Only and/or No Further Action	Not Yet Determined	
ANL-E		0	8,700	20	0	0	0	8,800
BNL		0	400	120,000	0	0	0	120,000
FEMP		1,800,000	180,000	480,000	0	0	5,800	2,500,000
Hanford		3,900,000	700	0	20,000,000	0	0	24,000,000
INEL		420,000	140,000	0	79,000	0	0	640,000
LLNL		0	0	0	0	0	0	0
LANL		0	15,000	0	200,000	8,900,000	110,000	9,300,000
NTS		0	1,100,000	0	1,200	0	0	1,100,000
ORR		30,000	9,800	850,000	51,000	0	0	940,000
Pantex		54	0	0	0	0	0	0
PGDP		770,000	150	0	0	56	0	770,000
PORTS		730,000	190	0	0	0	0	730,000
RFETS		61,000	36,000	0	0	0	0	96,000
SNL-NM		0	36,000	0	0	14,000	0	50,000
SRS		0	400,000	0	310,000	1,800	1,800,000	2,500,000
WVDP		0	0	0	0	0	0	0
Other Sites	Chicago Offsite	0	0	15,000	0	0	0	15,000
	FUSRAP	260,000	0	16,000	0	0	2,200	270,000
	Mound	0	3,100	120,000	0	0	0	120,000
	Nevada Offsite	0	0	0	26,000	0	0	26,000
	RMI	0	30,000	0	0	0	0	30,000
	Others	1,400	24,000	1,000	0	0	0	26,000
	Subtotal	260,000	57,000	150,000	26,000	0	2,200	500,000
TOTAL		8,000,000	1,900,000	1,600,000	21,000,000	8,900,000	1,900,000	
							GRAND TOTAL	**= 43,000,000**

Notes: Projected actions assume the "base case" scenario as described in *The 1996 Baseline Environmental Management Report* (DOE, 1996b). The actions are for nonliquid contaminated media and facilities; they exclude groundwater because of the high level of uncertainty in estimating volumes. For *ex situ* response actions, a relatively small quantity of waste that is already in storage is also included in the estimated volumes.

[a] Volumes are in cubic meters rounded to two significant figures; therefore totals may not sum exactly.

Source: May 1996 approved version of the "Environmental Restoration Core Database" (DOE, 1996c).

Table B.5–2. Planned Disposition of LLMW From Environmental Restoration Actions

DOE Sites Analyzed in the WM PEIS		Estimated Volumes for Each Type of Response Action[a] (m^3)						TOTAL by Site
		Ex Situ, Managed by ER	*Ex Situ*, Transferred to WM	*Ex Situ*, Commercial Disposal	*In Situ* Treatment or Containment	Access Controls Only and/or No Further Action	Not Yet Determined	
ANL-E		160	0.4	0	140,000	0	0	140,000
BNL		3,200	0	16,000	0	0	0	19,000
FEMP		0	2,200	2,400	0	0	0	4,600
Hanford		220	100	0	0	0	0	320
INEL		100,000	0	65	99,000	0	0	200,000
LLNL		0	0	0	0	0	0	0
LANL		0	0	980	0	500,000	0	500,000
NTS		0	50	0	0	0	0	50
ORR		0	3,900	0	0	450,000	1,900	460,000
Pantex		0	0	0	0	0	0	0
PGDP		210,000	0	0	0	240,000	0	450,000
PORTS		380	0	0	0	270,000	0	270,000
RFETS		140,000	42,000	0	9,900	180,000	0	380,000
SNL-NM		0	0	1,700	0	2,600	0	4,300
SRS		0	150,000	0	3,900,000	0	6,600,000	11,000,000
WVDP		0	0	0	0	0	0	0
Other Sites	FUSRAP	7,200	0	12,000	0	0	0	19,000
	LBL	0	0	0	42,000	0	0	42,000
	Nevada Offsite	0	0	0	11,000	0	0	11,000
	Other	96	4,400	520	0	0	0	5,000
	Subtotal	7,300	4,400	12,000	54,000	0	0	78,000
TOTAL		470,000	200,000	34,000	4,200,000	1,600,000	6,600,000	
							GRAND TOTAL =	13,000,000

Notes: Projected actions assume the "base case" scenario as described in *The 1996 Baseline Environmental Management Report* (DOE, 1996b). The actions are for nonliquid contaminated media and facilities; they exclude groundwater because of the high level of uncertainty in estimating volumes. For *ex situ* response actions, a relatively small quantity of waste that is already in storage is also included in the estimated volumes.

[a] Volumes are in cubic meters rounded to two significant figures; therefore totals may not sum exactly.

Source: May 1996 approved version of the "Environmental Restoration Core Database" (DOE, 1996c).

Table B.5–3. Planned Disposition of TRUW From Environmental Restoration Actions

DOE Sites Analyzed in the WM PEIS		Estimated Volumes for Each Type of Response Action[a] (m^3)					TOTAL by Site
		Ex Situ, Managed by ER	*Ex Situ*, Transferred to WM	*In Situ* Treatment or Containment	Access Controls Only and/or No Further Action	Not Yet Determined	
ANL-E		0	190	0	0	0	190
BNL		0	0	0	0	0	0
FEMP		0	0	0	0	0	0
Hanford		0	1,800	0	0	84	1,900
INEL		0	9,700	0	0	0	9,700
LLNL		0	0	0	0	0	0
LANL		0	0	4,400	0	0	4,400
NTS		0	0	0	0	0	0
ORR	ORNL	12	1,400	130	0	0	1,600
	Y-12	0	50	0	0	0	50
	Subtotal	12	1,500	130	0	0	1,600
Pantex		0	0	0	0	0	0
PGDP		7	0	0	0	0	7
PORTS		0	0	0	0	0	0
RFETS		0	1,900	0	0	3,000	4,900
SNL-NM		0	0	0	4,000	0	4,000
SRS		0	65,000	0	0	0	65,000
WVDP		0	0	0	0	0	0
Other Sites	BCL	0	95	0	0	0	95
	GE	20	0	0	0	0	20
	SPRU	0	36	0	0	0	36
	Subtotal	20	130	0	0	0	150
TOTAL		39	80,000	4,500	4,000	3,100	
							GRAND TOTAL = 91,000

Note: Projected actions assume the "base case" scenario as described in *The 1996 Baseline Environmental Management Report* (DOE, 1996b). The actions are for nonliquid contaminated media and facilities; they exclude groundwater because of the high level of uncertainty in estimating volumes. For *ex situ* response actions, a relatively small quantity of waste that is already in storage is also included in the estimated volumes.
[a] Volumes are in cubic meters rounded to two significant figures; therefore totals may not sum exactly.

Source: May 1996 approved version of the "Environmental Restoration Core Database" (DOE, 1996c).

as they become available). At certain sites, approximately 2,200,000 cubic meters of LLW, LLMW, and TRUW will be removed and transferred to the WM Program for final treatment or disposal. It is these "transferred" wastes that are addressed in this appendix. Finally, because some sites (1) have not yet developed an ER strategy, (2) do not yet have sufficient data to estimate the volume of contaminated media, or (3) disposition only fractions of certain media, the dispositions of some 8,500,000 cubic meters of contaminated media are not yet determined.

Some site-specific ER activities are described below (Source: 1996 BEMR [DOE, 1996b]).

Argonne National Laboratory-East (ANL-E). Environmental restoration activities at ANL-E are conducted under RCRA corrective action guidelines. There are several types of ER projects scheduled at ANL-E. "Treatment site projects" include soil, groundwater, and sediment media. Up to 70% of these areas are assumed to require no further action. "Solid waste storage and disposal projects" cover the investigation and remediation of contamination resulting from landfills, disposal wells, and leaking underground storage tanks. Additional projects are the Mixed Waste Storage and Disposal Sites (317/319 Areas) Project and decommissioning activities at the Facilities Conversion, Reactor Facilities, and Support Facilities operable units.

Future ER activities at ANL-E are estimated to generate about 8,800 cubic meters of LLW, almost all of which is expected to be transferred to WM facilities. Approximately 140,000 cubic meters of LLMW is expected to be addressed by the ER Program at ANL-E; very little of this waste is anticipated to enter into the WM system because current planning assumptions are that *in situ* treatment or containment technologies would be used to stabilize these areas of contamination. DOE anticipates that all of the TRUW that will be generated by ER activities at ANL-E (approximately 190 cubic meters) will be transferred to WM facilities.

Brookhaven National Laboratory (BNL). The ER Program at BNL is conducted under an RCRA/CERCLA Interagency Agreement between the EPA and the New York Department of Environmental Conservation. Groundwater is the principal contaminated medium at BNL. The current planning assumptions are that the BNL ER Program would transfer small quantities of its waste to WM for limited treatment (i.e., volume reduction and stabilization) prior to shipment off site for disposal. The majority of LLW and LLMW generated by ER activities is planned to be sent to offsite commercial facilities for treatment or disposal. Only 400 cubic meters of ER transferred LLW would be sent to WM facilities out of 120,000 cubic meters of LLW generated by remedial actions. No LLMW is expected to be sent to WM.

Fernald Environmental Management Project (FEMP). Remedies have been selected for all of the five operable units (OUs) at FEMP under the CERCLA process. For the OU 1 waste pits, the remedy includes removal, treatment (as necessary), and offsite disposal at a permitted commercial disposal facility. DOE anticipates that wastes that do not meet the waste acceptance criteria for the commercial facility would be shipped to the Nevada Test Site (NTS). Operable Unit 4 consists of two earthen-bermed concrete silos (Silos 1 and 2) containing K-65 residues, which are high-specific-activity, radium-bearing wastes; one concrete silo containing metal oxides (Silo 3); and one unused concrete silo. The selected remedy for OU 4 involves removal, vitrification, and offsite disposal of the materials in Silos 1, 2, and 3 at NTS. The majority of the wastes from the remaining OUs will be disposed of in an onsite disposal cell. Wastes that do not meet the acceptance criteria of the onsite disposal facility would be shipped off site for disposal at commercial facilities.

Up to 180,000 cubic meters of LLW and 2,200 cubic meters of LLMW are expected to be transferred to the WM Program. An estimated 1,800,000 cubic meters of LLW are planned to be managed onsite, while 480,000 cubic meters are anticipated to be shipped to a commercial disposal facility. Approximately 2,400 cubic meters of LLMW are planned to be shipped to a commercial facility.

Hanford Site. Environmental restoration activities at Hanford are conducted under the authority of the Tri-Party Agreement among the DOE, EPA, and the Washington State Department of Ecology. The Hanford Site has numerous areas with contaminated surface and subsurface soils and has several large plumes of contaminated groundwater. The ER activities also cover the decontamination and decommissioning of up to 800 buildings. The vast majority of the LLW and LLMW generated during ER activities would be managed within the ER Program. Excluding the wastes that would be treated *in situ*, the majority of the waste would be disposed in the Environmental Restoration Disposal Facility.

The ER Program at Hanford will manage approximately 24,000,000 cubic meters of LLW and 320 cubic meters of LLMW. Of these amounts, only 700 cubic meters of LLW and 100 cubic meters of LLMW are expected to be transferred to the WM Program. Approximately 1,800 cubic meters of TRUW would be transferred to the WM Program out of a total of 1,900 cubic meters.

Idaho National Engineering Laboratory (INEL). The ER Program at INEL operates within the framework of the Federal Facility Agreement/Consent Order signed in 1991 by the DOE, EPA, and the State of Idaho. The INEL has 98 OUs grouped into 10 waste areas. Waste Area Groups 8 and 9 cover the Argonne National Laboratory-West and the Naval Reactor Facility sites, respectively. Wastes generated

during remediation will be sent to either the ER Program or WM Program for final treatment and disposal. Since fiscal year (FY) 1986, a total of 381 potentially contaminated area or sites have been identified at INEL.

Approximately 140,000 cubic meters of LLW would be transferred to the WM Program out of 640,000 cubic meters of LLW generated by site remediation. All 200,000 cubic meters of LLMW would be managed within the ER Program. All 9,700 cubic meters of TRUW generated by remediation would be managed by the WM Program.

Lawrence Livermore National Laboratory (LLNL). Environmental restoration activities at the LLNL Main Site and Site 300 are conducted as two distinct projects and are governed by separate Federal Facility Agreements among the DOE, EPA, and the California Environmental Protection Agency Department of Toxic Substance Control and Regional Water Quality Control Boards. Assessments at the Main Site have focused on determining the extent of groundwater contamination and, as necessary, implementing cleanup actions that deal with the following three issues: capturing the western offsite plume, capturing the southern offsite plume, and interior source control and mass removal. Site 300 activities have included assessing the extent of both onsite and offsite soil and groundwater contamination, with treatment of trichloroethylene-contaminated groundwater beginning in 1991. Additional cleanup actions are currently planned at LLNL, some of which will continue to generate hazardous wastes that would be shipped to offsite commercial facilities. No LLW, LLMW, or TRUW is projected to be generated as a result of these cleanup actions.

Los Alamos National Laboratory (LANL). Environmental restoration at LANL is designed to meet the requirements of the facility's RCRA operating permit. The 2,100 potentially contaminated areas at LANL are grouped into six field units. As of FY 1995, one hundred of the areas had been remediated, with no further action proposed for up to 900 sites.

About 15,000 cubic meters of LLW generated from ER projects would be transferred to WM facilities for treatment or disposal. An estimated 980 cubic meters of LLMW would be sent off site for commercial treatment and disposal. All 9,700 cubic meters of TRUW generated by site cleanup would be transferred for disposal within the WM Program. Plans are to address the remaining media contaminated with LLW or LLMW by using *in situ* treatment or containment technologies. In addition, a large number of sites, containing almost 9,000,000 cubic meters of contaminated media, have been proposed for no further action.

Nevada Test Site (NTS). Environmental restoration at NTS is conducted according to RCRA guidelines under a Federal Facility Agreement and Consent Order. There are approximately 2,400 corrective action sites within the NTS and Tonopah Test Range that require some level of investigation and possible remediation under the ER Program. The sites have been grouped into three categories: (1) industrial sites, which include all sites used in support of testing operations; (2) soil sites, which include all surface and shallow subsurface soil contamination resulting from nuclear tests; and (3) underground test areas, which are sites that were impacted by underground testing of nuclear devices. From a waste generation standpoint, cleanup of the soil sites, which would involve excavation and bulk disposal of contaminated soil in an appropriate subsidence crater, represents the largest potential volume of ER generated wastes at NTS. As an interim action, DOE and the State of Nevada have negotiated a radionuclide concentration action level of 200 picocuries per gram, which would result in approximately 1,100,000 cubic meters of LLW that would be transferred into the WM Program for disposal. One of the major assumptions used to estimate the future waste contribution from these activities is that the final cleanup action level for plutonium would be near the 200-picocurie-per-gram level.

Oak Ridge Reservation (ORR). The ER Program at ORR is conducted under a 1992 Federal Facility Agreement and covers the K-25 Site, the Oak Ridge National Laboratory (ORNL), and the Y-12 Plant (Y-12). The K-25 Site has numerous solid waste management units and contaminated buildings. At ORNL, there are approximately 350 sites contaminated with radioactivity or hazardous chemicals. The sites are grouped into 20 waste area groupings, 13 of which are identified as potential sources of contamination. Areas of potential contamination at Y-12 are consolidated into three hydrologic, geographic units. Because of the large number of contaminated sites or buildings, remedial actions at ORR are site-specific and depend on the location and type of contaminated media, as well as the sources of contamination. For the most part, large volumes of radioactively contaminated soils and facilities to be decommissioned would be stabilized in place.

At ORR, the ER Program would manage approximately 940,000 cubic meters of LLW, 460,000 cubic meters of LLMW, and 3,100 cubic meters of TRUW. Approximately 9,800 cubic meters of LLW, 3,900 cubic meters of LLMW, and 2,900 cubic meters of TRUW are expected to be transferred to the WM Program.

Paducah Gaseous Diffusion Plant (PGDP). At PGDP, the DOE has retained responsibility for ER and related WM activities, and the United States Enrichment Corporation has assumed operation of the production portion of the plant. Most investigation and remediation activities at the site are subject to RCRA

and CERCLA regulations. There are 204 potential release sites (solid waste management units) grouped into 28 waste area groupings that are being addressed by the ER Program. Two groundwater contamination plumes are known to extend beyond the boundaries of the plant (a northwest plume and a northeast plume); both have been the subject of considerable ER activity. In addition, the ER Program is planning for the eventual decommissioning activities, which will be undertaken once the uranium enrichment processing facilities are no longer needed.

Current ER planning assumptions are that 770,000 cubic meters of LLW would be generated by the remedial and decommissioning activities, almost all of which is expected to be handled by the ER Program, either using offsite disposal facilities or through construction of an onsite disposal facility. Only 150 cubic meters of LLW is currently planned to be transferred to the WM system. At present, 240,000 cubic meters of LLMW is anticipated to remain on site, in an area with long-term institutional controls. Another 210,000 cubic meters of LLMW is expected to be generated and dispositioned by using either commercial facilities or possibly an onsite engineered disposal cell. Approximately 7 cubic meters of TRUW is estimated to be generated during remedial action and decommissioning activities and is expected to be managed by the ER Program, with possible future shipment to WIPP.

Pantex Plant. The ER Program at Pantex addresses 144 solid waste management units and 114 potential release sites that have been grouped into 15 OUs for investigation and cleanup. RCRA Facility Investigations have been initiated for all OUs. Activities to date have resulted in no adverse environmental impacts based on the RCRA and NEPA reviews and evaluations performed on a project-specific level. Future cleanup activities are expected to be of a similar nature, with a gradual decrease in intensity as more sites reach closure. The ER work is expected to generate 54 cubic meters of LLW. Beginning in FY 1997, the WM Program will assume responsibility for characterization, packaging, treatment, storage, and disposal of the relatively small volume of LLW generated by ER activities.

Portsmouth Gaseous Diffusion Plant (PORTS). At PORTS, the DOE has retained responsibility for ER and related WM activities, and the United States Enrichment Corporation has assumed operation of the production portion of the plant. Environmental restoration activities at PORTS are done under RCRA guidelines. Assessments conducted as part of the RCRA corrective action process have found that soil and groundwater underlying portions of the plant are contaminated with various solvents. The groundwater contamination appears to be limited to the shallow aquifer, which is not used for drinking water, and remains within the boundaries of the plant. Remedial actions have been completed at several sites, and

additional actions are ongoing or are currently in the planning stages. The ER Program is planning for the eventual decommissioning activities that will be undertaken once the uranium enrichment processes are no longer needed.

The majority of the LLW and LLMW expected to be generated in the future at PORTS would come from decommissioning activities. It is assumed that the gaseous diffusion facilities would be removed to ground level, and several low-profile disposal mounds would be located where the former structures stood. Consequently, a total of about 730,000 cubic meters of LLW and 270,000 cubic meters of LLMW are slated to be managed under the ER Program. These wastes are not scheduled to be transferred to WM facilities.

Rocky Flats Environmental Technology Site (RFETS). Environmental restoration activities at RFETS are conducted under an interagency agreement among DOE and Federal and State stakeholders. There are 16 OUs contaminated with hazardous and radioactive substances. The OUs include ponds, creeks, reservoirs, holding pads, trenches, storage pads, and ground surfaces and belowground areas. Several contaminated sites (OU 3) lie off site of the RFETS. In addition, the decommissioning of more than 400 structures is planned for the site. Contaminated media include soils, surface water, groundwater, sediments, and debris. Remedial actions planned for the site would utilize new and currently operating waste treatment facilities, including a soil-washing facility, a wastewater treatment facility, and a disposal facility.

The majority of the wastes generated during ER activities (61,000 cubic meters of LLW and over 320,000 cubic meters of LLMW) would be managed on site by the ER Program. Of this total, approximately 190,000 cubic meters of LLMW is expected to be managed via *in situ* containment or access controls. A Corrective Action Management Unit is expected to be ready in FY 1997 to dispose of LLW and LLMW soil and debris. This unit will be designed to meet RCRA performance standards. An additional 36,000 cubic meters of LLW, 42,000 cubic meters of LLMW, and 1,900 cubic meters of TRUW are expected to be transferred to WM facilities.

Sandia National Laboratories, New Mexico (SNL-NM). The ER Program at SNL-NM is being conducted under the authority of RCRA. Beginning in FY 1995, SNL-NM no longer divided the site up into OUs for purposes of ER activities. According to the 1996 BEMR, SNL-NM expects to establish a Corrective Action Management Unit under RCRA to dispose of hazardous wastes. For LLW, the current strategy is to ship such waste off site to NTS after using volume-reduction technologies to the extent practicable. LLMW is

expected to be treated on site and then disposed of as hazardous waste in the Corrective Action Management Unit or as LLW at NTS.

All 36,000 cubic meters of contaminated LLW media removed at the site would be transferred to the WM Program. An additional 14,000 cubic meters of contaminated media would be managed in place using access controls.

Savannah River Site (SRS). The ER Program at SRS is governed by a variety of regulatory requirements, including State and Federal laws, interagency agreements, and various settlement and consent decrees. Under CERCLA, in 1993, the DOE, EPA, and the South Carolina Department of Health and Environmental Control entered into a Federal Facility Agreement. Some remedial actions at inactive waste units have been conducted under the authority of the site's 1987 RCRA permit. At SRS, there are over 1,000 facilities potentially contaminated with hazardous and radioactive materials. Contaminant migration from some of the structures has resulted in groundwater contamination. The potential migration of contaminants is a public health concern. More than 90 areas of potential contamination are currently being characterized or remediated. An additional 478 areas are undergoing preliminary evaluation. An estimated 25% of these areas are expected to require a complete assessment and remediation.

Current SRS estimates are that approximately 400,000 cubic meters of ER generated LLW will have transferred to WM, out of a total 2,500,000 cubic meters of LLW generated by remedial actions at SRS. An additional 150,000 cubic meters of LLMW is expected to be transferred to the WM Program. Approximately 4,000,000 cubic meters of LLMW would be managed within the ER Program. All of the 65,000 cubic meters of TRUW generated by remediation would be transferred to the WM Program. The disposition of up to 8,400,000 cubic meters of ER media has not yet been determined.

West Valley Demonstration Project (WVDP). All wastes at WVDP are managed within the WM Program.

B.6 Estimated ER Transferred Waste Loads

Estimates of ER transferred waste are derived from the base case criteria as outlined in the BEMR (DOE, 1996b). Future site land-use decisions are a crucial factor in determining the base case remedial actions at

a site and the amount of transferred waste that will be produced during ER activities. Land-use choices can range from "restricted," where the area will be subject to restrictive access controls, to "unrestricted," where the public will have full access to the site. Unrestricted use options are also known as "greenfield" access.

Table B.6–1 provides a summary, by waste type, of the ER transferred wastes and the corresponding WM waste. Hazardous waste generated during ER is not included because such waste will most likely be sent off site for commercial treatment. The data are site-specific for the ER transferred waste totals. Some of the ER transferred wastes may be in a stable form that would only require disposal at WM facilities. These stabilized wastes would only affect disposal facilities, not WM treatment facilities.

B.7 Potential Effects of ER Transferred Waste Inputs to the WM PEIS Analyses

In this appendix, the relative volumes of ER transferred wastes are compared with WM waste volumes to determine whether there may be effects on the WM alternatives. Where facility capacity allows, the treatment of ER transferred waste would be conducted during the planned 10-year treatment time frame; and, if capacity is limited, treatment of ER transferred waste might continue for as much as 20 years beyond the WM treatment period (see Section B.8). In this appendix, potential effects of overloading on site treatment facility capacity are noted for those waste types, sites, and alternatives where the ER transferred waste load is equal to or greater than 100% of the volume of the comparable WM inputs. This level represents a doubling of the waste loading to the affected WM facility.

For sites where the volume of ER transferred waste is greater than 100% of the corresponding volume of WM waste, the additional waste loads could be managed by either utilizing up to 30 years of WM facilities' operating capacity or by increasing the capacity of the facilities. Volumes of ER waste that are less than 100% of comparable WM wastes could most likely be handled by utilizing the longer operational period and thus would not require increasing the facilities' capacity. If additional facility capacity were required, future NEPA analyses could evaluate the impacts of increasing WM facility capacity.

Tables B.7–1 through B.7–3 show a comparison, by site, between the expected volumes of ER transferred waste and the volumes of WM waste for each alternative. The tables also show the percentage ratio between the ER and WM wastes. As shown in Tables B.7–1 through B.7–3, the volume of ER transferred wastes

Table B.6–1. Total Site Volumes (m^3) of WM Wastes and ER Transferred Wastes[a]

	LLW		LLMW		TRUW	
Site	ER Transferred	WM	ER Transferred	WM	ER Transferred[b]	WM
ANL-E	8,700	6,700	0.4	160	190	1,300
BNL	400	5,600	0	190	0	0
FEMP	180,000	0[c]	2,200	2,600	0	0
Hanford	700	89,000	100	36,000	1,800	50,000
INEL	140,000	105,000	0	35,000	9,700	39,000
LANL	15,000	150,000	0	2,800	0	11,000
LLNL	0	3,200	0	4,300	0	1,700
NTS	1,100,000	1,700	50	3,000	0	610
ORR	9,800	270,000	3,900	59,000	1,500	2,700
Pantex	54	2,700	0	690	0	0
PGDP	150	50,000	0	600	0	14
PORTS	190	97,000	0	33,000	0	0
RFETS	36,000	41,000	42,000	21,000	1,900	6,200
SNL-NM	36,000	2,500	0	100	0	0
SRS	400,000	510,000	150,000	20,000	65,000	17,000
WVDP	0	42,000	0	55	0	0.5
Others[d]	57,000	130,000	4,400	1,000	130	1,500
Total	1,900,000	1,500,000	200,000	220,000	80,000	132,000

[a] May 1996 Approved Version of the "Environmental Restoration Core Database" (DOE, 1996c).
[b] Includes mixed TRUW.
[c] All FEMP LLW considered as ER.
[d] Others include Mound, RMI, LBL, Ames, BCL, ITRI, GA, GE, and LEHR.

may exceed 100% of the comparable WM wastes at ANL-E, NTS, FEMP, INEL, and SNL-NM for LLW; at RFETS and SRS for LLMW; and at SRS for TRUW.

Table B.7–4 shows, for each treatment alternative and waste type, the number of sites that would be affected by the addition of ER transferred waste. Overall, the addition of the ER waste would affect less than 25% of the treatment sites for most alternatives. The only effect on a Centralized Alternative would be for LLW, due to the large amount of LLW projected for NTS.

However, since it is likely that the bulk of the ER transferred LLW at NTS (primarily consisting of soils) would be treated on site using minimal treatment, the effects of this large waste load on the treatment facilities' LLW Regionalized and Centralized Alternatives would be minimized. In a similar fashion, the

Table B.7–1. Comparison of Total Volumes of ER Transferred LLW to WM LLW by Alternative

Site	Decentralized (Minimal Treatment Only at All Sites)			Centralized 3 and 4 (Treatment at 7 Sites)			Centralized 5 (Treatment at 1 Site)		
	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM
ANL-E	8,700	6,700	130%	--[a]	--	--	--	--	--
BNL	400	5,600	7%	--	--	--	--	--	--
FEMP	180,000	0	NA[b]	--	--	--	--	--	--
Hanford	700	89,000	<1%	700	95,000	<1%	1,900,000	1,500,000	136%[d]
INEL	140,000	105,000	130%	1,200,000	107,000	11×[c,d]	--	--	--
LANL	15,000	150,000	10%	51,000	150,000	32%	--	--	--
LLNL	0	3,200	0%	--	--	--	--	--	--
NTS	1,100,000	1,700	650×[c]	--	--	--	--	--	--
ORR	9,800	270,000	4%	10,000	300,000	3%	--	--	--
PGDP	150	50,000	<1%	--	--	--	--	--	--
Pantex	54	2,700	2%	--	--	--	--	--	--
PORTS	190	97,000	<1%	220,000	290,000	76%	--	--	--
RFETS	36,000	41,000	88%	36,000	41,000	88%	--	--	--
SNL-NM[e]	36,000	2,500	14×[c]	--	--	--	--	--	--
SRS	400,00	510,000	78%	400,000	515,000	78%	--	--	--
WVDP	0	42,000	0%	--	--	--	--	--	--
Other	57,000	130,000	41%	--	--	--	--	--	--

Table B.7–1. Comparison of Total Volumes of ER Transferred LLW to WM LLW by Alternative—Continued

Site	Regionalized 2 (Treatment at 11 Sites)			Regionalized 4 (Treatment at 7 Sites)			Regionalized 5 (Treatment at 4 Sites)		
	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM
ANL-E	--	--	--	--	--	--	--	--	--
BNL	--	--	--	--	--	--	--	--	--
FEMP	190,000	46,000	410%	--	--	--	--	--	--
Hanford	700	89,000	<1%	700	96,000	<1%	700	96,000	<1%
INEL	1,200,000	107,000	11×[c]	1,200,000	107,000	11×[c,d]	1,300,000	300,000	430%
LANL	51,000	150,000	32%	51,000	150,000	32%	--	--	--
LLNL	0	8,000	0%	--	--	--	--	--	--
NTS	--	--	--	--	--	--	--	--	--
ORR	9,800	270,000	4%	10,000	320,000	3%	230,000	600,000	38%
PGDP	150	50,000	<1%	--	--	--	--	--	--
Pantex	0	2,700	<1%	--	--	--	--	--	--
PORTS	30,000	230,000	13%	220,000	280,000	76%	--	--	--
RFETS	36,000	41,000	88%	36,000	41,000	88%	--	--	--
SNL-NM[e]	--	--	--	--	--	--	--	--	--
SRS	400,000	510,000	78%	400,000	510,000	78%	400,000	516,000	78%
WVDP	--	--	--	--	--	--	--	--	--
Other	--	--	--	--	--	--	--	--	--

Note: Waste volumes in total cubic meters.
[a] Not a treatment site under the alternative.
[b] All LLW at FEMP is ER waste.
[c] For clarity, factor increase is used instead of %.
[d] Under some alternatives, actual onsite ER transferred waste loads at INEL and Hanford would be reduced by use of minimal treatment onsite at NTS and SNL-NM.
[e] Includes ITRI.

Table B.7–2. Comparison of Total Volumes of ER Transferred LLMW to WM LLMW by Alternative

Site	Decentralized (Treatment at 16 Sites)			Regionalized 1 (Treatment at 11 Sites)			Regionalized 2 and 3 (Treatment at 7 Sites)		
	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM
ANL-E	0.4	160	<1%	--[a]	--	--	--	--	--
BNL	0	190	0%	--	--	--	--	--	--
FEMP	2,200	2,600	85%	2,200	2,800	79%	--	--	--
Hanford	100	36,000	<1%	100	36,000	<1%	100	41,000	<1%
INEL	0	35,000	0%	50	38,000	<1%	50	38,000	<1%
LANL	0	2,800	0%	0	2,900	0%	0	3,500	0%
LLNL	0	4,300	0%	0	4,700	0%	--	--	--
NTS	50	3,000	2%	--	--	--	--	--	--
ORR	3,900	59,000	7%	3,900	59,000	7%	3,900	60,000	7%
PGDP	0	600	0%	0	600	0%	--	--	--
Pantex	0	690	0%	0	690	0%	--	--	--
PORTS	0	33,000	0%	0	33,000	0%	2,200	36,000	6%
RFETS	42,000	21,000	200%	42,000	21,000	200%	42,000	21,000	200%
SNL-NM	0	100	0%	--	--	--	--	--	--
SRS	150,000	20,000	750%	150,000	20,000	750%	150,000	20,000	750%
WVDP	0	55	0%	--	--	--	--	--	--
Other	4,400	1,000	--	4,400	--	--	--	--	--

Table B.7-2. Comparison of Total Volumes of ER Transferred LLMW to WM LLMW by Alternative—Continued

Site	Regionalized 4 (Treatment at 7 Sites)			Centralized (Treatment at 1 Site)		
	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM
ANL-E	--	--	--	--	--	--
BNL	--	--	--	--	--	--
FEMP	--	--	--	--	--	--
Hanford	100	41,000	--	200,000	220,000	91%
INEL	42,000	62,000	68%	--	--	--
LANL	--	--	--	--	--	--
LLNL	--	--	--	--	--	--
NTS	--	--	--	--	--	--
ORR	5,100	96,000	5%	--	--	--
PGDP	--	--	--	--	--	--
Pantex	--	--	--	--	--	--
PORTS	--	--	--	--	--	--
RFETS	--	--	--	--	--	--
SNL-NM	--	--	--	--	--	--
SRS	150,000	20,000	750%	--	--	--
WVDP	--	--	--	--	--	--
Other	--	--	--	--	--	--

Note: Waste volumes in total cubic meters.
[a] Not a treatment site under the alternative.

Table B.7–3. Comparison of Total Volumes of ER Transferred TRUW to WM TRUW by Alternative

Site	Decentralized (Treatment at 16 Sites)			Regionalized 1 and 2 (Treatment at 6 Sites)			Regionalized 3 (Treatment at 4 Sites)			Centralized (Treatment at 1 Site)		
	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM	ER (m^3)	WM (m^3)	ER as % of WM
ANL-E	190	1,300	15%	--[a]	--	--	--	--	--	--	--	--
BNL	0	0	--	--	--	--	--	--	--	--	--	--
FEMP	0	0	--	--	--	--	--	--	--	--	--	--
Hanford	1,800	50,000	4%	1,800	50,000	4%	1,800	50,000	4%	--	--	--
INEL	9,700	39,000	25%	9,700	39,000	25%	12,000	56,000	21%	--	--	--
LANL	0	11,000	0%	0	11,000	0%	--	--	--	--	--	--
LLNL	0	1,700	0%	--	--	--	--	--	--	--	--	--
NTS	0	610	0%	--	--	--	--	--	--	--	--	--
ORR	1,500	2,700	56%	1,700	2,700	56%	1,700	2,700	63%	--	--	--
PGDP	0	14	0%	--	--	--	--	--	--	--	--	--
Pantex	0	0	--	--	--	--	--	--	--	--	--	--
PORTS	0	0	--	--	--	--	--	--	--	--	--	--
RFETS	1,900	6,200	31%	1,900	6,200	31%	--	--	--	--	--	--
SNL-NM	0	0	--	--	--	--	--	--	--	--	--	--
SRS	65,000	17,000	390%	65,000	18,000	360%	65,000	18,000	360%	--	--	--
WVDP	0	0	--	--	--	--	--	--	--	--	--	--
WIPP	--	--	--	--	--	--	--	--	--	80,000	130,000	62%

Note: Waste volumes in total cubic meters.
[a] Not a treatment site under the alternative.

Table B.7–4. Number of Sites Potentially Affected by the Addition of ER Transferred Wastes by Alternative

Waste Type	Decentralized: All Sites Treat	Regionalized: 11 Sites Treat	Regionalized: 7 Sites Treat	Regionalized: 6 Sites Treat	Regionalized: 4 Sites Treat	Centralized: 1 Site Treats
LLW	4/16 [a]	1/11	1/7	NA[b]	1/7	1/1
LLMW	2/16	2/11	2/7	NA	1/4	0/1
TRUW	1/10	NA	NA	1/6	1/4	0/1

[a] Indicates the number of WM treatment sites where the volume of ER transferred waste ≥ 100% of the WM waste volume, compared with the total number of treatment sites.
[b] Not applicable.

potential impacts on the Regionalized Alternatives for LLMW and TRUW are also due to large waste inputs from one or two sites (i.e., RFETS and SRS for LLMW and SRS for TRUW) rather than to substantial ER inputs at a large number of sites. Again, the site-specific treatment capacities could be expanded to accommodate the increased loading resulting from the addition of ER waste. There would be no effects to the Centralized Alternative for LLMW and TRUW.

B.8 Assumptions

The estimates of the volumes of ER transferred wastes that would be managed in WM facilities and the effects of such wastes on WM PEIS alternatives were based on several assumptions:

- All of the waste identified as ER transferred wastes would, in fact, be transferred to the WM Program.
- Although the proportional distribution of wastes may differ, ER transferred wastes are assumed to fall into the same treatability groups as the WM waste for each waste type and can therefore be processed in WM treatment plants.
- The majority of the ER wastes generated over the 75-year period evaluated in the BEMR (DOE, 1996b) would actually be produced between 2003 and 2033.
- ER transferred wastes would be sent to the WM Program during site remediation. The ER transferred wastes may be sent gradually during the remediation activities or all at once, depending on the specific ER operations.
- If shipped to other sites for treatment or disposal, ER transferred wastes would follow the same transport configuration as WM wastes.

- Once there is sufficient information to characterize ER transferred wastes, they would fall within the waste treatment categories already identified in characterizing WM wastes. In other words, it is unlikely that there would be a novel category of ER transferred waste that would be unlike any of the treatment categories of WM waste.
- All wastes identified as ER transferred wastes in this appendix would require some type of treatment, although the type of treatment cannot be determined until the wastes are characterized.
- Current ER data combine both TRUW and mixed TRUW. It is expected that the majority of transuranic-contaminated media will be TRUW.
- All ER transferred waste is likely to be contact-handled.
- Although plans to manage contaminated media are proceeding independent of the WM Program, excess WM facility capacity can be used for ER transferred wastes; after the planned 10-year facility operations period for WM wastes, as much as 20 years of additional operational treatment capacity of these facilities would be available to treat ER transferred wastes and newly generated WM wastes.
- The radiological activity of ER transferred waste would be lower than the activity of corresponding WM wastes.
- The ER transferred waste estimates do not include waste volumes for which no feasible remedial technology is available; these volumes were therefore not included in the base case (e.g., underground soils at nuclear test sites, major contaminated aquifers).
- Hazardous waste would be treated and disposed of at commercial facilities to the maximum extent practical.
- The majority of ER transferred LLW would require only minimal treatment to meet health and safety requirements prior to disposal. Minimal treatment (i.e., packaging) would be done at the site generating the waste.

B.9 Uncertainties

Determination of the effects that the addition of ER transferred wastes would have on the capabilities of WM facilities and on the alternatives evaluated in the WM PEIS depends on many factors. Major considerations include assumptions on future site land use and remedial actions, changes in WM technologies, the radiological composition and activity of ER transferred wastes, and changes in the characterization of contaminated media and facilities at DOE sites. The uncertainties inherent in estimating

the effects of ER wastes on WM facilities may affect final decisions on WM PEIS alternatives. The following factors contribute to the uncertainties:

- The adoption of alternate land uses than those assumed in the BEMR may alter the amounts of ER transferred waste. More restrictive access policies at each site and across the DOE complex would result in lower amounts of ER transferred waste going to WM facilities. Conversely, the adoption of less restrictive access policies would likely increase the volume of waste generated by ER actions. This could, in turn, increase the amount of ER transferred waste. For example, current BEMR projections estimate up to a 77% increase in costs for the most unrestricted greenfield uses. This scenario would be expected to create a comparable increase in the ER waste loads. However, adoption of the most unrestricted land use is unlikely. The choice of land uses between restricted and unrestricted uses would result in only minor changes in expected cleanup costs and, by extension, waste volumes (see 1996 BEMR [DOE, 1996b]: Table 9 and Figure 11, Executive Summary).
- Future ER decisions at each site could alter the amount of ER transferred wastes that would be sent to WM facilities for final disposition. If DOE decides that more sites will have their own ER management facilities, the result would be lower amounts of ER waste that would be transferred to WM facilities.
- Effects are also dependent on the volume of ER transferred wastes that require treatment and disposal, compared with those that will require disposal only. As considered here, all ER transferred wastes are assumed to require some treatment; however, it is likely that a sizable amount of the ER transferred waste load would require only disposal at WM facilities. The current ER data do not separate those ER transferred wastes that require treatment and disposal from wastes that would require only disposal. The final treatment and disposal volumes will only be determined when the contaminated media are removed.
- Because the ER transferred wastes would be shipped as generated during site cleanup, the volume that would be delivered to WM facilities at any given time is uncertain. If a site's wastes were generated early in remedial operations, all or a substantial portion of the estimated ER transferred waste might be sent to WM facilities in a relatively short time. Large loadings of ER transferred waste may have greater effects on WM waste storage facilities than on treatment and disposal facilities because even if a facility has adequate capacity to accommodate additional waste loading within the 30-year time frame, there may not be sufficient storage capacity to hold the wastes until they can be processed.
- This appendix only identifies the potential volumetric effects of sending ER transferred waste to WM treatment facilities. Because current data do not characterize the radiological composition or activity concentration of this waste, the additional contaminant emissions resulting from the treatment of ER waste and the subsequent additional impacts on human health and the environment cannot be directly quantified. However, because the radiological activities and chemical contaminant concentrations of ER

transferred waste are expected to be lower than those for the corresponding WM wastes, the direct impacts on human health and the environment from treating ER transferred wastes would likely be lower than those for processing similar volumes of WM wastes. The ultimate effects of the treatment of ER transferred wastes can only be determined when a site's contaminated media are removed and characterized prior to treatment.

- This appendix assumes that all of the ER transferred waste would be sent for treatment in WM facilities. However, future decisions may direct some of the ER transferred waste to commercial facilities. This would lessen the potential effects of ER transferred wastes on WM facilities.
- Because the exact radiological and chemical composition of the ER transferred waste is not yet known, it is possible that as more data about waste composition become available, the type categorization of ER transferred wastes could change. For example, the presence or absence of hazardous chemicals in the waste could alter the distribution between LLW and LLMW. Similarly, more detailed information about the levels of alpha-radionuclide activities in ER transferred waste could change the distribution between TRUW and LLW or LLMW.
- Although ER transferred wastes are expected to fall into the waste treatment categories already identified for WM wastes, the proportional distribution of the ER wastes among the treatment categories may not be the same as the distribution for WM wastes at a site. The ER transferred wastes can only be placed into specific treatment categories after determination of their chemical, radiological, and physical characteristics. Since such characterization can only be done after the ER wastes are generated, there is uncertainty in the amounts of ER transferred waste and in the treatment that they will require.

B.10 References

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Appendix C

Environmental Impacts Analysis Methods

Appendix C in the Final WM PEIS contains material formerly found in Appendix I in the Draft WM PEIS.

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Acronyms and Abbreviations

The following is a list of acronyms and abbreviations (including units of measure) used in this appendix.

Acronyms

AAL	ambient allowable limit
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
AGDSP	aboveground disposal module
ANL-E	Argonne National Laboratory-East
AQCR	Air Quality Control Region
ARARs	Applicable or Relevant and Appropriate Requirements
BEA	Bureau of Economic Analysis
BHDSP	borehole disposal
BNL	Brookhaven National Laboratory
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbons
CH	contact-handled
CISV	canister storage vault
CPI	consumer price index
D&D	decontamination and decommissioning
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
FEMP	Fernald Environmental Management Project
FTE	full-time equivalent
GCR	General Conformity Rule

HAPs	hazardous air pollutants
HI	hazard index
HLW	high-level waste
HW	hazardous waste
INEL	Idaho National Engineering Laboratory
I-O	input-output system
LANL	Los Alamos National Laboratory
LLMW	low-level mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
MEI	maximally exposed individual
MDVS	modular dry vault storage
NAAQS	National Ambient Air Quality Standards
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
O&M	operations and maintenance
ODS	ozone-depleting substance
ORR	Oak Ridge Reservation
PCBs	polychlorinated biphenyls
PGDP	Paducah Gaseous Diffusion Plant
PLCC	program life-cycle cost
PORTS	Portsmouth Gaseous Diffusion Plant
PPI	producer price index
PSD	prevention of significant deterioration
RFETS	Rocky Flats Environmental Technology Site
RH	remote-handled
RIMS	Regional Input-Output Modeling System
ROI	region of influence

SEL	significant emission level
SHOP	State Historic Preservation Officer
SIDSP	silo disposal module
SLDSP	shallow land disposal module
SNL-NM	Sandia National Laboratories-New Mexico
SRS	Savannah River Site
STOSI	silo storage module
TAP	toxic air pollutant
TRUW	transuranic waste
VMT	vehicle mile traveled
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WM	waste management
WMFCI	Waste Management Facility Cost Information
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WVDP	West Valley Demonstration Project

Abbreviations

BTU	British thermal unit
CO	carbon monoxide
gpd	gallons per day
L	liter
μg	microgram
m^3	cubic meter
mg	milligram
mph	miles per hour
mrad	millirad
mrem	millirem
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
O_3	ozone
Pb	lead
pCi	picocurie
PM_{10}	particulate matter equal to or less than 10 micrometers in diameter
SO_2	sulfur dioxide
yr	year

APPENDIX C
Environmental Impacts Analysis Methods

The Waste Management Programmatic Environmental Impact Statement (WM PEIS) environmental impacts analysis was accomplished using an engineering analysis of generic designs developed for the treatment, storage, and disposal facilities required to manage each waste type at the sites, and estimates of transportation requirements. Outputs from the engineering analysis were estimates of resource requirements, environmental discharges, and costs. These outputs were used as inputs to evaluate human health risk, environmental, socioeconomic, and cultural resources, and impacts at the sites and along the transportation corridors, and were the basis for discussions of environmental justice issues.

C.1 WM PEIS Environmental Impacts Analysis Approach

The environmental resources for which detailed impacts analysis methods are presented in this appendix include:

- ***Cost***
- ***Air Quality***
- ***Water Resources***
- ***Ecological Resources***
- ***Economic Resources***
- ***Population Impacts***
- ***Environmental Justice***
- ***Land Use***
- ***Infrastructure***
- ***Cultural Resources***

The environmental impacts for the five waste types were evaluated using an analytical process consisting of three phases for the waste management alternatives. This three-phased approach was applied as applicable in the analysis of treatment, transportation, storage, and disposal activities for each of the waste types at the 17 major U.S. Department of Energy (DOE) sites. The three phases, as shown in Figure C.1–1, were: (1) a Generic Design Engineering Analysis Input Phase; (2) an Engineering Analysis Output Phase; and (3) an Environmental Impacts Analysis Phase. It should be noted that in addition to the relationships indicated in Figure C.1–1, there are significant interrelationships between areas identified in the "Environmental Impact Analysis" phase. For example, facility discharges are directly linked to human health effects. Health risk effects in turn form the basis for the environmental justice analysis. The details of these relationships are presented in the remainder of this appendix.

Engineering Analysis Using a Generic Design. In the first phase, DOE made assumptions regarding waste loads for the five waste types. These assumptions related to the volume of waste currently in inventory and anticipated from future operations of DOE facilities and to its physical (gaseous, liquid, solid), chemical, and radiological characteristics. DOE then routed these estimated waste loads among specified DOE sites

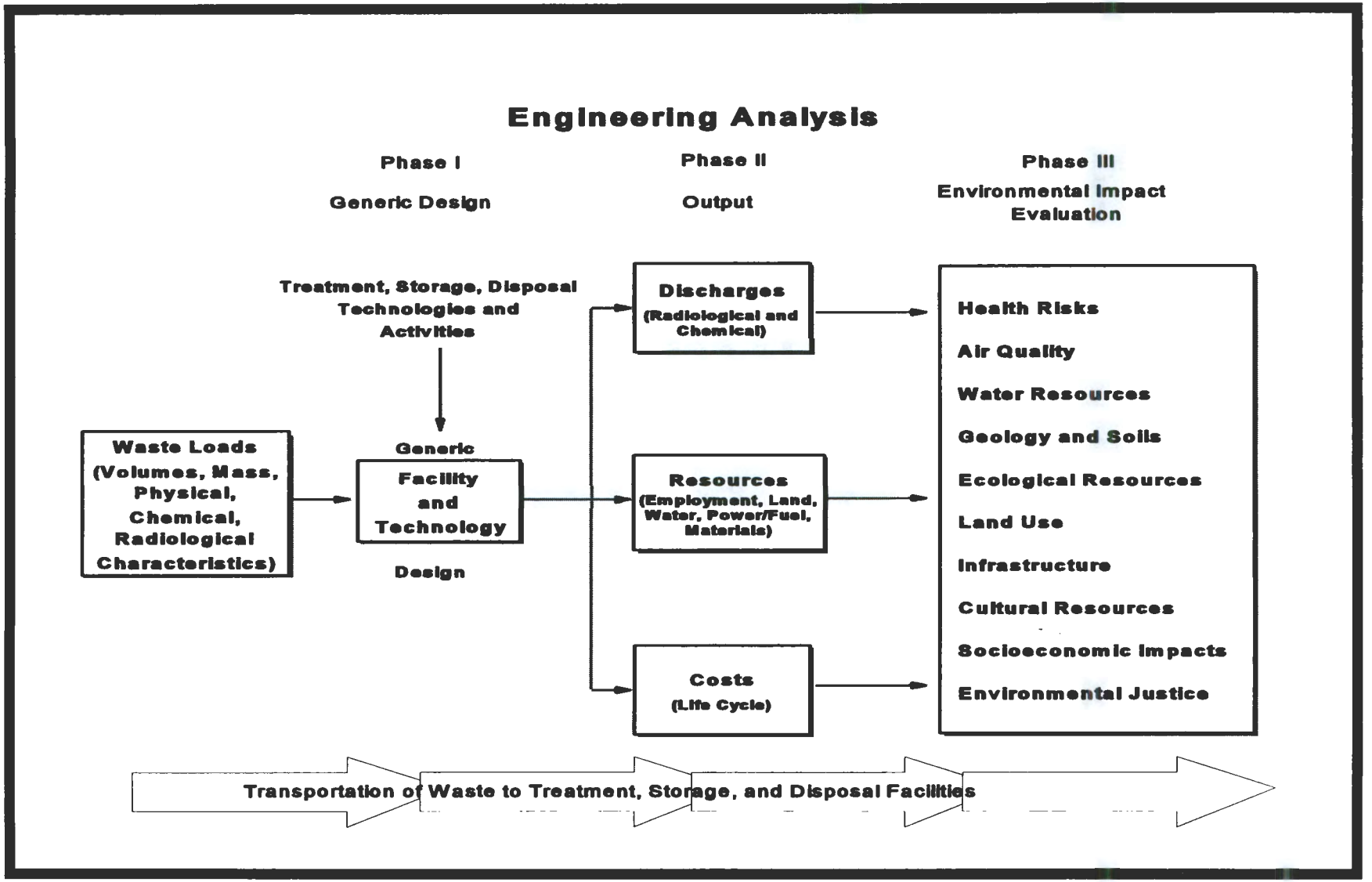

Figure C.1–1. WM PEIS Analytical Relationships.

according to certain criteria based on the closest site with appropriate treatment capabilities as defined for each of the waste management alternatives to determine how much waste would be handled at each site under each alternative. DOE also developed a generic design of the waste management processes and facilities and selected one technology option for purposes of analysis. The facilities considered and the technology chosen for each waste type, and the rationale for that selection, are described more fully in the waste-type chapters.

Engineering Analysis Output. In the second phase, the waste loads allocated to each site under each alternative were generically "processed" through a mathematical model of the generic waste management (WM) facility design, and estimates of outputs were obtained for the amounts and rates of radiological and chemical effluents released to the environment, volume and rates of resources required or consumed, numbers of full-time equivalent (FTE) workers required, and costs to build, operate, maintain, decontaminate and decommission the WM facilities.

Environmental Impact Evaluation. In the third phase, the effluents, resources, and costs became the input for evaluation of environmental and socioeconomic impacts, and human health risks.

C.2 Phase I: Engineering Analysis Using a Generic Design

C.2.1 Waste Loads

Waste Volumes. The WM Programmatic Environmental Impact Statement (PEIS) impact and cost analyses used DOE and U.S. Environmental Protection Agency (EPA) databases for waste inventories and generation rates. However, these databases are constantly upgraded, and a cutoff date was established for the data to allow the analyses to proceed.

Sources of data for each of the waste types are listed below and described in detail in the waste type chapters (Chapter 6–10) and Appendix I:

- **Low-level mixed waste (LLMW)**—The *Mixed Waste Inventory Report* (DOE, 1994) was used for all LLMW inventories and generation rates, except for Colonie, ETEC, and RFETS, whose generation

rates and inventories come from late 1994 site estimates, and ANL-E and NTS, whose generation rates and inventories come from the *Mixed Waste Inventory Summary Report* (DOE, 1995a).

- **Low-level waste (LLW)**—The *Integrated Data Base for 1992* (DOE, 1992) was used for generation rates and inventories of stored waste except for BNL, NTS, ORR, Pantex, and WVDP, whose generation rates and inventories come from the updated *Integrated Data Base Report - 1994* (DOE, 1995d). The Waste Management Information System (ORNL, 1992) was consulted for data not available in the Integrated Data Base.
- **Transuranic waste (TRUW)**—The *Integrated Data Base for 1992* (DOE, 1992) and the *Interim Mixed Waste Inventory Report* (DOE, 1993a) were used for TRUW inventories and generation rates except for Hanford and SRS. SRS generation rates and inventories come from the updated *Mixed Waste Inventory Summary Report* (DOE, 1995a), while Hanford's come from the *Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report* (BIR-2) for 1995 (DOE, 1995e).
- **High-level waste (HLW)**—Site-specific plans and NEPA documents for Hanford, INEL, SRS, and WVDP were used for HLW volume and canister production rates.
- **Hazardous waste (HW)**—The EPA Information System biennial and annual reports (EPA, 1991a) were used for HW generation rates. Offsite shipments to commercial treatment were derived from DOE fiscal year 1992 HW shipping manifests.

It is DOE policy that sites employ pollution prevention practices to reduce the amount of waste generated. The databases from which estimates of annual generation were obtained did not fully consider pollution prevention efforts. Possible impacts of pollution prevention are discussed in Appendix G.

The waste loads analyzed in this PEIS do not include wastes that may be generated as a result of environmental restoration (ER) activities. The anticipated ER waste loads are described in the waste-type chapters (Chapters 6–10) on a site-by-site basis, and compared to the anticipated WM waste loads at those sites. It is not anticipated that HLW will be generated through ER activities. These chapters also contain a qualitative discussion of the extent to which ER waste loads could affect the conclusions regarding environmental impacts.

Treatability Groups. While this PEIS covers five waste types, those wastes are not homogenous and are derived from thousands of different waste streams. Thus, the wastes were combined into treatability groups for purposes of developing treatment system designs. Each treatability group is identified with one or more of the five waste types considered in the PEIS and a treatment method, where appropriate, that EPA

recognizes as meeting the requirements of the Resource Conservation and Recovery Act (RCRA) (42 USC 6901 *et seq.*). For the PEIS analyses, the physical structure of the waste was used for the initial sort for treatability. At the most basic level of analysis, all waste can be grouped into six physical categories using common engineering criteria design parameters, which also served as the initial set of treatability categories:

- **Aqueous liquids**—Primarily water with organic content less than 1% (such as wastewater)
- **Organic liquids**—Liquids and slurries with organic content greater than 1% (such as solvents)
- **Organic and inorganic sludge and particulates**—Solid and semi-solid material other than debris (such as sludge from treatment plants, resins, and solids less than 2.5-inch diameter particle size)
- **Soils**—Contaminated soils (such as contaminated earth requiring remediation)
- **Debris**—Solid material exceeding 2.5-inch diameter particle size that is either (1) manufactured, or (2) plant or animal matter, or (3) discarded natural or geological material (such as cobblestones)
- **Other**—Special waste streams (such as batteries, laboratory packs, reactive metals, and toxic metals, which include mercury, lead, and beryllium)

Four waste types use this basic framework analysis: LLMW, LLW, TRUW, and HW. For purposes of the PEIS analysis, HLW, also in the above treatability categories, is assumed to have been treated (vitrified). The PEIS only addresses the environmental consequences of storing and transporting vitrified HLW.

Radiological and Chemical Composition. DOE used standard radiological profiles for each site and made assumptions about the concentration of contaminants in each treatability group based on available data. Hazardous constituents were apportioned to the treatability groups on the basis of the most prevalent hazardous chemicals using an average composition for all DOE sites. The assumptions for both radioactive and hazardous constituents are waste-type specific and are addressed in more detail in the waste-type chapters.

C.2.2 WM Technologies

Various technologies are used to sort and handle waste, reduce waste volume, destroy organic chemicals in waste, remove toxic metals from waste, treat hazardous characteristics to render them nonhazardous, recover and recycle materials, and stabilize and package waste for disposal. The facilities that use these technologies must be designed to accommodate the various physical and chemical forms and the radioactive and chemical characteristics discussed in previous sections. Existing, generic technologies necessary to meet

the treatment, storage, and disposal requirements for each waste type were identified and sized to meet anticipated waste volume needs. For analytical purposes, and to facilitate utilization in any system at any site, the waste management technologies were grouped into **common functions** (front-end support such as administrative and laboratory services; receiving, inspecting, dumping, and sorting the waste; maintenance of facilities; and certification and shipping of the waste), **pretreatment** (shredding and compaction), **primary treatment** (incineration, special processing, neutralization, deactivation, aqueous waste treatment, lead recovery, and mercury separation and recovery), **secondary treatment and stabilization** (polymer stabilization, grout stabilization, packaging, and vitrification of secondary processing residues), **storage** (administration, receiving and inspection, contact-handled storage, and remote-handled silo storage), and **disposal** (administration, receiving and inspection, shallow land disposal, engineered vault disposal, silo disposal, and borehole disposal). The technologies used in the WM PEIS were chosen for analytical purposes only; the Records of Decision based on the WM PEIS will not select technologies.

Existing, rather than advanced, technologies were used for the analysis because (1) the applicability of advanced technologies is more problematic, (2) impacts would more likely be bounded using existing technologies, and (3) the type of technology would be unlikely to determine the preferred alternative. However, advanced technologies will be considered in project-specific National Environmental Policy Act (NEPA) reviews expected to tier off from this programmatic review.

C.2.3 WM FACILITIES

Treatment, transportation, storage, and disposal "modules" were developed to represent every component required for waste management. Each module was assumed to contain several types of equipment, each able to perform a step needed in the waste management process.

Individual modules were linked together for each treatability group and were adjusted for the chemical and physical type of waste. This method was used so that impacts could be compared among sites, with each site assumed to be using the identical array of linked modules. Any variation in impacts would then result from site-specific environmental differences. This approach also allowed an examination of the changes in impacts resulting from changes in the linked modules.

Typically the type of facility considered was a building structure (i.e., a "fixed" facility at a given site). The analysis also considered the possible use of mobile treatment facilities that could be moved from site to site for treatment of the very small amounts of waste that exist at a number of the sites considered.

The generic design of the WM facility, consisting of these treatment, storage, transportation, and disposal modules, enabled the calculation of land utilization, worker-years, resource consumption (i.e., water and electricity), pollutant discharges, and costs for the treatment, storage, transportation, and disposal of each waste type. The engineering features of the generic facility and the waste loads "processed" through the generic facility formed the basis for the risk and environmental impacts analysis.

For purposes of analysis, the following assumptions were made regarding the construction and operation of the waste management facilities:

- The facilities were assumed to be built over a 10-year period and operated over a 10-year period to process inventories accumulated over a 20-year period. This was the basic assumption for LLW, LLMW, TRUW, and HW. This assumption was made prior to the analysis of facility costs required for the treatment, storage, and disposal of the various wastes. This assumption of similar operating conditions was made in order to allow the possible consolidation of facilities. Consolidation was not required in the PEIS, but would be attempted when facility requirements were being reviewed for justification of facility construction or for site-specific EISs.
- The facilities were assumed to operate 240 days per year with three 8-hour shifts.
- Except for HLW, a 20-year period of analysis is generally used for each waste type. Storage requirements for HLW under the No Action Alternative were assumed to be indeterminate in length, but in excess of this 20-year period. For this analysis, 30 years was assumed to be the longest period for which reasonable estimates of the HLW No Action Alternative could be made.

Although the WM PEIS only analyzes the environmental impacts from the operation of the WM facilities for 10 years, it is possible that the facilities could operate for up to 30 years. During this additional 20-year operating period, additional WM wastes or ER wastes could be processed. DOE believes that most of the impacts of operating the WM facilities for an additional 20 years would be similar to the impacts of operating these facilities for the 10 years analyzed in the WM PEIS. DOE believes this for the following reasons:

- The 10-year period of operations analyzed in the WM PEIS includes processing wastes accumulated for 20 years (i.e., waste accumulated during 10 years of construction and 10 years of operations) in

addition to any wastes in storage. Therefore the feed rate into the WM facilities would be expected to bound the feed rate during the latter 20 years of operations.

- Many of the impacts analyzed in the WM PEIS were analyzed on a daily or annual basis. For example, infrastructure impacts were analyzed for resource use in gallons of water per day, gallons of wastewater per day, and megawatts of power per year. Resource use during operation of the facilities for an additional 20 years is unlikely to exceed these rates of resource use and therefore is unlikely to exceed the environmental impacts predicted in the WM PEIS.
- Some impacts in the WM PEIS, such as human health risk to the offsite population, were analyzed for the entire 10-year operations period. DOE expects that the impacts during the additional 20 years of operations would be no more than twice the impacts predicted in the WM PEIS. For example, if the WM PEIS predicted a population health risk of 1 in 1 million (see Chapters 6 through 11 for actual risk estimates), the additional health risk of operating the facilities for 20 more years would be no more than 2 in 1 million, with a total health risk for 30 years of operations of 3 in 1 million.

This assumes that the characteristics of the waste processed during the additional 20-year operating period are similar to the characteristics of the wastes analyzed in the WM PEIS. If the characteristics of the wastes processed during the latter 20 years of operations are found in the future to be appreciably different from the characteristics of the waste analyzed in the WM PEIS, additional environmental documentation could be prepared to support continued operations.

C.2.4 ALTERNATIVES

In the PEIS, an alternative identifies the configuration of sites for treating, storing, or disposing of a specific waste type. Depending on the waste type, certain of these activities may not be analyzed in this PEIS. The categories of alternatives analyzed in this PEIS for each waste type are a No Action Alternative, Decentralized Alternative, Regionalized Alternative, and Centralized Alternative. These alternatives are described below:

- **No Action Alternative**—These alternatives would involve using only currently existing or approved WM facilities at DOE sites or commercial vendors.
- **Decentralized Alternative**—These alternatives would result in leaving waste at the site where it is currently stored or where it will be generated, treated, or disposed in the future. Unlike the No Action alternatives, the Decentralized Alternatives may require the siting, construction, and operation of new

facilities or the modification of existing facilities. Under the Decentralized Alternatives, the WM facilities would be located at a larger number of sites than under the Regionalized or Centralized Alternatives.

- **Regionalized Alternatives**—These alternatives would result in transporting waste to various numbers of sites (fewer than the number of sites considered for the Decentralized Alternative, but greater than the number of sites considered for the Centralized Alternatives). Generally, those sites that now have the largest volumes of a given waste type were considered as regional sites for treatment, storage, or disposal.
- **Centralized Alternative**—These alternatives would result in transporting wastes to one or two sites for treatment, storage, or disposal. As was the case with the Regionalized Alternatives, the sites that have the largest volumes of a given waste type were considered as sites for centralized treatment, storage, or disposal.

These four categories of alternatives encompass the range of reasonable alternatives available to DOE for siting of WM facilities. However, under each category of alternative, there are many possible combinations for the location of treatment, storage, and disposal facilities. To narrow these combinations to a feasible number for analysis, DOE selected particular site combinations for analysis under each category.

The alternatives were developed and defined based on waste type origin and character, volumes and locations within the DOE complex, existing facilities and capabilities, and specialized treatment and disposal requirements. DOE determined where the largest waste volumes are located and where transportation requirements would be minimized. Treatment, storage, or disposal facilities were analyzed at those sites. For example, if seven sites were to be considered under a Regionalized Alternative, then the seven sites with the largest volume of that type of waste became candidate sites for the analysis. Another Regionalized Alternative for the waste type being analyzed may evaluate management at three sites; in that situation, the three sites with the largest volume of that type of waste were considered as candidate sites. Existing capacity, transportation, and other factors were also considered in developing alternatives. As shown in Table C.2–1, a combined total of 36 alternatives were evaluated for the five waste types. The waste-type chapters (Chapters 6–10) contain more information on the alternatives analyzed in the WM PEIS.

Table C.2–1. Number of Alternatives Analyzed in the PEIS

Alternatives	LLMW	LLW	TRUW	HLW[a]	HW	Total
No Action	1	1	1	1	1	5
Decentralized	1	1	1	1	1	5
Regionalized	4	7	3	2	2	18
Centralized	1	5	1	1	0	8
Total	7	14	6	5	4	36

[a] HLW alternatives are analyzed in terms of both final disposal beginning in 2015 and final disposal beginning at some later date.

C.2.5 TRANSPORTATION

Transportation is an integral component of the alternatives being considered for the management of each type of waste in the PEIS. The magnitude of the transportation related activities varies with each alternative, ranging from minimal transportation under the Decentralized Alternatives to significant transportation under some of the Centralized Alernatives.

The transportation assessment included the onsite and offsite transportation of radioactive waste. Offsite transportation refers to transporting waste between distinct sites, including parts of the routes that may be within the boundaries of the origin and destination sites. Onsite transportation was evaluated for one sample site: Hanford.

The transportation linkages among generator, treatment, and disposal sites depend on the type of waste and are defined explicitly for each alternative under consideration. For the PEIS, representative offsite truck and rail routes were determined for all possible pairs of origin and destination sites. The routes were selected to be consistent with existing routing practices and all applicable routing regulations and guidelines.

The representative truck routes were determined by using the routing model HIGHWAY 3.1 (ORNL, 1993a). INTERLINE 5.0 (ORNL, 1993b) was used to determine the rail routes. For truck and rail transportation, the route characteristics most important to the assessment included the total shipping distance between each origin and destination pair and the fraction of travel in rural, suburban, and urban areas. Because the routes were determined for the purposes of impact assessment, they are not simply representative of the actual routes that would be used to transport waste in the future.

For the offsite transportation assessment, each specific alternative is defined as a set of pairs (origin and destination) representing shipping linkages among generator, treatment, and disposal sites. The number of origin-destination pairs varies among alternatives, ranging from a small number for the Decentralized Alternatives, to many pairs for the Centralized Alternatives. The sites that would not have the capability to dispose of wastes would ship their wastes to a sites that does. Appendix E contains more detailed information on the transportation analysis.

C.3 Phase II: Engineering Analysis Outputs

The engineering features of the generic facility and the waste loads "processed" through the facility formed the basis for the estimates of resources required, effluents released, and cost. The resources required and effluents emitted were used to estimate environmental impacts from construction and operation of the WM facilities.

Resource Use. The Waste Management Facility Cost Information (WMFCI) methodology model was used to estimate the resources required for construction and operations of each WM facility. The resources included labor (number of FTEs), land, water, electrical energy, fuel (natural gas, diesel oil, and coal), chemicals, concrete, carbon steel, and stainless steel. A description of the engineering analysis used to estimate the resources used is provided in this section.

Facility Environmental Discharges. Once the generic designs and the volumes and characteristics of the waste and the model throughput requirements were specified, the WASTE_MGMT model was used to estimate discharges from the treatment, storage, and disposal modules (Argonne National Laboratory [ANL], 1996c). DOE estimated the radiological and chemical components in air and water effluents from processing the waste, and the chemical components in air effluents from the burning of fuel during the operations period. Section C.4.2 of this Appendix identifies the airborne emissions used in the analysis of air quality impacts. Discharges were assumed to be 90% from point sources and 10% from fugitive releases (ANL, 1996c). Section C.4.3 provides the estimates of releases from LLMW and LLW disposal units into groundwater that were used in evaluating water quality impacts.

Facility and Transportation Costs. The WMFCI methodology was also used to estimate life-cycle facility costs. Total cost of each alternative include the sum of the treatment, storage, disposal, and transportation costs, and in some instances, special costs. Examples of special costs include the Oak Ridge Reservation

"B&C Pond sludge" treatment and disposal actions. Section C.3.2 describes the details of the engineering cost estimation procedures.

C.3.1 Resource Use

The resource use data-estimating process for LLMW, LLW, TRUW, and HW (part of the WMFCI methodology) used the mass/volume throughput to quantify resource consumption for each WM module. Supplemental methodologies provided resource estimates for modular throughputs which were bounded by WMFCI estimates. Samples of tabular presentations of resource use data accompany the discussions. Tabular details are provided (INEL, 1996). The resource use data-estimating process for HLW used regression formulas developed by ANL (ANL, 1996b).

C.3.1.1 Modular Estimating Approach

The resource consumption estimated for each module was dictated by a series of allocation rules. These rules were applied to each module to obtain resource quantities for the module size selected. The resource categories were selected before the actual analysis of any alternatives. During the impacts analysis process, it was determined that several resource categories were not directly needed in the analysis. However, the allocation rules for resources for all facilities are discussed.

C.3.1.1.1 *Construction Resource Use*

The following assumptions were common to developing the resource use parameters for construction activities.

A construction year was defined as 252 workdays, thus allowing time for holidays and weekends. Each workweek is assumed to be 40 hours and composed of five 8-hour days. An FTE (full-time equivalent) employee represents one person working full-time for one construction year, one shift per day.

Most modules were assigned a 2-year construction period, representing the total time assumed from the startup to end of construction activity. A 3-year period was assigned to modules requiring installation of

more complex equipment or special construction. The time needed to construct each module was included in tables in the resource use computer code. It was assumed that multiple modules will be placed within a single building. The time required to finish the entire plant is controlled by the interface requirements and staggered delivery schedules normally experienced during construction of a multipurpose facility. On any given site, construction of all required modules was assumed to take three to four years.

Many of the resource use parameters for construction were based on an estimate derived for construction of a generic treatment plant. A 120,000-square-foot generic plant and 3-year construction period were assumed (INEL, 1994).

The module area was a key parameter used in calculating the construction material quantities required. In the construction data tables of the resource use computer program, each construction material quantity is specified in terms of units per square foot. The area was used as a multiplier to calculate the total construction material quantities. The module area was determined from the plant area calculation presented later in this section. All buildings were assumed to be rectangular with a length-to-width ratio of 4:1.

Additional allocation rules for construction socioeconomic resource data included electrical energy, electrical load, fuel, water, laydown area, plant area, parking area, peak employment, and annual costs. Allocation rules for concrete, carbon steel, stainless steel, chemicals, and type of skills which were not used in evaluating environmental impacts are presented in the Environmental Impacts Technical Report (DOE, 1996a).

The resource use parameters for construction are as follows.

Electrical Energy (in megawatt-hours). This value represents the total amount of electrical energy consumed during construction.

Estimate Basis: Electrical energy was calculated by multiplying the connected electrical load, by the hours of use. The hours of use were based on a standard construction year (252 days). The average capacity was assumed to be 65%, which was determined by estimating the electrical energy consumed for construction of the generic treatment facility described above.

The typical allocation of electrical energy during construction was assumed to be 0.017 kilowatts per square foot for all types of facility modules.

Electrical Load (in kilowatts). This is an estimate of the connected electrical sources required during construction.

Estimate Basis: The electrical load factors for treatment and administration modules were based on the estimates developed for the generic treatment facility described above. The electrical load factor for each module was calculated in kilowatts per square foot of plant area. Total electrical load was obtained by multiplying the module area by 0.017 kilowatts per square foot for all types of facility modules.

Disposal modules with significantly less construction activity, such as the above-ground disposal module (AGDSP), silo disposal module (SIDSP), and silo storage module (STOSI), had an electrical load factor assumed to be approximately 20% of that of treatment modules. Modules such as shallow land disposal module (SLDSP), which do not include a plant with concrete and metal works, were assumed to have an electrical load factor of only 8%. Borehole disposal (BHDSP) was assumed to be constructed without electricity.

Fuel (in gallons). Fuel oil, gasoline, and propane are included in this parameter. In addition, an allowance of 840 gallons per FTE was assumed to account for fuel used by each employee on the job site and fuel required for travel to and from work.

Estimate Basis: The fuel factor for construction equipment was based on the fuel consumption estimate for the generic treatment facility described above. A consumption rate in gallons per square foot of plant area per year of construction was derived. A significantly lower value was estimated for the disposal modules. The fuel consumed by construction equipment for each module was obtained by multiplying by the module's area. Fuel consumption during construction for all modules was computed as the module area times 2.35 gallons per square foot of area.

Fuel consumption by construction employees was estimated by assuming that the workers will travel a 50-mile round trip to the construction site each day of a construction year. A fuel consumption rate of 15 miles per gallon was assumed. This gives 840 gallons per workyear (FTE) for all modules.

Water (in gallons). Estimates for water use include the water consumed during construction activities, potable water consumed by employees, and process water.

Estimate Basis: The estimate for the amount of water consumed during construction was based on the generic treatment facility estimate described above. The average use of water for dust control, equipment washdown, concrete water, and general cleaning of work areas was determined on a per square foot of plant area basis. A value equal to half of this estimate was used for all disposal and storage modules, based on the fact that fewer construction activities are included with these modules. Total water used for these activities was obtained by multiplying the quantity needed per square foot by the module's area.

The generic treatment facility estimate was also used to derive the amount of water used by a construction worker per year. The resulting yearly water usage factor was 3,400 gallons per FTE. General construction requirements were 27.5 gallons per square foot of area per year for all modules.

Laydown Area (in acres). The construction laydown area includes the area for each plant module plus that used for equipment and material storage.

Estimate Basis: The laydown area was estimated by adding a 25-foot-wide buffer to all four sides of the area required for each module. The laydown area for the site was obtained by adding the laydown areas for all modules composing the facility. A length-to-width ratio of 4:1 was assumed for all modules and the buildings containing the modules. The plant area was taken from the calculation below.

Plant Area (in acres). The plant area was obtained by summing the area requirements of the individual modules that constitute the facility. Each module's area was obtained by utilizing a relationship that relates the space required to the module's throughput capacity.

Estimate Basis: Three different module sizes were used to baseline the cost rollup and resource use data for most modules. Only two were used in a limited number of cases. The area required by any module was obtained by calculating a regression curve relating the three baseline sizes to their throughput capacity. The area needed for any other module was then obtained from this curve, based on the throughput capacity of the module in question. A scaling factor was applied in instances where the throughput capacity of the module in question was outside the range of the baseline facilities.

Parking Area (in acres). The parking area was obtained by allocating 400 square feet of space to 85% of the number of workers constituting peak employment.

Estimate Basis: A total individual parking area of 400 square feet was assumed, which includes space for both parking and maneuvering. The number of parking spaces required was based on the peak number of FTEs needed for construction. Parking space was assigned to 85% of this number, assuming that 15% will carpool. Unload/offload was assumed to take place in the laydown area.

Peak Employment (in FTEs). Peak employment is defined as the maximum number of construction employees that will be on the site on any workday during the entire construction period.

Estimate Basis: The total number of construction FTEs was obtained from the cost rollup data. The total number of FTEs divided by the construction period (in years) provided the average annual FTEs. Peak employment was estimated as 1.41 (i.e., the square root of 2) times the average number of FTEs per year.

Annual Costs (in $×1,000). Each of the various average annual construction cost items is divided among labor, material, or equipment categories.

Estimate Basis: The percentage of labor, materials, and equipment involved in the cost item breakdown was based on previously designed and constructed structures involving similar facilities. This cost information was taken from the cost rollup data.

C.3.1.1.2 *Operations Socioeconomic Resource Use*

The following assumptions were common to developing resource use parameters for facility operations.

An FTE employee represented one person working one shift per day for 252 days per year. Yearly plant operation was taken to be 4,032 hours assuming three 8-hour shifts daily, 240 days per year, with the plant available 70% of the time. The difference between an FTE-year and an operational year allows for the time when an employee may be working but the facility is not operating.

All socioeconomic parameters given for facility operations were annualized.

The module area were also an important factor in calculating operational resource use data. The calculation for module area used in this section is the same as that employed in the construction section.

Additional allocation rules for operations socioeconomic resource data include the following for electrical energy; electrical load; fuel, natural gas or liquid propane gas; fuel, liquid; water; total disturbed area; plant area; total number of worker years; hours per week for labor; operation and maintenance (O&M) labor; operations costs; and maintenance costs.

The resource use parameters for facility operations are as follows.

Electrical Energy (in megawatt-hours). This value represents the total electrical energy consumed during plant operations for one year.

Estimate Basis: Electrical energy was calculated by multiplying the connected electrical load by the hours of use. It was assumed that the equipment will operate half the time the plant is available. The "hotel load" (i.e., the electricity required for people), in watts per square foot, was multiplied by the module area (from below). Both were multiplied by the hours of use per year. The plant is assumed to operate 4,032 hours per year. This assumes three shifts per day, 240 days per year, with the module available 70% of the time.

Electrical Load (in kilowatts). This value represents the connected electrical load expressed in kilowatts. It was based on the electrical requirements of the equipment in the module plus the hotel load (i.e., the electrical load needed to support human occupancy). The hotel load includes lights, wall plugs, and where appropriate, air conditioning.

Estimate Basis: The resource use computer code contains estimates for the horsepower requirements of the equipment in the middle (or small) baseline facility. This was converted into watts and multiplied by the ratio of the module's throughput capacity to that of the baseline facility. A scaling factor was applied in instances where the throughput capacity of the module in question was outside the range of the baseline facilities.

The code also contains estimates of the hotel load in watts per square foot for each module. The hotel load was multiplied by the module's area and converted to kilowatts. Estimates of the hotel loads for the

processing, storage, and administrative modules were based on supporting technical documentation (INEL, 1996).

Fuel, Natural Gas or Liquid Propane Gas (in pounds). This value represents the fuel needed to heat the building for one year, assumed to be natural gas.

Estimate Basis: This estimate was based on supporting technical documentation (INEL, 1996). The calculation assumed that to heat the module for the entire winter, the furnace runs an equivalent of 2 months, 24 hours per day. It was further assumed that 3 British thermal units (BTUs) are needed to heat 1 cubic foot of volume for one hour. Multiplying the module volume by 3 BTUs/hour by 1440 hours yielded the total heat required. One cubic foot of natural gas equals 1,030 BTUs.

Fuel, Liquid (in gallons). This quantity represents the fuel required to operate specific pieces of process equipment for one year. Where required, it accounted for operating the equipment at full power as well as maintaining equipment in a hot standby condition. The fuel assumed for these calculations was standard diesel oil.

Estimate Basis: Some of the modules that process waste require fuel to operate. For those modules, the quantity of fuel required was calculated from the throughput capacity. Tables in the resource use computer program give the quantity needed for each 100 pounds of waste processed. The amount of fuel calculated from the throughput capacity per hour was then multiplied by the hours of operation per year.

In addition to the fuel needed to process waste, fuel is needed to keep the equipment in a hot standby condition. It was estimated that 75% of the amount needed for operation is required during the hours per year the plant is available. The plant was assumed to operate 4,032 hours per year, three shifts per day, 240 days per year, with the module available 70% of the time.

Water (in gallons). When required, water needed for operating process equipment was calculated specifically for the module in question. In addition, the quantities of water used and consumed by O&M employees were estimated. These were summed to derive the total water used per year.

Estimate Basis: Some of the modules that process waste utilize water. For those modules, the quantity of water required was calculated from the throughput capacity. Tables in the resource use computer program

give the quantity needed for each 100 pounds of waste processed. The amount of water calculated from the throughput capacity per hour was then multiplied by the hours of operation. The plant was assumed to operate 4,032 hours per year, three shifts per day, 240 days per year, with the module available 70% of the time.

Aqueous waste treatment was assumed to generate 86.7 pounds of water per hour for every 100 pounds of waste mass processed per hour. Incineration was assumed to use 109 pounds of water per hour, grouting 26.1 pounds of water per hour, and mercury recovery 10 pounds of water per hour.

Each FTE was assumed to use 20 gallons of water per day. The operating year for water use was taken as 252 days. The total water used was the sum of that used by the processing equipment and that used by the O&M personnel.

Total Disturbed Area (in acres). The disturbed area required for an individual module was assumed to encompass a space with sides 10 feet from the area needed for processing or other activities. The module was assumed to be rectangular with sides in a ratio of 4:1. The disturbed areas for each module were summed and the area of the parking lot added to yield the total disturbed area for the plant.

Plant Area (in acres). For each module, this value represents only the area needed for conducting the stated operation. The total facility area is a simple sum of the individual module areas that make up the facility.

Estimate Basis: Three different module sizes were used to baseline the cost rollup and resource use data for most modules. Only two sizes were used in a limited number of cases. The area required by any module can be obtained by calculating a regression curve relating the three baseline sizes to their throughput capacity. The area needed for any other module was then obtained from this curve, based on the throughput capacity of the module in question. A scaling factor was applied in instances where the throughput capacity of the module in question was outside the range of the baseline facilities.

Parking Area (in acres). Parking space was assigned to each FTE. Visitor parking was accounted for by assuming 15% of the FTEs will carpool. Unload/offload parking was assumed to be included within the plant area.

Estimate Basis: The number of FTEs was obtained from the cost rollup data by dividing the total number of O&M FTEs by the number of operating years. A total of 400 square feet was assigned to each FTE. This total included both parking area and maneuvering room.

Total Number of Worker Years (in FTEs). This value, in FTEs, was taken from the cost rollup data. An FTE represented one person working an 8-hour shift for 1 year composed of 252 days.

Hours per Week for Labor (in hours). A total of 40 hours was assumed.

Operating Labor (as a percentage of total skills). This value was taken as the total labor pool (i.e., the total number of O&M FTEs) less the number required for maintenance.

Estimate Basis: The average annual number of FTEs needed for both operations and maintenance was obtained from the cost rollup data. This number is equal to the total number of O&M FTEs divided by the number of operating years assumed for each module. The percentage of FTEs used for operating labor was obtained as follows: First, maintenance labor cost was calculated based on the equipment cost (see below). Next, the number of annual FTE maintenance employees was obtained by assuming each worker has an expense of $140,000 per year. The annual number of FTE operating personnel was obtained by subtracting the number needed for maintenance from the total average annual number of O&M FTEs. The ratio of annual operating FTEs to the total annual average O&M FTEs yielded a percentage.

Maintenance Labor (as a percentage of total skills). Annual maintenance labor was assumed to be equal to a percentage of the equipment cost plus a contingency factor. Equipment costs were obtained from the cost rollup data.

Estimate Basis: The annual number of maintenance FTEs was calculated as follows. First, the maintenance costs for labor were estimated by assuming that the labor costs are equal to 250% of the maintenance material costs for each module. The maintenance material costs were taken as a percentage of the equipment cost (between 3% and 7% depending on the module). By assuming each FTE cost was $140,000 per year, the total number of maintenance FTEs was calculated. The ratio of annual maintenance FTEs to the total annual average O&M FTEs yielded a percentage.

Maintenance ($×1,000). Annual maintenance costs were composed of two factors, material and labor. These values were estimated as a percentage of the cost of the equipment.

Estimate Basis: Maintenance cost was based on the equipment cost. It is assumed that 3% to 7% of the equipment cost was spent annually for maintenance materials, and the cost of maintenance labor is 2.5 times the material costs. To derive the total maintenance cost, a 25% contingency factor was added to this sum.

Operations ($×1,000). Operating costs constitute all costs needed except those required for maintenance.

Estimate Basis: The total annual cost of O&M was obtained from the cost rollup analysis. The annual cost was obtained by dividing the total cost by the number of operating years assumed for each module. The number of operating years was also obtained from the cost rollup data. The annual cost of operations was obtained by subtracting the maintenance costs (from above) from the annual O&M cost.

C.3.1.2 Resources Associated With Portable Modules

Small generator sites typically generate very small quantities of certain wastes. Where portable modules were used (TRUW and LLMW), resource consumption was identified for each portable module and its contribution was rolled up into the site resource totals.

C.3.1.3 Resource Data Estimate Methodologies for WM PEIS Alternatives

To analyze resources, the PEIS waste volume data were first divided into four waste types: LLW, LLMW, TRUW, and HW. These waste types were then subdivided into cases to analyze the alternatives. The cases were subdivided according to handling characteristics, sites, and construction or operations activities. Generic technology modules were identified and sized to meet the treatment, storage, and disposal requirements for each case. Resource data results were compiled for each alternative by summing the various resource data components for each module, then summing the module results for each site (DOE, 1996a).

For some alternatives, supplementary extrapolation methodologies were applied. The data for these alternatives were obtained from similar data computed as described in Sections 3.1.1–3.1.3, then scaled

based on either cost or waste processing rates. The supplemental resource methodologies used for LLW, LLMW, TRUW, and HW can be found in *Waste Management Environmental and Socioeconomic Impacts Methods and Results* (DOE, 1996a).

C.3.2 COST ESTIMATING

Costs were estimated using an approach that tied the cost of facilities and transportation to waste quantities. In addition, DOE used costs associated with existing technologies and historical industrial cost experience for estimating purposes.

C.3.2.1 Cost-Estimating Process Details

Each alternative includes a definition of the assumed technologies for the complete treatment process. For each site and each alternative, wastes were hypothetically routed through the waste management process, and the modules were individually sized to handled the processing requirements. Since many sites have existing treatment, storage, and disposal capabilities (INEL, 1994), the analyses accounts for existing facilities to minimize additional construction requirements. However, only O&M costs were estimated for existing facilities.

C.3.2.1.1 *Waste Management Facility Cost Information Reports*

The PEIS used a set of reports, collectively referred to as the "WMFCI reports," to develop cost and manpower estimates for the various alternatives and cases being considered. These reports were prepared for DOE by EG&G Idaho to provide a generic facility costing and resource use estimating methodology for programmatic analysis of treatment, storage, disposal, and inter-site transportation of radioactive and hazardous waste. The WMFCI reports consist of the following:

- Data extracts of the detailed facility equipment and construction estimates and other costing factors applied to base estimates for waste types
- Management analysis reports summarizing the findings of the data extract reports according to waste type

- Procedural reports that describe how to compute costs and manpower for the modules used for the treatment, storage, and disposal of waste types
- Data reports computed by PEIS alternative/case by waste type for cost and FTEs, and for resource consumption data supporting the environmental impacts analysis

The WMFCI reports provide a consistent and defensible basis for generating life-cycle cost information for treatment, storage, and disposal facilities using specific data for each major waste type. The WMFCI reports present cost and manpower information reports for LLMW, LLW, TRUW, and HW (INEL, 1995a-d). Within the waste-type categories listed above, cost information was developed for alpha-contaminated wastes (both LLW and LLMW) and remote-handled (RH) waste (LLW and TRUW). For some treatment processes, costs for portable systems were developed for non-alpha contaminated waste (LLW and LLMW); these were deemed more realistic and lower cost approach for treating extremely small waste loads. A separate report (INEL, 1995e) was developed to provide a cost computation methodology applicable to the shipment and routing information provided in Appendix E for the transportation of radioactive and hazardous wastes. A full listing of WMFCI reports is provided in the references cited section of this appendix.

The WMFCI reports were developed specifically for DOE-owned facilities. The cost-estimating used in the reports included provisions necessary to comply with all applicable regulatory requirements for a particular waste type and to meet the requirements of all applicable DOE orders. Indirect costs and overhead burden rates used in the WMFCI reports were based on those historically encountered at DOE's Idaho National Engineering Laboratory (INEL), which fall approximately in the middle of the range of cost factors found at several other DOE sites and which are, therefore, considered to be representative for complex-wide estimating purposes.

C.3.2.1.2 *Modular Estimating Approach*

To facilitate the development of comprehensive cost estimates covering cradle-to-grave management of wastes, the WMFCI reports categorized all necessary WM activities into a series of modules, each representing a discrete facility that carries out a single WM function. A unique set of cost information was developed for each WMFCI module (see Table C.3–1). Within a given module, a series of unit operations necessary to accomplish the specified function was defined in sufficient detail to enable development of the

Table C.3-1. Facility Cost Modules Included in WMFCI Reports[a]

Module	LLW	LLMW	TRUW	HW
Treatment Front-end Support	x	x	x	x
Small Generator Front-End/Back-End Support	x	x		
Waste Characterization			x	
Packaging	x	x	x	
Stored Waste Retrieval			x	
Receiving and Inspection	x	x	x	x
Open, Dump, and Sort	x	x	x	
Assay, Sort, and Package				x
Maintenance	x	x	x	
Incineration	x	x	x	x
Aqueous Waste Treatment		x	x	x
Neutralization	x		x	
Shredding/Compaction	x	x	x	
Supercompaction	x			
Metal Melting	x	x		
Wet-Air Oxidation		x		
Thermal Desorption		x		
Debris Washing		x		
Soil Washing		x		
Lead Recovery		x	x	
Mercury Separation		x	x	x
Organic Removal				x
Deactivation		x	x	x
Special Waste Processing	x	x	x	
Recycling				x
Organic Stabilization			x	
Grout Stabilization	x	x	x	x
Polymer Stabilization	x	x		
Vitrification	x	x	x	
Certification and Shipping	x	x	x	x
Storage Front-end and Back-end Support	x	x	x	
Storage Receiving and Shipping			x	
Storage	x	x	x	
Silo Storage	x		x	
Disposal Front-end Support	x	x		
Engineered Disposal	x	x		
Shallow Land Disposal	x	x		x
Silo Disposal	x	x		
Borehole Disposal	x	x		

[a] HLW facilities are covered in a separate report (ANL, 1996b) but included only storage facilities.

planning level cost information. For example, the incineration module included each of the following unit operations: feed preparation, incineration, secondary combustion, and off-gas treatment. The array of unit operations is sufficiently broad to accomplish the incineration tasks required by the identified waste inventories.

Once a particular WM alternative-based scenario was defined, a series of modules was selected that best represented all activities required to accomplish the necessary WM functions. Some scenarios may have required only 1 or 2 modules to fully define the WM functions, while others may have required 10 or more modules to capture all necessary functions. This modular approach to establishing the cost-estimating basis provided maximum flexibility; thus, the WMFCI was designed to be the full used to support a broad range of WM options.

Design of the WMFCI was based on standard, proven technologies and WM approaches. The modules represent a variety of treatment, storage, disposal, material handling, and support facilities, that were developed for all major DOE waste streams. The cost modules, are listed by waste type in tables found in (INEL, 1996).

Facility costs were established on the basis of the costs of DOE facilities (primarily at INEL) and commercial facilities. To the extent possible, equipment costs for each facility module were compared with data from anchor facilities to establish a cost confidence level with the boundaries established for programmatic life-cycle cost estimates. Both DOE and the commercial nuclear industry are now planning or operating similar facilities. These facilities were surveyed to obtain capacity and cost data and other information needed to support the cost methodology data. Before using these costs, the data were adjusted to account for capacity differences and escalation.

Additional assessment activities included a review of existing DOE facility capital and operating costs for comparison with the cost methodology data. Existing DOE facilities that have been evaluated include the Waste Experimental Reduction Facility (incineration, shredding, and compaction) at INEL; the Controlled Air Incinerator at Los Alamos National Laboratory; the Toxic Substances Control Act (TSCA) Incinerator at Oak Ridge Reservation; the Supercompactor and Repackaging Facility at Rocky Flats Environmental Technology Center; the Radioactive Waste Management Complex (LLW disposal) at INEL; and the Transportable Waste Water Treatment Unit from the Uranium Mill Tailings Remedial Action Project. Planned DOE facility costs at INEL were also evaluated for the Radioactive Waste Storage Facility, the

Waste Characterization Facility, the Idaho Waste Processing Facility, and the Mixed Low-Level Waste Treatment Facility.

Other facilities evaluated include the Illinois Compact Low-Level Engineered Disposal Facility and the Commonwealth of Massachusetts Low-Level Radioactive Waste Disposal Facility.

Cost estimates for facility components were adapted from commercial sources (INEL, 1995b-d, 1996). Commercial facilities evaluated include conceptual designs and cost estimates for air- and area-monitoring units from Eberline Corporation of Santa Fe, New Mexico; amalgam mixers from Miracle Paint Rejuvenator of St. Paul, Minnesota; blending equipment from Velmac Associates, Inc., of Novato, California; calciner/kiln units from ABB Raymond, Inc., of Lisle, Illinois; chemical oxidation units from Peroxidation System, Inc., of Tucson, Arizona; compactor units from Stock Equipment Company of Chagrin Falls, Ohio; concentrator units from LCI Corporation of Charlotte, North Carolina; drum capping and washing units from Stock Equipment Company of Chagrin Falls, Ohio; dry off-gas filters from Pall Advances Separation Systems of Cortland, New York; dry and wet off-gas treatment trains from NGK-Locke, Inc., and Callidus Technologies; drying equipment from Wyssmont Co., Inc., of Fort Lee, New Jersey; extruder equipment from Sterling Extruders, Davis-Standard Division of Edison, New Jersey; gross-organic removal units from McTighe Industries, Inc., of Mitchell, South Dakota; incineration packages from Joy Energy Systems of Charlotte, North Carolina, and ABB Raymond, Inc., of Lisle, Illinois; quencher and scrubber (wet scrubbing) units from Croll-Reynold Company of Westfield, New Jersey; melter units from Ajax Corporation and Retec Corporation; preparation and feed units from various vendor quotes; processing equipment from the U.S. Navy LLW processing facility of Lynchburg, Virginia; open, dump, and sort devices and robotic arms in consultation with personnel from DOE contractors involved with the Office of Technology Development, Robotic Technology Development Program; organic stripper units from APV Crepaco, Inc., of Tonawanda, New York; radiological and hazardous material measurement systems from conceptual designs and cost estimates provided by Lockheed-Martin; segmented gamma scanning (SGS) assay systems data from Atlan-Tech Corporation, Inc., of Roswell, Georgia; shredder units from Komor Industries, Inc., of Groveport, Ohio; feeder/shredder units from System Service Solutions of Wilsonville, Ohio; retort units from Denver Mineral Engineers, Inc., of Littleton, Colorado; size reduction and baler systems from Stock Equipment Company of Chagrin Falls, Ohio; selected solidification units from Stock Equipment Company; solidification module assemblies from Stock Equipment Company; stack monitoring units from Eberline Corporation of Santa Fe, New Mexico; suspended-solids filtration systems (Membralox) from U.S. Filter Corporation of Warrendale,

Pennsylvania; thin-film evaporator units from LCI Corporation of Charlotte, North Carolina; washing equipment from CF Systems (a subsidiary of Morrisen-Knudson); wet oxidation units from Zimpro of Rothchild, Wisconsin; and the commercial treatment and disposal processes for hazardous wastes from various vendors (INEL, 1995a-d).

C.3.2.1.3 *Cost-Estimating Basis*

A "bottom-up" estimating approach was used to develop the WMFCI unit costs. Initially, a capacity range for each facility cost module was established by studying the currently stored and future projections of DOE waste volumes. Process functional diagrams and facility layout drawings were developed at the individual unit operation level. After all unit operations required for a module were defined, major equipment lists, building configurations, and square footage requirements were established, and cost estimates for each facility were developed.

Data from the study defined baseline capacities for five facility sizes: portable, minimum-fixed, small, medium, and large. Using the five facility sizes, a generic design package for each cost module was developed and used as the basis for the Program Life Cycle Cost (PLCC) estimates. Each design package included a summary functional and operational requirements description, a process functional diagram with mass flow rates, a facility layout, manpower requirements for the processes, and cost and manpower (FTE) capacity-to-requirement curves. The design packages used as much available data from existing or planned DOE facilities as possible. This approach, referred to as "anchoring," provides the reference point used to estimate the various cost components. New designs were generated only if no existing data were available.

C.3.2.1.4 *Cost Components (Work Breakdown Structure)*

The costs for each WM facility included the following four components (each estimated separately): (1) pre-operational activities, including the costs of studies, demonstrations, generic designs, permitting, and startup; (2) facility construction, including definitive design, equipment and building, and construction labor costs; (3) O&M costs; and (4) decontamination and decommissioning (D&D) costs. Usages were determined separately for resources used during the construction period (which includes pre-operations and

construction) and resources used during the period of operations (which includes O&M and D&D). Life-cycle costs do not include speculative factors such as potential impacts on the long-term value of land.

Resource usage was estimated for all treatment, storage, and disposal facilities configured at each site for each waste type under each alternative. Building unit costs for various functions were developed by generating detailed material quantities, labor hours, and related costs for construction, using rates applicable to INEL. These building functional unit costs were multiplied by the functional floor space required within each module. The functional cost subtotals were summed to give a total building cost for each module.

Equipment costs were estimated either by soliciting budgetary costs from suppliers, by using existing data, or by making engineering judgments. Costs for the other three components of the estimate (operating budget-funded activities [pre-operation], O&M, D&D) were obtained from actual costs of existing facilities and from engineering estimates. These cost components do not include various site costs for the supporting infrastructure and basic site services known as "chargebacks." The allocation rules for chargebacks are site-specific and provide a similar site effect for all alternatives. They do not affect the relative cost ranking of the alternatives, and are not included in the PEIS.

To provide a comprehensive analysis of the WM facility requirements for support, the facilities required to manage the waste (for example, administration and maintenance) were also provided as separate facility cost modules. This approach facilitated analysis of scenarios that involve existing facilities where none, some, or all of the administrative functions may have already been in place.

C.3.2.1.5 *Cost Estimates Development*

To assist in application of the WMFCI, the baseline cost/capacity relationships defined for each cost module were translated into parametric cost relationships. These relationships were defined by linear and log-linear equations that uniquely define the costs over a broad range of capacity requirements. Each facility module had specific cost equations that defined the pre-operations costs, facility construction costs, O&M costs, and D&D costs. The cost relationships allowed the WMFCI to be consistently applied over a wide range of estimating scenarios.

Both DOE and the commercial nuclear industry have facilities similar to some of the cost modules examined by the WMFCI. Several facilities (for example, incinerators, metal-melters, supercompactors, spent nuclear fuel storage, and engineered disposal) were surveyed to obtain functional and operational requirements, capacity limitations, capital and operating costs, and other information needed to provide a basis for the WMFCI data.

To the extent possible, major equipment costs in each cost module were taken from similar facilities that had been constructed or that were in the advanced design stage. Before using costs from existing facilities, the data were adjusted to account for capacity differences and escalation. These cost validation steps established a cost confidence level for the PLCC estimates of plus or minus 30%.

Facility construction costs were based on the current cost-per-square-foot rates for five typical building functional envelopes defined by use—low hazard, moderate hazard, alpha-treatment, storage, and disposal functions—planned and under construction at INEL.

Indirect costs and overhead burden rates used in the cost-estimating methodology were based on those historically encountered at INEL. They fall approximately in the middle of the range of cost factors found at several other DOE sites and were therefore considered to be representative for complexwide estimating purposes.

C.3.2.2 WM PEIS Cost-Estimating Methodology

C.3.2.2.1 *Description of Alternatives*

Cost estimates for each PEIS alternative were developed at the module level for each site within the DOE complex. For a given WM alternative, every site with waste of that type played a role in management of that waste and consequently incurred some cost. The roles of the various sites could have ranged from simply packaging and shipping their own wastes to treating and disposing their own wastes and wastes from other sites. The contribution each site made toward the cradle-to-grave management of a given waste type was defined in each alternative through designation of treatment, storage, and disposal locations for each site's waste. The alternatives generally covered the range of possible configurations from a centralized waste

management strategy to a decentralized scenario. Other parameters that were also varied within the alternatives analyzed for a particular waste type included the level of treatment performed and the final waste form produced. Therefore, for each alternative, a unique set of responsibilities was defined for each site; this established the activities that had to be performed at each site and provided the basis upon which the cost estimates were developed.

C.3.2.2.2 *Waste Loads Development*

Once the WM activities to be performed at each site were defined for a particular alternative, the quantity of waste to be processed or handled through each module was calculated. This step was accomplished using a set of "raw" data that accounted for all waste stored and generated at each site. The waste information included quantities of waste currently in storage and projections for future waste generation. Each classification of waste (LLW, LLMW, TRUW, and HW) was broken down into "treatability groups." The treatability groups, based on the characteristics of the waste, helped to define which treatment processes were necessary to meet regulatory requirements for that waste type. (The generic configurations of processing modules necessary to treat, store, and dispose each waste treatability group were discussed earlier.) The raw data were transposed into the waste loads for each facility by applying the constraints and assumptions integral to the configuration designated for each alternative. Once a time factor was incorporated (for example, a 10-year operating period), the waste load for each module became a waste processing rate. The processing rates (throughput capacities) for each module was used to determine facility size and was the key factors used in developing the cost estimates.

C.3.2.2.3 *Existing Facilities Assessment*

A survey of existing and planned-or-approved WM facilities at each site, and their capacities, was performed to provide the baseline for cost-estimating purposes. Where existing capacities were identified, the total required operating capacity was reduced by that amount so that only the minimum necessary new facility construction was costed. Since existing facilities and their capacities were taken into account, the cost estimates developed for each alternative could be considered to be representative of actual future capital investments necessary to provide the additional capabilities required for the WM operations outlined in each alternative.

In some alternatives, where a homogeneous waste stream was currently being treated in a dedicated facility and actual operating costs were known, these actual costs were used in the PEIS cost estimates (rather than using bottom-up cost estimates for generic facilities designed to treat the same waste).

C.3.2.2.4 *Parameters and Assumptions*

The PEIS alternatives generally assumed that a 10-year implementation period was necessary to construct and start up the new WM facilities required for each alternative, and that a 10-year operating period would be used to work off the projected waste inventories. For new facilities, the costs of decontamination and demolition were included; for disposal facilities, the costs of custodial care after closure throughout a 300-year period of institutional control were included, but were not substantial.

Costs under the No Action Alternative for each waste type were estimated using a unique set of assumptions. The No Action Alernatives (with some exceptions for storage and disposal) used existing facilities for 20 years. This assumption was made to quantify the amount of useful facility life remaining in currently existing facilities. The assumption allows the current facilities to be considered for the complete 20-year period of analysis. Where projected waste loads exceeded existing treatment facility capacities, waste was assumed to be stored.

The HW alternatives were assumed to use commercial treatment contractors for 20 years; possible regional on-site treatment and disposal costs were also evaluated.

Costs associated with treating quantities totaling less than 0.1 pounds per hour or disposing quantities totaling less than 0.1 cubic feet per hour were considered to be insignificant and costs were not developed. These volume totals equate to treating a drum or less of waste per year and disposing 60 drums (one semi-trailer load) or less of LLW or LLMW per year. In such instances, bench-top-type treatment, or shipment to another facility, would be likely to occur.

The receiving and inspection module was used only for wastes received from another site for regionalized or centralized treatment. It was assumed that wastes generated on site would be characterized to the extent that inspection would not be required and that the waste could be transported directly to the treatment facility. Representative sampling of onsite waste characterization was assumed to be performed as necessary

through a variety of modules: certification and shipping (found at all sites), administration—with laboratory—(found at all treating, storing, and disposing sites), and waste characterization (found at all TRUW sites).

The "open, dump, and sort" module was used only for waste volumes currently in storage. It was assumed that these containerized wastes are heterogeneous and would need to be sorted before treatment. It was further assumed that wastes presently being generated or to be generated in the future would be segregated by treatment need and would not require sorting.

Except for TRUW, it was assumed that treated wastes would be accumulated in small batches (railcar or truckload quantities) and would be shipped directly for disposal, eliminating the need for storage. For TRUW, it was assumed that shipment could not be made directly to WIPP; therefore, costs were estimated for one year of storage before transportation to WIPP.

C.3.2.2.5 *Application of the Waste Management Facility Cost Information Methodology*

Curves for cost-versus-capacity and FTEs-versus-capacity were developed for each module through a bottom-up estimating method. These curves were developed over a finite range of capacities (referred to as the "standard capacity range") that, at the time the range was selected, would fit the anticipated cost-estimating needs. The standard capacity range selected was specific to each module. Cost versus capacity curves were developed for equipment (including installation), building requirements, operating labor, and operating materials. From these curves all other costs were determined through application of various cost factors. Combining all derived costs produced the life-cycle costs for each module. Costs for all modules were based on a 48-week year, three shifts per day, 5 days per week, and 70% availability, for a total operating period of 4,032 hours per year. The 4,032-hour year is a "rating" of achievable production capacity possible in a full 52-week workyear.

Curves for cost versus capacity were developed for numerous modules handling contact-handled (CH) LLMW, CH alpha-LLMW, RH LLMW, CH LLW, CH alpha-LLW, CH TRUW, RH TRUW, and HW. FTEs-versus-capacity curves were determined by applying a factor to the costs for an appropriate category.

With the release of updated waste data, the need for costs at capacities outside the standard capacity range of developed data became necessary. The following methodology was used to estimate the costs when the capacities fell outside the standard range for any particular module.

C.3.2.2.5.1 Costs Determination for Treatment Outside Standard Capacity Range

To estimate the costs for a treatment module at a throughput capacity falling below the standard range, the following extrapolation method was used. An "economy of scale" function was assumed to exist beyond the upper and lower bounds of the capacity-to-cost curve (developed as discussed above). The upper and lower bounds were the waste processing throughput capacities of the largest and smallest standard commercially available processing equipment for the particular module being adjusted. The basic formula is shown below:

[Cost for higher/lower capacity] = [Cost for high/low bounding point] × [(waste throughput capacity of higher/lower requirement)/(waste throughput capacity of high/low bounding point)] $^{0.7}$

The ratio of required throughput capacity to the throughput capacity of the high or low bounding point of the capacity-to-cost curve was raised to the 0.7 power. The use of the 0.7 power scaling factor was based on estimating methods presented by Peters and Timmerhaus (1968) and Remer and Chai (1990). The resulting value was used to adjust the cost of the equipment, building requirements, operating labor, and operating materials. These adjusted costs were then used to estimate the costs associated for the lower-than-standard capacity (to eliminate unrealistically small modules). A module was never scaled down to below 10% of the smallest capacity in the standard range. Similar judgment would have been used when scaling to modules several times larger than the upper bounding capacity; however, waste loads never became that large, so this approach was not tested.

For the incinerator module and the small generator front-end support module, costs were developed for a module of "minimum" size designation. This represented the smallest module size that could be constructed with off-the-shelf equipment. A slightly different approach was used to estimate costs. For capacities falling between the minimum capacity and the lowest capacity in the standard capacity range, the costs were determined by the method described above. For capacities falling at or below the minimum, the "minimum module" capital cost was used and operating costs were scaled down from the minimum capacity using the

0.7 power factor method. To eliminate an unrealistically small module for very small capacity requirements, the number of shifts was limited to 0.1 shift per workday.

For seven other non-alpha modules (aqueous waste treatment, wet-air oxidation, thermal desorption, deactivation, lead recovery, mercury separation, and polymer stabilization), the minimum module was the same as the lowest capacity in the standard range. Costs for these seven modules were treated in a parallel manner as stated for incineration (above). For capacity below the range associated with these seven modules, capital costs from the minimum module were used and the operating costs were scaled down from the minimum capacity using the 0.7 power factor method.

To determine the costs of an AGDSP or an SLDSP at a capacity falling below the standard range (18 to 126 cubic feet per hour), the following extrapolation method was used. For disposal capacities within the standard capacity range (1.44 to 5.9 cubic feet per hour) for the SIDSP, costs for silo disposal were used. For disposal capacities falling between the standard ranges of the SIDSP and the AGDSP or SLDSP (5.9 to 18 cubic feet per hour), the ratio of the actual capacity to the lowest capacity of the AGDSP or SLDSP standard capacity range was raised to the 0.7 power. The resulting factor was used to adjust the cost of the equipment, building requirements, operating labor, and operating materials. These adjusted costs were then used to estimate the associated costs. For disposal capacities falling below the standard capacity range of the SIDSP, costs were determined by scaling down with a factor developed by taking the ratio of the actual capacity and the smallest capacity in the standard range for the SIDSP raised to the 0.7 power.

C.3.2.2.5.2 Portable Module Costs

Small generator sites typically generate very small quantities of certain wastes. To treat these small quantities, installation of permanent treatment facilities would not always be cost effective. To handle these small quantities, portable treatment modules were identified as an economical alternative. Portable modules were used for certification and shipping, decontamination, polymerization (which is capable of performing grout stabilization for very small volumes), thermal desorption, and wet oxidation (which could substitute for incineration for very small volumes).

Costs for portable treatment modules were developed based on processing 2.5 cubic meters of waste per treatment campaign. Waste to be processed was assumed to have an incoming density of 40 pounds per

cubic foot for all modules, except aqueous waste, which has a density of 62.4 pounds per cubic foot. Each treatment campaign was assumed to require 2 weeks, including setup, processing, and shutdown. Counting travel time and equipment maintenance time, the number of campaigns was limited to 12 per year. (If waste quantities were sufficiently high to exceed 12 campaigns per year, permanently installed modules were estimated.) The portable equipment was assumed to have a useful life of 5 years, or 60 campaigns. A host facility (warehouse, garage, or similar structure) with suitable utility support was assumed to be required.

Costs associated with portable modules were developed on a campaign basis. Each portable module has its unique campaign cost, computed to include all programmatic life-cycle cost components.

C.3.2.2.5.3 Supplemental Cost-Estimating Methods

For most WM alternatives, costs, manpower, and resource use data were computed using the above-described methodology. The computations were made by selecting the same data results from cases estimated using the WMFCI methods in LLW Cases 5, 7, 12, and 14 for cost/manpower and in Cases 1, 2, 4, 5, 7, 12, 14, and 14a for resource data; in HW Case 1 for cost/manpower and Cases 1 and 2 for resource data; in TRUW Cases 1, 10, and 11 for resource data; and in LLMW Cases 1, 7, 10, and 17 for resource data. For certain data points, exact matches did not exist; in such instances, data were scaled linearly, using waste processing throughput proportions, from the nearest data point computed using the WMFCI method. These computations are summarized in *Data Collection on Existing and Planned/ Approved Waste Management Facilities in Support of the EM PEIS* (INEL, 1994). Resource use data estimates were discussed in Section C.3.1.

Where modifications to the originally computed data were required because of changes in costing assumptions, a similar "exact selection, or scaling from closest data point" method was used. These computations have been summarized (INEL, 1996).

In the case of HLW, cost and manpower estimates for canister storage and transportation were abstracted from the many cost studies performed for vitrification of HLW at the West Valley Demonstration Project (WVDP), Savannah River Site (SRS), Hanford, and INEL. A summary of these findings is found at Section C.3.2.2.8.

C.3.2.2.6 *Transportation Cost Estimates*

Transportation costs were calculated for each alternative using mileage between sites (either by highway or rail) and mass quantities requiring shipment. Transportation costs were included for waste shipments between generator sites and treatment sites, between generator sites and disposal sites, and between treatment sites and disposal sites. Costs were compiled for each alternative for both truck and rail transportation. Transportation costs for most waste types were computed using linear regression formulas, where a fixed cost per trip (depending upon waste type) was multiplied by the number of shipments and added to a variable cost-per-loaded-mile multiplied by the total shipping mileage. The fixed and variable costs per waste type and the background of the transportation cost-estimate development are provided (INEL, 1995e). The cost-estimating process for the transportation of HLW is found at Section C.3.2.2.9.

C.3.2.2.7 *Quality Assurance*

The PEIS cost estimates were compiled for each alternative, and the detailed estimating backup information is documented in data packages retained in the PEIS engineering files. Each cost data package was thoroughly reviewed before publication of any cost results. The quality reviews verified that the estimating methodology was correctly and consistently applied, that the assumptions and alternative descriptions were followed, and that the results provided reasonable PLCC that can be used to compare the relative costs of the various alternatives.

C.3.2.2.8 *Cost-Estimating Procedures for High-Level Waste Canister Storage and Transportation*

The generic cost methodology used was modified to reflect the specific assumptions for HLW. These modifications are discussed below.

C.3.2.2.8.1 Methodology and Assumptions

The life-cycle costs for facilities used for treatment, storage, and disposal are incurred from the beginning of the period of analysis, lasting for 20 years. The decontamination and decommissioning costs for new treatment and storage facilities, and custodial costs of disposal facilities, are also included. The total life-cycle costs include all costs associated with waste handling following its generation, current storage and treatment, transportation, future disposal and monitoring. The WM PEIS does not provide cost analysis of the current storage of HLW, pretreatment and treatment of HLW (resulting in canisters of vitrified waste), or environmental impacts of HLW disposal. The WM PEIS does provide cost analysis of the storage of canisters and the transportation to storage sites and a candidate geologic repository. Because of the possibility of a prolonged delay of HLW disposal, two sets of timing assumptions for acceptance of HLW at the candidate repository were analyzed.

Projecting the cost of the HLW alternatives involved developing estimates of the individual cost components. The cost was divided into two components—capital investment and annual operating charges. The capital cost of a facility was assumed to include process equipment, construction materials (for example, steel and concrete), and labor, as well as indirect costs such as those for design, contingencies, and environmental compliance. The annual O&M costs were expenses estimated for O&M staff, fixed and variable supplies, annual operating fees, administration, and general expenses. These two cost components were estimated by reviewing and abstracting available data on the costs of storage and transportation of HLW (ANL, 1996b).

C.3.2.2.8.2 Canister Storage

Vitrified HLW from Hanford, SRS, WVDP and INEL would be placed in on-site storage facilities awaiting transport to the candidate geologic repository. The WM PEIS alternatives for HLW management include: (1) No Action—Continued storage (assumed for 30 years), (2) Decentralized—All sites provide storage for canisters until the candidate geologic repository begins accepting DOE HLW in 2015, with shipments beginning in 2016; (3) Regionalized 1—WVDP ships its canisters to SRS for storage until transportation to the candidate repository starting in 2016; (4) Regionalized 2—WVDP ships its canisters to Hanford for storage until transportation to the candidate repository begins in 2016; and (5) Centralized—WVDP, SRS, and INEL ship their canisters to Hanford for storage until transportation to the candidate repository begins

in 2016. For the alternatives, the assumption was made that the approval of the candidate repository will occur in a timely manner so that the amount of storage facilities to be constructed could be kept to the minimum required.

The second set of timing assumptions is configured identically to the No Action, Decentralized, Regionalized 1, Regionalized 2, and Centralized Alternatives, except that acceptance of DOE HLW at the candidate repository is deferred past 2015, requiring the construction of storage facilities at each site capable of holding the full amount of canisters to be stored at that site. These alternatives are costed assuming that the approval of the candidate repository is made in time to begin transportation in 2016 but after each site has completed construction of storage facilities for all canisters produced at that site. Further deferrals of the decision will increase the total cost of storage. Depending upon the alternative, the costs for storage operations will increase by an additional $8 million for every year past 2015 that acceptance of HLW canisters at the candidate geologic repository is delayed.

The storage technology selected for costing is the modular dry vault storage (MDVS) concept. It is assumed that the interim canister storage facility at Hanford and at SRS for the vitrified HLW would hold canisters in vertically sealed cavities within a concrete structure forming the storage vault. Each canister storage vault (CISV) will be an air-cooled dry storage vault for vitrified HLW. A thermosyphon ventilation system would be used to remove heat generated by the stored vitrified HLW. Activities at a given CISV include receipt and unloading of transportation cask containing canister(s) of vitrified waste, inspection of the canister, and storage of the waste until transfer to a permanent geologic repository. The CISV consists of rows of tubes or vaults laced below grade into which the canisters are lowered. Concrete plugs provide a cover for the tubes. The canisters are to be stored in sealed sleeves so that the cooling air would not directly come into contact with the potentially contaminated surfaces of the HLW canisters. Although the design for storage of canisters at INEL has not been decided, the PEIS assumed the storage technology to be the same as that for Hanford and SRS. Because the storage facility has been constructed at WVDP, these costs are not included in the PEIS analysis.

The rationale for costing the construction and operations of these facilities is provided (ANL, 1996b). The cost experience for monitored retrievable storage facilities was modified to the above concept. The below formula was developed to estimate capital costs:

$$[\text{Capital Cost (\$ million)}]_{MVDS} = 0.71\ [\text{Capacity (HLW Canister)}]^{0.53}$$

Annual O&M costs include the routine handling, storage, and retrieval, with the predominance of costs pertaining to the operation of facilities. The operating lifetime of the various storage facilities varies depending upon the transportation instruction for each Alternative. The correlation of the annual operating costs for the storage period as a function of capacity is:

$$[\text{Annual O\&M Cost (\$1,000/yr)}]_{\text{Storage}} =$$
$$38.6 + 0.27 \times [\text{Capacity (HLW canisters being stored)}]$$

Loading/unloading operations were evaluated in the reference; the following formula was developed:

$$[\text{Annual O\&M Cost (\$1,000/yr)}]_{\text{Loading}} = 770 \times [\text{Throughput (HLW Canisters shipped/yr)}]^{0.52}$$

With respect to the shipping rate to be assumed for the various alternatives, the loading rate into storage is taken to equal the maximum annual vitrification rate (190 canisters per year for SRS, 790 canisters per year for Hanford (No Action is 320 canisters per year), 300 canisters per year for WVDP, and 327 canisters per year for INEL). The total time for unloading the HLW canisters before shipment to the candidate repository is assumed to be performed at a rate of 800 canisters per year. The loading/unloading duration is dependent upon the shipping rate.

The quantities and timings shown in Chapter 9 were applied to the formulas C-1, C-2, and C-3, and totaled for each alternative under both sets of timing assumptions. The computation summaries are provided (INEL, 1996).

C.3.2.2.9 *Transportation of Vitrified HLW Canisters*

The rationale for costing transportation of HLW canisters between sites is provided in ANL (1996b). Based on numerous reports, there is general agreement that transportation costs for HLW would be similar in cost for spent nuclear fuel. The life-cycle cost for HLW transportation can, in general, be calculated by summing the following cost categories: shipping cost; security cost; cask, capital and decommissioning cost; cask maintenance cost; inspection cost; demurrage cost; handling cost (loading and unloading); and transportation support system costs.

The following assumptions were made for the HLW transportation cost analysis:

- The costs associated with the inspection cost category are included in the annual operating charges for the various HLW storage facilities.
- Demurrage (the charge for the detention of a freight car or truck by the shipper or receiver beyond the time allowed for loading, unloading, or shipping) is assumed to be negligible in comparison with other cost components.
- The handling cost for loading and unloading at the HLW storage facility has already been considered in the storage cost; the handling cost at the candidate repository is assumed to be out-of-scope for this PEIS.
- Transportation support system cost include the costs to maintain the railcars and trailers which are assumed to be negligible (average annual O&M cost for a truck trailer is approximately $14,000; for a rail car, $5,000).

Table C.3–2 presents the formulas used to compute truck and rail transportation costs.

C.4 Phase III: Environmental Impacts Evaluation

This section describes the scientific approach and analytical methods used to evaluate the impacts of the WM alternatives on air quality, water resources, ecological resources, the local and National economies and social environments, environmental justice issues, land use, infrastructure, and cultural resources.

The general impacts methods were applied as appropriate to analyze the effects of management alternatives for each of the five waste types. Construction and operation of treatment, storage, and disposal facilities and intersite transportation of wastes were the principal activities analyzed for impacts, as applicable (Table C.4–1) under each of the waste-type alternatives.

The engineering analysis Phase II output data served as the input data for the environmental impacts assessments. These engineering outputs included estimates of the costs, labor, and resources required to build and operate the WM facilities and estimated facility discharges of pollutants to air and water.

Air quality impacts were analyzed by comparing estimated pollutant increases to applicable standards for the Air Quality Control Region (AQCR) at each site. The analysis addressed criteria pollutants, airborne

Table C.3–2. Assumed Relationship for the Four Transportation Cost Components

Cost Variable	Relationship Assumed in This Study	
	Rail-Based	**Truck-Based**
SPEED (mph)	DIS/(0.04204 × DIS + 4)[a]	35 (i.e., a constant value)[b]
Annual Cask Requirement, ACR	$\sum \{[(2 \times DIS)/SPEED_{rail}]/24 + 2 \times (5\ days)\}$[c]	$\sum \{[(2 \times DIS/SPEED_{truck}]/24 + 2 \times (3\ days)\}$[c]
Shipping Cost, less than 1,000 miles (1985 dollars)	$\sum ([2.32 + 0.0067 \times DIS] \times 2{,}000) + ([2.15 + 0.0063 \times DIS] \times 1{,}800) \times [No.\ of\ Canisters]/5$[c,d]	$\sum ([1.493 + 0.0033 \times DIS] \times 500) + ([0.428 + 0.0034 \times DIS] \times 475) \times [No.\ of\ Canisters]$[c]
Shipping Cost, greater than 1,000 miles (1985 dollars)	$\sum ([5.07 + 0.004 \times DIS] \times 2{,}000) + ([4.72 + 0.0037 \times DIS] \times 1{,}800) \times [No.\ of\ Canisters]/5$[c,d]	$\sum ([-0.16 + 0.0049 \times DIS] \times 500) + ([-0.19 + 0.004 \times DIS] \times 475) \times [No.\ of\ Canisters]$[c]
Security Cost (1985 dollars)	$\sum \{291.65 \times [DIS^{-0.5987}] \times DIS\} \times [No.\ Of\ Canisters]/5$	$\sum \{7.93 \times [DIS^{-0.1855}] \times DIS\} \times [No.\ of\ Canisters]$
Cask Capital Cost (1985 dollars)[e]	$\sum (ACR/300) \times [No.\ of\ Canisters] \times (2.5 \times 10^5)$	$\sum (ACR/300) \times [No.\ of\ Canisters] \times (1.5 \times 10^5)$
Cask Maintenance Cost (1985 dollars)[f]	$\sum (ACR/300) \times [No.\ of\ Canisters] \times (2.5 \times 10^4)$	$\sum (ACR/300) \times [No.\ of\ Canisters] \times (1.5 \times 10^4)$

[a] DIS = distance traveled (one-way miles); is a function of WM PEIS alternative.
[b] Conservative value, based on DOE (1986); a value of 40 mph is cited in DOE (1991).
[c] The summations are to be performed over all shipping routes.
[d] Assumes five HLW canisters per rail shipping cask, one HLW canister per truck shipping cask (DOE, 1986).
[e] Assumes a capital cost of $2.5 million for rail cask, $1.5 million for truck cask (both in 1985 dollars) (DOE, 1986).
[f] Assumes an annual maintenance cost of $125,000 for rail cask, $75,000 for truck cask (both in 1985 dollars) (DOE, 1986).

radionuclides, and other hazardous and toxic air pollutants from construction and operation of WM facilities at each DOE site. Criteria pollutant increases from mobile (transportation) and stationary sources were evaluated, as applicable.

Water resources impacts were analyzed by evaluating the effects on natural water sources of the use or discharge of large volumes of water during construction or operation of WM facilities at each site. Water quality impacts were evaluated for hypothetical releases of waste, that could leach into groundwater the releases were assumed to come from deteriorating packages or containers in disposal facilities.

Table C.4-1. WM Actions Analyzed for Environmental Impacts

WM Action	Waste Type				
	LLMW	LLW	TRUW	HLW	HW
Treatment Facility Construction and Operation	✓	✓	✓		✓
Storage Facility Construction and Operation	✓[a]		✓	✓	
Disposal Facility Construction and Operation/(& Postclosure Effects)	✓	✓			
Transportation of Wastes Between Sites	✓	✓	✓	✓	✓
Waste Transport to Repository or Commercial Treatment/Disposal			✓	✓	✓

[a] For No Action Alternative only.

Ecological impacts were evaluated in terms of the potential for loss of habitat from site clearing for WM facility construction, indirect facility construction and operation effects on sensitive habitats, exposure of terrestrial species to airborne contaminants released from treatment facilities, and a scenario-based assessment of the consequences of releases of wastes to aquatic habitats in transportation accidents.

Economic impacts were analyzed by estimating employment and income increases in the regional economies supporting the DOE sites that might be caused by the infusion of funds to build and operate WM facilities. Impacts on the National economy were also assessed using the sum of all expenditures at all sites and for waste transportation under each waste-type alternative.

Population impacts were evaluated in terms of changes caused by the in-migration of workers in response to increased labor requirements for construction and operation of facilities.

An analysis of environmental justice considerations—disproportionate effects on minorities or low-income populations—discusses and displays the minority and poverty status of the populations at each WM site to highlight sites where those populations might be disproportionately affected by WM activities.

Land use impacts were evaluated by estimating the likelihood that building WM facilities at the sites under a WM alternative would require a commitment of land that might substantively alter the use of land at the site or that might require DOE to acquire additional land to implement the alternative. Conflicts with site development plans and current adjacent land uses were also considered.

Infrastructure impacts were evaluated by estimating the effects of building and operating WM facilities on site water supply, waste water treatment facilities, electrical power supply, and transportation infrastructure. Community infrastructure impacts were evaluated in terms of the estimated level of increased demand on community infrastructure caused by the influx of new labor and their families to support the WM projects.

The potential for cultural resources effects was considered comparatively in terms of the extent of construction site disturbance at each site under each alternative as an indicator of the requirement for cultural resources surveys that would be conducted at the site or project level. Impacts on cultural resources were not evaluated directly because the WM facility locations on each site are not yet proposed.

Environmental impacts considered in the PEIS, but not evaluated in detail, included effects on geology and soils, the noise environment, and visual resources. Those impacts are discussed in Chapter 5 of the PEIS.

All chemical and radiological discharges and direct radiation effects were estimated using computer models that simulate the fate and transport of contaminants in the environment. The computer models are described in the sections on air quality, water resources, and ecological resources. The models are further described in the facility risk appendixes (Appendices D and F) and the transportation risk appendix (Appendix E).

C.4.1 HUMAN HEALTH IMPACTS

C.4.1.1 Human Health Risk Assessment for Waste Treatment, Storage, and Disposal

Human health risk assessments were conducted for the construction and operation of treatment and storage facilities, for hypothetical individuals exposed downgradient of disposal facilities, for transportation of wastes, for accidents involving facilities at the sites, and for transportation accidents. Details of the human health risk assessment that estimated risks at the facilities resulting from routine construction and operation activities and from facility accidents are given in Appendix D. Details of the routine transportation and transportation accident risk assessments are given in Appendix E. Further details of the facility accident risks are given in Appendix F.

C.4.1.2 Population Risk Vulnerability Evaluation for LLMW and LLW Disposal

The objective of the population risk vulnerability analysis was to develop a basis for comparison of LLMW and LLW disposal alternatives using measures that characterize their relative potential to cause risks to offsite populations from groundwater contamination.

C.4.1.2.1 *Introduction*

Although maximally exposed individual (MEI) and population (or collective) risk estimations are both routinely used to characterize the potential health consequences of Federal agency actions, certain considerations led DOE to conclude that an alternative to collective risk estimation was needed for comparison of LLMW or LLW disposal alternatives in the WM PEIS.

First, other DOE efforts to address disposal risk do not generally estimate population risk. DOE has been addressing the issue of protecting the public from the effects of exposures to radioactive and mixed waste constituents released from disposal facilities. Ongoing Department efforts include performance assessments conducted for LLW disposal facilities in compliance with the requirements of DOE Order 5820.2A (DOE, 1988) and performance evaluations conducted for candidate LLMW disposal sites by the FFCAct Disposal Workgroup. Although these efforts currently address risks to single individuals at specified compliance points, they do not attempt to predict collective risks to current or future populations. A brief description of these efforts is provided in Section C.4.1.2.5.

Second, DOE determined that estimation of offsite population risk from exposure to disposal facility contaminants in the WM PEIS would require too many speculative assumptions and would not provide a credible basis for comparison of LLMW or LLW disposal alternatives. The concentrations of contaminants in the groundwater and the number of people potentially exposed will be determined in large part by the locations of the disposal units and the receptor wells. Estimation of the number of adverse health effects in current offsite populations would require information about the exact locations of the disposal facilities on the sites. Since the WM PEIS does not attempt to make such siting decisions, offsite population doses (e.g., person-rem) and risks (e.g., number of latent cancer fatalities) from disposal were not estimated. Analysis of future offsite population risks requires similar siting information and involves additional

uncertainty with respect to the sizes of future populations. Therefore, the WM PEIS could not credibly estimate adverse health impacts from disposal for future offsite populations.

Therefore, an alternative analysis methodology was needed for the WM PEIS to characterize the LLMW and LLW disposal alternatives that would utilize relevant information about the sites but that would not require quantitative estimates of collective dose and risk. This section describes the statistical methodology and data used to characterize the population risk vulnerability of the proposed disposal sites and to compare the population risk vulnerability of the disposal alternatives. The results of the analysis are presented in Chapters 6 and 7 of WM PEIS Volume I.

C.4.1.2.2 *Analytical Methods*

The two-part methodology consisted of (1) a factor analysis to identify the principal axes of variability of the site environmental data and relate those factors to population risk vulnerability and (2) a cluster analysis to identify distinct groups of sites on those principal axes.

C.4.1.2.2.1 Factor Analysis

Factor analysis is a statistical technique that can be used to identify a relatively small number of factors to represent relationships among a set of many interrelated variables (Norusis/SPSS Inc., 1993). The factors are derived to explain the observed correlations among the interrelated variables. The more highly correlated the original set of observations (cases) on the variables, the fewer factors are required to describe the relationships—that is, the more of the total variability in the data set can be represented by the first few derived factors. If the variables are completely uncorrelated, factor analysis will not provide a more compact explanatory solution than the original variables. A good factor solution is also interpretable. The factors can be interpreted as revealing underlying attributes of the variable set that can be readily described in broad terms.

Norusis/SPSS Inc. (1993) describe a four-step procedure for factor analysis:

1. Correlation matrix computation and factor model assessment
2. Factor extraction

3. Factor rotation
4. Factor score computation

In step 1, the interrelatedness of the variables is determined by examination of the simple Pearson correlation coefficients and some simple statistical tests of the correlation matrix to determine if a factor analysis is an appropriate technique to apply to the data set. In step 2, factors are extracted, usually initially by using principal components extraction, in which linear combinations of the variables are derived. These principal component vectors account in sequence for decreasing portions of the data variability and are independent of one another (orthogonal). The principal components may then be interpreted by the analyst as identifying a general underlying measure of the variables. In step 3, the initial factor solution is rotated to produce factors that are easier to interpret. In step 4, the factor scores for each case are computed by multiplying the original variable set by the principal components or rotated factors. These factor scores can be plotted to show how the different cases relate to each other in factor-space.

C.4.1.2.2.2 Cluster Analysis

Cluster analysis is a statistical technique used to identify relatively homogeneous subgroups or clusters from data on members of a larger population. Members of these subgroups can then be considered to share common characteristics and to be relatively distinct from other subgroups in terms of the important measured variables used to determine the clusters (Norusis/SPSS, Inc., 1993). Cluster analysis establishes groupings based on distance/nearness calculations for a set of specified variables. In the most commonly applied calculation method, clusters are derived by using squared Euclidean distances.

C.4.1.2.3 *Analysis Methods Applied to Population Risk Vulnerability of WM Disposal Sites*

C.4.1.2.3.1 Selection and Transformation of Explanatory Variables

The variables selected for use in the factor and cluster analyses of the 16 candidate disposal sites were six site characteristics that were considered likely to cause or be associated with future levels of offsite population risk from radioactive or mixed waste disposal: annual rainfall, annual groundwater recharge,

aquifer depth, travel time of water (from the time it infiltrates the ground surface to the time it reaches the aquifer and appears in a downgradient well), current human populations within 50 miles of the site, and site acreage (Table C.4–2). The first three variables, which characterize the surface and groundwater hydrology of the sites, are measures known to determine the speed, duration, and extent of dispersal of contaminants from disposal facilities and the level of resulting downgradient contaminant concentrations in groundwater. The estimates of travel time are based on the physical properties of the soils, the aquifer depth, and the groundwater velocity at each site. Current census population levels are considered the most appropriate measure of the potential size of the population at risk in the near term, at least on a relative basis from site to site. Site acreage provides an indirect measure of two associated characteristics — the size of the potential populations at risk and the likelihood that contaminants in downgradient groundwater would appear in a publicly accessible wellwater source. Site size is related to population size because the larger sites exclude population growth on extensive areas. Site size is related to groundwater contamination and exposure because of the relationship between the proximity of offsite population centers to locations on the sites where disposal facilities would be constructed. Data on annual rainfall, aquifer depth, current human populations within 50 miles of the site, and site acreage were taken from ORNL (1995c). Estimates of time of travel were made using environmental setting data on unsaturated and saturated soil zones for the 16 disposal sites provided in ORNL (1995c). Data on annual groundwater recharge was taken from SNL (1996). These site characteristics are generally strongly correlated with each other — for example, the smaller sites tend to be situated in regions of denser population with higher rainfall. Therefore, it was expected that the six variable measures could be represented by a limited number of principal factors that are composite measures of the important variations in the site characteristics.

Examination of the variable distributions (see, for example, Figures C.4–1 and C.4–2) showed that many were not normally distributed, so log transformations were performed to create a more linearized data set (Table C.4–3). These transformations ensure a more appropriate application of the statistical general linear model and, among other benefits, help minimize the tendency for larger measures to be unduly weighted in the factor solutions.

Table C.4–2. Environmental and Population Data Used to Group Disposal Sites in Terms of Population Risk Vulnerability

Site	Population Within 50 mi	Acreage	Annual Rainfall (cm)	Aquifer Depth (ft)	Annual Aquifer Recharge (ft/yr)	Time of Travel of Water to Downgradient Well (years)
ANL-E	7,939,785	1,025	80	90	0.33	246
BNL	5,738,554	5,263	107	200	0.50	59
FEMP	2,764,589	1,050	104	59	0.50	18
Hanford	377,645	370,656	16	236	0.16	191
INEL	153,061	572,160	23	600	0.23	298
LLNL	6,324,234	6,900	36	98	0.08	70
LANL	159,152	28,000	47	749	0.05	411
NTS	14,266	864,000	19	787	<0.001	1,352
ORR	895,379	34,560	139	26	0.60	11
PGDP	500,502	3,425	120	49	0.43	17
Pantex	265,185	16,000	51	320	0.02	175
PORTS	639,062	4,032	101	24	0.39	24
RFETS	2,171,877	6,550	38	18	0.16	25
SNL	610,714	2,791	20	94	0.06	132
SRS	620,618	192,700	122	110	1.30	23
WVDP	1,698,391	220	104	10	0.23	226

Notes: ANL-E = Argonne National Laboratory-East; BNL = Brookhaven National Laboratory; FEMP = Fernald Environmental Management Project; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; NTS = Nevada Test Site; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; PORTS = Portsmouth Gaseous Diffusion Plant; RFETS = Rocky Flats Environmental Technology Site; SNL = Sandia National Laboratories; SRS = Savannah River Site; and WVDP = West Valley Demonstration Project.

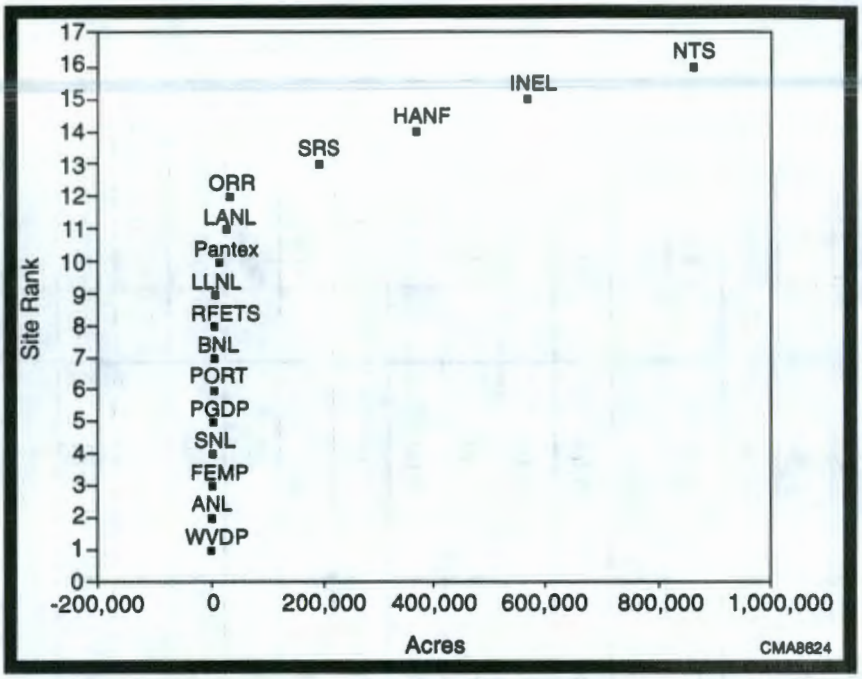

Figure C.4–1. Sites Plotted According to Increasing Acreage, Showing Nonlinearity in Data.

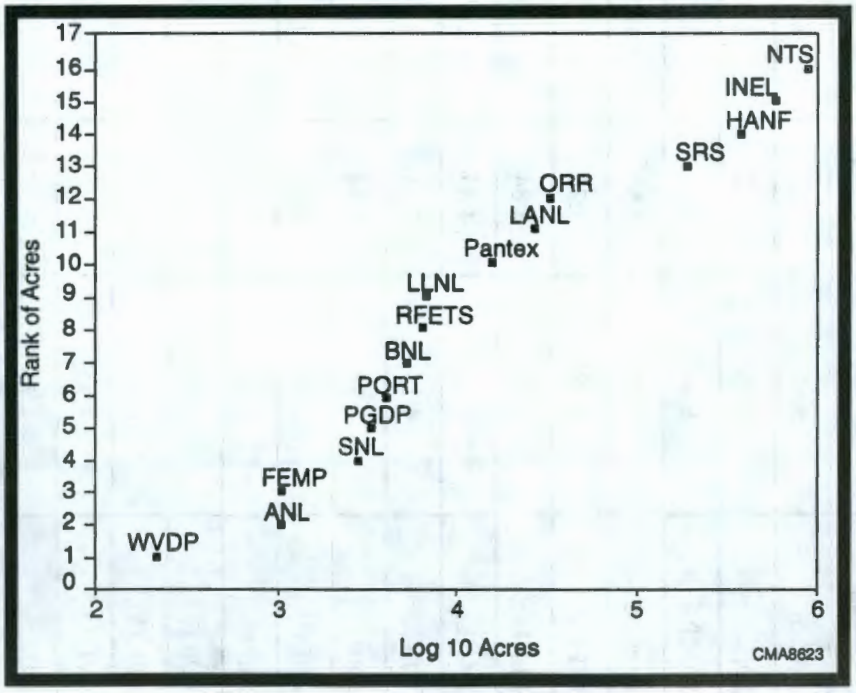

Figure C.4–2. Sites Plotted According to Increasing Site Acreage, Showing Applicability of Loglinear Transformation.

Table C.4–3. Transformed Environmental and Population Data Used to Categorize Disposal Sites in Terms of Population Risk Vulnerability

Site	log10 (Population in 50 mi)	log10 (Acreage)	log10 (Annual Rainfall [cm])	log10 (Aquifer Depth)	log10 (Recharge [m/yr])	log10 (Distance to Water)
ANL-E	6.90	3.01	1.90	1.95	-0.48	2.39
BNL	6.76	3.72	2.03	2.30	-0.30	1.77
FEMP	6.44	3.02	2.02	1.77	-0.30	1.25
Hanford	5.58	5.57	1.20	2.37	-0.80	2.28
INEL	5.18	5.76	1.36	2.78	-0.63	2.47
LLNL	6.80	3.84	1.56	1.99	-1.10	1.85
LANL	5.20	4.45	1.67	2.87	-1.30	2.68
NTS	4.15	5.94	1.28	2.90	-3.00	3.13
ORR	5.95	4.54	2.14	1.41	-0.22	1.03
PGDP	5.70	3.53	2.08	1.69	-0.37	1.22
Pantex	5.42	4.20	1.71	2.65	-1.69	2.24
PORTS	5.81	3.61	2.00	1.38	-0.41	1.37
RFETS	6.34	3.82	1.58	1.26	-0.80	1.40
SNL	5.79	3.45	1.30	1.97	-1.22	2.12
SRS	5.79	5.28	2.09	2.04	0.11	1.36
WVDP	6.23	2.34	2.02	1.00	-0.64	2.35

Notes: ANL-E = Argonne National Laboratory-East; BNL = Brookhaven National Laboratory; FEMP = Fernald Environmental Management Project; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; NTS = Nevada Test Site; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; PORTS = Portsmouth Gaseous Diffusion Plant: RFETS = Rocky Flats Environmental Technology Site; SNL = Sandia National Laboratories; SRS = Savannah River Site; and WVDP = West Valley Demonstration Project.

C.4.1.2.3.2 Factor Analysis of Environmental Variables

C.4.1.2.3.2.1 Correlation Matrix Computation and Appropriateness of the Factor Model

Simple correlations among the transformed environmental variables were computed (Table C.4–4). Measures of the appropriateness of the factor model were computed, including Bartlett's test of sphericity, the Kaiser-Meyer-Olkin (K-M-O) overall measure of sampling adequacy, and individual measures of sampling adequacy. Bartlett's test gave a value of 50.61 with a significance of 0.00001, indicating that it is highly unlikely that the variables are uncorrelated. The K-M-O value of 0.64851 indicates that correlations between pairs of variables can be adequately explained by the other variables. The substantial degree of correlation shown between variables and the results of the appropriateness tests indicated that factor analysis would be a fruitful technique for investigation of the data.

Table C.4–4. Correlation Matrix of Transformed Environmental Variables

	Site Acreage	Aquifer Depth	Population in 50 mi	Annual Rainfall	Groundwater Discharge	Time of Travel
Site acreage	1.00000					
Aquifer depth	.67119	1.00000				
Population in 50 mi	-.70651	-.57654	1.00000			
Annual rainfall	-.52114	-.54939	.47536	1.00000		
Groundwater recharge	-.35054	-.55470	.64883	.66101	1.00000	
Time of travel	.32030	.66135	-50204	-.65108	-.73246	1.00000

C.4.1.2.3.2.2 Factor Extraction

The first principal component derived in the analysis (Table C.4–5) accounts for approximately 64% of the variability (information content) in the site characteristics data. It is a vector that substantially measures all six variables—the absolute values of the loadings (vector elements that, by vector multiplication, transform the original data set into the components) exceed 0.5 for all variables. It can be interpreted as accounting for the fact that the smaller sites are generally the sites with higher populations and wetter hydrologic conditions. These conditions include higher rainfall, a generally shallow water table, and a relatively short groundwater time of travel. The second principal component accounts for an additional 15% of the data variability but is not as readily interpretable. (The sites are plotted according to their scores on the first two principal components in Figure C.4–3.) Therefore, factor rotation was performed to derive factors that could be more satisfactorily interpreted.

C.4.1.2.3.2.3 Factor Rotation

The factor rotation technique selected for the analysis, oblique rotation, produces more easily interpretable factors in this instance, although the factors are not independent. The first two oblique factors (Table C.4–5)

Table C.4–5. First Two Principal Components of Site Environmental Variables and Rotated Factors Derived From Oblique Rotation of the Principal Components

	Principal Components		Rotated Factors	
Site Environmental Variables	**First PC**	**Second PC**	**First RF**	**Second RF**
Acreage	-.73202	.63199	.20112	1.07112
Aquifer depth	-.83433	.15024	-.37317	-.57330
Population within 50 mi	.80974	-.30622	.19267	-.73860
Rainfall	.80146	.21037	.73326	-.14784
Groundwater recharge	.82579	.37202	.91960	.02403
Time to travel to downgradient well	-.80913	-.44507	-.98616	-.11504

can be interpreted as (1) a site hydrology factor that is positively loaded on rainfall and groundwater recharge and negatively loaded on time of travel of water to a downgradient well, and (2) a general site characteristics factor that might be described as the "small, shallow water table, high population" factor. The factors have a correlation of -.58603; sites that have higher scores on oblique factor 1 tend to have lower scores on oblique factor 2.

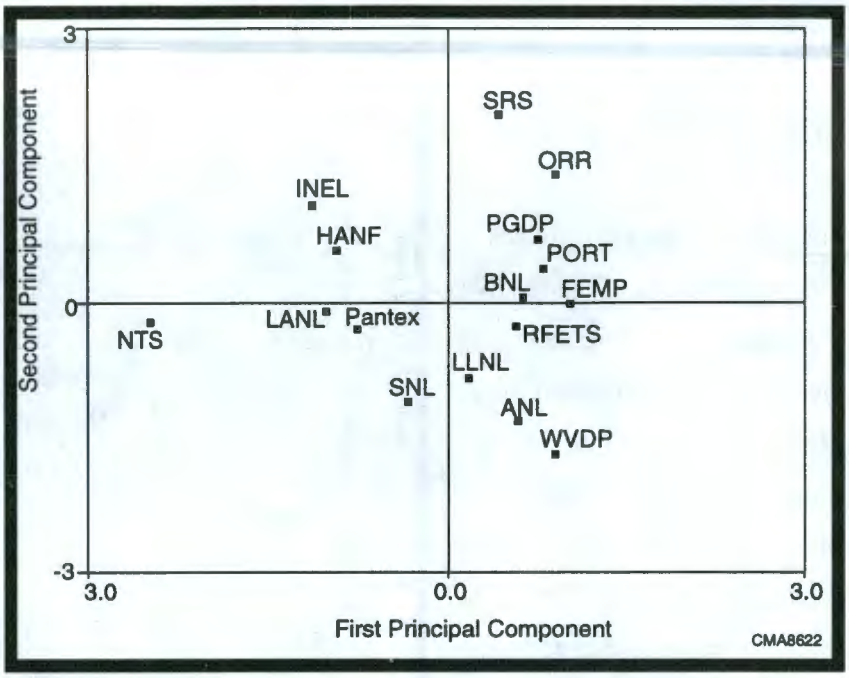

Figure C.4–3. Sites Plotted According to Their Scores on the First Two Principal Components of the Environmental Data.

C.4.1.2.3.2.4 Oblique Factor Scores

Sites are plotted according to their scores on the first two oblique factors in Figure C.4–4. To provide a more understandable presentation of the rotated factors, the site scores on the second oblique factor were reversed (multiplied by negative 1) before being plotted in the oblique factor diagram. Sites to the right in the diagram have higher scores on the first factor, indicating that they have groundwater hydrologic conditions that would tend to move contaminants more quickly downgradient from disposal units and possibly to drinking water wells that might be used by the public. Sites to the left in the diagram are those where site characteristics would tend to limit migration of contaminants and increase the time over which any movement might result in wellwater contamination. In terms of scores on the second factor, sites plotted in the upper portion of the diagram are those that are smaller in size with higher surrounding populations. Those plotted lower are the larger sites with lower surrounding populations. Land uses on and near the sites, the site size itself, and the size of the surrounding populations are more likely to change substantially during the time contaminants may be leaching from disposal units than are the physical characteristics of the site. Therefore, DOE considers the first factor scores more important than the second factor scores in characterizing the sites' relative potentials for offsite population risk.

C.4.1.2.3.3 Derivation of Population Risk Vulnerability Groups

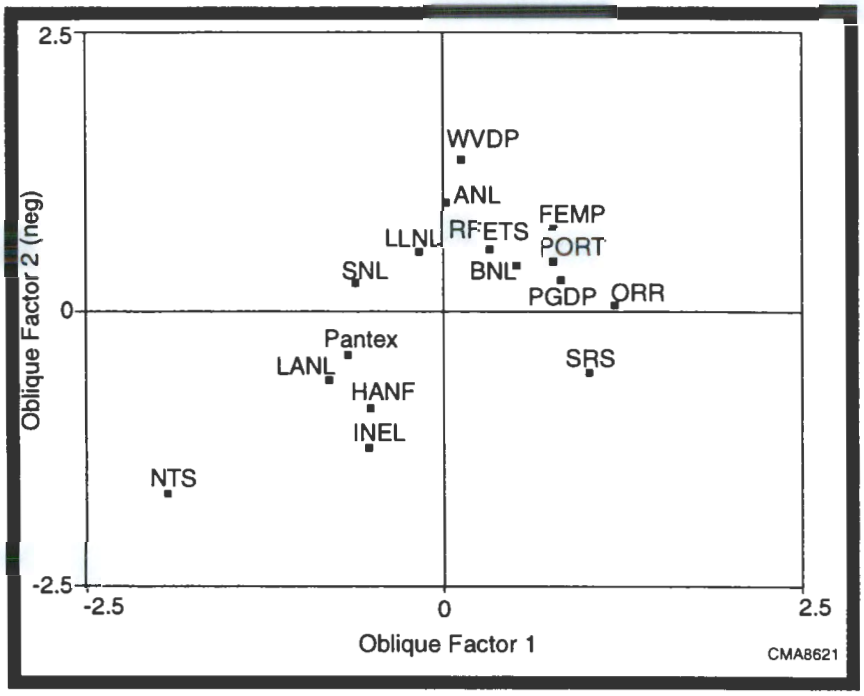

Figure C.4–4. Sites Plotted According to Their Scores on the First Two Oblique Factors of the Environmental Data.

The factor analysis provides a general indication of the relative population risk vulnerability of the 16 proposed disposal sites. The factor scores of the 16 sites show relationships among the sites in hydrologic and population characteristics that would be reasonable to conclude would be directly related to the levels of population dose and risk. DOE further identified distinct groups of sites representing similar levels of potential for population risk from waste disposal. The sites were grouped using a cluster analysis of the same six site characteristics.

In the cluster analysis, DOE used the site environmental data on the six variables to calculate measures of overall difference among the 16 sites. These difference measures were used to extract clusters of sites by combining sites with generally similar characteristics. The difference measures are greater between clusters than they are for sites within a cluster. By labeling the factor plots with the cluster membership of each site, distinct risk vulnerability groupings were identified. A dendrogram (Figure C.4–5) illustrates the combining of the sites into a decreasing number of clusters on the basis of the squared-Euclidean distance method applied to the standardized variables until all 16 sites are combined. A set of five clusters was derived for the population risk vulnerability analysis. Reading of the dendrogram from left to right as sites are successively linked, the last five clusters derived were used in the population risk vulnerability analysis. Two of the five clusters combine ANL, BNL, LLNL, RFETS, and SNL in Cluster 1 and combine FEMP, ORR, PGDP, PORTS, and SRS in Cluster 2. Hanford, INEL, LANL, and Pantex are linked as Cluster 3. NTS and WVDP are distinct enough to remain as separate Clusters 4 and 5. Sites are arrayed by cluster number in Figure C.4–6.

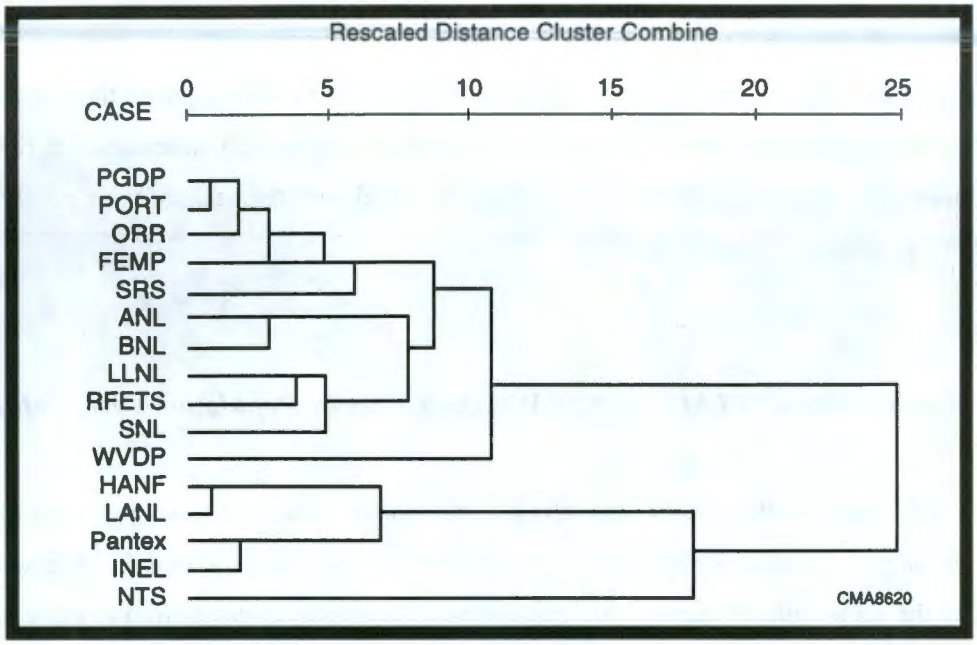

Figure C.4–5. Dendrogram Illustrating Derivation of Site Clusters From Environmental Data.

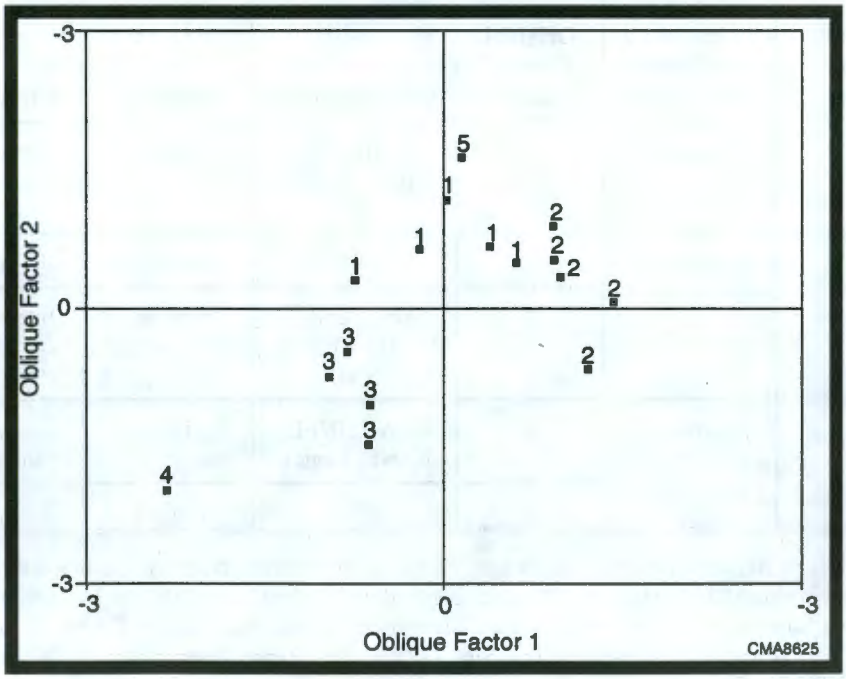

Figure C.4–6. Sites Arrayed by Cluster Number According to Their Scores on the First Two Oblique Factors of the Environmental Data.

The cluster analysis was used to identify three general site groups according to their expected relative population risk vulnerability. The single-site clusters (4 and 5) were combined with their nearest neighbor clusters. The resulting groups were renumbered to indicate higher (3), intermediate (2), and lower (1) relative population risk vulnerability. The groups are listed with the basis of their relative population risk vulnerability ratings in Table C.4–6.

C.4.1.2.4 *Comparison of LLMW and LLW Alternatives by Population Risk Vulnerability*

LLMW and LLW disposal alternatives were arrayed in terms of greater or lesser potential for population risk based on the population risk vulnerability designation of the sites proposed for disposal under each alternative and the waste volume, curie load, and number of disposal units required at those sites. LLMW

Table C.4–6. Interpretation of Site Clusters in Terms of Relative Potential for Offsite Population Risk From Disposal

Population Risk Vulnerability Group Number	Relative Offsite Population Risk Level	Original Cluster Number	Sites in Cluster	Scores on Oblique Factors	
				Hydrology	Site Size/Population
3	Higher	2	FEMP, ORR, PGDP, PORTS, SRS	High	Intermediate
2	Intermediate	5	WVDP	Intermediate	Highest
		1	ANL, BNL, LLNL, RFETS, SNL	Low to Intermediate	Intermediate to High
1	Lower	3	HANF, INEL, LANL, Pantex	Low	Low to Intermediate
		4	NTS	Lowest	Lowest

Notes: ANL = Argonne National Laboratory; BNL = Brookhaven National Laboratory; FEMP = Fernald Environmental Management Project; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; NTS = Nevada Test Site; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; PORTS = Portsmouth Gaseous Diffusion Plant; RFETS = Rocky Flats Environmental Technology Site; SNL = Sandia National Laboratories; SRS = Savannah River Site; and WVDP = West Valley Demonstration Project.

and LLW alternatives were then summarized in terms of the total waste volume, curie load, and number of disposal units required at all sites within each population risk group. Those alternatives with greater volume, curie load, and number of disposal units at group 3 sites could generally be considered to represent a relatively greater risk to populations than alternatives that concentrate disposed wastes at group 1 and 2 sites. From a population risk perspective, alternatives that concentrate disposed wastes at group 1 sites would represent the lowest risk.

C.4.1.2.5 *Disposal Analyses Conducted for DOE*

As a basis for analysis of radiological waste disposal, DOE issued Order 5820.2A (DOE, 1988), which requires DOE to dispose of all LLW and LLMW in a manner that ensures protection of the health and safety of the public.

DOE Order 5820.2A (DOE, 1988) contains policies, guidelines, and minimum requirements established by DOE for managing its radioactive waste, mixed waste, and contaminated facilities. Chapter III of this order is applicable to the management of LLW. The specific performance objectives set forth in this order state that DOE LLW that has been disposed of after issuance of the order shall be managed in a way that achieves the following goals:

- Protect public health and safety in accordance with standards in applicable environmental health orders and other DOE Orders.
- Ensure that external exposure to the waste and concentrations of radioactive material that might be released into surface water, groundwater, soil, plants, and animals results in an effective dose equivalent (EDE) that does not exceed 25 mrem/yr to any member of the public. The EDE is the sum of the products of the dose equivalent received by specific tissues of the body and tissue-specific weighting factors. The sum is a risk equivalent value and can be used to estimate health effects to the exposed individual. The EDE includes the CEDE (committed effective dose equivalent) from internal deposition of radionuclides and the EDE from penetrating radiation from sources external to the body. Reasonable efforts should be made to maintain radioactive releases in effluents to the environment as low as is reasonably achievable (ALARA).
- Ensure that the CEDE received by individuals who inadvertently intrude into the facility after the loss of institutional control (100 years) will not exceed 100 mrem/yr for continuous, chronic exposure or 500 mrem for a single acute exposure.

- Protect groundwater resources consistent with federal, state, and local requirements.

As indicated above, DOE Order 5820.2A provides general guidelines on how to safely dispose of LLW; however, the order does not specify (1) a time period over which they are to be applied; (2) a point of compliance; (3) which federal, state, and local requirements would be used to demonstrate that groundwater resources were adequately protected; or (4) the time and the number of people required for calculating a population dose.

C.4.1.2.5.1 Comprehensive Performance Assessments

A number of approaches have been used to demonstrate compliance with DOE Order 5820.2A. Some of these approaches have been documented in performance assessments (PAs) (systematic analyses of the potential risks posed by waste management systems to the public and environment, with a comparison of these risks to established performance objectives) of LLW management complexes (Martin Marietta, 1994; Maheras et al., 1994; Magnuson et al., 1993).

In general, the PAs derive radiological performance objectives from a combination of DOE Orders (including Order 5820.2A) and other guidance, as well as EPA regulations.

In demonstrating compliance with a combination of DOE Orders and other guidance, as well as EPA regulations, the PAs used three time periods of interest: the operational period (period of time that the facility is in operation), the institutional control period (period of time after closure in which institutional control is maintained for the facility, usually 100 years after the end of operations), and the postinstitutional control period (extending from the end of institutional control to 10,000 years in the future). If the maximum impact occurred after 10,000 years, analyses were also performed and evaluated at the time of maximum risk. EDE calculations for these times were performed at two distances: a point on the site boundary in the direction of groundwater flow downstream of the source (operational and institutional control periods), and a point 100 m downstream of the source (postinstitutional control).

Compliance with protecting the quality of groundwater is demonstrated in the PAs by showing that predicted contaminant concentrations are within guidelines specified by the EPA in the Safe Drinking Water

Act (40 CFR 141; EPA, 1991a). This compliance is usually demonstrated by showing that contaminant concentrations are below specified maximum concentration limits (MCLs) or proposed MCLs.

In addition to demonstrating compliance by showing that contaminant concentrations are below their associated MCLs, EPA's 40 CFR 141 requires that the EDE for a drinking water system (well that has at least 15 connections and serves 25 people) be below 4 mrem/yr. During operations, this well is assumed to be located at the site boundary, directly downgradient of the contaminated source. For the postinstitutional control period (10,000 years), the well is assumed to be located 100 m downgradient of the source. In either case, compliance is demonstrated by calculating the appropriate EDE, even if there is no drinking water system in place at the site.

C.4.1.2.5.2 Disposal Workgroup Performance Evaluations

Because mixed waste has a hazardous chemical component, it must be treated in compliance with land disposal restrictions (LDRs) of the Resource Conservation and Recovery Act. Because of a lack of sufficient capacity and available technologies to treat this type of waste, the Federal Facilities Compliance Act (FFCAct) of 1992 requires the Secretary of Energy to develop and submit site treatment plans (STPs) for the development of treatment capacity and technologies for treating mixed waste for each facility at which the DOE stores or generates these wastes.

Although the FFCAct does not specifically require addressing mixed waste disposal, the DOE and the States realized that the method of treatment for a specific waste is an integral component of any considerations for its ultimate disposal (Waters et al., 1996). In June 1993, DOE established the Disposal Workgroup (DWG) to work with the States to define and develop a process for evaluating LLMW disposal options. In particular, the DWG sponsored performance evaluations (PEs) at each of 15 sites (Lawrence Livermore National Laboratory, Rocky Flats Environmental Technology Site, Idaho National Engineering Laboratory, Argonne National Laboratory, Paducah Gaseous Diffusion Plant, Nevada Test Site, Los Alamos National Laboratory, Sandia National Laboratories-New Mexico, West Valley Demonstration Project, Fernald Environmental Management Project, Portsmouth Gaseous Diffusion Plant, Savannah River Site, Oak Ridge Reservation, Pantex Plant, and the Hanford Site) to quantify and compare the limitations of these sites for the disposal of LLMW (Waters et al., 1996).

For purposes of analysis and comparison, the PE teams used three primary performance measures consistent with DOE Order 5820.2A and EPA's 40 CFR 141. These performance measures are:

- 4-mrem/yr EDE from the drinking water pathway for releases to groundwater
- 10 mrem/yr for atmospheric releases
- 100 mrem/yr from all exposure pathways for chronic, long-term exposure to inadvertent intruders

For consistency, all of the calculations were performed at a performance boundary that was 100 m from the edge of the disposal facility, and all performance measures were applied for 10,000 years after disposal. This approach for demonstrating compliance is very similar to the methodology used for the comprehensive PAs. As with the PAs, the PEs do not attempt to calculate population dose.

C.4.1.2.5.3 Composite Analysis of Interacting Source Terms

In April 1996, DOE issued guidance (DOE, 1996b) on how to perform a "composite analysis" that is required by DOE pursuant to the Recommendations 94-2 from the Defense Nuclear Facilities Safety Board (DNFSB, 1994) and by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This analysis relates to LLW disposal facilities. The composite analysis is intended to supplement PAs required by DOE Order 5820.2A or risk assessments required by CERCLA.

The composite analysis will estimate the potential cumulative impacts to a hypothetical future member of the public from the active or planned LLW disposal facility and other sources of radioactive material in the ground that may interact with the LLW disposal facility. The projected total dose to a hypothetical future member of the public (receptor) from these sources will be compared with the DOE primary dose limit of 100 mrem/yr plus ALARA (as low as reasonably achievable) as set forth in DOE Order 5400.5 and proposed rule 10 CFR 834.

Under either of two conditions, an options analysis to identify alternatives for reducing future doses to tolerable limits is required. These conditions are (1) the calculated dose to the receptor exceeds the 100-mrem primary annual dose limit; or (2) the calculated dose exceeds a significant fraction of the dose limit, which is taken as 30 mrem/yr. The time of assessment is taken as 1,000 years.

The options analysis involves an ALARA process to assess cost-beneficial ways of reducing dose. The guidance discusses ways of applying an ALARA process and when an expensive, quantitative ALARA process is justified. The criterion is whether the cost of the ALARA review of alternatives is a small fraction (20%) of the monetary valuation of a possible dose reduction.

In using this criterion, the guidance suggests that the estimate of collective dose be conservative but reasonably realistic. It describes a reasonable screening process as considering the average dose from the groundwater pathway at the point of assessment to a number of individuals who might be considered to be at that point, such as the number of persons using water from a public drinking water supply system at the point of assessment. The guidance discusses that the point or points of assessment need not be in the immediate vicinity of the waste. A point of assessment should be a location where the public could be expected to have access based on future land-use plans (or conservative assumptions) and that is downgradient from the facilities that would release radioactivity to the ground.

The guidance provides that only options that could significantly reduce the dose should be considered in detail in the options analysis. Control or mitigation alternatives that might be considered include refining the analysis to reduce conservatism, improving the design of the LLW disposal facility, limiting the receipt of waste to be disposed of in the LLW disposal facility, requiring waste form performance for the waste to be disposed of at the LLW disposal facility, remediating the other sources of existing contamination, and optimizing the long-term land-use boundary. In an extreme case, termination of disposal in the LLW disposal facility may be considered. The options analysis should identify the preferred action and justify the choice based on the cost benefit analysis conducted, the level of uncertainty inherent in the composite analysis, and other relevant factors. When the 100-mrem annual dose limit is exceeded, the No Action Alternative is not acceptable.

To summarize, collective dose to a population from disposal plays a conditional role in a composite analysis. If the estimated dose to a hypothetical future member of the public does not exceed 30 mrem/yr, computation of a collective dose is not recommended. If the 30-mrem/yr value is exceeded, then the collective dose should be estimated.

C.4.2 AIR QUALITY IMPACTS

Air quality impacts were determined for pollutant-emitting activities associated with managing each of the five waste types: LLMW, LLW, TRUW, HLW, and HW. Air quality impacts were assessed for the construction of new treatment, storage, and disposal facilities; for the O&M of the facilities; and for shipment of wastes between sites. Air quality impacts were analyzed only for those pollutants for which emissions estimates were provided. The following sections describe in detail the methods used to estimate the air quality impacts for each WM alternative.

C.4.2.1 Air Quality Impacts Analysis Methods

Air quality impact assessments predict the consequences in terms of deterioration in air quality at off-site locations resulting from the release of contaminants from various categories of pollutant sources. This PEIS evaluated the potential for any of the alternative WM actions to lead to deterioration of local or regional air quality at any of the sites. The analysis also evaluated the potential for the actions across sites, in combination with pollutants emitted in the waste transportation corridors, to lead to deterioration of National air quality.

C.4.2.1.1 *Air Pollutants Considered*

The air quality impacts analysis estimated the air emissions for WM facility construction and O&M activities. O&M activities include waste treatment, storage, disposal, and transportation of waste. Estimates were made for each action for four classes of air pollutants: (1) the criteria air pollutants regulated under the National and State Ambient Air Quality Standards (NAAQS and AAQS), (2) radionuclides and other Hazardous Air Pollutants (HAPs) regulated under the National Emissions Standards for Hazardous Air Pollutants (NESHAP),

Major Types of Air Pollutants

***Criteria Air Pollutants**: Carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), ozone (O_3), and particulate matter less than 10 microns in diameter (PM_{10})*

***Hazardous Air Pollutants:** 189 hazardous substances (including radionuclides) whose emissions are regulated by the Clean Air Act*

***Toxic Air Pollutants**: Other toxic compounds regulated by EPA and state or local governments*

***Ozone Depleting Substances**: Certain man-made halocarbons (including CFCs, halons, carbon tetrachloride, and 1,1,1-trichloroethane) whose manufacture and use is regulated by EPA under the Clean Air Act.*

and (3) other types of toxic air pollutants (TAPs), which are regulated by some states, and (4) ozone depleting substances (ODS), such as chlorofluorocarbons (CFCs) and halons. The analysis evaluated air quality impacts qualitatively from stationary sources and transportation sources for the first three classes of pollutants. ODS impacts are discussed qualitatively, but their emissions were not quantified.

Criteria pollutants consist of the six substances regulated by EPA (40 CFR 50) for which NAAQS have been established under the Clean Air Act (CAA): carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), ozone (O_3), and particulate matter < 10 microns (PM_{10}). They are regulated both in terms of annual production in tons per year and in terms of ambient concentrations emanating from point and mobile sources. In addition to national criteria pollutants, certain states have adopted state-regulated criteria pollutants. The state-adopted criteria pollutants are listed in the *Technical Report on Affected Environment*, Volumes I and II, for each of the DOE sites (DOE, 1995b). Unlike the other five criteria pollutants, ozone is not a direct emission but is formed in the atmosphere through a complex reaction of ozone precursor pollutants, sunlight, and temperature.

Ozone precursor pollutants include nitrogen oxides (NO_x) and nonmethane hydrocarbons. The analysis of ozone impacts was done by evaluating NO_x and volatile organic compounds (VOCs) emissions as criteria pollutants.

Hazardous air pollutants include 189 substances listed in Section 112 of the CAA of 1990 (42 USC 7401 *et seq.*), as amended through May 1992, whose emissions standards are regulated by the NESHAP in 40 CFR 61. In particular, HAPs include cancer-causing agents such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as materials with noncancer health hazards, such as fluoride, ammonia, and hydrochloric and sulfuric acids. EPA regulates radionuclides as a total annual dose limit (10 mrem/yr) from the air pathway under the NESHAP (40 CFR 61). *Radionuclides* are also regulated by the DOE (DOE, 1990; 1993b) as a total annual dose limit (100 mrem/yr).

Toxic air pollutants include cancer causing agents and compounds with noncancer health hazards. These substances are regulated by the EPA, and on a state or local basis, through allowable ambient standards or guidelines.

Ozone depleting substances are certain man-made halocarbons, including CFCs, halons, carbon tetrachloride, and 1,1,1-trichloroethane, that react in the upper atmosphere to deplete the stratospheric

ozone layer. These compounds are regulated through the CAA and by the Montreal Protocol on Substances that Deplete the Ozone Layer.

Subsequent to December 6, 1995, HW and LLMW facilities are subject to the requirements of RCRA regulation 40 CFR Part 264, subpart AA, regarding air emission standards from process vents, and subpart BB, regarding air emission standards for process leaks. Compliance with the requirements of 40 CFR Part 264, subpart CC, regarding air emissions of volatile organic compounds from tanks, surface impoundments, and containers, was deferred until June 6, 1996 (60 FR 56952).

C.4.2.1.2 *Air Quality Impacts Analysis Procedures*

The air quality impacts analysis varied according to the pollutant classes and emissions sources expected to be important in each WM activity. Different analytical assumptions and techniques were used to best estimate the amounts of pollutants that could be emitted by each source. A summary of the air quality impacts that were evaluated in the PEIS is shown in Table C.4–7.

C.4.2.1.2.1 Analytical Approach for Different Pollutant Classes

For the air quality impacts analysis, stationary-source and area-source emissions were modeled and simple vehicular emissions factors were used to estimate mobile-source emissions for worker vehicle trips and waste transportation activities under each alternative.

C.4.2.1.2.1.1 Comparisons With Emission-Based and Concentration-Based Standards

The analysis of criteria pollutants varied according to the attainment status of a site's Air Quality Control Region (AQCR) for each pollutant. Annual emissions of the criteria pollutants from sites located in attainment areas were estimated for comparison with the allowable increment levels established in the Prevention of Significant Deterioration (PSD) regulations (40 CFR 52.21). The PSD allowable increments,

Table C.4–7. Impacts Evaluated for Air Quality

Impacts Assessed	Relevant Waste Types	Period of Analysis	Activities for Which Impacts Are Assessed	Impacts Measure	Presentation of Results
Criteria Air Pollutant Emissions	All five waste types	Construction	Use of construction equipment and worker vehicles	Percent of tons/year standard	Tabular or text discussion
		Operations	Operation of incinerators, fuel use by all other WM facilities, worker vehicles, and waste shipment vehicles, where applicable	Percent of tons/year or concentration standard	Tabular or text discussion
Radionuclide Emissions	LLMW, LLW and TRUW[a,c]	Operations[b]	Operation of WM treatment, storage and disposal facilities, where applicable	Percent of dose standard	Tabular or text discussion
Hazardous and Toxic Air Pollutant Emissions	LLMW, TRUW and HW[c]	Operations[b]	Operation of WM treatment, storage and disposal facilities, where applicable	Percent of concentration standard	Tabular or text discussion

[a] Emissions of radionuclides from HW are assumed to be negligible.
[b] Emissions assumed to be negligible during construction.
[c] Emissions of radionuclides and other hazardous and toxic air pollutants from storage of vitrified HLW are assumed to be negligible due to the physical form of the waste. Once HLW is vitrified, the glass matrix binds the radionuclides and hazardous chemicals, such that releases to the atmosphere are negligible.

in tons per year, regulate stationary-source emissions and do not include mobile-source emissions such as those from automobiles. Criteria pollutant emissions from sites located in nonattainment areas were estimated for comparison with the General Conformity Rule (GCR) guidelines *de minimis* levels, in tons per year (40 CFR 93). The GCR guidelines regulate both stationary-source and mobile-source emissions.

Ambient concentrations of the criteria pollutants were estimated for comparison with the NAAQS and State AAQS. Concentrations of the HAPs (including radionuclides) and TAPs were estimated to compare with the EPA or State ambient allowable limits (AALs).

C.4.2.1.2.1.2 Stationary-Source Estimates From Human Health Risk Modeling

In the analysis of air quality impacts from stationary-source emissions, it was assumed that ambient concentrations of criteria, hazardous, and radioactive pollutants would increase according to estimated emissions from treatment, storage, and disposal facilities and that the most conservative estimates of those increases would be the estimates of concentrations that the maximally exposed individual (MEI) would be subject to in the human health risk assessment done for this PEIS (ORNL, 1995a). Therefore, the air quality impacts analysis of stationary-source emissions used data on emissions, airborne transport and fate, and MEI doses assembled for the human health risk assessment to evaluate air quality effects. This is a conservative approach that will result in overestimating air quality impacts because the MEI doses from the health risk assessment include ingestion of farm products in addition to direct inhalation. The air quality impacts analysis used modeled estimates of local stationary-source ambient concentrations for hazardous and toxic air pollutants by waste type. Radionuclide data were taken directly from the offsite MEI doses estimated in the human health risk assessment.

C.4.2.1.2.1.3 Transportation Source Assumptions

In the air quality analysis, it was assumed that transportation sources (mobile-sources) may be an important source of criteria pollutant emissions in addition to those emanating from the facilities. Transportation sources were not expected to contribute significantly to hazardous (including radioactive) and toxic airborne contaminants in routine operations. Therefore, for criteria pollutants only, the analysis estimated local transportation-source annual tonnage of criteria pollutants, intersite transportation annual tonnage of criteria pollutants, and a national annual tonnage of criteria pollutants from all activities proposed under each alternative.

C.4.2.1.2.2 Emissions Estimation Techniques

Details of the estimation methods for construction-phase and operations-phase air emissions are presented in this section.

C.4.2.1.2.2.1 Construction-Phase Air Emissions Estimates

Emissions due to construction activities were calculated using estimates the amount of fuel used by construction equipment, and by construction workers traveling to and from the work site.

Construction Equipment Fuel Use. Fuel use in gallons of liquid fuel for the construction of WM facilities (as described in Section C.3) were used to calculate annual emissions for the WM alternatives, in tons per year, for the criteria pollutants CO, NO_2, SO_2, PM_{10}, and ozone (as NO_x and VOCs).

The fuel use values were divided by the WM alternative construction period (in years) to obtain an annual fuel usage in gallons. For the assessment of air emissions it was assumed that diesel fuel was used to operate construction equipment at the site. Emission rate factors, in pounds per gallon of fuel consumed, were obtained from *Compilation of Air Pollutant Emission Factors, Volume II, Mobile Sources*, also known as AP-42 (EPA, 1985a). The gallons of fuel used were multiplied by the pounds of pollutant per gallon consumed to obtain the annual emissions in pounds per year. This amount was divided by 2,000 pounds per ton to obtain the annual tons emitted for each of the criteria pollutants.

Worker Vehicle Fuel Use. The total number of FTEs for the construction period (as described in Section C.3) was divided by the construction period in years to obtain the total number of annual workers for each site and alternative combination. In order to provide an upper bound on air quality impacts, it was assumed that each construction worker travels to and from the construction site in a single vehicle, and that no employees carpool.

Vehicle emissions rates for the worker vehicle trips were obtained by running the EPA-approved vehicle emissions models Mobile5a (EPA, 1994a) and PART5 (EPA, 1994b). Emissions from the Mobile5a model were calculated in grams of pollutant emitted per vehicle mile traveled (VMT) for the pollutants CO, NO_2, and VOC. The PART5 model calculated PM_{10} emissions from vehicle exhaust in grams of pollutant emitted per VMT. For local impacts, it was assumed that the worker vehicles traveled 20 miles to and from work or 40 miles round trip each day. The total number of worker trips per day was multiplied by 40 miles per day and then by 240 working days per year to obtain the VMT per year. The annual VMT was then multiplied by the Mobile5a and PART5 emission rate factors in grams of pollutant per VMT to obtain the total number of grams emitted per year for the criteria pollutants CO, NO_2, VOC, and PM_{10}. The annual

emissions in grams were then multiplied by 0.0022 pounds per gram and divided by 2,000 pounds per ton to obtain the annual emissions for worker vehicles in tons per year.

C.4.2.1.2.2.2 Operations-Phase Air Emissions Estimates

The impacts to air quality from the operation and maintenance of WM treatment, storage, and disposal facilities were determined by calculating the emissions from facility fuel use, incineration of waste, transportation of waste, and worker vehicle trips to and from the sites.

Waste Management Fuel Use. Facility fuel use values during the operation period of WM facilities were supplied in pounds of natural gas and gallons of liquid fuel. These fuel use values were used to calculate annual emissions for the WM Alternative, in tons per year, for the six criteria pollutants at each site under each alternative.

The fuel use values were divided by the WM alternative period (in years) to obtain an annual usage for both natural gas, in pounds, and liquid fuel, in gallons. It was assumed that both classes of fuel were burned in an industrial boiler to produce heat and steam for the WM facilities. Emission characteristics for the burning of No. 4 fuel oil, with an assumed sulfur content of 1%, were used to represent the liquid fuel.

Emission rate factors in pounds per million cubic feet for natural gas and pounds per 1,000 gallons of liquid fuel for No. 4 fuel oil were obtained from the *Compilation of Air Pollutant Emission Factors, Volume I Stationary Sources* (AP-42) (EPA, 1985b). The estimates of natural gas use, in pounds, were divided by a natural gas density of 0.0448 pounds per cubic foot to obtain a total number of cubic feet. The total number of cubic feet was then divided by 1 million to obtain the number of million cubic feet used. The number of million cubic feet used was multiplied by the pollutant emission factor, in pounds per million cubic feet, to obtain the amount of pollutant emitted in pounds per year. The total annual pounds emitted was divided by 2,000 pounds per ton to obtain the annual tons emitted for each of the six criteria pollutants.

Direct Emissions From Incinerators: Criteria Pollutants. Criteria pollutant emissions from incineration of waste were calculated for annual emissions, in tons per year, and in parts per million or micrograms per cubic meter. The annual emissions were calculated using waste volumes for treatment and pollutant emission rate data. The emission rate data were supplied for each of the six criteria pollutants in grams of

pollutant emitted per kilogram of waste incinerated. The kilograms of waste incinerated per year were multiplied by the grams of pollutant per kilogram of waste treated to obtain the total amount of pollutants emitted in grams per year. The total grams emitted per year were multiplied by 0.0022 pounds per gram and then divided by 2,000 pounds per ton to obtain the total amount of pollutant emissions in tons per year.

Ambient concentrations of the criteria pollutant emissions were calculated by obtaining the annual emissions in grams per year, as described above, and dividing by the period of incineration operation, in seconds per year, to obtain a pollutant emission rate in grams per second. The annual emission rate in grams per second was multiplied by the highest off-site receptor concentration obtained from dispersion modeling. The dispersion model used was the EPA-approved Industrial Source Complex Long-Term Dispersion Model, Revision 2 (EPA, 1987). The model was run using an emission rate of one gram per second to produce annual receptor concentration values in micrograms per cubic meter per one gram per second ($\mu g/m^3/g/s$). To obtain a new concentration value for a different emission rate, the normalized concentration was multiplied by the new emission rate; the new concentration value was in micrograms per cubic meter ($\mu g/m^3$). The new annual concentration was divided by averaging period persistence factors, obtained from the EPA document *Air/Superfund National Technical Guidance Study Series, Screening Procedures for Estimating the Air Impacts of Incineration at Superfund Sites* (EPA, 1992a), to produce short-term concentrations for different averaging periods. These concentration values were compared to the NAAQS or State AAQS pollutant specific averaging periods as appropriate.

Direct Emissions From Incinerators: Hazardous and Toxic Air Pollutants. Annual exposure concentrations of HAPs and TAPs, in $\mu g/m^3$, to the off-site MEI were obtained from the human health risk assessment (Appendix D). For comparison of the HAPs and TAPs concentrations to State or EPA AALs, the concentrations were multiplied by the appropriate AAL averaging period persistence factor. The HAPs concentrations were divided by the AALs to obtain the percentage of the HAPs to the AALs.

The following four AAL guidelines were used; State, EPA Region III, EPA Region IX, and EPA long-term action level. The order in which the different guidelines were applied was as follows: the state guideline was applied in all cases where the state had established guidelines; for those states with no adopted guidelines and located in either EPA Region III or IX, the EPA Region guidelines were applied; for those states with no guidelines which were not located in either EPA Region III or IX, the EPA long-term action levels were applied.

Worker Vehicle Fuel Use. The total number of FTE employees for the waste treatment period was divided by the treatment period in years to obtain the total annual number of workers for each site and WM alternative. It was assumed (with the exception of Hanford) that each worker travels to and from the site in a single vehicle each day. For Hanford, the worker trips were adjusted to account for the percentage of employees who participate in ride-sharing programs. A worker trip reduction value of approximately 19% was obtained from the *FY 1993 Annual Report on In-house Energy Management* (Kaiser Engineers Hanford and Westinghouse Hanford Company, 1994), and applied to all Hanford worker trip numbers.

Vehicle emissions rates for the worker vehicle trips were obtained by running the EPA-approved vehicle emissions models Mobile5a and PART5. Emissions from the Mobile5a model are calculated in grams of pollutant exhaust per VMT for the pollutants CO, NO_2, and VOC. The PART5 model calculated PM_{10} emissions from vehicle exhaust in grams of pollutant emitted per VMT.

For local impacts, it was assumed that the worker vehicle traveled 20 miles to and from work, or a round trip distance of 40 miles per day. The total number of worker trips per day was multiplied by 40 miles per day and then by 240 working days per year to obtain the total VMT per year. The annual VMT was multiplied by the Mobile5a and PART5 emission factors in grams of pollutant per VMT to obtain the total number of grams emitted per year for the criteria pollutants CO, NO_2, VOC, and PM_{10}. The annual emissions in grams were multiplied by 0.0022 pounds per gram and then divided by 2,000 pounds per ton to obtain the annual emissions for worker vehicle trips in tons per year.

Indirect Emissions From Waste Shipments. Air emissions from shipment of waste from site to site (intersite), and to commercial waste handlers for HW, were calculated for local and national impacts. Local impacts were calculated for the site region of influence (ROI) (defined as a 50-mile radius), while intersite impacts were calculated based on the mileage traveled between sites, excluding the emissions calculated locally in the 50-mile radius. The intersite shipment emissions represent the contributions to regional or national levels of the criteria air pollutants, which are not accounted for in the site analysis.

The total number of waste shipments entering and leaving each WM site for the treatment period was obtained from ANL-E. The number of shipments per treatment period was then divided by the length of the treatment period in years to obtain the total number of shipments to and from the site on an annual basis.

Vehicle emissions rates for the truck shipments were obtained by running the EPA approved vehicle emissions models Mobile5a and PART5 as described above.

For local impacts the shipment miles were calculated using a travel distance of 50 miles to and from the site, or a round trip of 100 miles. The annual shipment numbers were multiplied by 100 miles to obtain the total annual VMT. The annual VMT was then multiplied by the Mobile5a and PART5 emission rate factors, in grams of pollutant per VMT, to obtain the total annual number of grams emitted for the criteria pollutants CO, NO_2, VOC, and PM_{10}. The annual emissions in grams were then multiplied by 0.0022 pounds per gram and then divided by 2,000 pounds per ton to obtain the annual emissions for shipment by truck in tons per year.

Radiation Dose Estimates. Total radiation dose values, in rem, were obtained from the human health risk assessment for the MEI at an offsite location. The total dose values in rem were multiplied by 1,000 to obtain the dose in millirem (mrem). The dose was then divided by the period of operation (10 or 20 years) and compared to the NESHAP dose standard of 10 mrem per year.

C.4.2.1.3 *Air Quality Impacts Evaluation*

In general, air quality impacts were evaluated by comparing estimated emissions and concentrations to 10% and 100% of Federal or State standards.

C.4.2.1.3.1 Impacts Evaluation for Criteria Pollutants

Criteria pollutant effects were assessed based on the air quality *attainment status* of each site's AQCR, for each of the six criteria pollutants. In general, the site's applicable AQCR is in attainment for a particular criteria pollutant if monitored ambient levels are below the NAAQS for that pollutant. The site's applicable AQCR is a nonattainment area for a particullar criteria pollutant if ambient levels equal or exceed the NAAQS for that pollutant. The attainment status of the DOE sites for the NAAQS criteria pollutants are listed in Table C.4-8. Table C.4-9 explains the nonattainment status designations.

Table C.4–8. Criteria Pollutant Attainment Status at the 17 Major Sites

Site	State	NAAQS Attainment Status					
		CO	NO_2	O_3	Pb	PM_{10}	SO_2
ANL-E	IL	A	A	S-17	A	MOD	A
BNL	NY	A	A	S-17	A	A	A
FEMP	OH	A	A	MOD	A	A	A
Hanford	WA	A	A	A	A	A	A
INEL	ID	A	A	A	A	A	A
LANL	NM	A	A	A	A	A	A
LLNL	CA	A	A	A	A	A	A
NTS	NV	MOD-2	A	A	A	MOD	A
ORR	TN	A	A	A	A	A	A
PGDP	KY	A	A	MAR	A	A	A
PORTS	OH	A	A	A	A	A	A
Pantex	TX	A	A	A	A	A	A
RFETS	CO	MOD-2	A	TRANS	A	MOD	A
SNL/NM	NM	MOD-1	A	A	A	A	A
SRS	SC	A	A	A	A	A	A
WIPP	NM	A	A	A	A	A	A
WVDP	NY	A	A	A	A	A	A

Notes: CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; PM_{10} = particulate matter < 10 micrometers; SO_2 = sulfur dioxide; A = attainment; nonattainment codes: S-17 = severe-17; MOD-2 = moderate-2; MOD-1 = moderate-1; MOD = moderate; MAR = marginal; TRANS = transitional.

Source: 40 CFR 81, Subpart C: Section 107 *Attainment Status Designations* (1992), except LLNL, which is based on 1995 data.

C.4.2.1.3.1.1 Impacts for Installations in Attainment Regions

Any predicted increases to ambient concentration levels in areas designated as attainment by the EPA were compared to the NAAQS. If the estimated ambient concentrations exceeded the NAAQS then that WM alternative and the affected area were noted in the PEIS.

The annual criteria emissions, in tons per year, were compared to the allowable increase levels specified in 40 CFR 52.21, Regulations for the PSD of Ambient Air Quality. PSD regulations are applicable in those