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Sec 8

F.7 Hazardous Waste

F.7.1 Alternatives and Sites Analyzed

The WM alternatives considered in the WM PEIS are summarized in Table F.7-1. The associated waste treatment categories are described in Table F.7-2. Calculational source term results for these alternatives are discussed herein.

A single site centralized alternative for the management of HW was not evaluated in the WM PEIS because the associated cost and risk, regulatory constraints, and practical considerations of attempting to manage all the diverse DOE waste classified as hazardous.

F.7.2 Risk-Dominant Accidents and Modeling Assumptions

The analysis herein develops distinct risk-dominant accident sequences and associated source terms for handling accidents, storage facility accidents, and treatment facility accidents. Accident scenarios involving chemical wastes that can (a) produce potentially life-threatening health effects and (b) have the potential for adverse health effects, were selected. Potential for adverse effects excluded carcinogenesis. Developing a category for carcinogenic effects alone would lead to accidents of negligible consequences, considering the specific chemicals present in the storage facilities. Consequently, only two categories of accidents were analyzed. The HW constituents of concern were chosen from the DOT list of poison inhalation hazards (PIHs) and from toxicological analyses for the determination of chemical wastes representative of potentially life-threatening health effects (Hartmann et al., 1994). Eleven sites that accept over 90% of the HW from the DOE complex were selected as representative of the DOE sites. Inventory data for the selected sites were taken from 1992 DOE HW shipment records. Because information on chemical concentrations is usually not given in HW inventory data, concentrations in industrial-grade products were assumed when modeling the source term from a release.

Table F.7-1. Hazardous Waste Alternatives

Alternative	Treat	ANL-E	FERMI	Hanford	INEL	KCP	LANL	LLNL	ORR	Pantex	SNL-NM	SRS
No Action	2				T				T			
Decentralized	3						T		T			T
Regionalized 1	5			T	T		T		T			T
Regionalized 2	2				T				T			

Note: T=Treatment. Blanks indicate that a site does not treat HW under the specified alternative.

Accidents were divided into three general categories, each having subcategories and including potentially life-threatening and any-adverse-effects end points:

- Spills resulting in partial vaporization of the waste ("pill only")
- Spills followed by ignition of the waste ("spill plus fire")
- "Other event combinations," which include
  - Spills followed by ignition of the waste and an induced explosion in a waste container ("spill plus fire plus explosion")
  - Facility fires resulting in a waste container breach ("fire only")
  - Mechanical failure of a compressed gas container resulting in an explosion ("spill and explosion")
  - Explosion from exposure of reactive material to air followed by fire ("fire and explosion")

Table F.7-3 lists the representative accidents chosen to serve as surrogates for all risk-dominant sequences and also lists associated mass of spill, release rate to the atmosphere, and annual frequency. Thirteen accidents involve the release of potentially life-threatening toxic gases. Five accidents (1e through 1g and 2e through 2f) involve the release of materials not considered potentially life-threatening but are analyzed for possible adverse effects. The development of the analysis is for these accidents took into account the following:

- The location proximity of classes of chemicals to each other in the storage facilities
- The typical designs of the storage facilities and the required separation of such groups of chemicals as flammable liquids, acids, caustics, combustibles, oxidizers, etc.
- The 90-day residence limit for RCRA HW in a storage facility, as it affects the MAR

Table F.7-2. Generic HW Treatment Categories and Descriptions

Treatment Capability	Abbreviation	Description
Organic destruction	ORDST	Destruction of organic liquids and solids by a broad spectrum of thermal and nonthermal technologies. Examples include incineration, vitrification, plasma hearth, molten metal, chemical oxidation, electron beam, and silent discharge plasma. Some of these technologies also apply to the STABL and METRC categories.
Aqueous liquids (wastewater treatment for organics)	WWTOR	Treatment technologies for oxidation of organics contained in predominantly aqueous media. Examples include wet oxidation, catalyzed wet oxidation, and supercritical water oxidation.
Metal removal	METRM	Metal ion and particulate removal from liquids by settling, filtration, precipitation, ion exchange, carbon adsorption, etc.
Stabilization	STABL	All immobilization and microencapsulation technologies (for example, cementation, vitrification, polymer encapsulation).
Metal recovery	METRC	Methods for separation and collection of metals from waste streams for reuse. Examples include sorting, melting, and decontamination.
Mercury separation	HGSEP	All Hg separation, collection, and immobilization methods. Examples include gravitational, thermal, and chemical techniques to separate Hg for recycling or for immobilization by amalgamation.
Decontamination	DECON	Extractive, mechanical, hydraulic, thermal, and electrochemical techniques used to remove contaminants from substrate materials.
Neutralization	NEUTR	Acid or base additions to neutralize waste streams.
Deactivation	DEACT	Appropriate technologies to deactivate reactive materials (such as sodium or uranium metal) or cyanides before disposal.

Table F.7–3. Airborne Release Assumptions for Representative HW Accidents

Scenario		Toxic Gas Released	Mass of Waste Spilled (lb)	Release Rate Functional Form (lb/min)	Annual Frequency (per Container-Handling[a] Operation)	Concentration Limit[b]	
						PAEC Value	PLC Value
Spill							
(1a)	Alkaline waste spill (i.e., NH_4OH) releasing moderately toxic by-products	NH_3	210 lb of 28% NH_4OH (59 lb)	0-10 min: 3 lb/min; 10-150 min: $3e^{-k_1(t-10)}$, c	2.0E-04	24.5	560
(1b)	Acid waste spill (i.e., HCl) releasing moderately toxic vapor	HCl	450 lb of 37% HCl (166 lb)	0-10 min: 2 lb/min; 10-600 min: $2e^{-k_2(t-10)}$	2.0E-04	0.8	100
(1c)	Acid waste spill (i.e., HF) releasing highly toxic vapor	HF	30 lb of 50% HF (15 lb)	0-10 min: 2 lb/min; 10-600 min: $2e^{-k_3(t-10)}$	2.0E-04	1	24
(1d)	Fuming acid waste spill (i.e., HNO_3) releasing moderately toxic by-products	NO_x	30 lb of 70% HNO_3 (21 lb)	0-10 min: 1 lb/min; 10-100 min: $1e^{-k_4(t-10)}$	2.0E-04	0.41	350
(1e)	Acid waste spill (i.e., $C_2H_4O_2$) releasing mildly toxic vapor	$C_2H_4O_2$	30 lb of 100% C_2H_4O2	0-10 min: 0.3 lb/min; 10-900 min: $0.3e^{-k_6(t-10)}$	2.0E-04	15	NA[d]
(1f)	Volatile liquid spill (i.e., CS_2) releasing toxic vapor	CS_2	18 lb of 100% CS_2	0-3 min: 0.5 lb/min; 3-60 min: $0.5e^{-k_7(t-10)}$	2.0E-04	0.55	NA
(1g)	Liquid spill (i.e., 1,1,1-trichloroethane) releasing mildly toxic vapor	1,1,1-trichloroethane	100 lb of 100% 1,1,1-trichloroethane	0-10 min: 40 lb/min	2.0E-04	31.2	NA
Spill Plus Fire[e]							
(2a)	Spill of aromatic hydrocarbon (i.e., BTX) results in burning pool; polyaromatic hydrocarbon (PAH) soot and unburnt hydrocarbon (HC) become airborne	PAH soot and unburnt HC	250 lb of benzene (12% raw, 40% soot, and 48% Co_x)	0-120 min: 2.1 lb/min	2.0E-05	18.0	3,000
(2b)	Spill of flammable liquid (e.g., toluene/acetone), which ignites (with help of $CaCl_2O_2$), and fire spreads to HF container	HF	10 lb of 50% HF (5 lb)	0-1 min: 5 lb/min (puff)	2.0E-05 probability of HF present	1	24
(2c)	Spills and ignition of flammable liquid, engulfing nearby H_2SO_4, KCN, and NaCN containers, releasing only toxic HCN fumes	HCN	40 lb of organic solvents; 20 lb of H_2SO_4; 40 lb of KCN and NaCN	0-1 min: 40 lb/min (puff)	2.0E-05 probability of KCN present	1 mg/m^3	5 mg/m^3
(2d)	Spills and ignition of flammable liquid, accelerated by $Na_2S_2O_8$ and NH_4NO_3, releasing Hg vapor from discarded Hg cells	Hg vapor	2,000 lb of naphtha; 630 lb of oxidizing agent; 50 lb of Hg cells	0-180 min: 2.8 lb/min	2.0E-05 probability of Hg present	0.01 mg/m^3	0.1 mg/m^3

Table F.7–3. Airborne Release Assumptions for Representative HW Accidents—Continued

Scenario	Toxic Gas Released	Mass of Waste Spilled (lb)	Release Rate Functional Form (lb/min)	Annual Frequency (per Container-Handling[a] Operation)	Concentration Limit[b] PAEC Value	Concentration Limit[b] PLC Value
(2e) Spills and ignition of flammable liquid, breaching nearby containers with Cd-containing compounds (i.e., Cd salts or Ni:Cd batteries)	Cd fumes	300 lb of CdO (17.5 lb of Cd fumes)	0-30 min: 10 lb/min (for fires of 950 °C)	2.0E-05 probability of Cd present	0.075 ppm	NA
(2f) Spills and ignition of flammable liquid, breaching nearby containers with dichromate salts (i.e., $Na_2Cr_2O_7$ or $K_2Cr_2O_7$)	Dust from burnt and unburnt dichromate salts	30 lb of dichromate dust	1-5 min: 6 lb/min	2.0E-05 × 1.2E-01 probability of dichromate salt present	0.1 mg/m^3	NA
Other						
(3a) Spills and ignition of flammable liquids; heat from fire causes explosion in compressed gas cylinder, venting NH_3	NH_3	Flammable liquid, 30.5 lb; compressed NH_3	0-5 min: 12 lb/min (puff)	2.0E-05 × 1.0E-02 probability of NH_3 present	24.5	560
(3b) Accidental confinement of oxidizing and reducing agents; reaction generates heat, igniting packaging and breaching nearby container	NH_3 or contents of any other nearby gas cylinder	NH_3 (60 lb)	0-5 min: 12 lb/min	3.0E-03 × probability of both agents present[f]	24.5	560
(3c) Accidental confinement of water with alkali-metal bases or alkali-earth oxides (i.e., Na_2O, K_2O, CaO); reaction generates heat, igniting packaging and breaching nearby containers	NH_3 or any other nearby gas cylinder	NH_3 (60 lb)	0-5 min: 12 lb/min	3.0E-03 × probability of both agents present[f]	24.5	560
(3d) Accidental rupture of compressed gas (NO_x; flammable) cylinder due to valve failure, releasing toxic gas	NH_3	Compressed gas (100 lb/container)	0-5 min: 100 lb/min	2.0E-05[g]	24.5	560
(3e) Accidental explosion (without previous spill) of diethyl ether peroxides formed by exposure to air; remaining diethyl ether ignites, spreading to nearby container	NH_3 or contents of any other nearby gas cylinder	Diethyl ether, 2 lb; 210 lb of NH_4OH (60 lb)	0-5 min: 12 lb/min	3.0E-03[h]	24.5	560

Notes: $CaCl_2$ = calcium hypochlorite; CaO = calcium oxide; CdO = cadmium oxide; $C_2H_4O_2$ = acetic acid; CS_2 = carbon disulfide; HCN = hydrogen cyanide; HF = hydrogen fluoride, HNO_3 = nitric acid; H_2SO_4 = sulfuric acid; KCN = potassium cyanide; $Na_2Cr_2O_7$ = sodium dichromate; Na_2O = sodium oxide; $Na_2S_2O_8$ = sodium persulfate; NH_3 = ammonia; NH_4NO_3 = ammonium nitrate; NH_4OH = ammonium hydroxide; and Ni = nickel.

a Number of containers at each site varies.

b Limits apply for a 15-minute exposure and are in parts per million (ppm) unless otherwise specified. PAEC = potential adverse effect concentration; and PLC = potential life-threatening concentration.

c Read as 3 × exp [-k (t-10)]; k_1 = 0.0145, k_2 = 0.0043, k_3 = 0.20, k_4 = 0.0494, k_6 = 0.0111, and k_7 = 0.2131; t = time (min).

d NA = not available.

e The assumption is that 1 in 10 spills will be ignited by a nearby spark (a conservative value) for an outdoor storage facility. When an accident scenario requires a number of initiating steps, involving more than one type of waste, the probability that all of the necessary constituents would be present at the same time must be included.

f The frequency of improper mixing of stored HW containers is approximately 3.0E-03 (according to Sasser [1992]).

g The value for the probability of compressed gas container breach is 1.0E-04 per container-handling operation; the value for breaching secondary containment is 1.0E-01.

h The frequency of improperly loading a container containing diethyl ether (allowing air to enter the container) is 3.0E-03 (according to Sasser [1992]).

The accident scenarios include a range from high-probability low-consequence accidents to high-consequence low-probability accidents. In general, the scenarios involve chemical or physical change in stored materials subsequent to an initial incident. Equations were written to represent the changes anticipated to occur during the accidents. Toxic gaseous products were identified, and the masses generated during an event were estimated from the mass of the reactants and the stoichiometry of the reactions. The annual frequency of accidents includes both the spill frequency and, where appropriate, the probability that all of the agents are present at the same time. Rates of releases were estimated based on the engineering judgement and the recognition that such rates usually decay exponentially with time. Obviously, the exact course of an accident is shaped by a multitude of factors, including (but not limited to) temperature, humidity, pooling versus spreading of spills, the exact composition and concentration of reactive materials (often unknown), and the proximity and nature of nearby reactive materials (including packaging, shelving, and flooring). Appendix H in ANL (1996a) provides details on the selection of the accident scenarios, on the chemistry involved in their progress, and on the estimation of the rates of release of the toxic gases.

The probability of an accident depends on the throughput of the waste type or types involved. The subsequent progression of some accident scenarios requires specific additional waste types to be in proximity to the initiating container; for instance, accident subcategory 2d is dependent on the probability that flammable liquids, accelerants, and Hg cells are being stored near one another.

A release is defined as some form of airborne release in terms of vapor, gas, aerosol, or particulates from the original chemical or the reaction product. Recall that all hazardous chemical releases were placed into one of 18 subcategories, depending on the category of accident (for example, spill or spill plus fire), the range of accidents within the category, and the particular health end point. Many chemicals in the inventory of each site pose no risk from release and therefore did not need to be considered further. The HW inventories for FY 1992 for 12 DOE sites (the 11 referred to earlier and NTS) were analyzed to determine the most representative set. Detailed chemical knowledge and engineering judgment were used to assign chemicals to categories. Accident risk during storage is dependent on the number of drums and the average masses of the chemicals placed in each category. Once each accident category was defined, the mass of a released chemical, the elapsed time for release, and the release rates were determined by the use of mass balance equations and consideration of vapor pressure and heat of vaporization at room temperature (ANL, 1996a).

F.7.2.1 Packaged Waste Storage and Handling Operations

Hazardous wastes are first accumulated in drums or laboratory packs at the source (laboratory or shop) and then are shipped to a centralized storage facility. Handling accidents during storage or staging operations are expected to dominate the risk of chemical releases to workers because of the frequency of handling and the proximity of the workers. Ignition or explosion of containers due to chemical reactions originating from container-loading errors have also been considered in handling accidents for HW.

F.7.2.1.1 *Material at Risk and Damage Fraction*

Because storage packages are typically plastic-lined, carbon steel 55-gal drums, the MAR for handling-accident scenarios is assumed to be one drum. Double containment with an intervening packing of absorbent material is typical of packaged chemically hazardous liquids; however, consistent with previous analyses, the assumption is made that the liquid is completely spilled (that is, DF = 1.0E+00) upon breach of the waste package (Salazar and Lane, 1992; ORNL, 1993).

F.7.2.1.2 *Spill Scenario Frequencies*

The frequency of container breaches is on the order of 1.0E–04 per handling operation (see Section F.2.7.1). Because HW storage facilities are allowed to hold materials for 90 days as a maximum, all of the containers that arrive at a facility are assumed to be shipped out within 90 days. Two handling operations per container of waste stored at the facility (one loading and one unloading) were assumed. Consistent with the discussion in Section F.2.7.1, the annual frequency for a spill from a container breach for chemical x due to a handling accident can then be given by

$$f_{sx} = 0.0002\, n_x \ , \qquad \text{(F.7–1)}$$

where n_x is the number of waste containers of chemical x received annually at the facility.

F.7.2.1.3 *Spill Plus Fire Scenario Frequencies*

The frequency of occurrence for subcategory 3a (the spill, ignition, and atmospheric release of chemical x) is given by

$$f_{sfx} = f_{sx} P_f \ , \qquad \text{(F.7-2)}$$

where P_f is the conditional probability of ignition (1E–01 for outdoor storage pads and 2E–01 for enclosed facilities) (Section F.2). The frequency of occurrence in accident subcategories 2b through 2f (the spill and ignition of a flammable chemical, followed by fire propagation and release of chemical y) depends on the concurrent presence of the flammable initiator and the container with the toxic chemical contents:

$$f_{sty} = 0.0002\ n_f P_f P_{fy} + 0.0002\ n_y P_f \ , \qquad \text{(F.7-3)}$$

where n_f is the number of flammable chemical containers, and P_{fy} is the conditional probability that fires involving the flammable chemicals propagate to and ignite the contents of drums containing chemical y. The expression P_{fy} is approximated by the ratio of the number of drums of chemical y to the total number of containers. The second term in the expression is added only if chemical y is also flammable.

F.7.2.1.4 *Frequencies of Other Event Combinations*

Accident subcategory 3a involves a spill and subsequent fire, which then induces an explosion. One SAR (EG&G, 1990) lists a value of 2.0E–02 for the annual probability of a fire-induced explosion sufficient to rupture the end walls of a facility. The reference scenario herein assumes the explosion of a compressed gas cylinder engulfed in fire. The frequency is given by

$$f_{sfey} = 0.0002\ n_f P_f P_{fy} P_e \ , \qquad \text{(F.7-4)}$$

where the probability P_{fy} of a drum or cylinders being engulfed is estimated as the approximate fraction of drums containing compressed gas cylinders and where P_e, the conditional probability that the engulfed gas canister will explode, is assumed conservatively to be 1.0E+00.

Fire-only scenarios 3b and 3c involve the inadvertent mixing of incompatible wastes. Human error probabilities between 1.0E–03 and 3.0E–03 are reported (Trusty et al., 1989; Sasser, 1992) for loading or sorting a chemical in the wrong place. Subsequent chemical reactions then generate enough heat to ignite the packaging material with a frequency estimated by

$$f_{frc} = 0.003\, n_{rc} \ , \qquad \text{(F.7–5)}$$

where n_{rc} is the number of containers containing potentially reactive chemical *rc* (or its equivalent) that are received annually at the facility. The surrogate toxic gas assumed to be released during the accident is ammonia (NH_3).

The fire may then spread to other containers and result in a release of toxic chemicals; however, the probability that a reaction among incompatible wastes will generate enough heat to ignite nearby combustible material (that is, paper or cardboard) is expected to be relatively small. The combustible material closest to the containers is usually a cardboard pallet, which requires temperatures of over 232 °C to ignite. Furthermore, the frequency with which containers of toxic waste are stored in proximity to the potential fire needs to be considered. Given the combination of events needed to result in other toxic gas releases, only the NH_3 release is treated herein.

Accident subcategory 3d involves a mechanical breach and subsequent explosion of cylinders of compressed gases. Such cylinders are expected to be stored inside drums, thus providing double-walled storage of the compressed gas. The annual frequency of double-walled container breach per unit handling operation is estimated as 1.0E–05, implying an order of magnitude credit for the second containment, which is probably conservative, given that conditional breach probabilities after a drop are estimated at 1.0E–02. Thus, the frequency of a handling accident resulting in an explosion of compressed gas cylinder *x* is conservatively estimated as

$$f_{secg} = 0.00002\, n_{cg} \ , \qquad \text{(F.7–6)}$$

where n_{cg} is the number of drums with compressed gas containers received annually at the facility.

The spontaneous fire and explosion scenario 3e corresponds to a waste fire and explosion induced by an error in the loading of the waste containers. Some chemicals react violently on contact and must be segregated. The gases produced by such reactions may produce enough pressure inside containers to cause explosions, with resulting container failure. The frequency of this scenario is

$$f_{ferx} = 0.003\, n_{rx}\ , \tag{F.7-7}$$

where n_{rx} is the number of containers containing potentially reactive chemical *rx* (or its equivalent) that are received annually at the facility. The spontaneous formation of peroxides upon exposure of ether to air (and the later ignition of those peroxides) is considered here to be an error in loading. In reality, ether should never be stored for extended periods because of this very problem.

F.7.2.2 Storage Facility Accidents

Hazardous wastes are generally packaged in 55-gal drums and stored in RCRA-compliant staging areas or weather protection sheds before offsite shipment for commercial treatment and disposal. A HWSF typically houses over 100 different chemicals, which may include chlorinated solvents, acids, bases, photographic chemicals, ignitable solids and liquids, compressed gases, metal salts, polychlorinated biphenyls, asbestos, and other regulated wastes. Because explosives are generally prohibited, the important hazard characteristics include volatility, flammability, dispersibility, and toxicity. The HW is characterized and segregated on the basis of toxicity, corrosivity, reactivity, and ignitability. Most HWSFs have containment berm areas and individual storage cells that permit waste segregation per RCRA and EPA criteria; some HWSFs have fire detection and suppression capability, and some have forced ventilation. Because of the great diversity of storage facility designs among the DOE sites, a generic facility with segregated storage (Figure F.2–5) was assumed in the analyses.

A facility-wide fire has been chosen as the representative internal accident. This fire is the type of accident scenario considered as the maximum reasonably foreseeable accident in the INEL HWSF SAR (EG&G, 1990). The fire would engulf a large fraction of the facility, could include secondary explosions and fire propagation from one area to another, and would consume numerous chemicals that vent hazardous substances on combustion or heating.

Externally initiated events have also been evaluated. The relevant chemicals identified in the operational accidents are assumed to be involved in the facility accident, with the amount of each chemical in facility sequences assumed to be proportional to the numbers of drums that, on average, are present at the facility.

A facility fire is the dominant sequence for aircraft impacts; a large spill resulting from numerous breached containers is the dominant sequence for earthquakes.

The chemicals in the facility fire source term are those identified as particularly hazardous in spills with fire (Table F.7–3). The sum of the amounts of these particularly hazardous chemicals defines the MAR, with the release rate and duration for each chemical the same as those for the individual drum fires. The DF is assumed to be 1.0E+00 because the accident scenario assumes no mitigation. In the representative seismic event, the assumption is that 1% of the containers fall and break (DF of 1.0E–02), leading to a large spill of varied chemicals. The externally induced fires (large- and small-aircraft impacts) result in a combined MAR that includes the hazardous releases in a facility-wide fire plus the hazardous releases due to explosions caused by fires or impacts. The representative chemicals in these accidents are shown in Table F.7–3. As in the case of facility fires, the DF for aircraft-induced accidents is taken as 1.0E+00.

Conditional probabilities for ignition and fire attendant upon violent breach of packages of flammable liquid are estimated to lie between 1.0E–01 and 1.0E+00 (ORNL, 1993). An initiating event frequency of 1.0E–02/yr for a fire involving local propagation is assumed here. A frequency of 1.0E–02 for failure of the segregation design, the fire suppression systems, or manual procedures is assumed, yielding a resulting facility-wide fire frequency of 1.0E–04/yr.

The frequencies of the external initiators are dependent on the site, as discussed in Section F.2.6. A conditional probability of container breach of 1.0E+00 has been used for large-airplane impacts and 9.0E–01 for small-airplane impacts, consistent with the LLW storage facility analysis (LLW and HW are both generally packaged in DOT 55-gal drums). For earthquakes, the best estimate (Kennedy et al., 1990) of the annual frequency of events with a peak ground acceleration exceeding 0.15 g at the different sites is taken as the frequency of seismic initiation. A ground acceleration of 0.15 g is assumed to be the minimum acceleration required to topple drums in the upper rows of a storage array. A conditional probability of 2.0E–01 for subsequent drum breach and spill, consistent with the LLW event tree analysis, has been used.

F.7.2.3 Treatment Facility Accidents

Evaluations show that incineration is also the risk-dominant thermal treatment technology for HW. Because SARs for both radioactive waste incinerators and commercial HW incinerators assign a high frequency to kiln explosions, the representative accident is taken to be an explosion that initiates a fire in the waste in the feedstock area. Three externally initiated events (large- and small-aircraft impacts and seismic events) that ignite a feedstock fire are also analyzed. A generic treatment facility, consisting of a series of linked treatment process modules, was described in Section F.2.6.3. A DOE Hazard Category of 2, concomitant performance of its systems, and double HEPA filtration systems were assumed.

The representative source term chemicals are those that were identified as particularly hazardous in case of a fire. The MAR is a fraction of the annual throughput of the incineration facility as established by the WM PEIS alternative. Information from commercial facilities indicates that only a few containers (a few hours' worth of throughput) are kept in the feedstock area. Therefore, 1% of the annual throughput was assumed to be in the staging area. This fraction represents the amount of waste in processing and lag storage. The DF depends on the magnitude of the initiator and is assumed to be 1.0E–01 for internal explosions, 2.0E–01 for seismic events and small-airplane crashes, and 3.0E–01 for large-airplane impacts. These values were assumed because of the scattered physical locations of the waste in the treatment facility and the fact that only some of the chemicals in the feedstock area were identified as airborne release hazards in Table F.7–3.

Estimates (discussed in Section F.2.7.3.5) of an annual frequency of 1.5E–02/yr for explosions in the rotary kiln assembly and in the SCC agree with the experience of commercial incineration operators and provide the basis for the internal fire frequencies used herein. The frequencies of aircraft-initiated accidents are dependent on the site. The frequencies were obtained in the same manner as those for the storage facilities. The conditional probabilities of containment and confinement rupture and fire initiation are consistent with those in the LLW accident analysis: 4.5E–01 and 1.0E–02 for large- and small-airplane crashes, respectively. The annual frequency of a seismic event exceeding the design basis for a Category 2 facility is 1.0E–03/yr. As in the LLW facility accident analysis, the conditional probability of rupturing containment and initiating a fire is estimated at 5.0E–02.

F.7.3 Results

The airborne release parameters for all accident types were shown in Table F.7–3. Table F.7–4 summarizes the estimated frequencies for the different handling accidents in the no-action decentralized, regionalized alternatives for each DOE site on the basis of the appropriate surrogate chemical inventories. Single-drum inventories are assumed for the handling accidents.

Table F.7-4. Site-Dependent Annual Frequencies of Representative HW Handling Accidents

Site/Event[a]	Decentralized Alternative						
Spill	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)
ANL-E	1.00E-03	3.00E-03	8.00E-04	6.80E-03	4.00E-04	2.00E-04	1.20E-03
Fermi	0	0	0	8.00E-04	0	0	2.00E-04
Hanford	1.80E-03	1.00E-03	4.00E-04	7.20E-03	4.00E-04	0.00E+00	3.20E-03
INEL	2.60E-03	5.40E-03	6.00E-04	6.00E-03	0.00E+00	0.00E+00	3.60E-03
KCP	1.60E-03	0.00E+00	0.00E+00	2.00E-04	0.00E+00	0.00E+00	0.00E+00
LLNL	6.40E-03	3.08E-02	4.40E-03	5.84E-02	7.60E-03	4.00E-04	2.26E-02
LANL	3.60E-03	6.20E-03	3.60E-03	4.22E-02	3.60E-03	0.00E+00	7.60E-03
ORR	0	0	0	0	0	0	1.00E-03
Pantex	0	2.20E-03	4.00E-04	1.22E-02	2.00E-04	0	0
SNL-NM	4.20E-03	0.00E+00	8.20E-03	2.96E-02	8.00E-04	0.00E+00	6.40E-03
SRS	2.00E-04	0.00E+00	0.00E+00	1.50E-02	1.56E-02	0.00E+00	4.00E-04
Spill Plus Fire	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	
ANL-E	8.00E-05	7.29E-04	3.19E-04	1.00E-03	1.82E-04	1.37E-04	
Fermi	0.00E+00	6.67E-05	6.67E-05	1.78E-04	0	0	
Hanford	4.00E-05	7.58E-04	9.48E-05	2.13E-04	1.90E-04	7.11E-05	
INEL	6.00E-05	1.34E-03	7.17E-05	2.15E-04	7.89E-04	2.63E-04	
KCP	0.00E+00	1.80E-03	2.95E-05	5.60E-04	1.18E-04	0.00E+00	
LLNL	4.40E-04	8.09E-03	5.04E-04	1.20E-03	8.16E-04	3.12E-04	
LANL	3.60E-04	3.20E-03	3.45E-04	0.00E+00	5.98E-04	4.37E-04	
ORR	0.00E+00	2.51E-03	0.00E+00	3.81E-05	3.81E-05	0.00E+00	
Pantex	4.00E-05	2.48E-03	5.52E-05	5.52E-04	3.31E-04	0.00E+00	
SNL-NM	8.20E-04	2.74E-03	3.62E-04	3.28E-03	2.31E-03	3.85E-04	
SRS	0	7.24E-03	2.78E-05	2.31E-03	2.37E-03	0	
Other Event	(3a)	(3b)	(3c)	(3d)	(3e)		
ANL-E	1.39E-05	3.00E-03	9.30E-02	2.80E-04	1.20E-02		
Fermi	0	0	3.00E-03	1.40E-04	0		
Hanford	3.33E-05	3.00E-03	6.60E-02	1.40E-04	1.20E-02		
INEL	5.09E-05	3.00E-03	1.47E-01	1.60E-04	2.70E-02		
KCP	7.57E-05	3.00E-03	9.00E-03	4.40E-04	3.00E-03		
LLNL	1.28E-04	1.20E-02	5.04E-01	6.40E-03	1.02E-01		
LANL	5.39E-05	1.80E-02	8.16E-01	1.48E-03	2.40E-02		
ORR	0	0	0	0	0		
Pantex	0	3.00E-03	1.02E-01	0.00E+00	3.00E-03		
SNL-NM	5.57E-05	8.40E-02	2.67E-01	1.26E-03	6.90E-02		
SRS	7.84E-06	0.00E+00	2.10E-01	0.00E+00	2.10E-02		

Table F.7-4. Site-Dependent Annual Frequencies of Representative HW Handling Accidents—Continued

Site/Event[a]	Regionalized Alternative						
Spill	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)
Hanford	8.20E-03	3.22E-02	4.80E-03	6.56E-02	8.00E-03	4.00E-04	2.58E-02
INEL	2.60E-03	5.40E-03	6.00E-04	6.00E-03	0.00E+00	0.00E+00	3.60E-03
LANL	7.80E-03	8.40E-03	1.22E-02	8.40E-02	4.60E-03	0.00E+00	1.40E-02
ORR	2.60E-03	3.00E-03	8.00E-04	7.80E-03	4.00E-04	2.00E-04	2.40E-03
SRS	2.00E-04	0.00E+00	0.00E+00	1.50E-02	1.56E-02	0.00E+00	4.00E-04
Spill Plus Fire	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	
Hanford	4.80E-04	7.38E-03	5.00E-04	1.18E-03	8.40E-04	3.20E-04	
INEL	6.00E-05	1.12E-03	6.00E-05	1.80E-04	6.60E-04	2.20E-04	
LANL	1.22E-03	7.00E-03	6.60E-04	3.30E-03	2.80E-03	7.20E-04	
ORR	8.00E-05	3.24E-03	3.60E-04	1.44E-03	2.60E-04	1.20E-04	
SRS	0.00E+00	5.20E-03	2.00E-05	1.66E-03	1.70E-03	0.00E+00	
Other Event	(3a)	(3b)	(3c)	(3d)	(3e)		
Hanford	7.85E-09	1.50E-02	5.70E-01	6.54E-03	1.14E-01		
INEL	0.00E+00	3.00E-03	1.47E-01	1.60E-04	2.70E-02		
LANL	0.00E+00	1.05E-01	1.19E+00	2.74E-03	9.60E-02		
ORR	7.28E-09	6.00E-03	1.05E-01	8.60E-04	1.50E-02		
SRS	0.00E+00	0.00E+00	2.10E-01	0.00E+00	2.10E-02		

Site/Event[a]	Centralized Alternative						
Spill	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)
East	2.80E-03	3.00E-03	8.00E-04	2.28E-02	1.60E-02	2.00E-04	2.80E-03
West	1.86E-02	4.60E-02	1.76E-02	1.56E-01	1.26E-02	4.00E-04	4.34E-02
Spill Plus Fire	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	
East	8.00E-05	8.44E-03	3.80E-04	3.10E-03	1.96E-03	1.20E-04	
West	1.76E-03	1.55E-02	1.22E-03	4.66E-03	4.31E-03	1.26E-03	
Other Event	(3a)	(3b)	(3c)	(3d)	(3e)		
East	7.41E-09	6.00E-03	3.15E-01	8.60E-04	3.60E-02		
West	3.76E-09	1.23E-01	1.90E+00	9.44E-03	2.37E-01		

[a] Refer to Table F.7-3 for definitions of accidents and released chemicals.

Tables F.7–5 and F.7–6 summarize the results for the storage and treatment facility accidents by site and alternative. The column labeled "Total Number of Containers" represents the MAR (that is, the total number of containers with the relevant chemicals for each accident that are estimated to be involved in accidents at the facility). The "Number of Containers Breached" is the product of the containers at risk and the DF. The remaining columns in the tables provide the breakdown of the total number of containers involved in the accident for each of the various relevant surrogate chemicals.

Table F.7-5. Frequencies and Source Term Parameters for WM HW Storage Facility Accidents

WM PEIS Alternative[a]	Site	Accident Frequency (per year)	Total Number of Containers	DF	Total Number of Containers Breached	Representative Subcategory Chemical Containers Involved[b]						
Representative Fire						(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	
1	INEL	1.0E-04	29	1.0E+00	29	14	1	1	2	8	3	
	KCP	1.0E-04	21	1.0E+00	21	15	0	0	5	1	0	
	LLNL	1.0E-04	119	1.0E+00	119	84	6	5	13	8	3	
	LANL	1.0E-04	56	1.0E+00	56	35	5	4	0	7	5	
	ORR	1.0E-04	17	1.0E+00	17	17	0	0	0	0	0	
	Pantex	1.0E-04	33	1.0E+00	33	23	1	1	5	3	0	
	Hanford	1.0E-04	15	1.0E+00	15	8	1	1	2	2	1	
	SNL-NM	1.0E-04	109	1.0E+00	109	30	10	4	36	25	4	
	SRS	1.0E-04	107	1.0E+00	107	65	0	0	21	21	0	
	ANL-E	1.0E-04	28	1.0E+00	28	8	1	4	11	2	2	
	Fermi	1.0E-04	4	1.0E+00	4	1	0	1	2	0	0	
2	INEL	1.0E-04	29	1.0E+00	29	14	1	1	2	8	3	
	Hanford	1.0E-04	94	1.0E+00	94	64	5	4	11	7	3	
	LANL	1.0E-04	151	1.0E+00	151	69	12	7	27	26	8	
	ORR	1.0E-04	52	1.0E+00	52	33	1	3	12	2	1	
	SRS	1.0E-04	107	1.0E+00	107	65	0	0	21	21	0	
3	INEL	1.0E-04	361	1.0E+00	361	194	24	16	58	53	16	
	ORR	1.0E-04	177	1.0E+00	177	106	1	5	39	24	2	
Seismic Events						(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)
1	INEL	1.8E-04	24	1.0E-02	0	0	0	0	0	0	0	0
	KCP	6.0E-05	2	1.0E-02	0	0	0	0	0	0	0	0
	LLNL	1.0E-03	165	1.0E-02	2	0	1	0	1	0	0	0
	LANL	6.0E-04	86	1.0E-02	1	0	0	0	1	0	0	0
	ORR	4.0E-04	1	1.0E-02	0	0	0	0	0	0	0	0
	Pantex	6.0E-05	19	1.0E-02	0	0	0	0	0	0	0	0
	Hanford	6.0E-05	19	1.0E-02	0	0	0	0	0	0	0	0
	SNL-NM	6.0E-04	61	1.0E-02	1	0	0	0	1	0	0	0

Table F.7–5. Frequencies and Source Term Parameters for WM HW Storage Facility Accidents—Continued

WM PEIS Alternative[a]	Site	Accident Frequency (per year)	Total Number of Containers	DF	Total Number of Containers Breached	Representative Subcategory Chemical Containers Involved[b]							
Seismic Events (Cont.)						(1a)	(1b)	(1c)	(1d)	(1e)	(1f)	(1g)	
	SRS	8.0E–05	40	1.0E–02	0	0	0	0	0	0	0	0	
	ANL-E	1.0E–04	17	1.0E–02	0	0	0	0	0	0	0	0	
	Fermi	1.0E–04	1	1.0E–02	0	0	0	0	0	0	0	0	
2	INEL	1.8E–04	24	1.0E–02	0	0	0	0	0	0	0	0	
	Hanford	6.0E–05	129	1.0E–02	1	0	0	0	1	0	0	0	
	LANL	6.0E–04	139	1.0E–02	1	0	0	0	1	0	0	0	
	ORR	4.0E–04	14	1.0E–02	0	0	0	0	0	0	0	0	
	SRS	8.0E–05	40	1.0E–02	0	0	0	0	0	0	0	0	
3	INEL	1.8E–04	374	1.0E–02	4	0	1	0	2	0	0	1	
	ORR	4.0E–04	61	1.0E–02	1	0	0	0	1	0	0	0	
Large-Aircraft Impacts						(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	(3a)	(3d)
1	INEL	2.0E–09	34	1.0E+00	34	14	1	1	2	8	3	3	2
	KCP	--	29	--	--	--	--	--	--	--	--	-	-
	LLNL	--	207	--	--	--	--	--	--	--	--	-	-
	LANL	--	80	--	--	--	--	--	--	--	--	-	-
	ORR	--	17	--	--	--	--	--	--	--	--	-	-
	Pantex	2.3E–07	33	1.0E+00	33	23	1	1	5	3	0	0	0
	Hanford	8.5E–09	19	1.0E+00	19	8	1	1	2	2	1	2	2
	SNL-NM	2.1E–05	130	1.0E+00	130	30	10	4	36	25	4	5	16
	SRS	8.2E–09	107	1.0E+00	107	65	0	0	21	21	0	0	0
	ANL-E	--	33	--	--	--	--	--	--	--	--	-	-
	Fermi	--	6	--	--	--	--	--	--	--	--	-	-
2	INEL	2.0E–09	34	1.0E+00	34	14	1	1	2	8	3	3	2
	Hanford	8.5E–09	157	1.0E+00	157	64	5	4	11	7	3	7	3
	LANL	--	189	--	--	--	--	--	--	--	--	-	-
	ORR	--	62	--	--	--	--	--	--	--	--	-	-

Table F.7–5. Frequencies and Source Term Parameters for WM HW Storage Facility Accidents—Continued

WM PEIS Alternative[a]	Site	Accident Frequency (per year)	Total Number of Containers	DF	Total Number of Containers Breached	Representative Subcategory Chemical Containers Involved[b]							
Large-Aircraft Impacts (Cont.)						(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	(3a)	(3d)
	SRS	8.2E–09	107	1.0E+00	107	65	0	0	21	21	0	0	0
3	INEL	2.0E–09	503	1.0E+00	503	194	24	16	58	53	16	23	119
	ORR	–	192	–	–	–	–	–	–	–	–	–	–
Small-Aircraft Impacts													
1	INEL	–	34	–	–	–	–	–	–	–	–	–	–
	KCP	2.70E–07	29	1.0E+00	29	15	0	0	5	1	0	2	6
	LLNL	2.70E–07	207	1.0E+00	207	84	6	5	13	8	3	8	80
	LANL	2.70E–07	80	1.0E+00	80	35	5	4	0	7	5	5	19
	ORR	2.70E–07	17	1.0E+00	17	17	0	0	0	0	0	0	0
	Pantex	–	33	–	–	–	–	–	–	–	–	–	–
	Hanford	–	19	–	–	–	–	–	–	–	–	–	–
	SNL-NM	–	130	–	–	–	–	–	–	–	–	–	–
	SRS	–	107	–	–	–	–	–	–	–	–	–	–
	ANL-E	2.70E–07	33	1.0E+00	33	8	1	4	11	2	2	1	4
	Fermi	2.70E–07	6	1.0E+00	6	1	0	1	2	0	0	0	2
2	INEL	–	34	–	–	–	–	–	–	–	–	–	–
	Hanford	–	157	–	–	–	–	–	–	–	–	–	–
	LANL	2.70E–07	189	1.0E+00	189	71	12	7	27	26	8	8	30
	ORR	2.70E–07	62	1.0E+00	62	33	1	3	12	2	1	2	8
	SRS	–	107	–	–	–	–	–	–	–	–	–	–
3	INEL	–	503	–	–	–	–	–	–	–	–	–	–
	ORR	2.70E–07	192	1.0E+00	192	106	1	5	39	24	2	3	12

Note: – = not applicable.
[a] Case 1 is the No Action/Decentralized alternative with two treatment sites. Case 2 is the Regionalized 1 alternative with five treatment sites. Case 3 is the Regionalized 2 alternative with two treatment sites.
[b] Refer to Table F.7–3 for definitions of released chemicals.

Table F.7-6. Frequencies and Source Term Parameters for WM HW Incineration Facility Accidents

WM PEIS Alternative[a]	Site	Accident Frequency (per year)	Total Number of Containers	DF	Number of Containers Breached	Representative Subcategory Chemical Containers Involved[b]					
						2a	2b	2c	2d	2e	2f
Representative Fire											
2	INEL	1.5E-02	20	1E-01	2	1	0	0	0	1	0
	LANL	1.5E-02	50	1E-01	5	3	0	0	1	1	0
	ORR	1.5E-02	50	1E-01	5	2	1	0	1	1	0
	Hanford	1.5E-02	30	1E-01	3	2	0	0	1	0	0
	SRS	1.5E-02	20	1E-01	2	1	0	0	1	0	0
3	INEL	1.5E-02	80	1E-01	8	5	1	0	1	1	0
	ORR	1.5E-02	80	1E-01	8	5	0	0	2	1	0
Seismic Events											
2	INEL	5.0E-05	20	2E-01	4	2	0	0	0	1	1
	LANL	5.0E-05	50	2E-01	10	7	1	0	1	1	0
	ORR	5.0E-05	50	2E-01	10	5	1	0	2	2	0
	Hanford	5.0E-05	30	2E-01	6	4	0	1	1	0	0
	SRS	5.0E-05	20	2E-01	4	2	0	0	1	1	0
3	INEL	5.0E-05	80	2E-01	16	9	1	1	3	2	0
	ORR	5.0E-05	80	2E-01	16	10	0	1	3	2	0
Large-Aircraft Impacts											
2	INEL	1.2E-09	20	3E-01	6	3	0	0	0	2	1
	LANL	--	--	--	--	--	--	--	--	--	--
	ORR	--	--	--	--	--	--	--	--	--	--
	Hanford	5.4E-09	30	3E-01	9	6	0	1	2	0	0
	SRS	5.0E-09	20	3E-01	6	4	0	0	1	1	0
3	INEL	2.7E-09	80	3E-01	24	12	2	1	4	4	1
	ORR	--	--	--	--	--	--	--	--	--	--
Small-Aircraft Impacts											
2	INEL	--	--	--	--	--	--	--	--	--	--
	LANL	7.0E-09	50	2E-01	10	6	1	1	1	1	0
	ORR	7.0E-09	50	2E-01	10	5	1	0	2	2	0
	Hanford	--	--	--	--	--	--	--	--	--	--
	SRS	--	--	--	--	--	--	--	--	--	--
3	INEL	--	--	--	--	--	--	--	--	--	--
	ORR	7.0E-09	80	2E-01	16	10	0	1	3	2	0

Note: -- = not applicable.
[a] Case 1 is the No Action/Decentralized Alternative with two treatment sites. Case 2 is the Regionalized 1 Alternative with five treatment sites. Case 3 is the Regionalized 2 Alternative with two treatment sites.
[b] Refer to Table F.7-3 for definitions of released chemicals.

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WSRC. *See* Westinghouse Savannah River Co.

Appendix G

Pollution Prevention

U.S. Department of Energy
Waste Management Programmatic Environmental Impact Statement

Contents

Tables

Acronyms and Abbreviations

The following is a list of acronyms and abbreviations (including units of measure) used in this appendix.

Ames	Ames Laboratory
ANL-E	Argonne National Laboratory-East
ANL-W	Argonne National Laboratory-West
BCL	Batelle Columbus Laboratories
Bettis	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
CISS	Colonie Interim Storage Site
CH	contact-handled
Charleston	Charleston Naval Shipyard
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	environmental restoration
ETEC	Energy Technology Engineering Center
FEMP	Fernald Environmental Management Project
Fermi	Fermi National Accelerator Laboratory
g	gram(s)
GA	General Atomics
GJPO	General Junction Projects Office
h	hour(s)
Hanford	Hanford Site
HLW	high-level waste
HW	hazardous waste
INEL	Idaho National Engineering Laboratory
ITRI	Inhalation Toxicology Research Institute
KAPL-K	Knolls Atomic Power Laboratory (Kesselring)
KAPL-S	Knolls Atomic Power Laboratory (Schenectady)
KAPL-W	Knolls Atomic Power Laboratory (Windsor)
KCP	Kansas City Plant
kg	kilogram(s)
km^2	square kilometer(s)
K-25	Oak Ridge K-25 Site

LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LDR	land disposal restrictions
LEHR	Laboratory for Energy-Related Health Research
LLMW	low-level mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level radioactive waste
m^3	cubic meter(s)
Mare Is	Mare Island Naval Shipyard
MAWS	Minimum Additive Waste Stabilization
mi^2	square mile(s)
Mound	Mound Plant
mrem	millirem(s)
nCi	nanocurie(s)
Norfolk	Norfolk Naval Shipyard
NTS	Nevada Test Site
ORR	Oak Ridge Reservation
Pantex	Pantex Plant
Pearl H	Pearl Harbor Naval Shipyard
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Naval Shipyard
PP	pollution prevention
PPOA	pollution prevention opportunity assessment
PPPL	Princeton Plasma Physics Laboratory
Puget So	Puget Sound Naval Shipyard
PWA	process waste assessment
RCRA	Resource Conservation and Recovery Act
RDDT&E	Research, Development, Demonstration, Testing, and Evaluation
R&D	research and development
RFETS	Rocky Flats Environmental Technology Site
RH	remote-handled
RMI	Reactive Metals, Inc.
SNL-CA	Sandia National Laboratories (California)
SNL-NM	Sandia National Laboratories (New Mexico)
SRS	Savannah River Site
TRUW	transuranic waste
TSD	treatment, storage, and disposal
UofMO	University of Missouri (Columbia)
VOCs	volatile organic compounds

WAC	waste acceptance criteria
WIPP	Waste Isolation Plant Project
WM	waste management
WMin/PP	waste minimization and pollution prevention
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WVDP	West Valley Demonstration Project
Y-12	Oak Ridge Y-12 Plant
yr	year(s)

Appendix G
Pollution Prevention

G.1 DOE's Pollution Prevention Program

A quantitative evaluation of the potential effect of pollution prevention is included in the WM PEIS in response to public comments during the scoping process (DOE, 1994a). Within the U.S. Department of Energy (DOE), pollution prevention encompasses those activities that involve source reduction and recycling of all waste and pollutants and includes those practices that reduce or eliminate pollutants through increased efficiency in the use of raw materials, energy, water, or other resources, or the protection of natural resources by conservation. The term "source reduction" can be applied to any practice that reduces the amount of any hazardous substance, pollutant, or contaminant that enters any waste stream or that otherwise is released into the environment prior to recycling, treatment, or disposal. Source reduction also describes any practice that reduces the hazards to public health and the environment associated with the release of any such substances, pollutants, or contaminants (DOE, 1994b).

Waste Minimization/Pollution Prevention (WMin/PP) programs derive from the Pollution Prevention Act of 1990 (Public Law 101-508, November 5, 1990), which established a national strategy for waste management and pollution control. This strategy places primary reliance on source reduction, followed by environmentally safe recycling, treatment, and disposal. DOE Order 5400.1, "General Environmental Protection Program" (DOE, 1988), requires that DOE facilities develop a WMin/PP plan as part of an environmental protection plan. The purpose of this appendix is to discuss how DOE's pollution prevention programs and practices may affect the waste loads that waste management (WM) facilities receive, and, consequently, the need for such facilities. This appendix contains estimates of reductions in waste loads, estimated risks associated with WM activities, and estimated WM costs resulting from pollution prevention practices.

On August 3, 1993, President Clinton issued Executive Order (EO) 12856, "Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements" (EO, 1993). To help ensure that Federal agencies manage their facilities so that the objectives of the Pollution Prevention Act are met to the maximum extent practicable, EO 12856 requires agencies to develop voluntary goals to reduce their total releases of toxic chemicals or toxic pollutants to the environment and offsite transfers of such toxic chemicals or toxic pollutants by 50% by December 31, 1999.

Subsequent to the issuance of EO 12856, the Secretary of Energy on December 28, 1993, directed that DOE's policy shall be to embrace pollution prevention as the DOE's strategy to reduce the generation of all waste streams and thus minimize the impact of DOE operations on the environment, as well as improving the safety of operations and energy efficiencies. The Secretary further directed cognizant Secretarial Offices in DOE to identify, plan, and allocate funds for field implementation of WMin/PP activities during the Departmental budget and review process so that there is an identified budget dedicated to pollution prevention activities each year.

On December 27, 1994, the Secretary of Energy approved a Departmental pollution prevention strategy for compliance with EO 12856. DOE has a pollution prevention strategy that requires DOE sites to engage in pollution prevention and to have an established program for implementing this policy. In approving the Departmental strategy, the Secretary directed that information on progress made toward meeting the milestones and achieving the goals set forth in the strategy are to be included in site pollution prevention awareness plans and in Annual Reports to the Secretary on Waste Generation and Waste Minimization Progress. Specific milestones and goals contained in the approved strategy include the following:

- Achieve a Departmentwide 50% reduction of total releases of toxic chemicals to the environment and offsite transfers of such toxic chemicals from the baseline year by December 31, 1999.
- Establish a Departmentwide plan, with goals, to eliminate or reduce unnecessary acquisitions of hazardous substances or toxic chemicals.
- Establish a Departmentwide plan, with goals, to reduce DOE manufacture, process, and use of extremely hazardous substances and toxic chemicals.
- Review DOE standards and specifications to identify opportunities to eliminate or reduce unnecessary acquisitions of hazardous or toxic substances by August 31, 1995, and complete all necessary revisions by December 31, 1998.

In accordance with DOE's policy on pollution prevention, DOE issued the 1994 Waste Minimization/ Pollution Prevention Crosscut Plan (DOE 1994b), which established Departmentwide goals to meet the targets of EO 12856. The 1994 crosscut plan, as well as the approved DOE strategy for compliance with EO 12856, calls for each DOE site to establish site-specific goals to reduce the generation and use of radioactive materials and other hazardous materials to the extent practicable. The 1994 crosscut plan focuses on wastes and pollutants generated within DOE and includes an activity plan. The outline of the activity plan, as presented in Table G–1, attempts to fully integrate WMin/PP practices into DOE operations.

Table G–1. Outline of the WMin/PP Activity Plan

1. WMin/PP Policy Direction Activities		
1.1	Establish goals to minimize waste generation	Each DOE site will set quantitative WMin/PP goals and implement plans for achieving these goals.
1.2	Establish senior management commitment and follow-through for DOE WMin/PP activities	All DOE and contractor organizations will translate the Secretarial WMin/PP policy into policies specific to their sites or programs and be accountable for incorporating WMin/PP into routine operations.
1.3	Distinguish WMin/PP budget allocations through activity data sheets	Specific WMin/PP budgets will be established through preparation of separate Activity Data Sheets.
1.4	Promote regulatory review and reform	The Department will work with regulators and stakeholders to ensure that the best waste management practices are evaluated and incorporated into Federal and State regulations and laws.
1.5	Update DOE policies, orders, and procedures to integrate WMin/PP	DOE policies, orders, and procedures will be updated to reflect the Department's focus on integrating WMin/PP objectives into all activities.
2. WMin/PP Infrastructure Development		
2.1	Standardize material and tracking systems	The Department will develop standards and criteria to measure materials and wastes and provide performance requirements for materials and waste tracking systems.
2.2	Estimate waste management costs for use in decision making	The Department will develop standards for estimating the costs and benefits of introducing WMin/PP changes into its operations.
2.3	Facilitate WMin/PP technology transfer and information exchange	The Department will enhance existing systems to optimize WMin/PP technology transfer and information exchange within the DOE complex.
2.4	Develop a DOE WMin/PP incentives program	The Department will acknowledge and reward reductions in waste generation and environmental releases.
2.5	Develop and conduct WMin/PP employee training and awareness programs	The Department will operate a comprehensive WMin/PP training program that considers all applicable job-specific situations.
2.6	Develop and implement a WMin/PP outreach and public relations program	The Department will inform government agencies and local communities of WMin/PP accomplishments and invite them to participate in environmental activities and initiatives.
3.1	Develop and maintain consistent sitewide WMin/PP programs at all sites	The Department will provide core sitewide WMin/PP activities and services at every site. It will clarify its organizational roles and responsibilities to ensure stable funding and consistent management of its sitewide WMin/PP programs.

Table G–1. Outline of the WMin/PP Activity Plan—Continued

3. WMin/PP Program Implementation	
3.2 Develop and maintain consistent generator-specific programs	The Department will require that waste-generating organizations include appropriate WMin/PP concepts and techniques into their program operations and other activities such as weapons disassembly, decontamination and decommissioning, and environmental restoration.
3.3 Perform opportunity assessments and identify WMin/PP projects	The Department, acting to minimize total costs, will perform opportunity assessments and identify and implement WMin/PP projects that show a rapid (within 36 months) return on investment.
3.4 Design WMin/PP into new products, processes, and facilities	The Department will integrate WMin/PP into all new design criteria.
3.5 Integrate WMin/PP into research, development, and demonstration programs	The Department will couple waste generation and R&D communities to ensure that WMin/PP R&D projects offering the greatest technical benefit are available to generator organizations.
3.6 Modify procurement practices to promote WMin/PP	The Department will promote the purchase of less toxic, more durable, more energy-efficient materials.
3.7 Develop multimedia WMin/PP strategies	The Department will require that all operations develop and implement engineering design-based pollution and waste prevention strategies, process chemistry and technology strategies, operations-based WMin/PP strategies, and maintenance-based proactive strategies.

Source: Appendix C of DOE (1994b).

DOE's WMin/PP practices in 1991 and 1992 are described in the WMin/PP annual report (DOE, 1993b). The following are some examples of WMin/PP practices:

- Substitution of nonhazardous (or less hazardous) for more hazardous solvents. For example, substitution reduced the use of naphtha-based solvents by 90% at the Pantex Plant. Several sites substituted a less harmful material for 1,1,1-trichloroethane.
- Resale to outside manufacturers of virgin chemicals that have exceeded the stringent shelf life requirements of the weapons programs.
- Offsite reclamation of lead batteries (lead acid, gel-cells, and nickel-cadmium), waste oil, and photo fixer for silver reclamation.
- Onsite reclamation and recycling of antifreeze, Freon, and waste oil.
- Implementation of a chemical exchange program whereby chemicals no longer needed were made available for use by other scientists who would otherwise buy additional chemicals.

- Offsite recycle of Freon and methylene chloride resulting in recovery for reuse of approximately 80% of the solvent.
- Replacement of flammable scintillation cocktails with a nonhazardous, biodegradable material that eliminated a mixed waste stream at Brookhaven National Laboratory.

A procedure that may identify opportunities and be a component of a facility's pollution prevention program is the process waste assessment (PWA), also known as a pollution prevention opportunity assessment (PPOA). A PPOA is an analysis of a process or activity to identify opportunities to eliminate or reduce the generation of waste or the consumption of raw materials, water, or energy. Once identified, opportunities are evaluated and compared to determine the most efficient and cost-effective option.

The approach used reflects one method of estimating waste minimization impacts in the absence of installation-specific goals for the reduction of wastes and pollution. A 50% reduction in the future generation of waste to be handled in WM treatment, storage, and disposal (TSD) facilities has been assumed. Cost and risk reductions for the operation of waste management TSD facilities have been calculated based on this assumption. The other factor in cost calculations not yet available is the probable cost of achieving this 50% level of waste generation in the operating facilities that generate the waste. In some instances, such as capital equipment investments to meet the goal, the cost could be substantial and the net dollar gain through pollution prevention would be lower than projected. Since these latter costs cannot yet be calculated, they are considered beyond the scope of this Waste Management Programmatic Environmental Impact Statement (WM PEIS).

G.2 Effect of Pollution Prevention on Waste Management Activities

Executive Order 12856 requires the Secretary of Energy and the heads of other Federal agencies to ensure that the agency develop voluntary goals to either reduce the agency's total release of toxic chemicals to the environment and offsite transfers of such toxic chemicals for treatment and disposal by 50%, or to plan for a 50% reduction in the release or offsite transfer of toxic pollutants. The Executive Order defines toxic chemicals to be those chemicals for which toxic chemical release forms shall be completed pursuant to section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Toxic pollutants include toxic chemicals. Federal agencies may choose to include other substances such as extremely hazardous chemicals as defined by EPCRA or hazardous wastes as defined under the Resource Conservation and Recovery Act as toxic pollutants.

The 1994 WMin/PP crosscut plan states that site-specific goals for reduction of wastes and pollution will be set. The Executive Order does not expressly refer to the various waste types; rather, it refers to and defines toxic chemicals and toxic pollutants. The DOE's interpretation of the Executive Order, whether ultimately strict or broad, will influence site-specific goals. It can be expected that these goals will call for source reductions of at least 50% in the aggregate. Source reduction and recycling would be greater than 50% for some waste streams and less than 50% for other waste streams. However, as site-specific pollution prevention plans may not be waste-stream-specific, a simple assumption is made that source reduction and recycling will result in a 50% reduction in the annual transfer to WM of each waste stream for each year of the time spans considered in the WM PEIS. This assumption does not represent the flexibility allowed by DOE policy; more precise estimates require the definition of site-specific goals. However, recent DOE experience indicates that more than a 50% source reduction is achievable for some waste streams.

G.2.1 WASTE TYPES ADDRESSED

DOE's pollution prevention program applies to all DOE activities and all types of waste that these activities generate. This appendix emphasizes pollution prevention as it relates to four waste types: (1) low-level radioactive waste (LLW), (2) low-level mixed waste (LLMW), (3) hazardous waste (HW), and (4) transuranic waste (TRUW). Because high-level waste (HLW) is no longer being generated, pollution prevention activities cannot be applied to HLW.

Much of DOE's pollution prevention policy is directed toward source reduction, which affects WM by reducing the quantity of waste that is transferred to its facilities. Source reduction by generators in Defense Programs, Energy Research, and other DOE offices will affect WM operations significantly by reducing the amount and radioactivity level of waste that WM handles. Source reduction could result in fewer shipments of waste and in either TSD facilities with smaller capacities or fewer TSD facilities.

The following sections contain estimates of reductions in the waste loads to TSD facilities, the cost of constructing and operating these facilities, and the human health risks to the public and workers from a 50% reduction in the annual generation of the four waste types described in WM PEIS Chapters 6–10. The impact of a given percentage reduction in general depends on the existing inventory of waste. If the inventory is large compared with annual generation, then a reduction in annual generation will have little effect because most of the waste processed will be from the inventory. On the other hand, if the inventory is small compared with annual generation, a reduction in annual generation will have a greater effect. For the four waste types considered, existing inventories are most significant for TRUW and least significant for HW.

G.2.2 Low-Level Waste

Estimates of the effect of source reduction on LLW facilities are based on information in the LLW technical report (ANL, 1996a), the WM facility human health risk appendix (Appendix D), and the waste management costs technical report (INEL, 1995a). LLW is divided into 10 waste categories (for example, combustible, surface-contaminated bulk metals and equipment) that define how the waste is treated. Two alternatives with volume reduction treatment (incineration, supercompaction, size reduction, and grout stabilization) are considered here. Regionalized Alternative 2 has volume reduction treatment at 11 sites and disposal at 12 sites; Regionalized Alternative 5 has such treatment at 4 sites and disposal at 6 sites. The waste inventory and annual generation information does not include waste transferred to waste management from environmental restoration (ER) operations. Some of these categories of waste are amenable to recycling. For example, surface-contaminated metals and equipment could be decontaminated and recycled.

G.2.2.1 Waste Load Reductions

Estimates of the effect of pollution prevention are given in Table G–2 for treatment waste loads and in Table G–3 for disposal waste loads. These tables contain waste loads based on current annual generation and waste loads when a 50% decrease in annual generation is assumed. The waste loads are based on the waste inventory and 20 years of annual generation being treated and disposed of in 10 years. It is assumed, in effect, that the inventory and waste generated for 10 years are stored until the treatment facilities become available during a second 10-year period. This assumption does not apply to aqueous waste and saltstone waste at SRS, which will be treated and disposed of over 20 years. Thus, the treatment and disposal waste loads in Tables G–2 and G–3 are for the second 10-year period. The effect of the first 10 years of operation (for aqueous waste and saltstone at SRS) is mainly on the need for disposal capacity. Existing capacity by technology is also given in these tables so that the effect of pollution prevention practices on the need for new capacity can be assessed.

Table G–2. Effect of Pollution Prevention on Waste Management LLW Treatment Waste Loads (Second 10 Years of Treatment)

Treatment Site	Treatment Technology	Existing Capacity (m^3/yr)	Regionalized 2 (m^3/yr)		Regionalized 5 (m^3/yr)	
			Current	WMin/PP[a]	Current	WMin/PP[a]
FEMP	Thermally treat	--	7.7E+02	4.4E+02	*	*
	Solidify	--	3.5E+01	2.0E+01	*	*
	Supercompact	--	NA	NA	*	*
	Size reduce	--	1.0E+02	6.4E+01	*	*
Hanford	Thermally treat	--	5.3	3.0	3.5E+01	2.0E+01
	Solidify	--	5.3E+01	3.0E+01	5.5E+01	3.1E+01
	Supercompact	4.0E+03	4.8E+03	2.4E+03	5.0E+03	2.5E+03
	Size reduce	--	3.1E+03	2.0E+03	3.2E+03	2.0E+03
INEL	Thermally treat[b]	2.3E+03	1.7E+03	1.0E+02	1.0E+04	5.8E+03
	Solidify	2.8E+04	1.0E+03	5.8E+02	1.3E+03	7.4E+02
	Supercompact	5.7E+03	6.8E+02	3.3E+02	5.7E+03	2.9E+03
	Size reduce	5.0E+03	2.1E+03	1.3E+03	7.1E+03	4.5E+03
LANL	Thermally treat	--	5.6E+03	3.2E+03	*	*
	Solidify	--	2.6E+02	1.3E+02	*	*
	Supercompact	--	4.8E+03	2.7E+03	*	*
	Size reduce	--	1.1E+03	6.9E+02	*	*
LLNL	Thermally treat	--	2.9E+01	1.7E+01	*	*
	Solidify	--	2.1E+02	1.2E+02	*	*
	Supercompact	1.5E+03	1.2E+02	5.9E+01	*	*
	Size reduce	1.2E+02	7.5E+01	4.8E+01	*	*
ORR	Thermally treat[b]	--	2.4E+02	1.4E+02	3.1E+03	1.8E+03
	Solidify[c]	--	7.9E+02	4.4E+02	9.3E+02	5.3E+02
	Supercompact	1.4E+03	4.4E+03	2.2E+02	5.0E+03	2.5E+03
	Size reduce	--	1.6E+04	1.0E+04	2.7E+04	1.7E+04
Pantex	Thermally treat	-	NA	NA	*	*
	Solidify	--	6.6E-02	3.8E-02	*	*
	Supercompact	1.1E + 03	1.8E+01	1.0E+01	*	*
	Size reduce	--	2.4E+02	1.5E+02	*	*
PGDP	Thermally treat	--	5.4E+02	3.1E+02	*	*
	Solidify[c]	--	5.4E+01	3.1E+01	*	*
	Supercompact	--	5.8E+02	2.9E+02	*	*
	Size reduce	--	9.4E+01	5.9E+01	*	*
PORTS	Thermally treat	--	1.5E+03	8.8E+02	*	*
	Solidify	--	1.3E+02	7.2E+01	*	*
	Supercompact	--	6.9E+01	3.5E+01	*	*
	Size reduce	--	1.1E+04	6.9E+03	*	*

Table G–2. Effect of Pollution Prevention on Waste Management LLW Treatment Waste Loads (Second 10 Years of Treatment)—Continued

Treatment Site	Treatment Technology	Existing Capacity (m^3/yr)	Regionalized 2 (m^3/yr)		Regionalized 5 (m^3/yr)	
			Current	WMin/PP[a]	Current	WMin/PP[a]
RFETS	Thermally treat	--	2.8E+03	1.6E+03	*	*
	Solidify	--	2.6E+02	1.5E+02	*	*
	Supercompact	5.6E+03	5.9	3.0	*	*
	Size reduce	--	4.2E+02	2.7E+02	*	*
SRS	Thermally treat[b]	8.2E+03	1.5E+03	8.3E+02	1.5E+03	8.3E+02
	Solidify	2.1E+02	2.0E+03	1.1E+03	2.0E+03	1.1E+03
	Supercompact	4.0E+03	9.4E+03	4.7E+03	9.4E+03	4.7E+03
	Size reduce	--	9.2E+02	5.8E+02	9.2E+02	5.8E+02

Notes: -- = no existing capacity; * = not a treatment site for this alternative.
[a] The pollution prevention case assumes a 50% reduction in annual generation. When the waste inventory to be worked off over 10 years is taken into account, the waste loads are 57.5%, 56.6%, 50.4%, and 62.5% of the no reduction waste loads for thermal treatment, solidification, supercompaction, and size reduction, respectively.
[b] There are thermal treatment facilities at INEL, ORR, and SRS; these are assumed to be dedicated to treating LLMW and unavailable for LLW.
[c] For ORR and PGDP, the existing solidification capacities are assumed to be adequate to meet the no action waste loads.

Table G–3. Effect of Source Reductions on Waste Management LLW Disposal Waste Loads (Second 10 Years of Disposal)

Disposal Site	Existing Disposal Capacity (m^3/yr)	Regionalized 2 (m^3/yr)		Regionalized 5 (m^3/yr)	
		Current	WMin/PP[a]	Current	WMin/PP
Hanford	8.5E+03	2.1E+03	1.1E+03	2.1E+03	1.1E+03
INEL	3.9E+03	3.9E+03	2.0E+03	4.7E+03	2.6E+03
NTS	4.5E+04	1.8E+02	9.1E+01	2.7E+02	1.4E+02
LANL	1.3E+03	5.1E+03	2.7E+03	6.4E+03	3.5E+03
ORR	6.0E+02	1.3E+04	8.2E+03	4.1E+04	2.3E+04
SRS	5.4E+03	4.5E+04	2.3E+04	4.6E+04	2.3E+04
PORTS	+	1.2E+04	6.3E+03	*	*
PGDP	+	4.2E+03	2.1E+03	*	*
LLNL	+	6.2E+02	3.1E+02	*	*
Pantex	+	2.9E+02	1.8E+02	*	*
RFETS	+	1.0E+03	6.3E+02	*	*

Notes: + = no existing capacity; * = not a disposal site for this case.
[a] The pollution prevention results are based on a 50% reduction in annual generation. However, the volumes disposed of decrease by less than 50% because the category-dependent inventory is also being disposed of.

The waste loads for the pollution prevention cases with a 50% reduction in annual generation are more than 50% of the base cases, that is, a 50% reduction in annual generation rate results in less than a 50% reduction in waste load. This is because the waste loads include existing inventories of waste that are treated along with the new waste. The ratio of inventory to annual generation is dependent on waste category and site. For simplicity, complex-averaged ratios are used for each waste category. These complexwide waste load reductions are 42.5% for thermal treatment, 43.4% for solidification, 49.6% for supercompaction, and 37.5% for size reduction. For the four technologies considered, source reduction is estimated to be most effective in reducing waste loads for supercompaction and least effective in reducing waste loads for size reduction. Overall, the total waste load reduction for the four volume reduction technologies is estimated to be approximately 43%. The waste categories contributing to each volume reduction treatment are taken from ANL (1996a).

As Table G-2 shows, a majority of the 11 sites have no existing capacity for most volume reduction treatments listed in the table. Except for the Idaho National Engineering Laboratory (INEL), the other DOE sites do not have existing capacities for the complete set of the volume reduction technologies considered. Source reduction would reduce the capacities required of new facilities. For the alternatives considered, an annual generation reduction of 50% is estimated to eliminate the need for additional supercompaction capacity at the Hanford Site; for the cases with four regional treatment centers, this annual generation reduction also would eliminate the need for new supercompaction and size reduction capacity at the INEL.

As indicated in Table G-3, the assumed annual waste generation reduction from pollution prevention practices affects the adequacy of the existing disposal capacity at INEL. Without the reduction in annual generation, the capacity is inadequate; with an assumed 50% reduction in annual generation, it is adequate. For new disposal sites and some existing disposal sites (LANL, ORR, and SRS), generation reduction would reduce the amount of new capacity needed. For Hanford and the Nevada Test Site (NTS), the existing disposal capacities are adequate regardless of generation reduction. Overall, a 50% generation reduction is estimated to result in approximately a 48% reduction in disposal waste loads.

G.2.2.2 Cost Savings

Cost savings from pollution prevention reductions are estimated for treatment, disposal, and transportation. Because installation-specific goals are as yet unavailable, it is assumed that pollution prevention practices reduce new source generation by the same percentage (50%) throughout the DOE complex. There may be additional costs to waste generators to effect such waste generation reductions; however, the costs of making reductions are beyond the scope of this WM PEIS. The savings from waste generation reduction considered here are the waste management cost savings, which may be higher than the net savings.

Waste management cost savings associated with treatment, disposal, and transportation are considered. These are based on planning-level life-cycle costs for 10 years of operations (see INEL, 1995a) and the Site Data Tables in Volume II. Facility costs for treatment and disposal can be considered to consist of costs related to operations and costs related to construction. Operations costs are assumed to be proportional to throughput (waste load). Cost savings for construction depends on whether there are existing facilities for the type of treatment at a site. If there are no existing facilities, then costs for construction are assumed to be proportional to waste load. If there are existing facilities, then costs for construction are assumed to be proportional to the difference between the existing capacity and the capacity needed to process (or dispose of) the waste load. A given percentage reduction in waste load results in a greater percentage decrease in capacity needed when there is existing capacity. For example, if existing capacity is half the capacity needed to treat a given waste load, a reduction of 40% in waste load will result in an 80% reduction in the new capacity needed. In general, if the existing waste load is equivalent to E; the fractional decrease in waste loads with pollution prevention is equivalent to F; the additional capacity needed without pollution prevention is equivalent to Δ; and Δ_{WMin} is the additional capacity needed with pollution prevention, then the fractional new capacity needed is:

$$\Delta_{WMin}/\Delta = (1 - F) - F \times E/\Delta \qquad (G.1)$$

Cost savings have been estimated for the two volume reduction cases considered above. Estimates of cost savings for treatment at the sites with volume reduction facilities are presented in Table G–4. The treatment costs considered are for thermal treatment, grout stabilization, supercompaction, size reduction (i.e., shredding and compacting), packaging, and certification and shipping. The same percentage decreases in costs (F) for thermal treatment, grout stabilization, size reduction, and supercompaction are used as percentage decreases in waste load (see Table G–2). The percentage decreases in costs for packaging and certification and shipping are taken to be the cost-weighted average for thermal treatment, grout stabilization, supercompaction, and size reduction. When there is an existing facility, the complement of Δ_{WMin}/Δ from equation (G.1) is used for the fractional decrease in construction costs. If equation (G.1) is negative, then the existing capacity is adequate for the assumed decrease in annual generation rate.

For three situations, the existing capacity is estimated to become inadequate for reductions in annual generation of between 0 and 50%. For a generation reduction of less than 26%, existing supercompaction capacity at the Hanford Site becomes inadequate; for a generation reduction of less than 10%, the existing supercompaction capacity at INEL becomes inadequate; and for a generation reduction of less than 37%, the existing size reduction capacity at INEL becomes inadequate. From Table G-4, overall, a 50% generation reduction is estimated to result in approximately a 40% reduction in costs for treatment.

Estimates of cost savings for disposal for an assumed 50% reduction in annual generation of LLW are given in Table G-5 for the alternatives being considered. Percentage cost reductions for disposal are assumed to be equal to percentage waste load reductions for disposal for operations and for construction when there is no existing disposal facility. When there is an existing facility, then the complement of equation (G.1) is used. Overall, a 50% reduction in annual generation is estimated to result in approximately a 48% reduction in disposal costs.

The waste management costs technical report (INEL, 1995a) also contains estimates of transportation costs of LLW for the two volume reduction cases being considered. From the volume information in (ANL, 1996a), percentage waste load reductions by generating site for a 50% reduction in annual LLW generation were calculated by volume-averaging over waste categories. These generating-site percentage load reductions were multiplied by the transportation costs from each site to yield an estimate of the reduction in transportation costs from a 50% reduction in annual generation. Thus, this estimate is based on the assumption that the cost of transporting waste is proportional to the volume of waste moved and that all transport is from the generation site. Table G-6 contains the estimate of the total savings in transportation and the total savings for treatment and disposal from the information in Tables G-4 and G-5, respectively. Overall cost reductions for treatment, disposal, and transportation are estimated to be approximately 45% for a 50% reduction in annual generation.

The total savings are in the range of $8 to $9 billion for 10 years of operations. These values are for a 20-year interval (inventory and 20 years of waste generation are treated and disposed of in 10 years) and are approximately $400 million per year. This estimate of savings is consistent with a recent estimate of avoidable DOE waste management costs (Teclaw et al., 1993), which estimated avoidable annual costs for LLW of between $10 million and $10 billion.

Table G–4. Effect of Pollution Prevention on Costs of Waste Management LLW Treatment[a] for Two Volume Reduction Alternatives (in dollars)

Installation	Regionalized 2		Regionalized 5	
	Current	WMin/PP[b]	Current	WMin/PP
FEMP	3.12E+08	1.83E+08	--	--
Hanford	9.62E+08	5.88E+08	1.00E+09	6.12E+08
INEL	1.11E+09	6.34E+08	2.86E+09	1.63E+09
LANL	8.12E+08	4.81E+08	--	--
LLNL	2.82E+08	1.60E+08	--	--
ORR	3.77E+09	2.38E+09	4.52E+09	2.82E+09
Pantex	1.42E+08	8.92E+07	--	--
PGDP	4.85E+08	2.88E+08	--	--
PORTS	9.14E+08	5.70E+08	--	--
RFETS	6.90E+08	4.08E+08	--	--
SRS	1.27E+09	7.17E+08	1.27E+09	7.48E+08
Total	1.07E+10	6.57E+09	9.65E+09	5.81E+09

Note: -- = not a regional treatment site for this alternative.
[a] Treatments considered are thermal treatment, grout stabilization, supercompaction, size reduction (i.e., shredding and compaction), packaging, and certification and shipment. The cost of other treatment steps is not considered for LLW in this Appendix.
[b] A 50% reduction annual generation rate is assumed. Costs for operations are assumed to be proportional to throughput. Cost reductions for construction depends on whether there are existing facilities or not. If there are no existing facilities, costs for construction are assumed to be proportional to throughput. If there are existing facilities, cost for construction are proportional to the capacity of new construction needed.

G.2.2.3 Human Health Risk Reduction

For the volume reduction cases considered above, reductions in human health risk from reduction in annual generation are estimated for routine operations at the volume-reduction treatment centers and disposal sites. Incidence of cancer is taken as the measure of human risk because it applies to the four waste types considered in this appendix (person-rem would apply to LLW, LLMW, and TRUW, but not to HW). Cancer incidence based on the risk from the second 10 years of treatment and storage, not risks per year of operations, were obtained from tables in the human health risk appendix (Appendix D).

Table G–5. Effect of Pollution Prevention 50% Reduction in Annual Generation on Costs for Waste Management LLW Disposal in Two Volume Reduction Alternatives (in dollars)

Installation	Regionalized 2		Regionalized 5	
	Current	WMin/PP	Current	WMin/PP
Hanford	3.8E+08	2.0E+08	3.8E+08	2.1E+08
INEL	4.2E+08	2.2E+08	6.2E+08	3.1E+08
LANL	6.0E+08	3.1E+08	1.8E+09	9.8E+08
LLNL	3.1E+08	1.6E+08	NA	NA
NTS	2.0E+07	1.1E+07	5.9E+07	3.1E+07
ORR	3.7E+08	2.1E+08	8.0E+08	4.3E+08
Pantex	8.0E+07	5.1E+07	NA	NA
PGDP	3.1E+08	1.6E+08	NA	NA
PORTS	5.2E+08	2.7E+08	NA	NA
RFETS	3.5E+08	1.8E+08	NA	NA
SRS	3.4E+09	1.7E+09	3.4E+09	1.7E+09
Total	6.8E+09	3.4E+09	6.6E+09	3.7E+09

Note: NA = not applicable; not a disposal site for this alternative.

Table G–6. Summary of Effect of Pollution Prevention 50% Reduction in Annual Generation on Costs[a] for Waste Management LLW in Two Volume Reduction Alternatives (in dollars)

Activity	Regionalized 2		Regionalized 5	
	Current	WMin/PP	Current	WMin/PP
Treatment[b]	1.0E+10	6.6E+09	9.6E+09	5.8E+09
Disposal	6.8E+10	3.4E+09	6.6E+09	3.7E+09
Transportation[c]	6.4E+07	3.3E+07	3.3E+08	2.1E+08

[a] Costs are life-cycle costs for treatment at regional treatment facilities, disposal, and all transportation.
[b] Treatments considered are thermal treatment, supercompaction, size reduction, packaging, and certification and shipment.
[c] Based on transport by truck.

Table G–7 contains estimates of the effect of a 50% across-the-board reduction in annual generation on cancer incidence among the offsite population and WM workers at sites with volume-reduction facilities. The alternatives considered have either 11 or 4 sites with volume reduction facilities. The radiological risk to the offsite population at the sites with volume reduction facilities arises mainly from releases from thermal treatment facilities. Thus, the effect of generation reduction is estimated on the basis of inventory and annual generation (with and without reduction) of waste in the two LLW categories (combustible, compactible solids; organic liquids) that feed a specific thermal treatment facility. There is an exception for the Pantex Plant volume reduction center, which does not treat the waste categories undergoing thermal treatment. At the Pantex Plant, the health risk to the offsite population is assumed to arise from size-reduction treatment. The human health risk to workers is more evenly distributed among treatment facilities, with the risk being greatest at handling facilities where all waste categories are handled. Therefore, the effect of source reduction is estimated on the basis of the ratio of inventory to annual generation for all waste categories for the LLW treated at a volume-reduction site. From Table G–7, a 50% source reduction is estimated to result in approximately a 46% reduction in cancer incidence to both the general public and workers at treatment facilities.

Table G–8 contains estimates of the effects of a 50% across-the-board reduction in annual generation on human health risk at disposal facilities. Here, the assumed population consists of farm families that are at risk through the groundwater pathway. The percentage reduction in risk at a site from source reduction to these farm families is taken to be the same as the reduction in disposal waste load in Table G–3. Overall, a 50% source reduction is estimated to result in a 49% human health risk reduction to farm families.

G.2.3 Low-Level Mixed Waste

LLMW is waste that contains both radioactive material and hazardous material. Thus LLMW should be processed so that the hazardous constituents can be treated in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA) and the radioactive components are treated for safe disposal. LLMW may be classified as either contact-handled (CH: dose at waste surface <200 mrem/h) or remote-handled (RH: dose at waste surface >200 mrem/h); and also as either alpha LLMW (combined activity of transuranic radionuclides between 10 and 100 nCi/g), or non-alpha LLMW (combined activity of transuranic radionuclides <10 nCi/g). The technologies appropriate for treatment of LLW depend on

Table G–7. Effect of Pollution Prevention 50% Reduction in Annual Generation on Health Risks from Waste Management LLW Treatment (Cancer Incidence Among the Offsite Population and WM Workers for Second 10 Years of Treatment)

Site	Receptor	Regionalized 2		Regionalized 5	
		Current	WMin/PP	Current	WMin/PP
FEMP	Population[a]	7.9E-01	4.3E-01	--	--
	Worker[b]	2.3E-02	1.2E-02		
Hanford	Population	1.2E-05	6.0E-06	1.6E-01	8.6E-02
	Worker	6.9E-01	3.5E-01	7.2E-01	3.6E-01
INEL	Population	4.6E-06	2.5E-06	1.4E-03	7.6E-04
	Worker	5.8E-01	3.0E-01	1.9	1.2
LANL	Population	2.7E-02	1.4E-02	--	--
	Worker	6.5E-01	3.4E-01		
LLNL	Population	1.3	7.0E-01	--	--
	Worker	1.7E-01	1.2E-01		
ORR	Population	2.8E-04	2.5E-04	1.0	5.0E-01
	Worker	1.1	6.7E-01	1.5	9.1E-01
Pantex	Population	1.5E-06	1.3E-06	--	--
	Worker	2.7E-03	2.5E-03		
PGDP	Population	6.4E-06	4.2E-06	--	--
	Worker	5.8E-03	3.2E-03		
PORTS	Population	1.8E-04	9.8E-05	--	--
	Worker	9.6E-02	4.9E-02		
RFETS	Population	6.3E-04	3.3E-04	--	--
	Worker	4.0E-03	2.1E-03		
SRS	Population	2.1E-03	1.8E-03	2.1E-03	1.8E-03
	Worker	9.6E-01	4.8E-01	9.6E-01	4.8E-01

Note: -- = not a volume-reduction treatment center for this case.
[a] Risk to the offsite population is assumed to arise predominantly from releases from thermal treatment. The reduction in risk from a 50% source reduction is estimated on the basis of site-specific inventories and annual generation rates for the waste categories that are thermally treated (Categories 1 and 9). At the Pantex Plant, which does not have thermal treatment, reduction in risk is based on size reduction treatment of waste categories 3 and 4.
[b] Risk to workers is relatively evenly distributed among treatments; site-specific inventories and annual generation averaged over all waste categories for the sites of origin are used to estimate the reduction in risk to workers from a 50% source reduction.

Table G–8. Effect of Pollution Prevention Reduction on Health Risk From Waste Management LLW Disposal (Cancer Incidence Among All Farm Family Lifetimes for Second 10 Years of Disposal)

Disposal Site	Regionalized 2		Regionalized 5	
	Current	WMin/PP[a]	Current	WMin/PP
Hanford	2.1E-01	1.2E-01	6.1E-01	3.4E-01
INEL	0	0	0	0
NTS	0	0	0	0
LANL	0	0	0	0
ORR	7.7E-05	4.8E-05	3.6E-05	2.2E-05
SRS	7.2E-03	3.6E-03	7.2E-03	3.6E-03
PORTS	4.5E-04	3.8E-04	*	*
PGDP	2.8E-02	1.4E-02	*	*
LLNL	2.3E-04	1.2E-04	*	*
Pantex	0	0	*	*
RFETS	2.1E-05	1.1E-05	*	*

Note: * = not a disposal site.
[a] The WMin/PP results are based on a 50% reduction in annual generation. However, the volumes disposed of decrease by less than 50% because the category-dependent inventory is also being disposed of.

the physical and chemical properties of the waste. In contrast, technologies appropriate for treatment of LLMW depend on both the physical and chemical properties of the waste, and on the RCRA contaminant category of the hazardous constituents. Only general categories of RCRA contaminants frequent in DOE waste have been considered. These are toxic organics, toxic metals, mercury, ignitables, corrosives, reactives, and combinations thereof. LLMW may require treatment by several technologies in series.

Estimates of the effect of a 50% reduction in annual generation have been made for three diverse alternatives for LLMW generated from waste management operations (WM LLMW). These are the Decentralized Alternative with disposal of CH LLMW at 16 sites, Regionalized Alternative 2 with treatment of CH non-alpha LLMW at 7 sites and disposal at 6 sites, and the Centralized Alternative with all CH treatment and disposal at one site, the Hanford Site. Estimates of the effect of this source reduction are based on information in the LLMW technical report (ANL, 1996b); Appendix D, "Waste Management Facility Human Health Risk Estimates;" and the waste management costs technical report (INEL, 1995b).

G.2.3.1 Waste Load Reductions

Estimates on annual treatment waste load of the effect of a 50% step decrease in generation of WM LLMW are given in Tables G-9 and G-10 for CH non-alpha LLMW and CH alpha LLMW, respectively. The waste loads without the WMin/PP source reduction (the columns labeled "Current") are from ANL (1996b). The effect of pollution prevention was obtained from the site-totaled inventories and annual generation rates and the assumption that inventory and 20 years of generation will be treated and disposed of in a 10-year period. With the assumed 50% reduction in annual generation, in effect, 20 years of generation is reduced to 10 years of generation. The ratio of inventory plus 10 years of generation to inventory plus 20 years of generation gives the impact of pollution prevention. This ratio is applied to the contribution to the waste load at a treatment site from a generation site. From these tables, it is seen that waste minimization is more effective in reducing the CH non-alpha waste load than the CH alpha waste loads. For CH non-alpha LLMW, the assumed 50% reduction is estimated to reduce the overall waste load by approximately 36%, while the same percentage decrease in annual generation of CH alpha LLMW is estimated to decrease CH alpha waste load by only approximately 9%. Table G-11 gives the estimated percentage decreases from a 50% source reduction for RH non-alpha LLMW.

The percentage reductions in the waste loads from a 50% source reduction for disposal of waste management CH non-alpha LLMW and waste management CH alpha LLMW are given in Tables G-12 and G-13, respectively. As can be shown from these tables, the impact of the assumed decrease in annual generation disposal waste loads is similar to the impact on treatment waste loads, namely, approximately a 35% reduction for non-alpha waste and a 9% reduction for alpha waste.

Some existing facilities in the DOE complex were assumed to be used for treatment of LLMW. Conversely, because disposal facilities for LLMW would have to be permitted pursuant to RCRA and existing DOE disposal facilities do not have such permits, it was assumed that there are no existing disposal facilities for LLMW. Table G-14 gives the capacities of existing treatment facilities (ANL, 1996b), except for aqueous treatment, the capacities required without source reduction, and the capacities required with the assumed source reduction. From the table it is seen that the existing capacities are adequate for those sites and technologies.

Table G–9. Percentage Reduction in Annual Treatment Throughput of Waste Management CH Non-Alpha LLMW

Site	Decentralized		Regionalized 2		Centralized	
	Current[a]	% Reduct[b]	Current	% Reduct	Current	% Reduct
Ames	4.0E–02	12	--	--	--	--
ANL-E	1.6E+01	40	--	--	--	--
ANL-W	2.0	21	--	--	--	--
BCL	1.0E–02	50	--	--	--	--
BNL	1.9E+01	28	--	--	--	--
Bettis	4.8	23	--	--	--	--
Charleston	3.0E–01	46	--	--	--	--
CISS	1.1	0	--	--	--	--
ETEC	1.7	24	--	--	--	--
FEMP	2.6E+02	1	--	--	--	--
GA	4.3	1	--	--	--	--
GJPO	1.5E–01	29	--	--	--	--
Hanford	3.6E+03	45	3.7E+03	46	1.4E+04	36
INEL	1.8E+02	30	6.1E+02	36	--	--
ITRI	3.5	46	--	--	--	--
K-25	2.7E+03	30	--	--	--	--
KAPL-S	8.3	49	--	--	--	--
KAPL-K	1.0E+01	49	--	--	--	--
KAPL-W	4.0	50	--	--	--	--
KCP	8.0E–02	0	--	--	--	--
LANL	3.8E+01	25	1.2E+02	32	--	--
LBL	2.8E+01	46	--	--	--	--
LEHR	7.0E–01	17	--	--	--	--
LLNL	2.2E+02	47	--	--	--	--
Mound	2.2E–03	25	--	--	--	--
Mare Is	5.2	41	--	--	--	--
Norfolk	6.0E–01	50	--	--	--	--
NTS	3.0E+02	45	--	--	--	--
ORR[d]	5.9E+03	36	6.3E+03	25	--	--

Table G-9. Percentage Reduction in Annual Treatment Throughput of Waste Management CH Non-Alpha LLMW—Continued

Site	Decentralized		Regionalized 2		Centralized	
	Current[a]	% Reduct[b]	Current	% Reduct	Current	% Reduct
Pantex	6.9E+01	40	--	--	--	--
PGDP	6.0E+01	0	--	--	--	--
Pearl H	6.0E-01	32	--	--	--	--
Ports Nav	1.0E-01	33	--	--	--	--
PORTS	3.3E+03	42	3.5E+03	38	--	--
PPPL	2.0E-03	25	--	--	--	--
Puget So	2.3E+01	33	--	--	--	--
RFETS	0	NA[c]	1.9E-01	20	--	--
RMI	2.9	12	--	--	--	--
SNL-CA	1.1E+01	45	--	--	--	--
SNL-NM	1.0E+01	0	--	--	--	--
SRS	9.4E+02	38	9.4E+02	38	--	--
Y-12	1.8E+03	19	--	--	--	--

Note: -- = not a treatment site under the Regionalized or Centralized Alternatives.
[a] Annual throughput in m^3.
[b] Percentage reduction annual throughout from a 50% reduction in annual generation.
[c] NA = not applicable because no CH non-alpha LLMW is generated at RFETS.
[d] ORR includes K-25, Y-12, and ORNL.

Table G-10. Reduction in Annual Treatment Throughput of Waste Management CH Alpha LLMW From a 50% Decrease in Annual Generation

Site	Decentralized		Regionalized 2		Centralized	
	Current	% Reduct	Current	% Reduct	Current	% Reduct
Hanford	--	--	--	--	1.0E+00	9
INEL	2.5E+03	0	2.5E+03	4	--	--
LANL	2.1E+02	42	2.1E+02	42	--	--
LLNL	2.0E+02	48	--	--	--	--
Mound	8.0	4	--	--	--	--
RFETS	2.1E+03	10	6.9E+03	10	--	--
SRS	4.1E+02	14	4.2E+02	14	--	--
WVDP	5.5	29	--	--	--	--

Note: -- = not a regional treatment site.

Table G–11. Percentage Reduction in Annual Treatment and Disposal Throughput of Waste Management RH Non-Alpha LLMW From a 50% Decrease in Annual Generation

Site	Treatment (m^3/yr)	Disposal (m^3/yr)	Reduction (%)
Hanford	7.4E–02	1.2E–02	0
INEL	8.6E+02	1.5E+02	49
ORR	3.5E+02	7.0E+02	17
SRS	2.8	8.8E–01	47

Table G–12. Percentage Reduction in Annual Disposal Throughput (m^3/yr) for Waste Management CH Non-Alpha LLMW

	Decentralized		Regionalized 2		Centralized	
Disposal Site	Current	% Reduct[a]	Current	% Reduct	Current	% Reduct
ANL-E	1.4E+02	40	--	--	--	--
BNL	8.4E+01	28	--	--	--	--
FEMP	1.1E+02	1	--	--	--	--
Hanford	1.3E+03	46	1.3E+03	46	5.3E+03	35
INEL	4.3E+01	30	1.4E+02	26	--	--
LANL	1.1E+01	25	3.3E+02	33	--	--
LLNL	1.9E+02	34	--	--	--	--
NTS	1.0E+01	50	--	--	--	--
ORR	1.5E+03	25	1.1E+04	32	--	--
Pantex	2.0E+01	40	--	--	--	--
PGDP	2.2E+01	0	--	--	--	--
PORTS	5.8E+02	42	--	--	--	--
RFETS	5.7E–01	29	--	--	--	--
SNL-NM	1.4	1	--	--	--	--
SRS	4.4E+02	38	4.5E+02	38	--	--

Note: -- = not a disposal site for this alternative.
[a] Percentage reduction annual throughput from a 50% reduction in annual generation.

Table G-13. Percentage Reduction in Annual Disposal Throughput for Waste Management CH Alpha LLMW

Disposal Site	Decentralized		Regionalized 2		Centralized	
	Current[a]	% Reduct[b]	Current	% Reduct	Current	% Reduct
Hanford	--	--	--	--	3.2E+03	9
INEL	6.1E+02	0	7.0E+02	6	--	--
LANL	5.6E+01	21	2.4E+03	10	--	--
LLNL	8.1E+01	48	--	--	--	--
RFETS	2.3E+03	10	--	--	--	--
SRS	1.1E+02	14	1.1E+02	14	--	--
WVDP	1.1	29	--	--	--	--

Note: -- = not a disposal site for this alternative.
[a] Annual throughput in m^3.
[b] Percentage reduction annual throughout from a 50% reduction in annual generation.

G.2.3.2 Cost Savings

Cost savings associated with the treatment, disposal, and transportation of CH waste management LLMW are considered. These are based on planning-level life-cycle costs for 10 years of operations (see INEL, 1995b). As with LLW, treatment and disposal costs are divided into operations costs and construction (or capital) costs. Operations costs are assumed to be proportional to throughput and (waste load). Capital costs are assumed to be proportional to throughput also, except when there is existing capacity for a specific treatment step that is inadequate for the waste load. However, as shown in Table G-14, the existing capacity is adequate for the waste load. Therefore, capital costs are also assumed to be proportional to waste load, because no new capacity is needed when there is existing capacity.

Estimates of the impact of a 50% reduction in annual generation for the three alternatives being considered are given in Table G-15 for CH waste management LLMW, both non-alpha and alpha. The transportation, operations, and capital costs without pollution prevention reductions are from INEL (1995b). The table indicates that for the assumed source reduction and linearity between waste load and cost, substantial savings may result from pollution prevention reductions. These savings range from over $3 billion for the Decentralized Alternative to nearly $2 billion for the Centralized Alternative.

Table G–14. Effect of Pollution Prevention 50% Reduction in Annual Generation on the Need for New Facilities to Meet Waste Management CH Non-Alpha LLMW Treatment Needs

Site/Facility	Existing Capacity (kg/h)[a]	Current WMin/PP	Capacity Required (kg/h)		
			Decentralized	Regionalized 2	Centralized
Hanford					
GROUT	2.1E+03	Current	3.1E+02	3.3E+02	1.1E+03
		WMin/PP	1.6E+02	1.8E+02	6.8E+02
INEL					
INCIN	3.2E+02	Current	7.3	1.5E+01	--
		WMin/PP	5.0	1.1E+01	--
GROUT	3.8E+02	Current	8.6	4.1E+01	1.0E-02
		WMin/PP	5.9	3.0E+01	7.E-03
ORR					
INCIN	1.9E+03	Current	5.9E+02	6.4E+02	--
		WMin/PP	3.8E+02	5.0E+02	--
Pantex					
GROUT	1.0E+01	Current	3.8	7.3E-02	7.3E-02
		WMin/PP	2.3	4.4E-02	4.4E-02
RFETS					
GROUT	3.8E+03	Current	--	1.5E-02	--
		WMin/PP	--	1.2E-02	--
SRS					
INCIN	1.1E+03	Current	1.7E+02	1.7E+02	--
		WMin/PP	1.0E+02	1.1E+02	--
GROUT	5.9E+03	Current	5.0E+1	5.0E+01	1.0E-02
		WMin/PP	3.1E+01	3.1E+01	6.8E-03

Notes: -- = no throughput for this process for this alternative; INCIN = thermal treatment; GROUT = grout stabilization.
[a] 1 kg/h=7.1 m^3/yr.

G.2.3.3 Human Health Risk Reduction

Reductions in human health risk for a 50% reduction in annual generation are estimated for routine operations of treatment facilities and from long-term releases from disposal facilities. As before, cancer incidence is taken as the measure of human health risk. For treatment facilities, cancer incidence among two populations are considered, the offsite population and WM workers. For disposal facilities, the risk to all nearby farm family generations is considered. For LLMW, cancer incidence arises from exposure to chemical carcinogens as well as from radiological doses. The estimated reductions in cancer incidence among the offsite population near treatment site, among WM workers at treatment sites, and among farm family generations near disposal sites are given in Tables G–16 through G–18, respectively. As before, it is assumed that health risk decreases linearly with waste load.

Table G–15. Effect of Pollution Prevention on Cost of Treatment, Disposal, and Transportation of CH Waste Management LLMW (in dollars)

Case/Operation	Non-Alpha		Alpha[a]	
	Current	**WMin/PP**	**Current**	**WMin/PP**
Decentralized				
Treatment				
Operations & maintenance	4.0E+09	2.6E+09	2.2E+09	1.8E+09
Capital	2.0E+09	1.4E+09	1.5E+09	1.3E+09
Disposal				
Operations & maintenance	1.1E+09	6.6E+08	7.6E+08	7.0E+08
Capital	2.7E+08	1.7E+08	3.0E+08	3.0E+08
Transportation	4.8E+05	3.5E+05	1.7E+05	1.4E+05
Total	7.4E+09	4.8E+09	4.8E+09	4.1E+09
Regionalized 2				
Treatment				
Operations & maintenance	2.7E+09	1.8E+09	2.5E+09	2.2E+09
Capital	9.1E+08	6.0E+08	1.6E+09	1.4E+09
Disposal				
Operations & maintenance	8.2E+08	5.0E+08	6.5E+08	5.8E+08
Capital	1.8E+08	1.0E+08	9.1E+07	8.2E+07
Transportation	1.5E+07	9.5E+06	8.4E+06	7.4E+06
Total	4.3E+09	2.8E+09	4.5E+09	4.0E+09
Centralized				
Treatment				
Operations & maintenance	2.8E+09	1.9E+09	2.0E+09	1.9E+09
Capital	7.6E+08	5.2E+08	1.2E+09	1.0E+09
Disposal				
Operations & maintenance	5.3E+08	2.9E+08	3.1E+08	2.9E+08
Capital	5.4E+07	2.9E+07	4.3E+07	3.9E+07
Transportation	1.9E+07	1.3E+07	7.8E+06	6.8E+06
Total	3.8E+09	2.5E+09	3.3E+09	2.9E+09

[a] CH non-alpha waste generated at INEL and LANL are treated at INEL and LANL CH alpha facilities.

Table G–16. Percentage Reduction in Risk to the Offsite Population[a] for Treatment of Waste Management LLMW

Site	Decentralized		Regionalized 2		Centralized	
	Current	% Reduct[b]	Current	% Reduct	Current	% Reduct
ANL-E	5.6E-05	40	2.0E-06	40	2.0E-06	40
BNL	4.1E-05	28	1.9E-07	28	1.9E-07	28
FEMP	9.1E-05	1	5.8E-07	1	5.8E-07	1
Hanford	5.0E-03	45	4.5E-02	45	8.5E-02	36
INEL	1.8E-04	30	2.1E-03	36	1.7E-05	36
KAPL-K	1.0E-03	49	8.9E-07	49	8.9E-07	49
KCP	1.3E-05	0	8.4E-09	0	8.4E-09	0
LANL	2.0E-03	25	2.9E-03	32	1.3E-04	25
LBL	3.5E-02	46	4.9E-08	46	4.9E-08	46
LLNL	5.2E-01	47	1.9E-06	47	1.9E-06	47
Mound	4.3E-04	25	7.3E-08	25	7.4E-08	25
NTS	2.7E-06	45	2.2E-08	45	2.2E-08	45
ORR	3.7E-03	25	4.1E-03	25	2.4E-05	25
Pantex	1.2E-04	40	8.0E-06	40	8.0E-06	40
PGDP	4.1E-04	0	2.8E-06	0	2.8E-06	0
PORTS	1.2E-05	42	3.6E-04	38	1.1E-07	38
RFETS	2.3E-04	20	2.4E-04	20	4.9E-06	20
SNL-NM	4.7E-04	0	6.1E-08	0	6.1E-08	0
SRS	5.9E-03	38	6.0E-03	38	4.6E-06	38
WVDP	8.6E-07	50	5.8E-07	50	5.9E-07	50
Total	5.8E-01	47	6.1E-02	42	8.6E-02	36

[a] Cancer incidence among the offsite population from radiation and chemical carcinogens.
[b] Percentage reduction in risk based on a 50% reduction in annual generation of LLMW.

Table G–17. Percentage Reduction in Risk to WM Workers[a] for Treatment of Waste Management LLMW

Site	Decentralized		Regionalized 2		Centralized	
	Current	% Reduct[b]	Current	% Reduct	Current	% Reduct
ANL-E	2.3E–04	40	1.1E–04	40	1.1E–04	40
BNL	4.3E–04	28	2.0E–04	28	2.0E–04	28
FEMP	1.1E–03	1	8.8E–04	1	8.8E–04	1
Hanford	3.6E–01	45	5.0E–01	45	1.8E+00	36
INEL	3.6E–01	30	3.9E–01	36	2.5E–01	36
KAPL-K	6.2E–03	49	2.2E–02	49	2.2E–03	49
KCP	1.2E–04	0	2.8E–06	0	2.8E–06	0
LANL	5.5E–03	25	8.2E–03	32	2.4E–03	25
LBL	1.3E–04	46	7.4E–05	46	7.4E–05	46
LLNL	2.8E–02	47	2.2E–03	47	2.2E–03	47
Mound	4.7E–05	25	4.3E–05	25	4.6E–05	25
NTS	4.8E–02	12	1.0E–02	12	1.0E–02	12
ORR	6.2E–01	25	4.2E–01	25	8.4E–02	25
Pantex	1.2E–03	40	5.8E–04	40	5.8E–04	40
PGDP	8.5E–04	0	5.2E–04	0	5.2E–04	0
PORTS	5.6E–03	42	2.7E–01	42	2.9E–03	42
RFETS	4.1E–03	20	4.6E–03	20	3.5E–03	20
SNL-NM	1.2E–03	0	6.1E–05	0	6.1E–05	0
SRS	3.7E–01	38	3.8E–01	38	1.1E–01	38
WVDP	8.6E–03	50	9.7E–05	50	1.0E–04	50
Total	1.8E+00	34	2.0E+00	36	2.3E+00	37

[a] Cancer incidence among the WM workers from radiation and chemical carcinogens.
[b] Percentage reduction in risk based on a 50% reduction in annual generation of LLMW.

Table G–18. Percentage Reduction in Risk[a] From Disposal of CH Waste Management LLMW

Disposal Site	Decentralized		Regionalized 2		Centralized	
	Current	% Reduct[b]	Current	% Reduct	Current	% Reduct
ANL-E	6.4E-04	40	--	--	--	--
BNL	9.0E-03	28	--	--	--	--
FEMP	2.6E-04	1	--	--	--	--
Hanford	6.5E-02	46	8.0E-02	46	8.7E-01	35
INEL	4.1E-05	30	4.2E-05	26	--	
LANL	5.5E-03	25	3.2E-03	33	--	--
LLNL	2.6E-04	34	--	--	--	--
NTS	4.3E-04	46	--	--	--	--
ORR	4.5E-01	25	8.1E-01	32	--	--
Pantex	3.6E-04	40	--	--	--	--
PGDP	2.4E-04	0	--	--	--	--
PORTS	8.8E-03	42	--	--	--	--
RFETS	2.5E-02	29	--	--	--	--
SNL-NM	3.2E-02	1	--	--	--	--
SRS	7.2E-03	38	7.2E-03	38	--	--
Total	6.1E-01	29	9.1E-01	33	8.7E-01	35

Note: -- = not a disposal site for this alternative.
[a] Cancer incidence among all farm family lifetimes from radiation and chemical carcinogens.
[b] Percentage reduction in risk based on a 50% reduction in annual generation of CH non-alpha LLMW.

From Table G–16, it is seen that the effectiveness of pollution prevention in reducing health risk to the offsite population near treatment sites varies significantly with alternative. For the Decentralized Alternative, this risk is dominated by the risk at LLNL and the health risk reduction is 47%. In contrast, the health risk for treatment at Hanford dominates the Centralized Alternative 17 and is reduced by only 36%. From Table G–17, the aggregate reduction in WM worker health risk at treatment sites is not as strongly dependent on alternative and is approximately 35% for all three alternatives. From Table G–18, the aggregate reduction in health risk from the assumed source reduction from pollution prevention varies from 29% for the Decentralized Alternative to 35% for the Centralized Alternative.

G.2.4 Hazardous Waste

Hazardous waste contains materials that are hazardous under RCRA and other Federal environmental statutes (such as the Toxic Substances Control Act) but does not contain radioactive materials. As with LLMW, HW is treated primarily to meet statutory requirements. Estimates of the effect of reduction in annual generation on HW facilities are based on information in the hazardous waste technical report (ANL, 1996c); Appendix D, "Waste Management Facility Human Health Risk Estimates;" and the waste management costs technical report (INEL, 1995c).

The vast majority of HW is contaminated wastewater and is always treated onsite in wastewater treatment facilities. This appendix addresses HW other than contaminated wastewater, that is, HW that is transferred for treatment at specialized facilities, either onsite or offsite. Most, approximately three–quarters, of the HW generated in the DOE complex is generated at 11 sites. This appendix considers only HW generated at these 11 sites.

G.2.4.1 Waste Load Reductions

Table G–19 contains quantities of HW transferred for treatment by type of treatment for 1992 for the 11 top HW-generating sites. Storage of HW is limited by RCRA to 90 days at unpermitted facilities. Therefore, unlike the other waste types, there is no year-to-year storage of HW and no inventories to be worked off with the HW generated annually. Also, because there is no long-term storage, waste loads for HW generated by waste management operations are based on 20 years of generation being treated and disposed of in 20 years. Thus, a given percentage reduction in annual production is estimated to result in the same percentage reduction in treatment waste loads. For a 50% across-the board reduction in annual generation, the values in Table G–19 would be cut in half.

G.2.4.2 Cost Savings

Two of the alternatives considered in the WM PEIS are elaborated here. The first is Regionalized Alternative 2 in which there are two DOE treatment hubs: one in the east at ORR and the second in the west at INEL. In this alternative, all HW is shipped to the DOE hubs where approximately 90% of treatment is performed. Three treatments (stabilization, battery recycling, and mercury removal) take place at

Table G–19. Technologies Used to Treat Hazardous Waste Transfers (1992)

Treatment Technology	Quantity[a] (kg)	Comments
Incineration	1.6E+06	This is the principal form of treatment for a wide range of organic wastes.
Organic removal/recovery	9.8E+05	This treatment technology is primarily fuel burning or blending, and solvent recycling or distillation.
Stabilization	2.6E+05	This treatment technology is most commonly used for inorganic waste. The waste is mixed with solidification agents, such as Portland cement, to meet disposal facility waste acceptance criteria.
Deactivation	2.7E+05	Treatment technologies that are so classified include neutralization of corrosive waste, and controlled detonation, reaction, or deactivation of explosives.
Metal removal/recovery	9.4E+04	This technology involves precipitation of heavy metals from aqueous solutions. The resulting precipitate may be further treated to recover metals or be stabilized prior to land disposal.
Mercury recovery/treatment	1.1E+05	This is a specialized treatment (e.g., mercury roasting or retorting, amalgamation, or incineration of organic wastes containing mercury) that is offered only by a few commercial facilities in the country.
Aqueous treatment	6.3E+04	This type of treatment includes a range of technologies, including biological treatment, wet air oxidation, and chemical oxidation/reduction.
Recycling	6.8E+03	Most DOE "recycled" wastes are lead acid storage batteries and scrap metals.

[a] Quantities are based on offsite transfers from the eleven top HW generators.

commercial facilities after shipment from DOE hubs. The second case is Regional Alternative 1 in which HW is shipped to five DOE hubs. The DOE hubs perform roughly half of the organic removal and recovery treatment and ship treated HW to commercial facilities for other treatment.

Table G-20 shows the cost savings for a 50% across-the-board reduction in annual generation based on cost information in the waste management costs technical report (INEL, 1995c). The table breaks out costs for treatment and disposal at DOE and commercial facilities, and for transportation. In ANL (1996c), existing facilities for treatment of HW are identified. However, the cost estimates in INEL (1995c) are based on the assumption that these existing facilities are dedicated to treatment of LLMW and that all HW

Table G–20. Cost Savings at HW Treatment Hubs and From Pollution Prevention 50% Reduction in Annual Generation ($1,000)

Site	Regionalized 2[a]	Regionalized 1[b]
ANL-E		
Transportation	1.5E+03	3.3E+03
Commercial Treatment and Disposal	NA[c]	NA
Fermi		
Transportation	5.8E+02	1.5E+04
Commercial Treatment and Disposal	NA	NA
Hanford		
Government Treatment and Disposal	NA	3.0E+04
Transportation	6.8E+01	2.4E+03
Commercial Treatment and Disposal	NA	4.2E+03
INEL		
Government Treatment and Disposal	6.6E+04	1.1E+04
Transportation	1.8E+03	6.8E+02
Commercial Treatment and Disposal	2.7E+03	1.0E+03
KCP		
Transportation	3.9E+03	8.0E+03
Commercial Treatment and Disposal	NA	NA
LANL		
Government Treatment and Disposal	NA	2.8E+04
Transportation	1.3E+01	1.2E+03
Commercial Treatment and Disposal	NA	4.0+03
LLNL		
Transportation	7.1E+03	5.2E+03
Commercial Treatment and Disposal	NA	NA
ORR		
Government Treatment and Disposal	5.6E+04	3.3E+04
Transportation	6.8E+01	1.4E+03
Commercial Treatment and Disposal	1.1E+04	1.5E+04
Pantex		
Transportation	1.9E+03	1.9E+03
Commercial Treatment and Disposal	NA	NA
SNL-NM		
Transportation	4.4E+03	5.0E+03
Commercial Treatment and Disposal	NA	NA

Table G-20. Cost Savings at HW Treatment Hubs and From Pollution Prevention 50% Reduction in Annual Generation ($1,000)—Continued

Site	Regionalized 2[a]	Regionalized 1[b]
SRS		
Government Treatment and Disposal	NA	1.4E+04
Transportation	1.3E+03	2.2E+03
Commercial Treatment and Disposal	NA	1.5E+03
Total		
Government Treatment and Disposal	1.2E+05	1.2E+05
Transportation	2.4E+04	4.4E+04
Commercial Treatment and Disposal	1.4E+04	2.5E+04
Total	1.6E+05	1.9E+05

[a] This case has two DOE treatment hubs, one in the east and one in the west; only hubs ship to commercial facilities.
[b] This case has five DOE treatment hubs; only hubs ship to commercial facilities.
[c] NA = not available.

treatment facilities at DOE sites are new facilities. Therefore, the values in Table G-20 are based on the assumption that both operations and construction cost savings are proportional to source reduction.

G.2.4.3 Human Health Risk Reductions

Reduction in human health risk for a 50% across-the-board reduction in annual generation of HW from routine operations of hazardous waste facilities were estimated for the same two alternatives (Regionalized 2 and Regionalized 1) considered above. The human health risk considered cancer incidence for three types of receptors: the onsite population of noninvolved workers, the offsite population, and workers at WM facilities. Risks to the onsite and offsite population are proportional to throughput. Aggregate risks to WM workers are proportional to the number of such workers, which will be assumed to be proportional to throughput. The estimated reduction for 20 years of operations is tabulated by DOE site and case in Table G-21. With these assumptions, the reductions in human health risks are 50% of the human health risks given in Appendix D.

Table G–21. Reduction in Cancer Incidence[a] at DOE HW Treatment Hubs From Pollution Prevention 50% Reduction in Annual Generation

Hub/Receptor	Regionalized 2	Regionalized 1
Hanford		
Noninvolved worker population	--	1.3E–03
Offsite population	--	2.1E–03
WM workers	--	1.4E–01
INEL		
Noninvolved worker population	6.5E–04	7.0E–05
Offsite population	4.8E–04	5.0E–05
WM workers	3.7E–01	3.8E–02
LANL		
Noninvolved worker population	--	4.7E–03
Offsite population	--	1.0E–02
WM workers	--	1.5E–01
ORR		
Noninvolved worker population	1.6E–02	5.5E–03
Offsite population	4.7E–02	1.8E–02
WM workers	5.5E–01	2.1E–01
SRS		
Noninvolved worker population	--	3.0E–04
Offsite population	--	6.0E–04
WM workers	--	4.6E–02
Total		
Noninvolved worker population	1.7E–02	1.2E–02
Offsite population	4.8E–02	3.0E–02
WM workers	9.2E–01	5.8E–01

Note: -- = not a treatment hub for this alternative.
[a] Cancer incidence arising from 20 years of treatment.

G.2.5 TRANSURANIC WASTE

TRUW is defined as radioactive waste contaminated with alpha-particle-emitting transuranic radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. The DOE distinguishes between CH TRUW (packaged waste with an external surface dose rate not exceeding 200 mrem/h) and RH TRUW (packaged waste with an external surface dose rate exceeding 200 mrem/h). TRUW generated prior to 1970 is buried in shallow landfill-type disposal grounds and is considered as an ER waste. TRUW waste generated since 1970 is considered a waste management waste. Some TRUW wastes are contaminated with hazardous materials. Such material can be treated using the same processes as for LLMW, with additional precautions appropriate for the radioactive component being TRUW rather than LLW.

Estimates of the effect of source reduction on TRUW facilities are based on information in the transuranic waste technical report (ANL, 1996d); Appendix D, "Waste Management Facility Human Health Risk Estimates;" and the waste management costs technical report (INEL, 1995d).

G.2.5.1 Waste Load Reduction

Tables G–22 and G–23 contain estimates of the effect on generating site waste loads of an across-the-board 50% source reduction of CH TRUW and RH TRUW, respectfully. Inventory and generation rates for a site are obtained from volume-weighted averages over treatment classes. The waste loads are based on inventory and 20 years of generation being treated in 10 years. The inventories and waste loads include the following waste stream categories from the DOE (1994e) *Mixed Waste Inventory Report*: 1000 (aqueous liquids); 2000 (organic liquids); 3000 (solid process wastes); 4000 (soils); and 5000 (debris). Waste categories 6000 (special: lab packs with and without reactive metals) and 7000 (inherently hazardous; for example, reactive metals, mercury, and cadmium batteries) are not included because impacts of their treatment, storage, and transportation were not considered elsewhere in the WM PEIS. The percentage differences in waste load attributed to source reduction are smaller than for the other waste types considered because the inventories are larger relative to annual generation. Thus, changes in annual generation rates have relatively smaller effects on waste loads. Averaged over the DOE complex, a 50% reduction in annual generation of CH TRUW is estimated to reduce CH TRUW waste loads by 19%, and a 50% reduction in annual generation of RH TRUW is estimated to reduce RH TRUW waste loads by 48%.

The effect of a 50% across-the-board reduction in annual generation is considered for four representative CH TRUW alternatives and one RH TRUW alternative. The four CH TRUW alternatives are: Regionalized Alternative 3, 3 regional sites with treatment to RCRA compliance; Regionalized Alternative 2, 5 regional sites with treatment to RCRA compliance; Regionalized Alternative 1, 5 regional sites with stabilization treatment; and the Decentralized Alternative, 16 sites treating to the Waste Isolation Plant Project (WIPP) waste acceptance criteria (WAC). These four alternatives provide diversity in the number of treatment sites and the level of treatment. The RH alternative has two sites with RCRA treatment. The effect of this source reduction on the waste loads at the regional treatment facilities for the three regional site and five regional

Table G–22. Effect of Pollution Prevention 50% Reduction in Annual Generation on CH-TRUW Generating Site Waste Loads

TRUW Site	Inventory (m^3)	Generation Rate (m^3/yr)	Waste Loads[a] (m^3/yr)		Percentage Difference
			Current	WMin/PP	
ANL-E	1.5E+01	4.7E+01	9.6E+01	4.9E+01	49%
Hanford	1.2E+04	1.2E+03	3.6E+03	2.3E+03	35%
INEL	3.8E+04	1.4E+01	3.8E+03	3.8E+03	1%
LANL	8.2E+03	1.3E+02	1.1E+03	9.3E+02	12%
LBL	8.0E-01	1.0E-02	1.0E-01	9.0E-03	10%
LLNL	2.0E+02	7.4E+01	1.7E+02	1.1E+02	33%
Mound	2.7E+02	1.2E+03	1.5E+02	9.0E+01	40%
NTS	6.1E+02	0	6.1E+01	6.1E+01	0%
PGDP	1.4E+01	0	1.4	1.4	0%
RFETS	1.5E+03	2.4E+02	6.2E+02	3.7E+02	38%
SNL-NM	1.0	0	1.0E-01	1.0E-01	0%
SRS	5.1E+03	5.8E+02	1.7E+03	1.1E+03	35%
UofMO	0	1.0E-01	2.0E-01	1.0E-01	50%
Total	6.7E+04	2.4E+03	1.1E+04	8.8E+03	19%

[a] Assumes inventory and 20 years of generation are treated in 10 years; for the WMin/PP case, the annual generation rate is half the current generation rate. Includes waste stream categories: aqueous liquids (1000); organic liquids (2000); solid process residues (3000); soils (4000); and debris (5000).

site CH TRUW cases and for the two regional site RH TRUW cases is given in Table G–24. For the Decentralized Alternative, with 16 sites treating to the WIPP WAC, the treatment takes place where the waste originates so that the percentage waste load reductions in Table G–22 apply.

G.2.5.2 Cost Savings

Cost savings from WMin/PP are considered for the four CH TRUW alternatives and for one RH TRUW alternative. Since disposal at WIPP is common to all alternatives, costs of disposal are considered to be beyond the scope of this appendix. The estimates of the effects of a 50% reduction in annual generation on costs used the effects of that reduction on waste loads in Tables G–22 through G–24. Table G–24 was used for the effects on treatment at and transportation from regional treatment facilities. Tables G–22 (for CH

Table G–23. Effect of Pollution Prevention 50% Reduction in Annual Generation on RH TRUW Generating Site Waste Loads

TRUW Site	Inventory (m^3)	Generation Rate (m^3/yr)	Waste Loads[a] (m^3/yr)		Percentage Differences
			Current	WMin/PP	
ANL-E	0.00	1.7E+01	3.4E+01	1.7E+01	50%
Hanford	2.0E+02	7.7E+02	1.6E+03	7.9E+02	49%
INEL	1.1E+02	2.5E+01	6.1E+01	3.6E+01	41%
LANL	7.9E+01	5.0E-01	8.9	8.4	6%
ORR	1.3E+03	1.8E+01	1.7E+02	1.5E+02	12%
SRS	1.0	1.0	2.1	1.1	48%
Total	1.7E+03	8.5E+02	1.8E+03	9.4E+02	48%

[a] Assumes inventory and 20 years of generation are treated in 10 years; for the WMin/PP case, the annual generation rate is half the current generation rate. Includes waste stream categories: aqueous liquids (1000); organic liquids (2000); solid process residues (3000); soils (4000); and debris (5000).

Table G–24. Effect of Pollution Prevention 50% Reduction in Annual Generation on Regional Treatment Site TRUW Waste Loads

Regional Treatment Site	Percentage Decrease in Waste Load[a]		
	CH 3 Regional Sites	CH 5 Regional Sites	RH 2 Regional Sites
Hanford	41	41	49
INEL	7	1	--
LANL	NA	35	--
ORR	NA	NA	19
RFETS	NA	39	--
SRS	35	12	--

Notes: -- = not a regional treatment site under the specified alternative; NA = not applicable.
[a] Assumes inventory and 20 years of generation are treated in 10 years; for the WMin/PP case, the annual generation rate is half the current generation rate.

waste) and Table G–23 (for RH waste) were used for the effects on treatment at and transportation from other sites.

Reductions in costs of treatment storage, and transportation were assumed to be proportional to reduction in waste load. In estimating the effect of reduction in annual generation on the facilities cost, the same distinction was made between situations where there are existing facilities and when there are no existing facilities, as in Section G.2.2.2. Using information on existing facilities from INEL (1995d), Table G–25 summarizes the effect of a 50% reduction in annual generation on the need for new capacity. For the cases considered, the existing facilities at the Rocky Flats Environmental Technology Site (RFETS) and the aqueous treatment facility at LANL are estimated to have adequate capacity regardless of source reduction in annual generation. On the other hand, the grout stabilization facility would not have sufficient capacity even with a 50% reduction.

The effects of the assumed source reduction on the planning level life-cycle costs of operations and maintenance, construction, and transportation are given in Tables G–26 and G–27 for the TRUW alternatives and an RH TRUW alternative, respectively. For the TRUW alternatives, the assumed reduction in annual generation is estimated to result in a 22% reduction in costs, while the cost reduction for RH TRUW is estimated to be 26%. In Table G–26, the costs are for both CH and RH TRUW.

G.2.5.3 Human Health Risk Reduction

Reductions in human health risk from a 50% across-the-board reduction in the annual generation of TRUW were estimated for the same four CH TRUW alternatives and RH TRUW alternative considered above. The human health risk considered was cancer incidence among the offsite population and among workers at WM facilities. Risk reduction is assumed to be proportional to throughput reduction. With this assumption, the estimated reductions in risk for 10 years of operation of treatment facilities are given in Table G–28. The table shows that reduction in annual generation of CH TRUW is estimated to have a larger impact on human health risk to the public (approximately 30% reduction) than to WM workers (approximately 18% reduction). This is because human health risks are estimated to be greater at SRS than at other sites. Because SRS has a relatively small ratio of inventory to annual generation, reductions in annual generation are relatively effective in reducing human health risk.

Table G–25. Effect of Pollution Prevention Reduction[a] on the Need for New CH TRUW Facilities

Site/Facility	Existing Capacity (m^3/yr)	Current/ WMin/PP	Total Capacity Required by Case (m^3/yr)			
			Decentralized	Regionalized 1	Regionalized 2	Regionalized 3
LANL						
AQWTR	2.0E+02	Current	NA	NA	6.7E+01[c]	NA
		WMin/PP	NA	NA	6.0E+01[c]	NA
INCIN[b]	6.8E+02	Current	NA	NA	3.9E+02[c]	NA
		WMin/PP	NA	NA	3.4E+02[c]	NA
GROUT	7.7	Current	1.6E+02	1.4E+02	1.5E+02	NA
		WMin/PP	1.4E+02	1.2E+02	1.3E+02	NA
RFETS						
AQWTR	1.5E+05	Current	NA	NA	4.3E+01[c]	6.1[c]
		WMin/PP	NA	NA	2.6E+01[c]	3.8[c]
CMPCT	3.6E+03	Current	NA	3.7E+02[c]	3.9E+02[c]	NA
		WMin/PP	NA	2.3E+02[c]	2.4E+02[c]	NA
GROUT	5.0E+02	Current	1.1E+02[c]	7.2E+01[c]	8.5E+01[c]	6.1E-01[c]
		WMin/PP	6.4E+01[c]	5.4E+01[c]	5.0E+01[c]	6.1E-01[c]

Notes: NA = not applicable; AQWTR = aqueous water treatment; INCIN = thermal treatment; CMPCT = shredding and compaction; and GROUT = grout stabilization.

[a] The required capacities for pollution prevention are based on an assumed 50% across-the-board reduction in annual generation.

[b] Thermal treatment unit at LANL is currently unfunded and in shutdown mode.

[c] The existing capacity is sufficient regardless of reduction in annual generation.

Table G–26. Effect of Pollution Prevention on Costs for Four TRUW Alternatives[a] (in dollars)

Alternative	O&M[b]		Construction[c]		Transportation	
	Current	WMin/PP	Current	WMin/PP	Current	WMin/PP
Decentralized	4.7E+09	3.6E+09	2.1E+09	1.6E+09	5.6E+08	4.8E+08
Regionalized 1	4.9E+09	3.7E+09	2.3E+09	1.8E+09	5.1E+08	4.4E+08
Regionalized 2	5.5E+09	4.2E+09	3.0E+09	2.2E+09	4.5E+08	4.1E+08
Regionalized 3	5.1E+09	3.9E+09	2.9E+09	2.1E+09	4.9E+08	4.0E+08

[a] Based on a 50% across-the-board reduction in annual generation.

[b] Includes decontamination and decommissioning costs for both CH and RH TRUW.

[c] Includes preoperations costs for both CH and RH TRUW.

Table G–27. Effect of Pollution Prevention on Costs for an RH TRUW Alternative[a]

Site	O&M[b]		Construction[c]		Transportation	
	Current	WMin/PP	Current	WMin/PP	Current	WMin/PP
ANL-E	3.4E+06	1.7E+06	NA[d]	NA	2.1E+05	1.0E+05
Hanford	7.7E+08	5.6E+08	4.2E+08	3.0E+08	1.3E+07	9.4E+06
INEL	3.9E+07	2.3E+07	1.0E+07	6.0E+06	3.5E+05	2.1E+05
LANL	1.2E+07	1.1E+07	3.3E+06	3.1E+06	1.0E+05	9.5E+04
ORR	3.6E+08	3.0E+08	2.6E+08	2.1E+08	5.5E+05	4.5E+05
Total	1.2E+09	9.0E+08	6.9E+08	5.2E+08	1.4E+07	1.0E+07

[a] This is for treatment to RCRA standards at two installations (Hanford and Oak Ridge); ANL-E ships to ORR; INEL and LANL ship to Hanford. It is assumed that there is a 50% across-the-board reduction in annual generation.
[b] Includes preoperations costs.
[c] Includes decontamination and decommissioning costs.
[d] NA = not applicable.

Table G–28. Effect of Pollution Prevention Source Reduction on Cancer Incidence for TRUW Alternatives

Alternative	Offsite Population		WM Workers	
	Current	WMin/PP[a]	Current	WMin/PP
CH Decentralized	5.5E-04	4.0E-04	2.1	1.8
CH Regionalized 1	8.6E-04	6.3E-03	2.2	1.8
CH Regionalized 2	2.8	2.0	2.0	1.7
CH Regionalized 3	6.5E-01	4.3E-01	2.2	1.8
RH[b]	1.6E-01	1.3E-01	3.4E-01	2.8E-01

[a] 50% across-the-board reduction in annual generation.
[b] Treat RH TRUW at 2 sites to RCRA LDR.

In contrast, health risks to WM workers are more evenly spread among sites, with WM workers at INEL having the greatest cancer incidence. At INEL, the inventory of CH TRUW far exceeds annual generation. Thus, pollution prevention has a smaller impact on estimated cancer incidence among WM workers.

G.3 Pollution Prevention Applied to Environmental Restoration and Decontamination and Decommissioning Activities

Environmental restoration activities are directed toward removal and treatment of contaminated media and facilities. Waste and pollution may be generated during restoration activities just as they may be generated by decontamination and decommissioning (D&D) of plants and equipment and by dismantlement of weapons systems. Appendix B of the 1994 crosscut plan (DOE, 1994b) states that pollution prevention is applicable to the processes and techniques used to perform ER and D&D activities. In this section, application of pollution prevention practices to ER and D&D activities is discussed in view of the Office of Science and Technology's research, development, demonstration, testing, and evaluation program.

G.3.1 Groundwater and Soils Cleanup

Some of DOE's most pressing ER needs are for cleanup or containment of radioactive and hazardous contaminants in soils and groundwater. DOE is responsible for waste management and cleanup of more than 100 contaminated installations (containing approximately 3,700 contaminated sites) in 36 states (DOE, 1993b). These sites have over 26,000 acres with hazardous and radiologically contaminated surface water, groundwater, and soil that are in need of some measure of remediation. The following are a few examples of the extent of the contamination. At SRS and the Hanford Site, for example, soils and groundwater are contaminated with volatile organic compounds (VOCs). At the Nevada Test Site, more than 13 km^2 of soil are contaminated with plutonium, and a large quantity of soil is contaminated with uranium at the Fernald Environmental Management Project (FEMP) Site.

The DOE Office of Science and Technology Research, Development, Demonstration, Testing and Evaluation (RDDT&E) efforts include several programs directed for groundwater and soils cleanup. One concept being explored that is in conformity with pollution prevention principles is the Minimum Additive Waste Stabilization (MAWS) concept for stabilization of LLW and LLMW (DOE, 1994c). This new approach to vitrification uses multiple waste streams as substitutes for additives otherwise needed to be purchased. The MAWS concept integrates vitrification with other treatment technologies as appropriate, increasing waste loadings and reducing costs. The minimum additive waste stabilization technology is being demonstrated at FEMP. Applicable waste streams appear to be soils, sludges, groundwater, and ash and debris from burn pits.

Most of the RDDT&E programs in the ER area are integrated programs or demonstrations. In an integrated program, multiple technologies are assembled and evaluated as a cradle-to-grave solution to a representative generic environmental problem (DOE, 1993a). Some current RDDT&E integrated demonstrations are for VOCs in non-arid soils, VOCs in arid soils, cleanup of mixed waste landfills, uranium in soils, and in-situ remediation. Some of the technologies in the integrated demonstrations can be considered source reduction technologies. One such technology is methane-enhanced bioremediation, in which methane is injected via horizontal wells to become a food source for indigenous microorganisms known to be capable of degrading trichloroethylene (DOE, 1994d). By destroying contamination rather than transferring it from one medium to another, methane-enhanced bioremediation can be considered a pollution prevention technique (DOE, 1994d).

G.3.2 Decontamination, Decommissioning, and Recycle

Because many facilities in the DOE complex are aging or changing their missions, there is a need to deactivate and decommission a large number of surplus buildings that currently contain radiological, hazardous, mixed, and special (such as asbestos) contaminants. Facilities in the DOE complex are assumed to contain substantial quantities of scrap steel, nickel, aluminum, and copper, which if decontaminated could be recycled and reused. The Office of Science and Technology's RDDT&E program has a component concerned with reuse and recycle of both metal and concrete from decommissioned facilities (DOE, 1993a). Technologies being considered for the removal of both surface and volume contamination because they appear to have no technological barriers, worker safety problem, or public health limitations are:

- Surface decontamination of concrete using a microwave process
- Surface decontamination of metals using a laser process
- Volumetric decontamination of concrete using an electrostatic process
- Volumetric decontamination of stainless steel and of mild steel using a refining process
- Surface decontamination (internal) of equipment using a gas-phase process
- Volumetric decontamination of transite/asbestos using a melting process

This component includes developing industrial capacity to reuse and recycle the contaminated material.

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Appendix H

Technology Development

U.S. Department of Energy
Waste Management Programmatic Environmental Impact Statement

Contents

Table

Acronyms and Abbreviations

The following is a list of acronyms and abbreviations (including units of measure) used in this appendix.

Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
BDAT	best demonstrated available technology
BUSS	Beneficial Uses Shipping System
CAA	Clean Air Act
CEM	continuous emission monitoring
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH	contact-handled
CWCO	catalytic wet chemical oxidation
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DNAPL	dense nonaqueous phase liquid
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
ESC	expedited site characterization
FTIR	Fourier transform infrared
FY	fiscal year
INEL	Idaho National Engineering Laboratory
ISV	in-situ vitrification
LDR	land disposal restriction
LIBS	laser-induced breakdown spectroscopy
LLMW	low-level mixed waste
LNAPL	light nonaqueous phase liquid
MAWS	minimum additive waste stabilization
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
PCB	polychlorinated biphenyl
PHP	plasma hearth process
PNA	polynuclear aromatic
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
SCDE	supercritical carbon dioxide extraction

SCWO	supercritical water oxidation
TCLP	toxicity characteristics leach procedure
TD	Technology Development
TSCA	Toxic Substances Control Act
VOC	volatile organic compound
WM PEIS	Waste Management Programmatic Environmental Impact Statement

Abbreviations

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
psi	pounds per square inch

APPENDIX H
Technology Development

H.1 Introduction

This appendix addresses the potential impact of technology development on the Waste Management Alternatives described in Chapter 3 of the Waste Management Programmatic Environmental Impact Statement (WM PEIS). This discussion outlines the approach taken by the U.S. Department of Energy's (DOE's) Office of Environmental Management (EM) through its Office of Technology Development and discusses selected examples of emerging technologies that may influence the WM PEIS Alternatives or mitigate the impact of EM activities.

The Office of Technology Development is responsible for managing an aggressive national program of applied research, development, demonstration, testing, and evaluation for environmental cleanup, waste management, and related technologies. This Technology Development (TD) Program undertakes a focused problem-oriented approach to have technologies available for use to support the DOE's environmental management needs in a manner that also supports the DOE's industrial competitiveness goals. The TD Program is designed to resolve major technical issues, to rapidly advance beyond current technologies for waste management operations, and to expedite compliance with applicable environmental laws and regulations. The underlying strategy is to identify and develop high-payoff waste management technologies that can: (1) cleanup the inventory of DOE nuclear component manufacturing sites and (2) better manage DOE-generated waste than is possible with existing environmental cleanup technologies. In many cases, the development of new technologies presents the best hope for ensuring a substantial reduction in risk to the environment and improved safety for workers and the public within realistic financial constraints.

The availability, and the projected availability, of appropriate technologies govern what can be cleaned up, how, and how soon. DOE's objective is to manage its waste with the greatest effectiveness, efficiency, and lowest tolerable risks to people (health, safety, jobs) and the environment. Although emerging technologies are discussed in the context of the WM PEIS, they will likely play their most prominent role in the National Environmental Policy Act (NEPA) process during remediation at individual sites or during the decision-making process of facility design and selection. This is the point at which candidate technologies would receive specific consideration. To date, thirty-nine technologies developed and demonstrated by the Office of Technology Development have been either implemented or selected for implementation by DOE sites. Many of these technologies have been transferred to industry and are commercially available. Many more are in various stages of demonstration needed to become viable candidates for implementation. Past accomplishments in technology development are detailed in a series of Annual Reports to Congress required under Public Law 101-189.

The technologies postulated by DOE for use in waste management applications for the purpose of estimating attributes associated with the various WM PEIS Alternatives are ones which have already been widely approved by regulators. On the other hand, the technologies discussed in this Appendix, while believed to be sound in theory, require significant development before they would be considered proven, demonstrated, and generally acceptable to regulators. Emerging technologies must meet at least one, and preferably all, criteria for being "better, faster, safer, cheaper" than the current baseline technologies that they may supplant. Representative emerging technologies, if available for wide application, are considered in this appendix to help determine whether they might alter the selection of WM PEIS Alternatives. Consideration is also given to the potential ability of technology development to mitigate the environmental and economic costs of the EM program.

H.2 Focus Areas and Crosscutting Programs

The EM Office of Technology Development is organized on the basis of focus areas and cross-cutting programs. Five major remediation and waste management focus areas identified and targeted for action on the basis of risk, prevalence, or need for technology development to meet environmental requirements and regulations include: contaminant plume containment and remediation; mixed waste characterization, treatment, and disposal; high-level waste tank remediation; landfill stabilization; and facility transitioning, decommissioning, and final disposition.

Subsurface Contaminants. This focus area deals with uncontained hazardous and radioactive contaminants in soil and groundwater. At most sites, information about contaminant distribution and concentration is insufficient. Moreover, many containment and treatment technologies are ineffective or too costly to use. Improvements are being sought in containment systems and systems to remediate contaminated soils and groundwater.

Mixed Waste Characterization, Treatment, and Disposal. This focus area addresses major technical challenges to managing low-level mixed waste. Disposal capacity for mixed waste is expensive and severely limited; DOE now spends millions of dollars each year to store mixed waste because of the unavailability of accepted treatment technology and disposal capacity. ,urrently available waste management practices require extensive, and therefore expensive, waste characterization before disposal. Improvements are being sought in thermal and nonthermal treatments emissions, nonintrusive drum characterization, material handling, and final waste forms.

High-Level Waste Tank Remediation. This focus area is primarily concerned with deteriorating tank structures and consequent leakage of their contents. Research and technology development activities must concentrate on safe, reliable, cost-effective methods for characterization, retrieval, treatment, and final disposal of high-level tank wastes. Special emphasis is placed on in-situ or remotely handled processes and waste volume minimization.

Landfill Stabilization. This focus area addresses the significant remediation challenges posed by numerous DOE landfills. Some existing landfills have contaminants that are migrating, thus requiring interim containment before final remediation. Materials buried in "retrievable" storage pose another problem—retrieval systems that reduce worker exposure and reduce the quantity of secondary waste must be developed. Development of in-situ methods for containment and treatment is also a high-priority need.

Facility Transitioning, Decommissioning, and Final Disposition. This focus area addresses the technological problems associated with the numerous weapons complex facilities no longer needed because of age or changing national security requirements. While the building and scrap materials at the facilities are a potential resource with significant economic value, current regulations lack clear release standards. The recovery, recycling, or reuse of these resources can be encouraged by enhanced technological developments for their decontamination. In addition, material removal, handling, and processing technologies must be improved to enhance worker safety and to reduce cost.

In addition to these focus areas, the Office of Technology Development manages three cross-cutting programs: *characterization*, *efficient separations*, and *robotics*. The objective of these cross-cutting programs is to provide needed research or technologies, in a timely, cost-effective manner, to support waste management, environmental restoration, and facility transition and management missions.

The remainder of this appendix contains a discussion of several emerging technologies. Section H.3 discusses emerging treatment and airborne monitoring technologies for waste management, with example technologies for managing low-level mixed waste, particularly the organic components of such waste. Section H.4 is an analogous discussion of emerging technologies particularly relevant to characterization and environmental remediation issues, with emphasis on their impacts on groundwater and soil contamination. The technology discussed in Section H.4 is relevant to this PEIS to the extent to which it increases (that is, by making remediation technically and economically feasible at additional DOE sites) or decreases (that is, by enabling in-situ cleanup of soil and groundwater sites) the volume of waste to be transferred to the EM Office of Waste Management for treatment and disposal. Section H.5 discusses technologies that relate to transportation risks associated with most WM PEIS Alternatives. While technologies are discussed under particular categories for convenience, the reader should note that many technologies overlap both site remediation and waste management categories.

H.3 Waste Management Technologies in Development

DOE has identified nearly 2,000 different stored mixed, high-level, transuranic, or low-level waste streams at more than 50 of its sites. The Office of Technology Development has undertaken a systematic approach to solving key problems in waste management (and environmental restoration) by conducting technology development in the categories of characterization and monitoring, retrieval, treatment, and stabilization in a form suitable for final disposal. During fiscal year (FY) 1996, the Office supported the work packages shown in the Attachment to this appendix. Waste management (as opposed to environmental restoration) efforts are being conducted most extensively in the Mixed Waste Characterization, Treatment, and Disposal Focus Area and in the crosscutting areas of characterization, robotics, and efficient separations; some other efforts (for example, pollution prevention) are also being conducted.

In this section, the technical capabilities and limitations of emerging technologies are compared with the baseline technology (usually incineration) for organic destruction in low-level mixed waste. This discussion will concentrate on the treatment of low-level mixed waste (LLMW) for several reasons: this type of waste is most broadly distributed throughout the DOE complex, at large and small sites; past practices for the storage and treatment of these wastes have led to public concerns about possible safety and health impacts; few treatment technologies have been proven for LLMW; and these are not acceptable for most of the LLMW streams. Thus, new technological advances for mixed waste treatment are widely sought.

The organic destruction step is particularly suited for illustration because it clearly offers the potential for advances in an overall system integrating treatment, monitoring, and improved final waste forms. Technology for each of these areas is included in this discussion. The choice of organic destruction technology is also important within the framework of the WM PEIS because of the potential impacts at sites of all sizes within the DOE complex. Thus, this issue relates directly to the degree of centralization and the choice among the Alternatives analyzed in this PEIS.

H.3.1 DEFINITION OF THE ISSUE

Most of the approximately 50 DOE sites where LLMW now exists, has existed, or is expected to exist, generate and store small volumes of LLMW. More than 99% of DOE LLMW exists at just 13 of them. Of the 50 sites, about half would require treatment of 10 cubic meters or less of LLMW per year, and several would require treatment of less than 1 cubic meter. Although much LLMW would not be suitable for incineration (for example, bulk wastes contaminated with heavy metals) the baseline technology for dealing with the organic components of these wastes is assumed for discussion purposes to be treatment using a thermal technology, such as incineration. Specific treatment categories and volumes for DOE sites are provided elsewhere in the WM PEIS.

Land disposal restrictions specifically prohibit the disposal of a wide range of waste categories into the earth (40 CFR Part 268). Prominent on the list of prohibited waste categories are organic compounds regulated under the Resource Conservation and Recovery Act (RCRA). The inventory of DOE-generated LLMW contains the regulated organics as well as substances, such as inorganics, metals, and low-level radioactive constituents.

Use of emerging technologies in treating organic mixed wastes could change the number of treatment facilities, as well as respond to concerns about the social equity of treating waste at one site shipped from elsewhere—particularly from other States or regions. Alternate thermal or nonthermal approaches to organic destruction that would make onsite treatment of small volumes more feasible could minimize these concerns and reduce the importance of organic LLMW components in decisions between centralized and decentralized treatment configurations. The degree of centralization may also be affected if similar emerging technologies, applicable at larger scales, alter the balance of costs, risks, or public acceptance of currently available technologies for treating wastes at the larger volume sites.

H.3.2 BASELINE TECHNOLOGY

According to 40 CFR 268.42, the U.S. Environmental Protection Agency (EPA)-approved technology-based standard treatment for organic destruction is incineration; a technology that has attained this status is commonly referred to as best demonstrated available technology, or BDAT.

The schedule for availability for incineration is not a problem; the technology has been applied to the treatment of both hazardous and mixed waste. Although improvements in technique are still being made, no further development is required for using the technology at conventional fixed facilities.

The cost of incinerators is a concern. Incinerators have a relatively high initial capital cost, especially when used to treat small volumes of mixed waste. An incinerator must be designed and sized to maintain a sufficient residence time at an elevated temperature to ensure the high level of destruction necessary to meet regulatory requirements. In addition, current units are larger than the size required to treat the low volumes of waste at smaller sites. The size of the treatment unit cannot simply be reduced proportionally for smaller waste volumes; therefore, the cost per unit volume would increase as less material is treated. Because of the high capital costs for constructing fixed facilities, industry has developed mobile incinerators for hazardous waste treatment. However, no mobile systems are yet commercially available to treat DOE's mixed wastes.

Technical limitations are also a concern when applied to the DOE complex. Treatment units must be designed to accommodate a wide range of wastes with different compositions and physical characteristics. Some degree of overdesign will be necessary, resulting in a larger, more costly, and more complex system. Difficulties with segregating secondary wastes (for example, ash) may also require additional treatment and incur additional costs. Incinerators require a complex off-gas treatment system to ensure that the release of hazardous compounds will be below specified or permitted levels. This problem is compounded for many DOE wastes by the presence of radionuclides. These may contaminate the off-gas stream as entrained particulates, or through volatilization resulting from the elevated temperatures required for complete combustion. The off-gas treatment system needs redundancy in design to insure appropriate levels of safety under all conditions.

Public acceptability issues are complicated by the interplay between onsite treatment and transportation. (Public acceptance is explicitly or implicitly considered by regulators under RCRA and the Comprehensive

Environmental Response, Compensation, and Liability Act (CERCLA); therefore, public acceptance strongly affects the timing for new technologies to become widely accepted and the willingness of the private sector to invest in these technologies. Consequently, judgments about acceptability are necessarily a part of an emerging technologies evaluation.) Public and stakeholder concerns about the potential for release of hazardous materials during treatment have affected the application of incineration at existing public sites and may similarly affect DOE sites. On the other hand, construction of treatment units at a site would eliminate the costs and risks associated with transportation of the wastes to other locations for treatment. These decentralized, onsite options should be favored by those stakeholders along the transportation routes, and those near the sites that would otherwise have been receivers of shipped wastes.

H.3.3 EMERGING TREATMENT TECHNOLOGIES (MIXED WASTE CHARACTERIZATION, TREATMENT, AND DISPOSAL FOCUS AREA)

H.3.3.1 Introduction

This section contains a general discussion of some alternative technologies and addresses several in greater detail. Many alternative treatment technologies are being developed or demonstrated within DOE or the private sector. These include thermal treatments that destroy organic components at high temperatures and nonthermal treatments that destroy organic components at lower temperatures. Table H-1 lists specific technologies applicable to the destruction of small volumes of LLMW that were examined during preparation of this document. The list of technologies applicable to larger sites would be similar.

H.3.3.2 General

The potential advantages of the emerging technologies are compared to the baseline (incineration) using similar criteria.

The schedule for availability for these emerging technologies *is* an issue. The alternative technologies are not developed to the point where application is guaranteed, especially within the time frame important to

Table H-1. Emerging Technologies Evaluated for Organic Destruction of LLMW at Small-Volume Sites[a]

Thermal Treatments
Plasma hearth (fixed hearth and centrifugal hearth units are commercially available)
Steam reforming
Mobile incinerators
Molten salt oxidation (MSO)
Catalytic extraction (e.g., molten metal technologies)
Reverse burn gasification (e.g., ChemChar)
Thermal reductive (e.g., ECO-Logic)
Pyrolysis
Vitrification
Nonthermal Treatments
Chemical oxidation Acid digestion Wet oxidation Wet air oxidation Wet chemical oxidation Supercritical water oxidation Catalyzed wet chemical oxidation Catalyzed acid oxidation Chemical and biological treatment
Biological treatment (both oxidative and anaerobic)
Photolytic oxidation Ultraviolet (UV) oxidation, including UV-hydrogen peroxide and UV-ozone Catalyzed UV oxidation Laser-induced oxidation Photothermal detoxification unit
Electrochemical oxidation Direct (electron beam) Indirect (catalyzed electrochemical oxidation [CEO], mediated electrochemical oxidation [MEO])
Dehalogenation (e.g., potassium ethylene glycolate KPEG process)

[a] Technologies tabulated are being evaluated by either private industry or the Federal Government.

selecting a programmatic Alternative. Thus, the capability of a new technology, or combination of technologies, to treat all incinerable wastes is not certain.

While some pilot-scale testing has been completed for many emerging technologies, some technologies are still being evaluated at the bench scale. Because of the limited amount of data available from the testing that has been completed, considerable technical testing is necessary before full-scale demonstrations are justified. For example, because of the difficulties and costs of handling radioactive materials, only a few tests have been carried out so far with actual mixed wastes. Most developmental efforts have used surrogates (nonradioactive materials with similar chemical or physical properties to the radioactive contaminants).

The capital cost of many of these technologies, both thermal and nonthermal, may be lower than an incinerator with similar capacity. However, because of the early stage of development, only rough cost estimates have been completed for most emerging technologies. Emerging technologies may also offer advantages in simplicity and may be more readily transported from site to site. A portable system would reduce the capital costs by avoiding the construction of multiple facilities. Another potential cost saving occurs with the reduction in characterization required for those technologies that are more "robust" than incinerators. For these cases, a wide variety of wastes can be processed without the need for extensive characterization before treatment. This would also reduce the cost for constructing complex characterization facilities at the small-volume sites and thus cut total system costs.

Technical limitations may be fewer than for incineration in the case of some of these emerging technologies; however, others may have additional limitations. Nonthermal technologies do not involve high temperature, reducing the potential for volatilization of metals and radionuclides. In addition, many of these approaches generate much lower volumes of off-gas compared to incineration. Similarly, some thermal treatment technologies under development would generate lower volumes of off-gas. Thus, a less complex off-gas treatment system may be possible. However, for some nonthermal systems, other components (such as nitrogen oxides [NO_x]) and secondary waste streams (such as spent reaction solutions) may also require treatment. The complexity of the total system, including secondary treatment, must be considered when comparing to the baseline. As with the baseline treatment, many emerging technologies may be designed for application in mobile units.

Public acceptability may be higher for nonthermal treatment technologies than for incineration, inasmuch as they do not bear the incineration label and may be viewed as alternatives.

The situation is further complicated by private sector market considerations. Because incineration is controversial, but is nonetheless BDAT for organic destruction of hazardous wastes, private industry is developing many alternatives to incineration to capture non-Federal markets. Much of the technology development effort has been directed toward specific waste streams found in large volume within the private sector. Only a limited amount of testing has been done to learn the range of waste types that can be treated efficiently with any particular technology. A significant amount of additional work will have to be done to show applicability, and to find acceptable processing conditions for a broader variety of waste streams, before wide market acceptance of an emerging technology is likely. Further, the emergence of a technology capable of capturing a significant share of the private sector market could lead to a sharp decline in the willingness of industry to act in partnership with DOE to continue to address DOE waste streams for which the new technology is not applicable—with adverse implications for the development of technology useful to DOE.

H.3.3.3 Specific Example: Plasma Hearth Process

The plasma hearth process (PHP) is a robust process that can treat a wide variety of wastes through exposure to plasma at temperatures greater than 3,000°C. The fixed-hearth plasma process has the potential to treat nearly all mixed waste streams present in the DOE complex, including solid combustibles, heterogeneous debris, and chemical containers. The process burns off organic components of the waste stream. The inorganic components are melted to form a glassy slag and a metal phase that can be separated and potentially recycled. Radionuclides and heavy metal contaminants are bound in the slag, which has been shown to have sufficiently low leachability to pass the EPA toxicity characteristics leach procedure (TCLP). The process includes a secondary destruction unit to ensure high organic destruction efficiency regardless of the properties of the incoming waste. Additional treatment of this secondary waste may be necessary to render the final form compliant with land disposal restriction (LDR) regulations.

The PHP can treat multiple mixed waste types contained in drums without opening them. This would greatly reduce the need for characterization of the waste before treatment and may result in a large saving in the total system cost compared with that for a less robust technology.

Schedule for availability. The plasma hearth process may be usable at one or more small-volume sites within a few years. Scale-up to larger volume applications would follow. Development of the plasma hearth process is still at the pilot scale. Tests have been carried out with several surrogate low-level mixed and transuranic waste streams. An integrated nonradioactive pilot-scale demonstration system was constructed at Retech, Inc. (California) in FY 1995, with bench-scale radioactive testing scheduled for FY 1997. Argonne National Laboratory–West conducted an integrated bench-scale radioactive demonstration in FY 1995. The results of the demonstration on actual mixed wastes allowed a more reliable estimate of the availability of the PHP for treatment of LLMW. An integrated pilot-scale plasma hearth test system will be ready for operation in FY 1997 at Retech, Inc. This system is expected to be similar in capacity to that required to provide treatment at the smaller DOE sites. Thus, a significant amount of information on the capabilities and any limitations of this technology will be available at the time NEPA and other regulatory decisions are made about application of technologies for treating DOE's wastes at specific sites.

Cost. Savings could occur with use of the plasma hearth process. (Estimated cost savings will be a product of the Office of Technology Development Cost/Benefit Project, an ongoing activity to establish economic parameters for technologies as a guide to setting priorities in the program and a support for technology transfer.) Baseline incineration and cementation technology requires detailed characterization and segregation of containerized heterogeneous mixed waste, followed by high-temperature incineration and cementation of the ash byproduct. PHP technology has an economic advantage over the baseline technology, with the major differences being driven by the costs of process equipment and operation, annual maintenance, and disposal. The reduced cost of process equipment is the principal factor accounting for a large cost difference over the 20-year life cycle. In PHP, pretreatment characterization requirements are reduced and the final waste form usually passes leachability requirements for final disposal.

Technical limitations. Two problem areas exist for the plasma hearth process: off-gas and materials (drum) handling. Only 1% of the air for fossil fuel burners is required for operation of the plasma torch; therefore, the volume of off-gas is much lower. The lower volume of gas is easier to monitor and control, and increases the potential for operation with a closed off-gas system, in which the release of contaminants to the atmosphere is eliminated by recycle of the off-gas. However, test results to date have shown the possibility of high levels of NO_x formation.

The plasma hearth process can be designed with a primary destruction chamber that is relatively small (e.g., contains a single 55-gallon drum of waste at a time) or scalable to accommodate multiple drums. Thus, it is applicable to small-volume DOE sites, either as fixed or mobile units. However, design issues do arise in handling drums of waste with the plasma torch before and after treatment. For example, the inorganic slag produced will initially be at a high temperature. The temperature complicates the process of moving the slag into waste drums for disposal without compromising the integrity of the drums.

Public acceptability. The public acceptability of this process is unknown. Although the PHP involves high temperatures, the low volume of off-gas may minimize fears about the release of hazardous substances. In addition, the low thermal mass of the system would allow rapid shutdown in case of a process upset. This attribute should also be viewed favorably.

H.3.3.4 Specific Example: Catalytic Wet Chemical Oxidation

Wet chemical oxidation systems use the reaction of oxygen, or an alternative oxidizing agent, to destroy the organic constituents of a waste in an aqueous solution. In catalytic wet chemical oxidation, one or more chemical species are added to increase the rate at which the oxidation reactions progress. The example catalytic wet chemical oxidation system being developed by Delphi Research, Inc. (DETOX), uses an iron catalyst and a co-catalyst to degrade the organic contaminants in a strong acid solution. The system operates at temperatures much below those used in incineration and at moderate pressures. The expected operating conditions are approximately 150°F and 70 psi.

Schedule for availability. The DETOX system will undergo a pilot-scale cold test at the Savannah River Technology Center in FY 1997. Because design of a portable system is under way, application to wastes at small sites may be possible within 3 to 5 years. However, because of the early stage of development, a high degree of uncertainty remains about issues associated with the technology.

Cost. Catalytic wet chemical oxidation uses equipment typical of that used in chemical processing operations. A system could be constructed at a scale appropriate for treatment of the wastes at the small-volume sites or scaled up. Because the equipment is readily available, development costs should not be an impediment to commercialization. However, because development is still in the early stages, equipment and treatment costs have not yet been determined. The processing required for spent reaction acid solutions and for stabilization and disposal would add to the cost.

Technical limitations. The DETOX technology has been demonstrated at bench scale, with destruction efficiencies of 99.9999% achieved for liquid hydrocarbons, including some chlorinated organics. Successful treatment has also been demonstrated for solid combustibles and for contaminated soils. However, only a limited amount of data is available. Treatment of materials that volatilize from the reactor will require further study even though off-gas volume will be small. Because of the strongly acidic nature of the reaction mixture, engineering development is focused on construction materials, along with scale-up problems. Other technical problems include treatment of the spent reaction solutions and system integration.

Public acceptability. As stated above, catalytic wet chemical oxidation is a nonthermal technology that operates at moderate temperature and slightly elevated pressure. Although the technology should not suffer from the incineration stigma, achieving public acceptability will likely require educating the public.

H.3.3.5 Specific Example: Vitrification

Vitrification of wastes into glass is an alternative to incineration, as well as a stabilization technology for incinerator secondary waste. Wastes and glass additives are combined and melted in a refractory furnace at approximately 1,100°C. Organic components and liquids are destroyed while radionuclides and metals are entrapped in a glass final waste form.

A broad range of waste, such as organic liquids, wet solids, dry solids, and heterogeneous solids, can be processed in a glass melter. Contaminants are chemically bound into the glass rather than simply encapsulated in the material. This will lead to improved leachability resistance over grout. Long-term stability is being evaluated as part of the technology development efforts. The stability of glass waste forms is higher than that for cement-based waste forms. Initial studies show the leachability results of low-level waste vitrification to be comparable to high-level waste glass standards. The glass reduces waste volume by at least 30% and meets land disposal restrictions. Minimal volatilization of most metals occurs because of the oxidizing atmosphere that allows wastes to form oxides and stay in the glass phase. Employing appropriate melter technology, such as a cold top unit, will minimize volatilization of other metals, such as mercury, by causing condensation on the cap.

Schedule for availability. Waste vitrification is the selected waste form process for high-level waste at DOE's Savannah River Site near Aiken, South Carolina. The Defense Waste Processing Facility (DWFP) became operational on March 12, 1996. Vitrification of mixed waste inorganic sludge has been demonstrated at the bench scale at the Rocky Flats Environmental Technology Site (RFETS) using microwave energy. Further technology development of low-level waste vitrification for higher waste loading and for organic destruction will incorporate experience gained from high-level waste solidification.

Cost. Oxide raw materials for glass are inexpensive. However, melting equipment, energy required for melting, and off-gas requirements may be more expensive than incineration. The volume reduction of at least 30% for waste vitrification translates into a large cost savings in disposal. The Minimum Additive Waste Stabilization (MAWS) concept of combining waste streams and using waste materials as the glass additive is also being developed by DOE. This would decrease costs in two ways—by further reducing volume and by decreasing the cost of additives.

Technical limitations. One important concern remaining to be addressed for organic destruction application is a potential problem with glass integrity because of concentration sensitivity for carbon, some radionuclides (e.g., uranium), and some hazardous metals. This integrity concern may prove to be a stumbling block for this application. Vitrification is expected to have other important applications in DOE remediation and waste management where these materials are not present in the streams. Applications may include environmental restoration wastes, decontamination and decommissioning wastes, and incinerator ash.

Public acceptability. Public confidence should be high considering that high-level waste vitrification began at the DWPF and also at the West Valley Demonstration Project (WVDP) in 1996.

H.3.4 EMERGING AIR MONITORING TECHNOLOGIES

Progressive monitoring technologies are not treatment technologies like those listed in Table H-1, but may be a key factor in enhancing public acceptance of currently available and advanced waste treatment and organic destruction technologies. The baseline monitoring methodology involves periodic sample collection of process emissions, transferring samples to a laboratory instrument, and analysis. Advanced air monitoring technologies would allow improved and real-time evaluation of the effectiveness of toxic compound destruction during treatment of mixed waste, thereby contributing to the safety and acceptability of current and advanced treatment technologies.

The primary technical limitation of current methods is the inability to conduct real-time monitoring of certain species. Online analysis of the incinerator effluent would satisfy the requirements of the Clean Air Act (CAA) while simultaneously addressing public concern over waste incineration. Public acceptance of any waste treatment depends heavily on the ability of sensors to monitor the effectiveness of the treatment and to demonstrate that effluent streams do not contribute to worker and public risk exposure. The sensors need to be integrated with control systems and safety procedures to ensure that, if effluent levels exceed their limits, contaminants are controlled in a manner that prevents their entry into the environment.

Several technologies are emerging with the potential to effectively monitor important waste treatment parameters, such as those that measure incinerator performance. These new, real-time, continuous emission monitoring (CEM) technologies would be significantly cheaper than currently required monitoring techniques. Real-time monitoring makes it possible to perform diagnostic control of feed materials to help maintain necessary incinerator operating parameters and to allow process control of gaseous effluents containing unacceptably high levels of contaminants before release. Continuous monitoring will directly address issues of environmental safety, and the technology can be used to identify and quantify organic chemicals in the air. Thus, a continuous monitor directly addresses some public concerns about thermal treatment systems.

Typical examples of these new technologies should be available for demonstration in 1 to 5 years. The schedule is controlled by technical and regulatory acceptance concerns that can only be satisfied by testing.

Fourier transform infrared (FTIR) monitoring is one emerging technology that has already undergone testing on the Toxic Substances Control Act (TSCA) incinerator at Oak Ridge. FTIR is a mathematical method that allows for spectroscopic signal averaging to significantly improve signal-to-noise ratios and improve levels of detection of organic and selected inorganic molecular stack emissions. FTIR is not a new technique, but advances in instrument design allow its use in association with in-situ devices. FTIR is thus beneficial for generating rapid results while dramatically reducing the problem of spectral interference, or failure to differentiate between different chemical species.

In an indication of potential regulatory acceptance, EPA has facilitated these tests by issuing a protocol for an FTIR continuous emission monitor to ensure that the data that the technology can obtain will be compliant. The method can readily be extended to cover thermal treatment, stack, and ambient air monitoring.

Techniques for continuous emission monitoring of elements (for example, heavy metals and radionuclides) has not yet gone through a similar protocol/data verification process. Laser-induced breakdown spectroscopy (LIBS) is one such technology. In LIBS, laser light is focused on a specific region to vaporize a small amount of material. The vaporized material forms a short-lived plasma, which emits light that is collected, dispersed, and analyzed. Elements targeted specifically are among those of primary concern at many DOE and industrial waste sites—chromium, lead, arsenic, selenium, antimony, cadmium, zirconium, uranium, beryllium, and thorium. Technical issues that must still be addressed include: (1) determining possible spectral interferences; and (2) understanding detection limits, sensitivities, and precisions of the best spectral line or lines to be analyzed. Both issues must be resolved before LIBS can achieve regulatory acceptance.

FTIR development was completed in FY 1995 and the technology will be demonstrated in FY 1997 as part of the Plasma Hearth Process project. The LIBS system has been demonstrated in FY 1995 and FY 1996. Other important CEM technology demonstrations include the real-time airborne alpha emissions monitor (will be demonstrated in FY 1997), and the total, elemental and speciated mercury monitor (successfully demonstrated in FY 1996).

These monitoring technology advances are not expected, by themselves, to alter the ranking of the WM PEIS waste management configuration Alternatives, but they may mitigate public concerns about air quality for whichever configuration is adopted.

H.3.5 CONCLUSIONS ABOUT EMERGING TECHNOLOGIES FOR WASTE MANAGEMENT

Emerging technologies exist that should enhance waste treatment at many small sites. Some of these emerging technologies offer the potential to be:

- Less costly than those using fixed incineration
- Technically suited for the treatment of small volumes of waste
- Transportable, if permitting and decontamination requirements are resolved
- Ready for application in a time frame compatible with the requirements for key policy decisions at individual sites
- More readily acceptable to the public and other stakeholders

The plasma hearth process, catalytic chemical oxidation, and vitrification appear to have the potential to treat mixed waste streams at many of the smaller sites; however, neither the successful development of the necessary technologies nor their application to all waste streams at DOE's smaller sites are certain within the time-frame for formulating policy decisions. The difficulty of organic destruction argues against treatment of all DOE mixed wastes at all small-volume sites.

The emerging technologies discussed in this section may also be suitable for large-scale applications and may affect decisions on the overall waste treatment configuration. Private sector development directed toward larger scale organic destruction applications is also active because of non-DOE markets. Although not directed toward small DOE sites, the pilot-scale versions of private sector technologies might be adaptable at such sites on a case-by-case basis, if the developers see such adaptation as closely tied to eventual commercialization at larger scales.

Emerging air monitoring technologies will also enhance the acceptance of current and advanced treatment technologies; this may have the greatest impact at large-volume treatment sites, but should be viewed primarily as a mitigation measure rather than one that affects configuration selection.

H.4 Restoration Technologies in Development

The environmental restoration of DOE sites and facilities will likely affect groundwater and soil. The restoration waste loads identified as part of the sensitivity analysis in this PEIS assume reliance on land use restrictions rather than remediation to handle certain exposure pathways. A rationale for such restrictions is that applying currently available (baseline) technology to the treatment of large volumes of soil or groundwater imposes excessive time, cost, and risk (to workers and transportation) penalties. This section describes several emerging characterization and treatment technologies, and addresses their potential impacts. Their potential to mitigate the cost of implementing baseline Environmental Restoration Program technologies is also discussed. Emerging technologies could also have a significant impact on other restoration problems not specifically addressed here.

Groundwater remediation is particularly important because due to relative volumes involved, it is more costly than soil remediation and would allow greater potential for cost savings from the application of new and emerging technology. However, as discussed below, new approaches to groundwater remediation increasingly recognize that the behavior of the solid matrix above and surrounding the groundwater is critical to a technology's success or failure.

The Office of Technology Development's efforts affecting soil and groundwater are conducted principally in two focus areas (Landfill Stabilization Focus Area and Contaminant Plume Containment and Remediation Focus Area), as well as in two cross cutting areas—characterization and robotics.

H.4.1 DEFINITION OF KEY ANALYSIS ISSUES

H.4.1.1 Contaminated Groundwater

Conventional technology cannot successfully treat the groundwater contamination occurring at some DOE sites to levels that would allow unrestricted access after remediation—particularly where the contaminant plume is large. Any emerging technology that radically increases the feasibility of treating groundwater to acceptable levels would lessen the need to restrict land use. Furthermore, even if cleanup levels consistent with such restrictions were adopted, but not envisioned as necessarily permanent (in effect, adopting a policy of taking interim actions and delaying cleanup while awaiting a new technology), the timing of technology emergence would determine when the restrictions would ultimately be lifted.

Groundwater contaminant plumes at DOE sites include volatile organic compounds (VOCs), such as carbon tetrachloride, trichloroethylene, and tetrachloroethylene; semivolatile organics, such as petroleum oil and polynuclear aromatics (PNAs), pesticides, and polychlorinated biphenyls (PCBs); heavy metals, such as chromium, lead, and mercury; toxic inorganic salts, such as nitrates; and radionuclides, such as uranium, transuranics, and tritium. Although most radioactive substances are inorganics and often can be treated similarly to other heavy metal extraction processes (with regard for the special problems of radioactivity), unique treatments are sometimes required for the lower-molecular-weight species of cesium, strontium, and tritium.

Tritium isolation, containment, and/or removal poses unique problems for waste management. Tritium, as an isotope of hydrogen, is primarily contained in waste bound in water molecules; thus, tritium is released to the environment as water vapor is released. Standard production-scale chemical separation methods are ineffectual in removing tritium from the water molecule. The only method that can segregate tritium-containing water molecules from normal water uses extremely expensive isotopic separation techniques, and at present, these are not developed to process bulk quantities of water. The only possible method to lower the release of tritium in water vapor would be to condense all water vapor released during the incineration process and collect the liquid water for disposal. This method would not be practical for two reasons. First, containment and storage of large quantities of liquid water are simply not cost effective and may be prohibited by current land-ban disposal restrictions. Second, since the tritium is effectively one with the water molecule, any alternative treatment of the contained water that would result in water evaporation and/or surface/groundwater discharge would introduce tritium to the environment through other pathways. Tritium-containing wastes could be segregated and stored until the tritium decays to harmless levels. The waste could then be treated and disposed of. This last method is feasible, given the approximately 12-year half-life of tritium.

In addition to the contaminants in the plume, contaminants are adsorbed onto the aquifer matrix material and referred to as "secondary contamination." Low-water-solubility organics adsorb to natural organic matter in the aquifer matrix, and positively charged ions (cations) of inorganic contaminants (for example, heavy metal and radionuclide cations) adsorb by ion exchange to the surface of clays or natural organic matter. When the plume is remediated and replaced by clean groundwater, the secondary contamination recontaminates the plume; this source may continue to release contaminants long after the primary source and the original plume have been remediated, thereby extending the life of the contamination plume. A means is needed to destroy secondary contamination in place, or to accelerate the desorption/exchange of the contaminants back into the groundwater. Thus, full cleanup of contaminated groundwater requires removal of the primary source (if it has not been completely depleted in generating the plume), removal of the plume itself, and removal of the secondary contamination.

Dense nonaqueous phase liquids (DNAPLs) are contamination sources that are difficult to locate or remove. DNAPLs flow downward through the surface soil and vadose zone to the water table; because they are denser than water, they can continue to sink into the aquifer until they reach an impermeable zone. Many DOE groundwater contaminants are potential DNAPLs, including PCBs, mercury, trichloroethylene, and tetrachloroethylene.

Small volumes of DNAPLs can give rise to large groundwater plumes having concentrations far above acceptable health-based levels. DNAPL pools, which may be hidden in weathered bedrock layers or dead-end fractures in bedrock, can continue to diffuse back into the aquifer gradually over prolonged periods. They may take 50 to 100 years or more to disappear through natural dissolution in groundwater. Because locating DNAPLs is so difficult, attempting to use conventional excavation methods for DNAPL removal may result in disturbance rather than recovery and can cause DNAPL migration to deeper positions in the subsurface.

Water-insoluble liquids that are less dense than water are called "light nonaqueous phase liquids" or LNAPLs. Refined petroleum fuels and oils can be LNAPLs, which are another source of contaminant plumes. LNAPLs tend to be more easily detected than DNAPLs and are thus more easily remediated. They tend to float on the water table and spread within the vadose zone. If present, LNAPLs tend to be readily collected with groundwater samples and during pumping of groundwater, and are seen as a separate phase floating on top of the water samples. Thus, LNAPLs are not nearly the special detection and removal problem that DNAPLs are, and will not be considered in detail in this discussion.

H.4.1.2 Contaminated Soils

A wide variety of soil types are present at DOE sites, including desert and humid climate soils, shallow and deep soils, permeable (sandy) and impermeable (clayey) soils, homogeneous and heterogeneous size mixes, and true soils and weathered bedrock (pre-soils). In general, common usage of the term "soil" (the correct geologic term is "overburden") includes all of the non-coherent subsurface matrix above the water table. The large volumes of soil requiring remediation at DOE sites imply that the risk to the public and to workers from handling so much soil, treating it, and transporting it to treatment facilities would be substantial. Emerging soil remediation technologies that would radically alter the need for handling and transport would also radically alter these estimated risks and capacity of required WM facilities.

The soil contaminants at DOE sites include the same VOCs, semivolatile organics, inorganics, and radionuclides found in groundwater (which is usually contaminated by soil-borne contamination). Because of the inherent affinity of many inorganic contaminants to adsorb on soil and subsurface minerals, and the low solubility and resultant accumulation of organics in the subsurface (which is enhanced immensely if the soil contains any natural organic matter), the solid matrix of the saturated and unsaturated zones can contain far more contamination than the water. Remediation attempts that approach the water alone are either destined for failure or extremely long-term programs.

The type of soil remediation technology that can greatly reduce the risks of excavation and treatment on the surface (or disposal in an engineered and approved facility) is remediation in the actual zone of contamination, that is, in-situ remediation. In-situ biological treatment is an available technology in need of significant refinement. In-situ chemical, thermal, and electrokinetic treatment technologies are being developed. Depending on the extent to which these technologies can be developed and implemented, future soil remediation should become considerably safer and more effective than existing approaches.

H.4.1.3 The Role of Characterization

The ability to remediate all DOE facilities to current Applicable or Relevant and Appropriate Requirements (ARARs), and to remediate many contamination sites to ARARs in a timely and cost-effective manner, is partly limited by the inability to characterize wastes effectively; that is, to identify locations and boundaries of the contaminated region and to identify the level and kind of contaminants present at the start and the conclusion of cleanup.

Inefficient characterization also increases worker risk, because of exposures during the characterization process and during actual remediation. Within the Office of Technology Development, characterization programs are given specialized, cross-cutting, technology development emphasis. Consideration involves not only environmental restoration needs, but also those associated with waste management and facility transition; the former will be emphasized in this section. Analogous "monitoring" technologies directly relevant to waste management are discussed in Section H.3.4 of this appendix.

The scope of characterization, monitoring, and sensor technology consideration includes:

- Initial location and characterization of wastes and waste environments (for example, transport and fate) before treatment
- Monitoring of waste retrieval, remediation, and treatment processes
- Characterization of the composition of final waste treatment forms to evaluate the performance of waste treatment processes
- Site closure and compliance monitoring

H.4.2 BASELINE REMEDIATION TECHNOLOGIES

H.4.2.1 Baseline Groundwater Remediation

The most commonly used baseline technology for plume remediation is pumping the groundwater to the surface through an extraction well, followed by treatment above ground. For organics, treatment might involve air stripping, biological treatment, or oxidation; for inorganics, treatments might involve ion exchange, oxidation, or precipitation. If the groundwater were accompanied by a LNAPL phase, an oil/water separation would be performed before further conventional treatment.

In general, ex-situ groundwater treatment technologies exist for almost any conceivable situation. Remediating contaminated groundwater with these technologies, however, often provides inadequate removal of secondary adsorbed organic or inorganic contaminants (both hazardous and radioactive) from the aquifer matrix during extraction pumping. Furthermore, if the source was a DNAPL, then remediation of groundwater by conventional pump-and-treat methods is usually effective only for remediating the existing plume, not for removing the contamination source or the secondary contamination.

The common technology now used to remove secondary heavy metals or inorganic radionuclides contamination is pumping and treating. The rate of desorption of secondary metal contaminants depends on the aquifer matrix material's ion exchange capacity (which depends on organic matter and mineral—especially clay—content), the pH and redox potential of the groundwater, and the specific metal species. Desorption may be extremely slow if conditions are not optimal, but no technology to create optimal conditions for metal desorption is now widely accepted by regulators as effective.

Although pumping and treating groundwater is often proposed for cleaning up plumes, in relatively few cases can this be expected to achieve acceptable levels of cleanup in a reasonable period (for example, 5 to 10 years) because of inadequate solubilization of secondary contamination. Pumping and treating for 50 to 100 years may often be required to desorb secondary contaminants adequately. In-situ bioremediation of organics and certain inorganics in groundwater is another currently available technology and, under appropriate conditions, it has the advantage of simultaneously treating the secondary adsorbed contamination in the aquifer. It can be effective for volatile, semivolatile, and relatively nonvolatile organic compounds. It is not considered effective for DNAPLs still in "pool" form. Also, inadequate in-situ treatment of secondary contaminants is likely to occur if:

- The organic material is only slightly water soluble (groundwater concentration would be too low to support biological activity); this tends to include many DNAPLs and most high molecular weight organics.
- The hydraulic conductivity of the aquifer is too low; in this case, the flow rate of nutrients or gases would be too low to support increased biological activity.
- The aquifer temperature is too low; here biological activity would be too weak to accomplish cleanup with microbes.
- The total amount of dissolved organics or toxic metals in the groundwater is high enough to poison the microbes.
- The destruction efficiency of the microbes for the contaminants is too low (refractory chemicals); then the contamination would remain untreated.

When in-situ bioremediation is adequate for cleaning up a plume and any secondary contamination of the aquifer, it should be possible to complete the cleanup in 1 to 5 years.

A currently available groundwater remediation technology for VOCs is in-situ air sparging, which will strip VOCs from the groundwater and will accelerate the removal of VOCs from the aquifer matrix as well. In-situ air sparging will also strip volatile LNAPLs and DNAPLs from the subsurface. This technique is discussed further in the following section because it also applies to soils.

H.4.2.2 Baseline Soil Remediation

The most commonly used baseline technology for soil remediation is excavation followed by transport to an acceptable disposal facility. Other available technologies involve excavation and surface processing. Ex-situ soil treatment methods (specifically, waste volume reduction methods) such as separation of the contaminated soil fraction and soil washing are being used more often to reduce the volume of waste requiring land disposal. A primary baseline technology for contaminant removal applicable to oxidizable substances is incineration. Other thermal processes induce volatilization and then capture the contaminants for further treatment or disposal.

In-situ treatment technologies are focusing on either immobilizing the contamination in an artificially generated rock matrix, or extracting the contamination by soil-washing. The primary immobilization technology involves solidification by chemical cementation. Depths are limited by the availability of the deep-soil mixing equipment needed. Soil washing is applicable to greater depths, but does require that the contaminant be readily mobilized by the wash fluid. Injection of solubilizing agents such as oxidants, reductants, acids, bases, or complexing substances is still an emerging technology.

In-situ bioremediation can be effective for many organic compounds. However, inadequate in-situ treatment of soil contaminants will occur under the same conditions described above for groundwater (insoluble contaminants, low temperatures, excessively high levels of contaminants, low hydraulic conductivity, inadequate destruction efficiency of the microbes). When in-situ bioremediation is appropriate for a site, it is possible to complete the remediation in 1 to 5 years.

In-situ air sparging is another currently available soil remediation technology, applicable to VOCs. This technique involves pumping air into the subsurface and sweeping out the more volatile substances. To some extent, this flushing can also enhance the volatilization of these compounds from an underlying aquifer matrix. In-situ air sparging will strip volatile separated phases—LNAPLs and DNAPLs—from the subsurface. Air sparging is inefficient for semivolatile organics such as most pesticides, PCBs, and PNAs.

H.4.2.3 Baseline Site Characterization

Today, the general method for characterizing a site entails drilling wells or clusters of wells, based on a grid outline of the site. Samples are taken from these wells to determine the geology, hydrology, and aquifer contaminant levels. When drilling a well, a split spoon auger may be used to sequentially collect soil samples until the aquifer is reached. Then, the well is cased and a section (approximately 10 feet) is screened to monitor the aquifer over a period of time. This procedure, when done for a specific grid pattern across the site, provides a horizontal mapping of aquifer contaminants. If a vertical profile is desired, a cluster of wells is installed at a specified point to monitor discreet levels of contaminants in the aquifer. For example, if the depth of an aquifer at a certain grid point is 50 feet, and 10-foot screens are called for by the regulators for well monitoring, then five wells must be drilled to analytically profile the aquifer at one grid point. Certain volatile contaminants and radioactive particles, such as gamma rays, are detectable at the surface, and certain information about the nature of the subsurface contaminants and potential exposures may be inferred. However, it is not generally possible to use that information to provide much more than guidance in planning the more detailed subsurface sampling.

The primary objective of site characterization is to map the contours of a contaminated area or contaminant plume; this mapping may be difficult if grid sample points are not well positioned along the plume contours, or if many data points indicate nondetectable contaminant levels. Further, the geological, hydrological, and chemical data are generally analyzed separately, not integrated. Thus, migration pathways and contaminant plume contours may not easily be determined.

Regulators establish protocols for the characterization program at each site, based upon data quality requirements, pre-existing knowledge of the site contaminants, hazards of known contaminants, and the particular statutes and regulations applicable to the program (for example, sites regulated under CERCLA and under RCRA within the same State may be responding to different regulators). Thus, instrumentation to be used, sampling frequency, and sample handling will not necessarily be identical across the entire DOE complex.

Samples are normally sent to an analytical laboratory where standard chemical and radiological instrumentation is used to measure contaminant identities and levels. Except under special circumstances, these laboratories typically are not on the site itself. The laboratories may be government operated, depending on the source site of the sample and suspected contaminants, but are often commercial enterprises, approved by the EPA through the Certified Laboratory Program.

Current characterization methods are expensive, time-consuming, intrusive, may give rise to new contaminant migration pathways, and can produce large quantities of secondary wastes. People collecting samples and those performing the analysis often do not communicate directly. Therefore, not all aspects of the data may be fully understood during analysis. Furthermore, appropriate modifications in the protocol based on past analyses may be slow to reach the field.

H.4.3 Emerging Remediation Technologies (Subsurface Contaminants Focus Area)

A number of strategies and technologies for contaminated groundwater and soil characterization and remediation are emerging. These technologies promise improvements in the scope of applicability, cost effectiveness, and completion times for future cleanups that would significantly reduce environmental hazards and risk. They include technologies for better field detection and pinpointing of groundwater and soil contamination, as well as chemical and thermal technologies for improved mobilization of contaminants for extraction and treating.

H.4.3.1 Improved Techniques to Detect, Remove, and Contain Primary Groundwater Contamination Sources

The detection of concentrated primary sources of contamination, especially DNAPLs, is difficult with conventional technologies. The existence and location of DNAPLs at DOE sites may often be undetermined. The cone penetrometer, a vehicle-mounted punch-like device used for many years to characterize the engineering properties of the shallow subsurface, has recently been adapted for sensing subsurface contamination using optic fiber sensors, and for continuous sampling of liquids or vapors without requiring removal of the penetrometer. Many punches of a cone penetrometer can be accomplished in the time and for the cost of installing a single groundwater monitoring well. The penetrometer should eventually permit detection of small pockets (0.5 cubic meters or less) of DNAPLs in-situations where installing a well would likely disturb, or spread them, but not accurately determine their location.

Recent improvements in the design and use of the cone penetrometer include the ability to penetrate rocky soils—through the use of higher drive weights and stronger, larger diameter penetrometer rods—and the ability to emplace well points and tubing, which can be used for soil gas measurements. The emplacement of well points may ultimately be modified to allow vapor or groundwater recovery without the necessity of installing a well.

Improved nonintrusive detection methods are being developed that may be expected to detect shallow pockets of DNAPLs. These detection technologies include seismic, passive and active magnetic, ground-penetrating radar, and induced resistivity/polarization methods. Current development is focused on improving their sensitivities at greater depths. Ground-penetrating radar shows the most promise. At present, none of these technologies is sensitive enough to be used alone or on all sites for DNAPL characterization, but when used in combination with other techniques such as the cone penetrometer, they can result in excellent delineation of DNAPLs.

Methods for adsorbing or siphoning pockets of DNAPLs are also needed to exploit these detection advances. A continuous sampling cone penetrometer may be adapted to pump DNAPLs to the surface, but such development has not yet begun. Conventional excavation methods may be adaptable for DNAPL removal without causing deeper migration, if conducted in conjunction with precise locating of DNAPLs with a cone penetrometer or other sensing device.

Emplacing conventional slurry walls or sheet piling, or hydraulic control using down-gradient extraction wells, are methods for containing a DNAPL source that can be used once DNAPL detection technologies emerge. These temporary containment technologies would allow time for source study while DNAPL removal methods are being considered or tested, without delaying initiation of other plume remediation activities.

Development of equipment capable of locating DNAPLs accurately enough for containment will likely occur in the next 3 to 5 years, but pinpointing individual DNAPL pools precisely enough for removal may be 5 to 10 years in the future. Because DNAPLs are one of the most common sources of groundwater contamination, these advances can be expected to save decades in remediation times, and hundreds of millions of dollars as compared with the alternative of simply attempting to pump and treat as long as necessary to exhaust the DNAPL source.

H.4.3.2 Improved Techniques to Detect Soil Contaminants

Detection and characterization of contamination using conventional technology involves the use of either fixed monitoring wells or shallow soil-gas surveys. Although improvements have occurred in location, sampling, and analysis speed, significant limitations of these methods make them expensive and somewhat unreliable. Improved techniques are under development to reduce cost and improve accuracy. These include the SEAMIST™ system and the previously discussed cone penetrometer. SEAMIST™ is an add-on to well technology that improves measurements of soil or water-borne contamination in both vertical and horizontal boreholes. The system facilitates chemical characterization and is a platform for geophysical sensors and video devices. Installation can be either temporary or permanent.

The technology uses an airtight membrane to line a conventional well or borehole. The membrane is forced into a drilled or punched well pneumatically. After emplacement, the entire hole wall is sealed, preventing ventilation of the pore space or circulation of pore water in the well. Once monitoring instruments are placed on the outer surface of the membrane, in contact with the hole wall, the membrane isolates each measurement location. High spatial resolution of the contaminant distribution is thereby possible.

Nonintrusive detection methods for contamination in groundwater are also applicable to characterization of soils. A suite of improved techniques for locating soil contamination probably will be in place in the next 3 to 5 years.

The same set of containment technologies already described for groundwater can usually be applied to soils once contaminants have been accurately located.

H.4.3.3 Improved General Site Characterization

In addition to purely "hardware" solutions, innovations that involve methodology may also be a key to characterization advances. The expedited site characterization (ESC) is one method for rapid, less expensive, and technically superior characterization of a site's groundwater and soil. ESC, as initially conceived, deploys a highly technical, multidisciplinary team to the field. The team collects data daily, discusses and integrates the results, and then formulates a strategy for sampling and analysis for the following day's activities. While field chemical instrumentation analysis costs vary, they are generally more than five times lower than offsite laboratory costs. For example, costs associated with sample transportation are eliminated. One typically exploits this cost savings potential, and the associated time savings from field analysis, to take more field samples. In addition, field testing is facilitated by being able to relocate sampling locations rapidly, if analytical results suggest that this is desirable. The resulting improvement in resolution of the plume allows for sampling many fewer monitoring wells and more than compensates for any differences in the quality of analyses that might occur between field and centralized laboratory settings. This dynamic approach to characterization saves time by reducing data integration and analysis turnaround times and saves money by minimizing well drilling and laboratory sample analyses. The net result is a faster and cheaper process that is arguably more accurate than conventional site characterization techniques.

The ESC has been successfully demonstrated at several U.S. Department of Agriculture sites in Nebraska and Kansas and at Bureau of Land Management landfill sites in New Mexico. Near-term tests will demonstrate the functionality and benefits of the process compared to conventional characterization methodologies and will characterize smaller sites focusing on organics, heavy metals, and radiological contaminants.

H.4.3.4 Improved Techniques to Mobilize and Remove Secondary Sources From Groundwater

In-situ air sparging can remediate a plume and its secondary contamination simultaneously if the contaminants are water insoluble VOCs, such as trichloroethylene and carbon tetrachloride. If semivolatile or nonvolatile organics are present that are also water insoluble, heat can be added to enhance volatility or water solubility. The aquifer matrix can be heated with steam, as has been shown in the Office of Technology Development's Dynamic Underground Stripping Project. There, steam was used to remove spilled gasoline by a combination of heating and gas stripping in the vadose zone and in the aquifer itself. If this technique were applied to nonvolatile, slightly soluble, secondary contamination, including inorganics or organics, solubilization in the groundwater could be enhanced.

Methods for heating the vadose zone also are being tested, including radio frequency or microwave heating and multiphase joule (conductive) heating of the subsurface. The solubility of contaminants in water, and the volatility of organics, can be enhanced by such heating. These techniques may also be applicable to aquifer matrices that have been pumped down temporarily.

Solubility enhancement for secondary contaminants is more developed than heating techniques. Organic secondary contaminants may be solubilized by flushing with appropriate ionic or nonionic surfactants or with enzymes. Aqueous surfactant solutions have been effective in removing water insoluble organics from soils, and would be expected to be as effective with aquifer matrices. Various surfactants are already approved for use on cropland as soil penetrants; inasmuch as they are also biodegradable, their use in aquifers should be considered acceptable by regulators. Enzymes are used in a variety of domestic cleaning and clothes washing materials because of their ability to degrade large organic molecules.

A wide variety of organic chelating agents (organic compounds that form soluble complexes with metal cations) can be used to solubilize heavy metals. These agents include ethylenediamine tetraacetic acid and citric acid. Some inorganics can be solubilized by acidic or basic buffers, or with oxidizing or reducing agents, allowing extraction. Electrokinetic techniques are being developed that would be applicable to shallow aquifers for mobilization of ionic contaminants. They would not require injection of reactive substances to promote mobility, but would use electrical fields to induce movement toward an extraction point.

The laboratory development of in-situ solubilization methods, including chelation, oxidation, and reduction, is in progress. Successful application in the field will depend on general improvements that must include treatment-chemical introduction and monitoring techniques, control and mass balance of contaminants and treatment reagents in the subsurface, and obtaining and maintaining sufficient permeability of the treatment zones. These developments can probably be expected in the next 3 to 10 years and will be widely applicable for groundwater remediation. The eventual savings in remediation times and costs will likely be a full order of magnitude.

H.4.3.5 Improved Techniques to Mobilize and Remove Soil Contamination

Many of the same technologies discussed above in connection with mobilization of contamination in groundwater are also applicable to soil remediation, particularly for soils where the groundwater table extends upward to shallow depths. Successful application of these technologies will require major improvements in general subsurface operations methods, including:

- Techniques for the injection of treatment solutions
- Techniques for monitoring reactions and movement
- Techniques for subsurface hydraulic control
- Techniques to enhance and maintain adequate subsurface permeability

As in the case with groundwater, these developments can probably be expected in the next 3 to 10 years and will be widely applicable for subsurface remediation. The eventual savings in remediation times and costs will probably be a full order of magnitude.

H.4.3.6 Improved In-Situ Treatment Technologies for Plumes and Secondary Sources in Groundwater

In-situ treatment of a groundwater plume tends to be cheaper than pumping and treating because less groundwater must be pumped, secondary sources can be treated simultaneously, and secondary waste streams are minimized. Both in-situ chemical and in-situ biological remediation technologies are under development.

In-situ chemical oxidation can destroy toxic organics or oxidize secondary organic contamination to the point that solubility increases and the oxidized products desorb and can be pumped to the surface for more complete ex-situ treatment. The candidate oxidants are those that degrade spontaneously to nontoxic products in the environment, such as ozone and hydrogen peroxide.

In-situ biodegradation recently became an available technology. Even so, technology development continues to address the significant limitations previously mentioned. Some examples are:

- For organics that are too water insoluble to desorb significantly, solubilization can be increased with surfactants or enzymes that do not harm the microbes. The desorbed contaminants can then be biodegraded in-situ.
- In areas where low aquifer temperature makes the rate of biodegradation very slow, in-situ heating will accelerate these rates so that bioremediation becomes practical.
- At sites where high levels of dissolved organics or toxic metals are present in the groundwater, or where the contaminants to be treated are refractory to biodegradation, microbes that can tolerate these conditions need to be developed and introduced into the subsurface. These goals are quite difficult, especially spreading microbes through the subsurface (which essentially behaves like a filter).
- In-situ biodegradation may be expected to tie up nonbiodegradable contaminants only temporarily, such as heavy metals and nonmetal radionuclides. Biomass decay may also produce byproducts capable of chelating and mobilizing toxic heavy metals. Methods must be developed for assessing this problem beforehand and for controlling it.

H.4.3.7 Improved In-Situ Treatment Technologies and Stabilization Technologies for Soil

In-situ treatment of soil contamination, by reducing the generation of secondary waste streams, tends to be cheaper than excavation and treating. In addition to in-situ immobilization technology, chemical and biological remediation technologies are under development. Many of the emerging technologies described above for groundwater and aquifer remediation may be applicable to soil and the vadose zone as well.

In-situ vitrification (ISV) is one emerging treatment technology for soils. Melting of the soil minerals and subsequent cooling to an impermeable glass-like mass will immobilize many soil contaminants. During the heating process some organics will volatilize; others will degrade. Any that escape the glass must be captured for treatment. The technology shows great promise for immobilization of radionuclides and for treatment of mixed wastes.

MAWS is a related process in which several waste streams with complementary characteristics are combined in order to take advantage of their separate characteristics. Doing so minimizes the need to add uncontaminated materials. In some cases, two merged streams can be vitrified when it would be impractical to vitrify one of the two alone. The benefit of this approach is that the final waste volume (for example, the wash residues from soil washing) is minimized because few or no additives are used and vitrification itself results in volume reduction.

In-situ biodegradation technology has advanced rapidly. Development continues to address the significant limitations previously mentioned in connection with groundwater. In addition, accessibility of microbes and nutrients to the contaminants sorbed in the soil interstices needs to be improved. General techniques such as soil-fracturing may be inadequate to improve the rate of degradation through access to the soil micro-structure.

H.4.4 Conclusions About Emerging Environmental Restoration Technologies

The conventional approach to groundwater contaminant extraction (pump and treat) is suitable for only a few sites and contaminants. The regions associated with many contaminated DOE sites:

- Are in the vadose zone without water
- Have such low permeabilities that pumping cannot extract the contaminated water
- Have contaminants with low solubilities or volatility and high soil affinities and are difficult to mobilize

The ability to locate primary sources of contaminants effectively, especially before they move into groundwater, and to contain them at those locations is a significant part of any strategy to avoid increasing costs and risks in the future. Emerging characterization technologies can reduce the cost, time, and worker risk associated with restoring sites by minimizing sampling and well costs, by reducing the number of trips and time in the field to collect potentially unnecessary samples, and by precisely locating contaminated region boundaries to minimize the handling of uncontaminated soil or groundwater.

The potential for significant cost reductions because of the availability of these or other advanced technologies could result in regulatory decisions to undertake more extensive remediation at particular DOE sites than would otherwise be the case. These decisions could result in increasing the waste loads being delivered from environmental restoration activities to waste management. However, this waste load effect is unlikely to be important at a programmatic level for at least two decades because in-situ technologies (which reduce waste loads) have greater potential for emergence and impact between now and that time. For unremediated sites, advanced characterization technologies can make it possible to monitor contaminant transport and provide confidence of the immobility of many contaminants and, therefore, minimal risk to public health.

Development of characterization and in-situ treatment technologies—reducing the need to excavate material for processing onsite or for transport elsewhere for disposal—will achieve the greatest improvement in safe, cost-effective soil remediation and minimization of waste management loading. Exposure risk, remediation cost, and danger to the population, from both contaminant contact and transport hazards, are substantially reduced through applying in-situ technologies. In-situ technologies are being developed and demonstrated for applications in the next 5 to 10 years. Some sites will still be recalcitrant, including those:

- With such poor hydraulic conductivity that most remediation methods would have difficult access
- Where the mix of contaminant chemistry (and subsurface interferences) limits the technology
- For which the extent of contamination, even with the best of innovative technology, would overwhelm financial resources

Although extremely difficult to remediate, situations of the first type (or others where the soil affinity makes the contaminant immobile) may pose less immediate risk. In other words, the same factors that inhibit remediant access may inhibit movement by the contaminants themselves. However, such inhibition is not reliable because of differing physical and chemical characteristics among the contaminants and remediants. Further, almost all sites will have soils that vary significantly in quality and characteristics. Accessibility to remediation injection or extraction will be patchy, and thus long-term "bleeding" of contaminants from isolated pockets of contamination will be a common problem.

These factors stress the importance of continuing research that enhances formation accessibility. This includes work to increase formation hydraulic conductivity and the ability to target, or pinpoint, the insertion of reagents and extraction of fluids. At present, the ability to manipulate groundwater flow is rudimentary. Plans for the application of any in-situ technologies will hinge on significant improvements in subsurface control. Because many technologies will involve powerful reagents and microbes and their nutrients, regulatory approval will depend on presentation of proof that the remediation can be controlled and will not worsen the environmental hazard by replacing one contaminant with another.

With regard to schedule, technologies adequate for soil remediation are expected to be successfully developed during the next 5 to 10 years. Their implementation should be widespread in another 5 to 10 years as they become generally accepted by remediation managers, regulators, and other stakeholders. The large number of possible approaches provides a basis for confidence that one or more approaches will prove successful despite uncertainties that may exist about any particular approach. The extent of soil contamination problems at DOE sites and non-DOE sites also provides confidence of continued private sector interest in commercialization.

On shorter time scales, there is little indication that all or most sites that cannot be remediated by available technologies could be remediated with emerging technologies. Formation accessibility is too difficult and hydraulic control in the subsurface is insufficient to ensure the success of in-situ methods. Short-term control until usable technologies are sufficiently mature, or long-term control and isolation, will be necessary to minimize risk where remediation is currently impossible.

Emerging technologies could mitigate the costs of remediation significantly. In the WM PEIS, DOE assumed a generic process that used new supplies of commercially available equipment and materials. Cost saving could result from the application of technologies discussed in this section. For example, the MAWS vitrification process could be less expensive than the generic vitrification process for certain applications, if on-site waste could be substituted for commercial oxide new material. Similarly, the use of the SEAMIST™ technology would provide better control of test wells, reducing the cost of characterization, and ultimately reducing the cost of pump and treat operations. These technologies are only a small fraction of the remediation technologies now under development within DOE, and many technologies should have numerous applications outside the DOE complex.

H.5 Transportation Technologies

Some of the waste management alternatives considered in the WM PEIS may require extensive transport of radioactive or hazardous materials on or between DOE sites. DOE's Transportation Management Division, with the EM Office of Compliance and Program Coordination, is sponsoring packaging research and development, packaging engineering and analysis, and packaging operations studies to produce a new generation of hazardous materials packaging.

H.5.1 PACKAGING RESEARCH AND DEVELOPMENT

Packaging research and development includes several related areas of development: development of analytical design codes, evaluation of packaging components, materials characterization, and packaging concepts.

Development of analytical methodologies design codes is the first such area. Structural analysis techniques are developed to predict packaging response accurately. Activities in this area emphasize establishing nonlinear dynamic analysis as an alternative for use in package certification. Specific activities will include investigation of acceptance criteria for inelastic analysis and benchmarking of these analysis codes. Thermal computational techniques are being improved. A better engineering description of hypothetical accident environments through use of new and existing analysis techniques and additional instrumentation is under development.

Development of analytical methodologies and design codes also includes activities to automate the analytical process. Transportation packagings are the final product of an iterative process of design, analysis, interpretation, modification, and redesign. This inherently inefficient design process can be vastly improved by automating evaluation of the structural, thermal, and shielding constraints to produce a more uniform factor of safety and thus more efficient design.

Evaluation of packaging components has already provided data on impact-limiting material and screening methods. A new constitutive plasticity model for wood stress through the crush range is being developed. Verification and refinement of a proposed crush failure theory for general triaxial stress states will be undertaken. A research and testing program for seal materials, begun in 1988, is characterizing the behavior of seal materials commonly used in radioactive material packages under normal and accident conditions, performance of the seals in nondeformed closures at both high and low temperatures, and response of seals to deformations in the closure region. A topic of particular interest to package designers is short-term closure movements that return to their initial configuration after a few milliseconds, resulting in the so-called "burp" release. Also of interest for many package types is the release of particulate materials instead of gaseous materials.

DOE currently is sponsoring work to establish the fracture mechanics methodology for ferritic materials, thereby extending the range of structural materials potentially usable for package construction.

One new concept is design of "Type B" transport packaging for plutonium and uranium that meets future regulatory requirements. The new package design uses nested cylindrical containment vessels with threaded closures and elastomeric seals and a composite material overpack of metallic wire mesh and ceramic or quartz cloth insulation material.

H.5.2 PACKAGING ENGINEERING AND ANALYSIS

The packaging engineering and analysis programs involve engineering, design, analysis, and testing for packaging development. New packaging concepts emerge to meet specific programmatic requirements. Innovative packaging designs for transporting high activity liquid waste and environmental samples that need cooling during transport are under development. The Beneficial Uses Shipping System (BUSS) cask has been developed for transporting special-form cesium chloride and strontium fluoride capsules and conceptual designs have been completed for packages for offsite shipment of Hanford tank waste liquid samples, Hanford tank waste core samples, and onsite shipment of large volume wastes.

Attachment to Appendix H

Office of Technology Development
FY 1996 Budget Request Work Packages
for the Focus Areas and Crosscutting Programs (Excluding Program Support, Program Direction, and Technology Integration)

Information From the Back-Up to the Budget Submission to the Office of Management and Budget, 10-10-94

Mixed Waste Focus Area

Plasma

- Prepare and conduct pilot-scale demonstration of the plasma arc treatment process (including off-gas system) using nonradioactive surrogates. Determine partitioning of surrogate radionuclides.
- Complete bench-scale testing of the plasma arc treatment process with actual radioactive mixed waste. Develop and demonstrate waste materials handling capabilities, both on the front and back ends of the treatment processes, in preparation for the field demonstration of the plasma hearth process. Test a closed-loop off-gas system with appropriate process monitoring and control (continuous emission monitors and control loop electronics) hardware.
- Facilitate the early field implementation of the plasma hearth process.

Vitrification

- Complete compact vitrification system demonstration integrating melter, off-gas systems, etc. Evaluate and implement closed-loop off-gas systems with complete process monitoring and control systems on the compact vitrification units.
- Modify high-level waste vitrification technology for the treatment of low-level waste. Complete demonstration of polymer solidification for quality assurance and process control of final forms production. Perform field-scale demonstrations on LLMW employing low-temperature waste stabilization processes such as polymer encapsulation and phosphate-based ceramics.

Rocky Flats compliance

- Design a nonradioactive demonstration unit for catalytic wet chemical oxidation (CWCO) system. Begin fabrication of demonstration unit for CWCO process. Test new materials for reactor vessel of CWCO process. Test waste blending to improve process parameters.
- Test more complex waste forms with a supercritical carbon dioxide extraction (SCDE) system. Evaluate enhancements for the SCDE system. Conduct a cold demonstration of SCDE. Begin design of volatilization, low-temperature thermal desorption, full-scale system.
- Continue development of microwave system. Test pelletizing process and select a drying technology. Demonstrate off-gas treatment and monitoring system. Design, fabricate, and install an upgraded bagless posting system. Design, fabricate, and test components of a break-open system. Perform nonradioactive bench-scale tests on surrogates of additional wastes. Perform tests on currently generated by-pass sludge. Perform full-scale tests on spiked surrogate wastes.
- Begin demonstration of macroencapsulation of miscellaneous waste. Conduct a polymer microencapsulation demonstration on radioactive nitrate salt waste. Conduct lab-scale testing of a thermal treatment process for waste. Prepare for radioactive lab-scale tests on surrogate waste of backlog sludge microencapsulation. Conduct a nonradioactive demonstration on new sludges. Conduct nonradioactive bench-scale tests on nonthermal treatment of waste.

Supercritical water oxidation

- Complete nonradioactive testing and demonstration of the supercritical water oxidation (SCWO) pilot plant with DOE hazardous and surrogate mixed wastes.
- Prepare an Environmental Impact Statement and a Preliminary Safety Analysis Report for the radioactive demonstration of the SCWO pilot plant.
- Complete a conceptual design of the SCWO pilot plant for the radioactive demonstration.

Other

- Complete a radioactive demonstration of the Delphi DETOX process to catalytically oxidize the organic constituents of waste streams in a contained reactor.
- Develop advanced effluent control systems, continuous emission monitors, cleanable high-efficiency particulate air filters, and other off-gas treatment and monitoring systems.
- Develop alternative low-temperature treatment technologies for mixed waste, specifically for combustible contaminants.
- Develop intelligent remote sensing systems and survey robots for radioactive storage areas.

- Develop alternative low-temperature final forms for mixed waste.
- Develop processes to refine and/or enhance basic knowledge solutions for the removal of heavy metals and mixed hazardous wastes from soils; use metal oxide particles as reagents for destruction and immobilization of hazardous substances.

Radioactive Tank Waste Remediation Focus Area

- Demonstrate real-time tank integrity inspection and waste mapping technologies with the light-duty utility arm (LDUA):
  - Camera systems, laser range finder, structured light hardware
  - Tank riser interface and confinement system
  - LDUA decontamination system
  - Supervisory control and data acquisition system for LDUA
- Conduct integrated testing and development of waste dislodging and conveyance tools for retrieval of multiple waste types:
  - Waste dislodging and conveyance hydraulic test bed
  - High-pressure water jet scarifier
  - Medium-pressure water jet scarifier
  - Further waste dislodging and conveyance work to plan retrieval operations and meet 99% retrieval minimum from TPA (Hanford Tri-Party Agreement)
- Conduct a hot cell demonstration of characterization of waste, which includes the Raman spectroscopy system:
  - Raman spectroscopy system
  - Further development for a higher resolution scanning Raman spectroscopy system
  - In-situ characterization and on-line monitoring of waste and data analysis methods
- Perform radioactive testing of an out-of-tank mobile evaporator:
  - Fabrication and radioactive testing of evaporator/concentrator compact processing unit (CPU)
- Conduct a radioactive demonstration of a mobile, field maintainable CPU for cesium removal:
  - Complete resin and skid testing and CPU design
  - CPU test unit
  - Cesium extraction resin

- Demonstrate sample retrieval and on-line, in-situ waste analysis with the LDUA system in Idaho:
  - LDUA adaptation for Idaho tanks and sample retrieval
  - Waste dislodging and conveyance tools adaptation for LDUA and Idaho tanks
- Conduct a hot demonstration of solid/liquid separation by using a cross-flow filtration system.
- Demonstrate low-pressure water-jet tools for waste removal from tanks, leading to a radioactive retrieval demonstration at Oak Ridge/Idaho; adapt the waste dislodging and conveyance scarifiers for Oak Ridge gunnite tanks.
- Using actual waste from the Melton Valley Storage Tank Farm, demonstrate sludge and supernatant processing of this waste:
  - Demonstrate sludge dissolution and TRUEX solvent extraction for partitioning of transuranic waste (TRUW) components.
  - Demonstrate sorbent removal of cesium, strontium, and technetium from supernate.
  - Complete sorbent testing for removal of strontium and technetium.
  - Continue development of general site-specific waste processing flowsheets.
  - Adapt sludge/supernate processing system for demonstration on Hanford tank waste.
  - Continue development of waste processing flowsheets.
- Demonstrate in-tank equipment designed to remove scrapped hardware from waste tanks.
- Use analysis techniques and sensors to characterize and monitor chemical and physical conditions within tanks (work includes spectroscopic techniques and LDUA development).
- Develop end-effectors for waste dislodging and conveyance.
- Develop solutions for tank waste by using CPUs.
- Develop waste disposal technologies.
- Refine and enhance basic knowledge solutions in the development of in-situ measurement of fissile, moisture, thermal properties, fission products, and head space gases; identify wide dynamic range tank hot spot.

Subsurface Contaminants Focus Area

Containment

- Demonstrate physical barriers formed from viscous liquids (polybutene and colloidal silica) emplaced under controlled viscosity conditions.

- Evaluate two new flowable bentonite-mineral-water-inorganic grout techniques to reduce the cost of barrier emplacement.
- Demonstrate hydraulic and diffusion barriers in the vadose zone surrounding buried waste.
- Demonstrate surface-controlled emplacement horizontal planar barriers beneath waste sites by using tilt meters and models to predict effectiveness.
- Assess polymer cement, ion-exchange cement, cement glass, and latex cement grouts for vertical subsurface barrier long-term effectiveness.
- Demonstrate four innovative advanced landfill cover designs and compare them with existing U.S. Environmental Protection Agency designs.
- Demonstrate dry barriers by using active/passive ventilation of coarse barrier layer to remove water.
- Demonstrate migration barrier covers by using locally available soils/rocks and synthetic barriers.
- Demonstrate a prototype model for the selection of barrier cover systems by using a decision analysis tool that analyzes tradeoffs to compare the effectiveness, risk, and cost of landfill cover technologies.

Stabilization

- Perform field-scale testing of buried waste encapsulation techniques at arid site burial grounds by injecting naturally occurring cementing solutions to form soil/waste monoliths that immobilize contaminants and are impervious to water migration.
- Initiate in-situ treatment techniques for buried waste (through field testing at a full-scale cold test pit location) that establish a vitrified glass matrix while destroying volatile organics.
- Develop other stabilization technologies (in association with industrial programs).
- Demonstrate long-term monitoring techniques and in-situ monitoring to predict failures, and assess the effectiveness of the stabilization technology by using time domain reflectometry/in-situ moisture monitoring, leachate collection systems, directional well holes, plant and intruder analysis, and subsurface geophysical evaluations.

Containment and stabilization

- Demonstrate active/passive acoustic system for the placement and monitoring of barrier technologies.
- Demonstrate electromagnetic measurement techniques for the monitoring of containment and stabilization activities.
- Demonstrate specialized borehole-deployed geophysical instrumentation for the monitoring of containment and stabilization activities.

Treatment

- Conduct hot bench-scale thermal treatment tests by using a direct current Graphite plasma furnace that can operate in the submerged or transfer arc mode.
- Conduct a hot bench-scale thermal treatment test by using a millimeter wave radiometer to determine spatial resolution of the temperature measurements.
- Conduct hot bench-scale thermal treatment tests by using a microwave plasma analyzer in the off-gas flow from a high-temperature furnace that allows real-time assay of off-gases for metals and organics.
- Conduct hot bench-scale off-gas treatment tests by using nonthermal electrical discharge plasma for the destruction of hazardous chemicals.
- Demonstrate batch/continuous leach technology for uranium-containing soils at Fernald Environmental Management Project (FEMP).
- Demonstrate by laboratory simulation the performance and economics of uranium heap leaching for comparison with the batch-reactor method using transparent leaching columns.
- Demonstrate minimum additive waste stabilization at Pantex by further developing the concept of blending waste in an integrated system centered on vitrification, using the Duramelter, and also including soil washing.
- Demonstrate magnetic techniques on uranium-contaminated soils at FEMP.
- Demonstrate biphasic separation techniques on uranium-contaminated soils at FEMP.
- Demonstrate ex-situ treatment technologies for the removal of mercury from Oak Ridge Reservation.

Removal

- Initiate a hot demonstration for Idaho National Engineering Laboratory (INEL) TRUW waste pits by using a dual-arm cooperative retrieval system that delivers dual manipulator capability to the dig-face and deploys various retrieval support tools.
- Initiate a hot demonstration for INEL TRUW waste pits by using innovative end-effectors and a conveyance system that achieves dust-free dumping and uses a self-guided vehicle to convey retrieved waste to a treatment facility.
- Initiate a hot demonstration by using dig-face characterization that uses multiple sensor data integration and interpretation for real time characterization data in support of retrieval operations.
- Initiate a hot demonstration of TRUW dust monitoring by using laser optical scattering techniques for dust assessment and laser-induced breakdown spectroscopy for real-time composition determination.

- Initiate a hot demonstration of retrieval integration by using a "rad hardened," teleoperated, 60,000-pound class excavator with supervisory control for data transfer and collision avoidance for the integrated system.
- Demonstrate buried waste contamination control in a "hot" environment by using dust generation minimization hardware/procedures and implement dust/contamination control measures (misting, wetting agents, forms, vacuum).

Assessment

- Conduct hot demonstrations of a radiological hazardous materials measurement system that consists of multiple measurement cells and integrates individual measurements to improve quantitative assay capability.
- Demonstrate a combined thermal epithermal neutron system that uses thermal neutrons to interrogate for fissile isotopes in waste drums.
- Demonstrate active passive computed tomography, which uses a high-purity germanium detector for nondestructive assay of gamma-emitting nuclides in sludge, combustibles, and metal matrices with a 55-gallon drum.
- Demonstrate digital radiography by using a high-energy x-ray source installed in a commercial scanner to measure density and nondestructively view the contents of high-density drums.
- Conduct glass/ceramic performance assessment to provide the necessary database and the thermodynamic/kinetic modeling capabilities to make reasonable long-term predictions regarding the performance and durability of low-level waste (LLW)/LLMW vitreous waste forms under potential disposal site conditions.
- Conduct a glass/ceramic composition envelope study to provide a database of vitreous waste form compositions and properties plus an easy-to-use modeling tool by using actual wastes, where available from three DOE sites, or reasonable surrogates to develop vitreous waste forms that are then tested for processability as well as durability characteristics.
- Demonstrate technologies for waste assay during waste handling operations.

Other

- Conduct research on and design advanced monitoring technologies for remediated landfills.
- Refine and enhance basic knowledge solutions in the development of methods and processes for nonintrusive and intrusive site characterization and waste assay.

- Refine and enhance basic knowledge solutions in the development of verification technologies for the emplaced barrier continuity with reduced site disruption; hot spot and full-scale retrieval of untreated waste.
- Refine and enhance basic knowledge solutions in the development of pre-, primary, and secondary ex-situ treatment and recycling secondary waste streams; subsurface contaminant technologies.

Contaminant Plume Containment and Remediation Focus Area (Merged With the Landfill Stabilization Focus Area to Form the Subsurface Contaminants Focus Area)

- Develop, demonstrate, and test reactive barriers and deep subsurface barriers:
  - Demonstrate a reactive barrier for strontium-90 and cesium-137 at an arid site.
  - Demonstrate a reactive barrier for technetium-99 and trichloroethylene at a humid site.
  - Conduct field-scale testing of permeable barriers at a humid site.
  - Develop methods to emplace reactive barrier materials at depths up to 50 feet.
  - Develop methods to extract or rejuvenate reactive materials to prolong barrier life.
  - Develop performance monitoring techniques for reactive barriers and subsurface impermeable barriers.
  - Demonstrate barrier emplacement tools to create an integrated barrier/floor wall.
- Develop and field test technologies for detecting/immobilizing/removing metals and radionuclides in groundwater:
  - Develop in-situ redox manipulation for immobilization of uranium in groundwater at Hanford.
  - Field test the MAG*SEP process for removal of radionuclides from groundwater at Savannah River.
  - Demonstrate the ex-situ biosorption of the uranium process on Fernald groundwater.
  - Develop new methods for the removal of technetium-99 from groundwater.
  - Demonstrate electrokinetic removal of uranium from Oak Ridge groundwater at the pilot scale.
  - Demonstrate electrokinetic methods for migration and removal of heavy metals in groundwater.
  - Develop in-well removal methods (recirculating wells) for various metals.
  - Field test mobile lab-based characterization methods for metals in groundwater, such as laser-based spectroscopy methods.
  - Demonstrate electrokinetic methods for removal of chromium at Sandia.

- Develop and field test detection, extraction, and treatment systems for dense nonaqueous-phase liquids (DNAPLs) in groundwater:
  - Develop and field test advanced extraction systems for DNAPLs by using foam/surfactant mixtures at Paducah or Oak Ridge.
  - Further develop and field test extraction systems for DNAPLs by using heating methods (e.g., radio-frequency heating, steam injection, ohmic heating).
  - Develop and field test DNAPL degradation by using aerobic/anaerobic bioremediation at Hanford.
  - Develop and field test advanced DNAPL detection systems.
- Develop, demonstrate, and evaluate in-situ groundwater treatment technologies for heavy metals, radionuclides, and DNAPLs:
  - Develop contaminant-specific ionic complexant soil flushing solutions.
  - Demonstrate in-well removal methods (recirculating wells) for various metals at the Pinellas Plant.
  - Demonstrate mobile lab-based characterization methods for metals in groundwater, such as laser-based spectroscopy methods.
  - Evaluate and demonstrate biological systems that concentrate tritium from groundwater.
  - Demonstrate DNAPL degradation by using staged aerobic/anaerobic bioremediation at Hanford.
  - Develop methods to reduce chemical contaminants (e.g., uranium and chromium) to an insoluble form by using bioremediation or chemical addition to soil.
  - Develop molecular diffusion and diffusion-related chemical reactions to concentrate tritium from groundwater.
  - Demonstrate advanced extraction systems for DNAPLs by using foam/surfactant mixtures at Paducah or Oak Ridge.
- Develop and demonstrate advanced remediation systems at arid sites (including biologic and chemical treatment and characterization and sensor systems):
  - Conduct a complete demonstration of measurement-while-drilling technology at Savannah River restoration site.
- Develop and demonstrate technologies for heavy metals and radionuclides to minimize secondary waste treatment and reuse treatment fluids:
  - Develop chromatography columns to selectively adsorb contaminant species.
  - Demonstrate MAG*SEP technology on radionuclide- and heavy-metal-contaminated groundwater at the Savannah River Site.

- Demonstrate and test technologies to immobilize or remove heavy metals, radionuclides, and DNAPLs in soil:
  - Demonstrate chromium (VI) immobilization by using gas-phase reducing agents at Savannah River restoration site.
  - Perform pilot-scale test of DNAPL destruction by using in-situ chemical oxidation with peroxide or permanganate at Portsmouth.
  - Perform pilot-scale test of electrokinetic removal of radionuclides from arid soil.
  - Perform pilot-scale test of staged anaerobic/aerobic biodegradation of DNAPLs in soil.
  - Test an ex-situ process of plant uptake and concentration at the pilot scale for radionuclide removal from groundwater.
- Improved subsurface access technology for difficult soil conditions:
  - Enhance cone penetrometer technology as an assay tool for subsurface characterization.
  - Develop horizontal drilling methods that can utilize existing well holes as points of origin.
  - Adapt and demonstrate existing remote sensing techniques for the characterization of contaminant plumes.
- Demonstrate temporary barrier systems for use with in-situ treatment systems.
- Develop and demonstrate in-situ treatment technologies for nonvolatile organic compounds (polychlorinated biphenyls [PCBs], PAHs):
  - Develop and demonstrate bioremediation techniques for degrading polyaromatics.
  - Demonstrate methods to destroy PCBs by using chemical oxidation.
- Develop and demonstrate in-situ remediation (stabilization, biological treatment, electrokinetic treatment, surfactant flushing, etc.), containment technologies (diffusion barriers, reactive barriers, etc.), and barrier technologies for site remediation (contaminants of special interest are DNAPLs and chlorinated organics).
- Develop characterization instruments for pre-, post-, and on-line analysis to determine the type, concentration, and location of contaminants to assist site remediation activities:
  - Demonstrate mobile lab-based characterization methods for metals in groundwater, such as laser-based spectroscopy methods.
  - Demonstrate advanced extraction systems for DNAPLs by using foam/surfactant mixtures at Paducah or Oak Ridge.
  - Demonstrate MAG*SEP technology on radionuclide- and heavy-metal-contaminated groundwater at the Savannah River Site.

- Develop and demonstrate on-line process control for in-situ treatment and mobile labs or onsite testing, and secondary waste minimization and recycling:
  - Demonstrate mobile lab-based characterization methods for metals in groundwater, such as laser-based spectroscopy methods.
  - Conduct a complete demonstration of an advanced volatile organic compound (VOC) remediation system at Hanford, including in-situ air stripping, in-situ chemical oxidation, and/or staged aerobic/anaerobic destruction of VOCs.
- Treat tritium in groundwater and aqueous waste streams and process data for fate and transport modeling.
- Refine and enhance basic knowledge solutions in the development of characterization of subsurface contamination, modeling of contaminants under heterogenous conditions; identifying and quantifying residual DNAPLs contamination in the subsurface and heavy metals in groundwater; lab to field experimentation on micro bio-organisms to analyze survivability and longevity.
- Refine and enhance basic knowledge solutions for groundwater and soils remediation of halogenated hydrocarbons; monitoring technologies for post-closure of the vadose zone; bioremediation technologies of DNAPLs.
- Refine and enhance basic knowledge solutions in the development of the destruction and removal of VOCs by using naturally occurring phenomena; competitive and mass transfer effects on the sorption and desorption of contaminants in soils.
  - Perform pilot-scale test of staged anaerobic/aerobic biodegradation of DNAPLs in soil.
- Refine and enhance basic knowledge solutions in the development of pre-, primary, and secondary ex-situ treatment and recycling secondary waste streams; subsurface contaminant technologies.

Decontamination and Decommissioning Focus Area

- Concrete decontamination: Demonstrate improved processes for the decontamination of surface and volumetric contaminated concrete (field pilot-scale electrokinetic process, field pilot-scale wall process, field pilot-scale coating process).
- Metal decontamination: Demonstrate improved processes for the decontamination of surface and volumetric contaminated metal (field pilot-scale flushing process, field pilot-scale carbon dioxide process, field pilot-scale ultrasonic process, field pilot-scale mechanical process, field pilot-scale chemical process).

- Concrete and metal structure dismantlement: Demonstrate improved processes for size reduction, dismantlement and containment of concrete and metal structures (field pilot-scale telescopic boom process, field pilot-scale overhead platform delivery system, field pilot-scale mobile platform delivery system, field pilot-scale size reduction end effectors, field pilot-scale dismantlement end effectors).
- Metal recycling: Demonstrate improved processes for the conversion of metal with residual contamination into useful products (field pilot-scale stainless steel into waste drums and boxes, field pilot-scale slab casting process, field pilot-scale nickel into stainless steel, field pilot-scale plasma melting process).
- Material stabilization: Demonstrate improved process for the stabilization of asbestos in place.
- Facility stabilization: Demonstrate improved processes for the stabilization of facilities (field pilot-scale fuel pool treatment processes, field pilot-scale fuel pool characterization processes, field pilot-scale plutonium glove-box size reduction process, field pilot-scale glove-box disposition process, field pilot-scale plutonium residue handling process).
- Facility stabilization: Demonstrate improved processes for the stabilization of facilities (field pilot-scale equipment disposition process, field pilot-scale equipment size reduction process, field pilot-scale equipment decontamination process, field pilot-scale equipment in process monitoring process, field pilot-scale glove-box in process monitoring system).
- Material disposition: Demonstrate improved process for the disposition of depleted uranium (field pilot-scale nonmetallic applications, field pilot-scale shielding application).
- Develop advanced worker systems.
- Develop systems for the removal of contaminated paint and other contaminants, such as grease, oil, and PCBs, from concrete and metal surfaces.
- Develop mobile workstations for decontamination and decommissioning (D&D).
- Develop recycling of radioactive contaminated scrap metal.
- Develop decontamination and dismantling end effectors and plasma arcs.
- Develop sampling, imaging, and characterization systems for pre-, post-, and on-line analysis during D&D.
- Develop robotics for D&D.
- Refine and enhance basic knowledge solutions in the development of solvent and material substitution and cryogenic decontamination and cutting.

Crosscutting Programs—Characterization

- Develop process monitors and controls for three candidate mixed waste treatment systems.
- Develop continuous real-time air monitors.
- Develop nondestructive remote techniques to characterize unopened waste containers and final waste forms.
- Develop process monitors and controls for treatment techniques other than the three candidate mixed waste treatment systems (e.g., supercritical oxidation).
- Detect tank leaks, head space gases (volatile and poisonous), and water content of waste tank matrices (for safety and public health issues).
- Test tank imaging technology for retrieval operations in a radioactive environment.
- Develop methods for less expensive and faster hot cell analysis and in-situ tank waste analysis (chemical analysis).
- Conduct in-situ testing of physical properties of tank waste.
- Develop on-line process monitoring and control for tank waste retrieval, transfer, and treatment operations.
- Develop field-deployable, real-time chemical and geophysical sensors and in-situ surface-based deployment systems to identify subsurface contaminants (DNAPLs) in support of the expedited site characterization process:
  - Develop performance monitoring techniques for reactive barriers.
  - Field test mobile lab-based characterization methods for metals in groundwater, such as laser-based spectroscopy methods.
  - Develop and field test advanced DNAPL detection systems.
  - Modify and adapt high-resolution geophysical technologies to better identify contaminant plumes (e.g., DNAPLs).
  - Enhance decision support and data fusion of optimal sampling; develop additional capabilities to map subsurface contaminant plumes.
- Develop large-area scanning and mapping systems for detection of uranium and other contaminants on facility and land surfaces.
- Develop nondestructive assay techniques to assay contaminants in constrained areas such as inside pipes and equipment.
- Transfer airborne deployment sensors from the classified community and configure them for environmental applications.

- Develop real-time sensor systems for decontamination of concrete surfaces to identify PCBs, uranium, plutonium, tritium, fission products, and mercury in the near-surface layer of concrete.
- Develop real-time sensor systems to characterize metal scrap contaminated with technetium-99 and activation products such as cobalt-60.
- Develop continuous real-time monitors for radioactivity in liquid streams.

Crosscutting Programs—Efficient Separations

- Develop/adapt radionuclide separation technologies for application to liquid mixed wastes.
- Develop technologies to remove volatile species (e.g., mercury, chlorides, organics) and therefore simplify treatment of mixed wastes.
- Complete the development and demonstration of cesium/strontium removal technologies to meet milestones for LLW pretreatment facilities; evaluate and integrate separation pretreatment processing schemes to meet LLW glass performance specifications:
  - Develop a baseline sludge treatment to determine the feasibility of meeting milestones at Richland; develop alternative sludge pretreatment technologies to ensure the minimization of high-level waste volume.
  - Accelerate sludge treatment efforts to meet the fiscal year 1998 Tri Party Agreement milestone at Hanford; emphasize the hot testing of actual tank wastes to evaluate behavior and HLW volume reduction under both alkaline (baseline) and acid conditions.
  - Develop technologies to remove technetium and TRUW from tank waste to improve waste form performance and to meet requirements for vitrification.
- Develop and adapt separation agents for cleanup of soils containing contaminants other than plutonium and uranium (e.g., technetium, heavy metals).
- Provide sorbents for incorporation into reactive barriers used for plume mitigation.
- Evaluate feasibility/cost of tritium removal technology (D&D) for cleanup of groundwater:
  - Perform pilot-scale test of electrokinetic removal of radionuclides from arid soil.
- Demonstrate tritium removal technologies from waste storage basins.
- Demonstrate improved residue treatment technology to meet Rocky Flats schedule.
- Expand and adapt sludge leaching technologies to D&D of solids.
- Evaluate separation need for recycle of wash liquids (D&D, soil) and process chemicals.

Crosscutting Programs—Robotics

- Develop systems to automatically handle drums of mixed waste on the front end of the mixed waste treatment process.
- Develop robotic systems to automatically inspect stored drums of mixed waste.
- Develop and demonstrate a back-end materials handling system at a waste treatment facility.
- Develop automated analytical chemistry modules for radionuclides, metals, organics, and inorganics.
- Develop a cooperating manipulators (dual-arm) system for D&D and tank waste applications.
- Develop automated analytical chemistry modules for radionuclides, metals, organics, and inorganics.
- Develop a mobile system to automatically measure and record chemical and radiological contamination on internal surfaces (e.g., walls, hot cells) of buildings.

Appendix I

Update of Site-Specific Waste Volumes for LLMW, LLW, and TRUW

Appendix I in the Final WM PEIS is a completely new appendix written specifically for the Final; therefore, there are no marginal rules or shading to indicate changes. Appendix I from the Draft WM PEIS has been combined with Appendix C in the Final.

U.S. Department of Energy
Waste Management Programmatic Environmental Impact Statement

Contents

Tables

Acronyms, Abbreviations, and Elements

The following is a list of acronyms, abbreviations (including units of measure), and elements used in this document.

Acronyms

Ames	Ames Laboratory
ANL-E	Argonne National Laboratory-East
ANL-W	Argonne National Laboratory-West
BCL	Battelle Columbus Laboratory
Bettis	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
Charleston	Charleston Naval Shipyard
DOE	U.S. Department of Energy
ER	Environmental Restoration
ETEC	Energy Technology Engineering Center
FEMP	Fernald Environmental Management Project
Fermi	Fermi National Accelerator Laboratory
GA	General Atomics
GJPO	Grand Junction Projects Office
Hanford	Hanford Site
HLW	high-level waste
IDB	Integrated Data Base
INEL	Idaho National Engineering Laboratory
ITRI	Inhalation Toxicology Research Institute
K-25	Oak Ridge K-25 Site
KAPL-K	Knolls Atomic Power Laboratory (Kesselring)
KAPL-N	Knolls Atomic Power Laboratory (Niskayuna)
KAPL-S	Knolls Atomic Power Laboratory (Schenectady)
KAPL-W	Knolls Atomic Power Laboratory (Windsor)
KCP	Kansas City Plant
LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LDRs	land disposal restrictions
LEHR	Laboratory for Energy-Related Health Research
LLMW	low-level mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste

Mare Is	Mare Island Naval Shipyard
Mound	Mound Plant
MWIR	Mixed Waste Inventory Report
NEPA	National Environmental Policy Act
Norfolk	Norfolk Naval Shipyard
NR	Naval Reactor
NRF	Naval Reactor Facility
NTS	Nevada Test Site
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
Pantex	Pantex Plant
Pearl H	Pearl Harbor Naval Shipyard
PGDP	Paducah Gaseous Diffusion Plant
Pinellas	Pinellas Plant
PORTS	Portsmouth Gaseous Diffusion Plant
Ports Nav	Portsmouth Naval Shipyard
PPPL	Princeton Plasma Physics Laboratory
Puget So	Puget Sound Naval Shipyard
RFETS	Rocky Flats Environmental Technology Site
RMI	RMI Titanium Company
SLAC	Stanford Linear Accelerator Center
SNL-CA	Sandia National Laboratories (California)
SNL-NM	Sandia National Laboratories (New Mexico)
SRS	Savannah River Site
TBE	Teledyne Brown Engineering
TRUW	transuranic waste
UofMO	University of Missouri
WAC	WIPP Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WM	Waste Management
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WVDP	West Valley Demonstration Project
Y-12	Oak Ridge Y-12 Plant

Abbreviations

Ci	curie(s)
ft^3	cubic foot (feet)
kg	kilogram(s)
m^3	cubic meter(s)
yr	year(s)

Elements

Ac	actinium
Am	americium
Ba	barium
Bi	bismuth
C	carbon
Ce	cerium
Cm	curium
Co	cobalt
Cr	chromium
Cs	cesium
Eu	europium
Fe	iron
Mn	manganese
Ni	nickel
Np	neptunium
Pa	protactinium
Pb	lead
Pm	promethium
Po	polonium
Pr	praseodymium
Pu	plutonium
Ra	radium
Rh	rhodium
Ru	ruthenium
Sb	antimony
Sm	samarium
Sr	strontium
Tc	technetium
Te	tellurium
Th	thorium
Tl	thallium
U	uranium
Y	yttrium
Zr	zirconium

APPENDIX I
Update of Site-Specific Waste Volumes for LLMW, LLW, and TRUW

I.1 Introduction

The Draft WM PEIS used the best available data for waste inventory, projected waste generation, and waste classification for estimates of the waste loads at the DOE sites when the analyses were prepared. Since that time, the Department has continued to update these estimates as part of an ongoing effort to improve the quality of information available for decision making.

Accordingly, DOE reviewed more recent waste load data for low-level mixed waste (LLMW), low-level waste (LLW), and transuranic waste (TRUW) to determine whether it needed to revise the analyses for the Final WM PEIS. For high-level waste (HLW), DOE used updated data in the Final WM PEIS that are generally consistent with recent HLW program estimates. Hazardous waste (HW) data, however, were not revised because DOE determined that the HW data used for the analyses in the Draft WM PEIS are sufficient to determine whether DOE's decisions should continue to rely on commercial management of HW, unlike the management alternatives for other waste types.

Selected reanalyses were performed for LLMW, LLW, and TRUW where warranted, and the results of the reanalyses have been incorporated into the Final WM PEIS. This appendix identifies the criteria DOE used to decide to reanalyze using the more recent data, compares the waste load data used in the Draft WM PEIS with the more recent data, and describes DOE's conclusions about the need to use the more recent data for specified sites. This information is contained in sections I.2, I.3, and I.4 for LLMW, LLW, and TRUW, respectively.

All alternatives were reanalyzed consistently for the sites identified as requiring reanalysis as a result of DOE's review. Health risks were reanalyzed for all sites selected for reanalysis. Cost and other parameters were reanalyzed only where changes in impacts were considered to be potentially large based on changes in waste volume. The appropriate sections of Volumes I and II of the Final WM PEIS were revised to incorporate all results of the reanalyses.

I.1.1 SOURCES OF WASTE LOAD ESTIMATES

Analyses presented in the Draft WM PEIS used existing inventory and projected waste generation data for each site from several sources that are specific to the waste types. The sources of the prior estimates were the:

- Mixed Waste Inventory Report (MWIR) for 1994 (DOE, 1994) and updates from some sites—used for LLMW
- Integrated Data Base (IDB) for 1992 (DOE, 1992), Waste Management Information System (ORNL 1992), and updates from some sites—used for LLW
- MWIR for 1993 (DOE, 1993) and IDB for 1992 (DOE, 1992)—used for TRUW

The more recent information appears in the sources listed below. This information was compared with estimates used in the Draft WM PEIS to determine where reanalysis was warranted and was used for all of the reanalyses presented in the Final WM PEIS.

- MWIR for 1995 (DOE, 1995a)—used for LLMW
- IDB Report–1994 (DOE, 1995b)—used for LLW
- MWIR for 1995 (DOE, 1995a) and Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report (BIR-2) for 1995 (DOE, 1995c)—used for TRUW

The data for TRUW were taken from two sources, MWIR 1995 and BIR-2, with most of the new information being taken from MWIR 1995. MWIR 1995 contains information on waste as it currently exists, specifying treatability groups, and is therefore more relevant to the WM PEIS analyses for calculating impacts from consolidating or decentralizing treatment of TRUW throughout the DOE complex. The information on as-generated waste forms is readily available from MWIR 1995, but is not readily extracted from the BIR-2 data. Some of the BIR-2 waste loads reflect some level of treatment, since they are intended to represent the volume of wastes in the forms in which they might be disposed of at WIPP. The BIR-2 was used in developing the *Waste Isolation Pilot Plant Disposal Phase Draft Supplemental Environmental Impact Statement* (WIPP SEIS-II; DOE, 1996b). For impacts at potential treatment sites, the Draft WIPP SEIS-II scaled the analysis presented in the Draft WM PEIS to reflect BIR-2 and other more recent information, as explained in the Draft WIPP SEIS-II. Thus, information on as-generated waste forms was not required for the WIPP analysis. BIR-2 was used in the Final WM PEIS, however, for its radiological profiles and for more definitive waste volume estimates for the years that are not covered by MWIR.

A BIR-3 database was published in June 1996 (DOE, 1996a). BIR-3 waste volumes and hazardous constituent inventories are unchanged from BIR-2, although the radionuclide inventories at some sites are changed slightly. This database was not available at the time of this analysis; however, the differences between BIR-3 and BIR-2 are minor and therefore BIR-2 data were considered sufficient for purposes of reanalysis involving TRUW.

I.1.2 COMPLEXWIDE CHANGES

A comparison of the data used in the Draft WM PEIS and the more recent data shows that when waste volumes are summed across the complex, the total estimated volumes in the more recent data changed by -15%, -45%, and +27% for LLMW, LLW, and TRUW, respectively. These changes do not include any estimates for waste transferred from environmental restoration (ER) activities to WM treatment facilities. The comparison also revealed differences in waste volumes at individual sites, as well as changes in their waste treatment category and radiological profiles. Each site was reviewed with regard to whether new waste load information was likely either (1) to cause an appreciable change in site-specific impacts identified in the Draft WM PEIS, or (2) to result in a change that could significantly alter the comparison of the alternatives.

I.1.3 ALTERNATIVES CONSIDERED

In order to determine whether to update waste load information, alternatives were selected for each waste type that were determined to be most sensitive to changes in waste load data. The alternatives used for each waste type are as follows.

For LLMW, DOE's determination regarding the need for reanalysis is based on the potential impacts associated with the Decentralized Alternative, comparing the data used in the Draft WM PEIS with the more recent data reported for each site. For LLW, DOE used either the Decentralized Alternative or Regionalized Alternative 2 impact estimates, whichever were higher (i.e., more conservative), as the best indicator of the effect of the more recent data. The Decentralized Alternative analyzes the data as reported by each site, without the averaging produced by the consolidation of waste inherent in the Regionalized or Centralized Alternatives. However, for LLW, the Regionalized Alternative 2 analyzes treatment with volume reduction, which tends to generate higher risk estimates for treatment than the Decentralized Alternative, which assumes minimum treatment.

For TRUW, DOE's determination regarding the need for reanalysis is based on the potential impacts associated with Regionalized Alternative 2 for all sites except WIPP. Regionalized Alternative 2 assumes treatment to Land Disposal Restrictions, which generates higher potential risk estimates for the offsite public than the Decentralized Alternative (assumes treatment to WIPP Waste Acceptance Criteria) or the Regionalized 1 Alternative (includes less intensive treatment technologies than Regionalized Alternative 2). Treatment under the Centralized Alternative, which potentially generates the highest risk estimates at WIPP, was reviewed to determine the need to reanalyze impacts at WIPP.

I.1.4 CRITERIA FOR REANALYSIS

Using the specified alternative for each waste type (e.g., Decentralized, Regionalized 2, or Centralized Alternatives), DOE examined the potential changes in impacts that could be associated with changes in waste volume and radioactivity between the Draft WM PEIS and more recent data on a site-by-site basis. For the sites not analyzed as major sites in the Draft WM PEIS, changes in waste loads did not warrant reclassifying these sites as major sites, and they were removed from further consideration for reanalysis.

For the 17 major sites, DOE used two criteria to identify the need for reanalysis: (1) waste volume was used as an indicator of change for those impacts that are likely to vary with the amount of waste to be managed (e.g., worker risks, air quality, infrastructure, and economic impact); and (2) total radioactivity or the activity of key radionuclides were used as indicators of the degree to which new estimates would affect measures of potential human health risk and water quality. Using these criteria, DOE determined that reanalysis was warranted where potential changes to impacts (for either the Decentralized, Regionalized 2, or Centralized Alternatives, depending on the waste type) were large enough to substantially affect the site-specific results presented in the Draft WM PEIS or where the changes would likely affect comparisons among the alternatives. In a few instances, an individual impact area for a given site was projected to change enough to warrant reanalysis of that particular impact area, although other impact areas were not sufficiently changed to warrant full reanalysis. In these instances, results from the Draft WM PEIS data were retained, and the estimates for the impact area from the more recent data were noted in the appropriate sections of Volume I of the Final WM PEIS.

At sites where DOE determined it should update waste loads, it was not necessary to use these new waste loads in all alternatives. Updated waste volumes were used only in alternatives where these sites treat their own wastes. In Regionalized and Centralized Alternatives where these sites ship their waste to other sites for management, increases and decreases in waste loads from all contributing sites tend to balance out. There was therefore no need to universally update waste loads at Regionalized or Centralized management sites. Tables 6.3-1 through 6.3-7, 7.3-1 through 7.3-14, and 8.3-1 through 8.3-6 define shipment configurations for LLMW, LLW, and TRUW, respectively. These tables document the percent of waste received from off site. Percentages reported in these tables reflect updated waste loads in all alternatives regardless of whether the actual impact analyses were updated.

Table I.1-1 Summary of Sites Identified for Reanalysis

Site	LLMW	LLW	TRUW
ANL-E	V_d		
BNL		NPD	
FEMP			
Hanford			R_i
INEL			
LANL			
LLNL			
NTS	NPD	NPD	
ORR		R_i	
Pantex		V_d	
PGDP			
PORTS			
RFETS			
SNL-NM			
SRS			R_d
WVDP		NPD	
WIPP			R_d

Key: NPD = no previous data; V_d = volume decrease; R_i = radioactivity increase; R_d = radioactivity decrease.

Potential chemical emissions from treatment and chemical concentrations in the groundwater from disposal were not used as criteria for reanalysis of sites. Generally, chemical-related impacts were not large in the Draft WM PEIS or would be addressed through technology adjustments.

Sections I.1.4.1 and I.1.4.2 describe how each criterion was applied. Table I.1-1 summarizes the sites and waste types identified for reanalysis as a result of the review. The table also identifies the primary basis for the decision to reanalyze, as will be explained in the following sections.

I.1.4.1 Changes in Waste Volume

Volume Decreases. More recent data reveal a decrease in volumes of some waste types at some sites, although such decreases are relatively small. Where a decrease in volume occurred at a site for any waste type, the Draft WM PEIS data were retained for those sites for purposes of analysis, since the higher volumes would tend to generate greater impacts. However, large decreases in waste volumes were reported for ANL-E and Pantex for LLMW and LLW, respectively, and these sites were thus identified for reanalysis.

No Previous Data. Sites previously reporting no or negligible volumes for any waste type in the Draft WM PEIS but reporting any increases in more recent data were identified for reanalysis due to the potential for error in the prior data. The sites identified for reanalysis on this basis were NTS (for LLMW) and BNL, NTS, and WVDP (for LLW).

Volume Increases. Sites previously reporting some waste volumes and reporting increases in those volumes were considered individually. Potential effects of the increased waste volumes were estimated for several parameters: (1) worker risk from radiological exposure or physical hazards, (2) criteria air pollutant emissions, (3) infrastructure effects, and (4) socioeconomic impact in the region of influence. These four impact areas are roughly proportional to the volume of waste being treated or disposed of (i.e., the impacts increase as the volume increases).

However, an economy of scale is generally expected as volumes increase; an increase of one unit of waste would require less than one unit of resource or personnel for treatment or disposal. As described in Appendix C, Section C.3.2.2.5, an economy-of-scale factor was used in the WM PEIS to extrapolate from capacity to cost or resource curves whenever waste estimates fell outside the limits of the curves. The basic formula used was:

$$\text{New Resources} = \text{Old Resources} \times (\text{New Volumes/Old Volumes})^{0.7}$$

This economy-of-scale adjustment was used to estimate the increases in impacts that might be expected from increases in waste volumes, except in the case of air quality. If criteria pollutants were released from construction equipment or commuters' vehicles, the adjustment was applied, since emissions were directly related to resources (workers), which follows the economy-of-scale relationship above. Emissions from a facility are directly proportional to volume, however, so an economy-of-scale adjustment was not made in projecting emissions from facilities.

A review of the sites that reported increases in waste volumes from the estimates used in the Draft WM PEIS resulted in no additional sites being identified for full reanalysis. However, a potential increase was projected for air emissions for treatment of LLW at ANL-E sufficient to warrant identification in the discussion of air quality in Chapter 7 (LLW) of Volume I.

I.1.4.2 Changes in Radioactivity

More recent information on radionuclide profiles for LLMW, LLW, and TRUW was reviewed for each site to identify the potential for any changes in the health risk impact analyses. Changes in radionuclide profiles were examined for their potential to affect both waste treatment and disposal results for LLMW and LLW. For TRUW, the review focused only on the treatment because disposal of TRUW is outside the scope of this PEIS. The methodology that was used in the Draft WM PEIS for determining the radionuclide content of the air emissions and of the wastes disposed was applied to the more recent data for consistency in the comparisons.

For waste treatment impacts, potential increases in the offsite maximally exposed individual (MEI) cancer fatality risk were considered to be representative of all risk endpoints. Radionuclides in air emissions contributing to the highest risks were evaluated. A threshold of one in one million (E–06) was selected as a conservative indicator of the need to reanalyze human health risk impacts. This threshold is consistent with guidelines established by the U.S. Environmental Protection Agency (EPA, 1991).

For waste disposal impacts, increases in long-lived radionuclides (half-life greater than 300 years) were reviewed. This approach recognizes that groundwater contamination by radionuclides in waste in disposal facilities requires longer time frames because movement of the contaminants into groundwater occurs over many lifetimes. Changes in these radionuclides in terms of their potential to cause exceedances in Drinking Water Standards, which are related to human health risk, were used as the indicator.

The following criteria and rules were established to identify sites at which reanalysis was necessary as a result of more recent information on radionuclide profiles.

- Where the more recent data for a particular site ***did not result in*** (1) an offsite MEI cancer fatality risk estimate above a probability of E–06 or (2) an exceedance of drinking water standards, one of two courses was followed:
  - If the Draft WM PEIS had predicted (1) an offsite MEI cancer fatality risk much less than E–06 or (2) no exceedance of drinking water standards, then the change was not considered significant, and no reanalysis was needed.

   - If the Draft WM PEIS had predicted (1) an offsite MEI cancer fatality risk only slightly less than or greater than E–06 or (2) an exceedance of drinking water standards, then the original analysis was retained to preserve the conservative nature of the WM PEIS. An exception was made in cases where the risk estimates decreased considerably when the more recent data were used.

- Where the more recent data for a particular site ***resulted in*** (1) an offsite MEI cancer fatality risk estimate above a probability of E–06 or (2) an exceedance of drinking water standards, one of two courses was followed:
   - If the Draft WM PEIS had predicted (1) an offsite MEI cancer fatality risk only slightly less than or greater than E–06 or (2) an exceedance of drinking water standards, then the change was not considered sufficient to warrant a full reevaluation; however, the appropriate sections of Volume I were revised to indicate that an analysis using the more recent data is likely to show an increase in human health risks and that the extent of mitigation measures to prevent exceedances is likely to be greater than indicated by the Draft WM PEIS analysis.
   - If the Draft WM PEIS analysis originally resulted in (1) an offsite MEI cancer fatality risk much lower than E–06 or (2) no exceedance of drinking water standards, this constituted a significant change, and a full risk reanalysis was performed.

As a result of this review, a full reanalysis was conducted for LLW at ORR, and for TRUW at Hanford, SRS, and WIPP. Revisions to the discussion of risk were made to Volume I for (1) LLNL for LLMW, (2) FEMP and LANL for LLW, and (3) INEL and RFETS for TRUW. Potential exceedances of drinking water standards were noted in Volume I for (1) LLMW at FEMP, Hanford, SNL-NM, and SRS and (2) LLW at Hanford and SRS.

I.1.5 UNCERTAINTIES

Periodic updates of data on waste loads at the sites will continue in the future. Circumstances that may alter waste volume or radioactivity level estimates include the following:

- Changes in DOE's site missions that are not reasonably foreseeable at this time may occur in the future.
- Changes in regulations and statutes concerning the definitions of waste types may occur. For instance, if a "below regulatory concern" level is established for radionuclides, significant volumes of waste currently managed as low-level radioactive waste could be disposed of in solid (nonhazardous and nonradioactive) waste landfills.
- The success of pollution prevention efforts could reduce rates of waste generation.

- Waste management activities that result in opening, sorting, and surveying the contents of containers currently reported to be at full capacity may reveal actual volumes of waste less than those of the containers. These activities will provide better information on the relationship between the mass of the waste and its volume.
- Waste characterization techniques may affect the waste type assigned to a given inventory. Some waste currently classified as TRUW, for instance, may not contain 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste and may require reclassification as LLMW or LLW. Conversely, some LLW could be reclassified as TRUW.
- Waste characterization could result in different assignments to treatability groups, which dictate the type of treatment necessary. Emissions and associated risks to workers and the public may vary significantly, depending on treatment technology.
- Volume reduction of LLMW and LLW during treatment may result in a residue with sufficient concentrations of transuranic elements to warrant reclassification of the residue as TRUW. Regardless of classification, DOE may choose to manage certain waste streams together, even though they are different waste types, because they have similar characteristics and pose similar risks, such as alpha LLW and TRUW.
- Ongoing characterization of the contaminated sites will result in better estimates of ER-transferred waste. Likewise, increased program maturity will lead to more consistent reporting.

Some wastes included in the estimates used for analysis in the WM PEIS may have already been treated or disposed of, because DOE's waste management activities are an ongoing effort. Although the information used for analysis at any point in time may be subject to updates in the future, waste management decisions must nevertheless be based on currently available information. DOE will consider new information as it becomes available and will determine the need for additional NEPA reviews as appropriate.

I.2 LLMW Inventory Update

This section addresses the changes in LLMW volume at each DOE site as reported in MWIR 95. The more recent data were used to reanalyze the projected source terms on waste feedstock inputs to some of the treatment facilities, facility air emissions, and disposal volumes for the LLMW Decentralized, Regionalized, and Centralized Alternatives. The results of the new analysis were then compared with the results in the Draft WM PEIS, which were derived using the MWIR 94 data, to determine the need for any complete reanalysis. Radiological profiles for LLMW at individual sites were unchanged in the more recent data. As a result, changes in the radiological content of site air emissions are generally proportional to the changes in site waste volumes reported in this section.

Table I.2–1 presents a site-by-site comparison of the current waste inventory volume plus the projected 20-year waste volume for each site as reported in MWIR 94 and MWIR 95. Overall, the 1995 data show an approximate 15% decrease in the total amount (from 226,000 to 193,000 m^3) of LLMW that will need treatment across the DOE complex. The lower total is due primarily to large reported waste reductions at ANL-E, Hanford, and PORTS. Of the 42 sites that have (or will generate) LLMW, 27 showed increases in the expected amount of LLMW as reported in the 1995 data.

I.2.1 Analysis of LLMW Alternatives

To assess how the more recent estimates of LLMW treatment volumes may affect the WM PEIS, the Decentralized Alternative was analyzed as the best indicator of potential effects of changes in volume because the data can be analyzed for each site without the consolidations inherent in the Regionalized and Centralized Alternatives. The updated estimates for LLMW for each site and each waste treatment category were entered into the same computational model (WASTE_MGMT) used to analyze LLMW data in the Draft WM PEIS. The model uses the annual projected volume of LLMW at each site (derived from the site's waste inventory and projected waste generation), the radiological and chemical contaminant profile of the waste, and specific operating parameters for treatment facilities to estimate feedstock volumes for individual treatment and disposal facilities and radionuclide and chemical air emissions. The model results derived using the MWIR 95 waste volume data were then compared with the results using estimates derived from the MWIR 94 data. The comparison assumed equivalent radionuclide and chemical profiles and the same treatment facility parameters for the MWIR 95 and the MWIR 94 estimates. In the Decentralized Alternative, in which every site treats its own waste, the changes in radionuclide and chemical contaminant levels correlated directly with the changes in the input treatment volume. However, this relationship does not apply to contaminant levels in site air emissions from treatment facilities or treatment and disposal shipping volumes when there are changes in treatment categories. This is because changes in treatment categories result in the use of different treatment technologies.

A comparison of the Draft WM PEIS (MWIR 94) and more recent (MWIR 95) treatment volumes expected at the various treatment sites for the LLMW Regionalized Alternatives is given in Table I.2–2. This table shows that, in general, the difference in waste volume between the Draft WM PEIS and more recent data decreases at Regionalized and Centralized sites, reflecting the complexwide decrease in LLMW reported in the more recent data. This table thus illustrates that the Decentralized Alternative is the most sensitive to potential changes in impacts related to changes in waste volume, because each site treats its own waste. Thus impacts estimated in the Draft WM PEIS are expected to bound those estimated from the more recent data. Costs and transportation impacts, which are tabulated at the national level in the WM PEIS for the purposes of comparison of alternatives, rather than at sites, would similarly not increase, since volumes overall do not increase.

Tables I.2–3 and I.2–4 compare, for the Decentralized and Centralized Alternatives respectively, the disposal volumes and radionuclide concentrations at various disposal sites derived from the 1994 and 1995 data. Across the complex, disposal volumes after treatment of LLMW are predicted to decrease by approximately 15% when 1995 data are used. However, there is a predicted 35% increase in the overall, complexwide disposal volume, due primarily to the 37,000 m^3 of final-form waste (waste that does not require additional treatment) from Puget Sound Naval Shipyard (Puget So) reported with Hanford's disposal inventory.

I.2.2 Radiological Profiles

Tables I.2–5 and I.2–6 compare the total annual radiological air emissions (Ci/yr) expected at each site under the Decentralized and Centralized Alternatives, respectively. These tables compare the air emissions predicted for each site using estimates of LLMW based on MWIR 94 and MWIR 95 data. Total complexwide radiological air emissions are predicted to increase about 15% on the basis of 1995 data for alpha-emitting radionuclides and nearly 300% for tritium emissions due primarily to increases at LLNL.

For consolidation of waste in the Regionalized and Centralized Alternatives, the tritium-bearing wastes at western sites pose the only potential major increase in risks to the MEI. The emissions of tritium increase by a factor of 3 to 4 at several sites, which could increase MEI risks by the same factor. Only one site other than LLNL, Hanford, has MEI risks that are within a factor of 3 to 4 of 1E–06. Since waste from LLNL is treated at Hanford in the Regionalized and Centralized Alternatives, the increased tritium could affect Hanford emissions in a similar manner as at LLNL. This is discussed further in Section I.2.3.

For disposal, only Hanford is sensitive to increases in long-lived radionuclides from additional wastes in the Regionalized and Centralized Alternatives (other Regionalized or Centralized disposal sites either

Table I.2-1. Comparison of Low-Level Mixed Waste Treatment Volumes

	Estimated Inventory + 20 Years Generation (m^3)				Estimated Inventory + 20 Years Generation (m^3)		
Site	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c]	Site	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c]
Ames	0.4	0.2	-2.0	Mare Is	52	84	+1.6
ANL-E[d]	8,400	159	-52.8	Mound	80	100	+1.3
BCL	0.1	12[e]	+120.0	NTS[d]	0.3	3,000[e]	7,500
Bettis	48	4,800	+100.0	Norfolk	6	300	+50.0
BNL	190	30	-6.3	ORR[f]	59,000	50,000	-1.2
Charleston	3	9	+3.0	PGDP	600	1,000[e]	+1.7
Colonie	11	15	+1.4	Pantex	690	2,200	+3.2
ETEC	3.7	17[e]	+4.6	Pearl H	6	130	+21.7
FEMP	2,600	2,700[e]	+1.0	Pinellas	0.02	NR	NA
GA	43	69[e]	+1.6	PORTS	33,000	15,500[e]	-2.1
GJPO	1.5	0.8[e]	-1.9	Ports Nav	1	11	+11.0
Hanford[g]	36,000	12,000	-3.0	PPPL	0.02	9.4	+94.0
INEL	35,000	28,000	-1.3	Puget So[h]	230	3,000	+13.0
KCP	0.8	0.2	-4.0	RMI	29	32[e]	+1.1
KAPL-K	80	76	-1.1	RFETS	21,000	22,900[e]	+1.1
KAPL-S	100	64	-1.6	SNL-NM	100	290	+2.9
KAPL-W	40	75	+1.9	SRS	20,000	37,000[e]	+1.9
LEHR	7	NR	NA	SLAC	NR	6	NA
LBL	280	34	-8.2	UofMO	2	5	+2.5
LLNL	4,300	7,500	+1.7	WVDP	55	220	+4.0
LANL	2,800	1,000	-2.8	**Total Complex**	226,000	193,000	-1.2

NR = no data reported; NA = not applicable; no data to compare.

Notes: Charleston = Charleston Naval Shipyard; ETEC = Energy Technology Engineering Center; FEMP = Fernald Environmental Management Project, GA = General Atomic; GJPO = Grand Junction Projects Office; KAPL-K = Knolls Atomic Power Laboratory-Kesselring; KAPL-S = Knolls Atomic Power Laboratory-Schenectady; KAPL-W = Knolls Atomic Power Laboratory-Windsor; LEHR = Laboratory for Energy-Related Health Research; Mare Is = Mare Island Naval Shipyard; Norfolk = Norfolk Naval Shipyard; Pearl H = Pearl Harbor Naval Shipyard; Ports Nav = Portsmouth Naval Shipyard; RFETS = Rocky Flats Environmental Technology Site; RMI = RMI Titanium Company; and UofMO = University of Missouri.

[a] For LLMW, data used in the Draft WM PEIS are from 1994 MWIR (DOE, 1994).

[b] For LLMW, more recent data are from 1995 MWIR (DOE, 1995b).

[c] Factor of change is the ratio of more recent data (1995 MWIR) to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.

[d] These sites are evaluated in the Final WM PEIS using data from the 1995 MWIR (DOE, 1995b).

[e] These site estimates include Environmental Restoration wastes. Such wastes may not be transferred to WM facilities.

[f] Volume excludes 15,400 m^3 of grouted pond sludge that is being shipped for commercial disposal.

[g] Volume excludes 114,600 m^3 of wastewater to be generated and managed under the HLW program.

[h] Volume excludes 37,000 m^3 of waste in final form assumed to be shipped directly for disposal at Hanford as generated (see Table I.2-3).

Sources: DOE (1994, 1995b).

Table I.2–2. Comparison of Total Volumes of LLMW Proposed to be Treated at Treatment Sites (m^3)

Site	Alternative									
	41 Treatment Sites (Decentralized)		11 Treatment Sites (Regionalized 1)		7 Treatment Sites (Regionalized 2 or 3)		4 Treatment Sites (Regionalized 4)		1 Treatment Site (Centralized)	
	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95
Ames	0.4	0.2								
ANL-E	8,400	159								
BCL	0.1	12								
Bettis	48	4,800								
BNL	190	30								
Charleston	3	9								
Colonie	11	15								
ETEC	3.7	17								
FEMP	2,600	2,700	11,100	2,900						
GA	43	69								
GJPO	1.5	0.8								
Hanford	36,000	12,000	36,200	15,100	40,800	22,700	40,800	22,700	225,000	191,500
INEL	35,000	28,000	35,000	31,000	35,000	31,100	59,600	56,600		
KCP	0.8	0.2								
KAPL-K	80	75								
KAPL-S	100	64								
KAPL-W	40	75								
LEHR	7	0.0								
LBL	280	34								

Table I.2-2. Comparison of Total Volumes of LLMW Proposed to Be Treated at Treatment Sites (m^3)—Continued

	Alternative									
	41 Treatment Sites (Decentralized)		11 Treatment Sites (Regionalized 1)		7 Treatment Sites (Regionalized 2 or 3)		4 Treatment Sites (Regionalized 4)		1 Treatment Site (Centralized)	
Site	**MWIR 94**	**MWIR 95**	**MWIR 94**	**MWIR 95**	**MWIR 94**	**MWIR 95**	**MWIR 94**	**MWIR 95**	**MWIR 94**	**MWIR 95**
LLNL	4,300	7,500	4,680	7,700						
LANL	2,800	1,000	2,900	1,290	3,590	3,490				
Mare Is	52	84								
Mound	80	100								
NTS	0.4	3,000								
Norfolk	6	300								
ORR	59,000	50,000	59,000	50,000	59,600	51,000	104,000	75,200		
PGDP	600	1,000	600	1,000						
Pantex	690	2,200	690	2,200						
Pearl H	6	130								
Pinellas	0.02	0.0								
PORTS	33,000	15,500	33,600	21,300	44,700	24,200				
Ports Nav	1	11								
PPPL	0.1	9.4								
Puget So	230	3,000								
RMI	29	32								
RFETS	21,000	22,900	21,000	22,000	21,000	22,000				
SNL-NM	100	290								
SRS	20,000	37,000	20,000	37,300	20,000	37,300	20,000	37,300		

Table I.2–2. Comparison of Total Volumes of LLMW Proposed to Be Treated at Treatment Sites (m^3)—Continued

Site	Alternative									
	41 Treatment Sites (Decentralized)		11 Treatment Sites (Regionalized 1)		7 Treatment Sites (Regionalized 2 or 3)		4 Treatment Sites (Regionalized 4)		1 Treatment Site (Centralized)	
	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95	MWIR 94	MWIR 95
SLAC	0.0	6								
UofMO	2	5								
WVDP	55	220								

Notes: Blanks indicate that no treatment (other than aqueous treatment) occurs at a site. The total volumes under each alternative will vary due to rounding. These values are 226,000 m^3 using data from MWIR 94 and 193,000 m^3 using MWIR 95, as shown in Table I.2–1.

Table I.2-3. Comparison of Volumes and Radionuclide Concentrations in LLMW Disposed of Under the Decentralized Alternative

Site	Volume (m^3/yr)			Major Radionuclide[e]	Concentration (Ci/yr)		
	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c,d]		Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c,d]
ANL-E	577	3.0	-190	U-238	4.8	0.05	
				Ni-59	2.1	0.022	
				Tc-99	0.4	0.0041	
				Total	7.3	0.076	-96
BNL	8.4	0.7	-12.0	U-238	0.1	0.019	
				Ni-59	0.046	0.0085	
				Tc-99	0.0086	0.0016	
				Total	0.155	0.029	-5.3
FEMP	108	96	-1.1	U-238	0.44	0.53	
				Tc-99	0.0067	0.0080	
				Th-232	0.0037	0.0043	
				Total	0.45	0.54	+1.2
Hanford[f]	1,250	4,290	3.4	Ni-59	4.4	40	
				U-238	0.87	7.6	
				Total	5.3	47.6	+9.0
INEL	655	1,000	1.5	Ni-59	100	160	
				U-238	18	29	
				Nb-94	5	7	
				Total	123	196	+1.6
LANL	67	29	-2.3	Pu-240	0.072	0.019	
				Ni-59	0.036	0.013	
				Total	0.11	0.032	-3.4
LLNL	187	175	-1.1	U-238	1.3	2	
				Ni-59	0.84	0.53	
				Total	2.1	2.5	+1.2
NTS	90	208	2.3	U-238	0.35	0.0024	
				Total	0.35	0.0024	-146
ORR	2,040	1,770	-1.2	U-238	29	63	
				Ni-59	13	8.9	
				Total	44	74	+1.7
PDGP	22	23	1.0	U-238	29	27	
				Tc-99	8.7	8.1	
				Th-232	0.24	0.22	
				Total	38	35	-1.1
Pantex	20	62	3.1	Ni-59	0.013	0.029	
				Total	0.013	0.029	+2.2

Table I.2-3. Comparison of Volumes and Radionuclide Concentrations in LLMW Disposed of Under the Decentralized Alternative—Continued

Site	Volume (m^3/yr)			Major Radionuclide[e]	Concentration (Ci/yr)		
	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c,d]		Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c,d]
PORTS	590	336	-1.7	U-238	0.56	0.20	
				Tc-99	0.17	0.058	
				Th-232	0.0046	0.0016	
				Total	0.73	0.26	-2.8
RFETS	1,390	1,240	-1.1	Pu-240	4.6	0.68	
				Pu-239	1.3	0.19	
				U-238	0.12	0.018	
				Total	6.0	0.88	-6.8
SNL-NM	1.4	6.1	+3.3	Ni-59	0.047	0.12	
				Pu-240	0.0098	0.042	
				Total	0.057	0.16	+2.8
SRS	552	929	+1.7	Ni-59	13	45	
				U-238	0.43	1.8	
				Total	13	47	+3.6
WVDP	0.0	3.6	NA	Ni-59	0.0	0.07	
				U-238	0.0	0.016	
				Total	0.0	0.086	NA
Total	7,560	10,200	1.35	Total	240	404	+1.7

Note: NA = not applicable; no data to compare.
[a] For LLMW, data used in the Draft WM PEIS are from MWIR 94 (DOE, 1994). Includes volume from smaller sites.
[b] For LLMW, more recent data are from MWIR 95 (DOE, 1995b). Includes volume from smaller sites.
[c] Factor of change is the ratio of more recent data (1995 MWIR) to data used in the Draft WM PEIS. Positive values indicate the more recent data are greater than data used in the Draft WM PEIS; negative values indicate that the more recent data are less than data used in the Draft WM PEIS.
[d] Changes in radiological concentration may differ from changes in volume due to changes in treatment categorization.
[e] Major radionuclides include only isotopes with half-lives ($t_{1/2}$) > 300 years.
[f] Includes 3,700 m^3/yr of final-form waste from Puget Sound Naval Shipyard.

Table I.2–4. Comparison of Volumes and Radionuclide Concentrations in LLMW Disposed of Under the Centralized Alternative

Site	Volume (m^3/yr)			Major Radionuclide[d]	Concentration (Ci/yr)		
	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c]		Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c]
Hanford[e]	7,590	10,100	1.3	Ni-59	140	260	
				U-238	86	130	
				Tc-99	12	11	
				Total	238	401	+1.7

[a] For LLMW, data used in the Draft WM PEIS are from MWIR 94 (DOE, 1994).
[b] For LLMW, more recent data are from MWIR 95 (DOE, 1995b).
[c] Factor of change is the ratio of more recent data (1995 MWIR) to data used in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data used in the Draft WM PEIS; negative values indicate that the more recent data are less than data used in the Draft WM PEIS.
[d] Major radionuclides include only isotopes with half-lives ($t_{½}$) > 300 years.
[e] Includes 3,700 m^3/yr of final-form waste from Puget Sound Naval Shipyard.

Table I.2-5. Comparison of Radiological Air Emissions for LLMW: Decentralized Alternative

Site	Radionuclide Contributing Greatest Risk / Total Alpha Radioactivity[a]	Draft WM PEIS Data[b] (Ci/yr)	More Recent Data[c] (Ci/yr)	Factor of Change[d]
ANL-E	U-238	4.7E-05	4.3E-05	-1.09
	Total alpha	1.7E-04	1.6E-04	-1.1
BNL	U-238	1.0E-06	1.3E-07	-7.7
	Total alpha	3.3E-06	4.5E-07	-7.3
FEMP	U-238	3.7E-06	3.4E-06	-1.09
	Total alpha	1.1E-05	1.0E-05	-1.1
Hanford	Pu-238	8.6E-04	5.0E-04	-1.7
	Total alpha	1.2E-03	6.4E-04	-1.9
INEL	Tritium	2.8E+02	1.1E+03	3.9
	Total alpha	6.4E-04	2.3E-03	3.6
LANL	Tritium	2.3E+02	1.2E+02	-1.9
	Total alpha	2.3E-05	1.8E-05	-1.3
LLNL	Tritium	1.1E+04	3.7E+04	3.4
	Total alpha	5.0E-05	5.3E-05	1.1
NTS	U-238	2.1E-07	1.0E-07	-2.1
	Total alpha	4.9E-06	3.9E-07	-13
ORR	U-238	3.1E-04	7.3E-05	-4.2
	Total alpha	1.1E-03	8.6E-04	-1.3
Pantex	Tritium	1.0E+02	2.5E+02	2.5
	Total alpha	3.7E-06	6.1E-06	1.6
PGDP	U-238	1.8E-04	2.0E-04	1.1
	Total alpha	6.1E-04	6.0E-06	-1.02
PORTS	U-238	3.2E-06	1.9E-06	-1.7
	Total alpha	9.5E-06	5.6E-06	-1.7
RFETS	Pu-238	1.5E-05	1.8E-05	1.2
	Total alpha	1.6E-04	2.0E-04	1.3
SNL-NM	Tritium	5.9E+00	2.6E+01	4.4
	Total alpha	8.4E-07	1.7E-06	2.0
SRS	Tritium	1.5E+03	5.9E+03	3.9
	Total alpha	1.1E-04	2.6E-04	2.4
WVDP	Pu-238	1.5E-07	2.0E-05	130
	Total alpha	7.4E-07	2.5E-05	34

Footnotes appear on next page.

Table I.2-5. Comparison of Radiological Air Emissions for LLMW: Decentralized Alternative—Continued

[a] Radioactivity is for alpha-emitting radionuclides only. Tritium and other non-alpha emitting radionuclides are not included in this sum because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the health risk.
[b] For LLMW, Draft WM PEIS values calculated on the basis of data from 1994 MWIR (DOE, 1994).
[c] For LLMW, more recent values calculated on the basis of data from 1995 MWIR (DOE, 1995b).
[d] Factor of change is the ratio of more recent data (1995 MWIR) to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.

Table I.2-6. Comparison of Radiological Air Emissions Under the Centralized Alternative (Ci/yr) (Alpha-Emitting Radionuclides Only)

Site	Draft WM PEIS Data[a]	More Recent Data[b]	Factor of Change[c]
Hanford	4.0E-03	4.5E-03	+1.13

[a] For LLMW, Draft WM PEIS values calculated on the basis of data from 1994 MWIR (DOE, 1994).
[b] For LLMW, more recent values calculated on the basis of data from 1995 MWIR (DOE, 1995b).
[c] Factor of change is the ratio of more recent data (1995 MWIR) to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than the Draft WM PEIS data; negative values indicate that the more recent data are less than data in the Draft WM PEIS.

receive very little additional waste for disposal or have very low predicted concentrations of radionuclides in the groundwater over the period of analysis). The effect of the radiological increases for disposal at Hanford is discussed in Section I.2.3.

I.2.3 Conclusions About LLMW Sites With Waste Load Increases

Two sites—ANL-E and NTS—required reevaluation based on volume or radionuclide changes. The reanalyses are discussed below.

Ten additional sites with volume or radiological increases were reviewed and did not require further reevaluation: FEMP, Hanford, INEL, LLNL, Pantex, PGDP, RFETS, SNL-NM, SRS, and WVDP. However, the pertinent LLMW risk and water quality sections of Chapter 6, Volume I, were revised to note continuing management requirements for the disposal of uranium at FEMP, Hanford, and SRS and for the disposal of plutonium at SNL-NM. The risk sections of Chapter 6 were also revised to note the continuing requirement to carefully manage treatment of tritium-bearing wastes at LLNL and Hanford.

The four other major LLMW sites did not experience volume increases that caused large risks of cancer fatalities to the offsite MEI (exceeding one in one million) or radiological changes that would cause exceedances of water quality standards.

As noted earlier, sites other than the 17 major sites were not considered for evaluation. However, the radionuclides at these sites were included in the radiological profiles assessed for decentralized disposal. Volume changes at these sites, as discussed, did not affect the Regionalized or Centralized Alternatives. Radiological effects in treatment were assumed to correlate with volume changes and similarly would not affect Regionalized or Centralized Alternatives for treatment.

The following discussion of the sites expands upon the data in Tables I.2–7, I.2–8, and I.2–9, which are found at the end of Section I.2.3.2. The tables provide site comparisons showing the change for key parameters between the waste load data used in the Draft WM PEIS and more recent waste load data, including:

1. Change in volumes (see Table I.2–7). This relies on the waste volume tables presented in this section.
2. Change in both the emission of the radionuclide that has the greatest contribution to risk and the total radioactivity emission to the air for alpha-emitting radionuclides (see Table I.2–8). Non-alpha-emitting

radionuclides, such as tritium, are not included in the total radioactivity because their dose conversion factors for inhalation are several orders of magnitude less than those of the typical alpha emitter, and thus the tritium contributes little risk in most cases. However, in those cases where tritium may pose a significant potential risk at a particular site, it is listed separately in the table. The table also shows a projected new offsite population MEI risk by multiplying the MEI risk from the Draft WM PEIS by the factor of change for both the radionuclide that has the greatest contribution to risk and the total overall alpha radioactivity.

3. Increases in those long-lived radionuclides proposed for disposal at a site (see Table I.2–9). The table also shows projected new concentrations in the groundwater for the long-lived radionuclides and discusses whether these concentrations are likely to exceed water quality guidelines. The projected new concentrations are derived by multiplying the change factor by the previous concentrations in the groundwater. Because the water guidelines are risk-based, values lower than the guidelines are assumed to be protective of human health.

I.2.3.1 Sites Requiring Reevaluation

ANL-E

Volumes: As shown in Table I.2–2, the predicted 20-year volume of LLMW decreased at ANL-E from 8,400 m^3 to 159 m^3—a factor of 52.8. This is a much greater decrease than for any other major site and could cause the presentation of very inaccurate impact information. Although impacts predicted using data in the Draft WM PEIS are conservative, they would overestimate impacts and justify a reevaluation.

Radionuclides: Although radionuclide concentrations are not predicted to increase, the substantial decrease in volumes requires that impacts be reevaluated for their effect on health risks to the offsite population.

Conclusions: Reevaluate all LLMW impacts at ANL-E.

NTS

Volumes: As shown in Table I.2–1, the predicted 20-year volume of LLMW increased at NTS from 0.4 to 3,000 m^3—a factor of 7,500. This very large increase justifies a reevaluation.

Radionuclides: Although radionuclide concentrations are not predicted to increase, the substantial increase in volumes requires that impacts be reevaluated for their effect on health risks to the offsite population.

Conclusions: Reevaluate all LLMW impacts at NTS.

I.2.3.2 Sites Not Requiring Reevaluation

FEMP

Volumes: LLMW increased by a factor of 1.04, which results in an increase in workers and resources of 1.03, considering economy of scale. The Decentralized Alternative was used to estimate effects from volume increases.

The estimate of worker risk at FEMP presented in the Draft WM PEIS is 0.17 worker fatalities from treatment and disposal physical hazards and 0.0006 worker fatalities from radiological exposure. The increases in fatalities would thus be 0.005 (physical hazards) and 0.00002 (radiological exposure). These increases are small.

The most limiting criteria air pollutant is NO_2 emitted during construction operations. The concentration is estimated to reach 22% of the standards, so NO_2 emissions would increase to approximately 23% of the standards, which is still well below the standards.

For infrastructure, required acreage would increase from 8.5 to 8.8 acres; water, wastewater, and power, which were estimated to be 6.5% or less of capacity, would increase to 6.7% or less; and job increases would be less than 0.05% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, the projected offsite MEI risk of cancer fatalities from air emissions is less than one in one million (< E–06). In the Draft WM PEIS, concentrations of U-238 in the groundwater exceeded standards assuming unconstrained disposal; increases in U-238 reported for more recent data could increase the exceedance of groundwater standards by a factor of 1.2 in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage U-238 in disposal has been noted in the risk and water quality sections of Chapter 6, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

HANFORD

Volumes: Overall volumes decreased at the Hanford Site. An increase in disposal volumes, noted in Table 1.2–3, is caused by disposal of macro-encapsulated lead components from naval vessels. Disposal of these components will not cause large resource-related impacts. Radionuclide-related impacts are discussed below.

Radionuclides: For more recent waste data, the projected offsite MEI risk from air emissions under the Decentralized Alternative is less than one in one million (< 1.0E–06). For air emissions under the Regionalized and Centralized Alternatives, the overall increase in tritium releases for the DOE complex could cause the MEI risk at Hanford to increase from current projections of 3E–07 to 5E–07, to 1E–06. This potential increase has been noted in Chapter 6. For disposal, concentrations of U-238 in the groundwater exceeded standards in the Draft WM PEIS, assuming unconstrained disposal; increases in U-238 reported for more recent data could increase the exceedance of groundwater standards by a factor of 9 for the Decentralized Alternative and 1.5 for the Centralized Alternative in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage U-238 in disposal has been noted in the risk and water quality sections of Chapter 6, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

INEL

Volumes: LLMW disposal volumes increased by a factor of 1.5, which results in an increase in workers and resources of 1.33, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases. Only disposal was considered.

The estimate of worker risk in the Draft WM PEIS from disposal at INEL is 0.05 worker fatalities from treatment and disposal physical hazards and 0.14 worker fatalities from radiological causes. The increases in fatalities would be 0.01 (physical hazards) and 0.05 (radiological exposures). These increases are small.

Disposal operations produce localized, fugitive emissions and were not a significant contributor to adverse air quality.

For infrastructure, approximately 25% of the resources are required for disposal, as shown by the cost tables in Volume II. Disposal volume increases would therefore have less effect than the 33% resource increase. Because existing requirements for acreage are 56 acres; water, wastewater, and power requirements are estimated to be less than 13% of capacity; and jobs generated by the entire LLMW activity are only 1.6% of jobs in the region—the additional requirements for increased disposal volumes are small.

Radionuclides: Radionuclide increases at INEL are not predicted to exceed water quality standards. Air emissions from disposal are not significant contributors to risk; projected offsite MEI risk from treatment air emissions using more recent waste data is less than one in one million.

Conclusions: No further evaluation is required for volume or radionuclide changes.

LLNL

Volumes: LLMW volume increased by a factor of 1.7, which results in an increase in workers and resources of 1.4, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at LLNL in the Draft WM PEIS is 0.29 worker fatalities from treatment and disposal physical hazards and 0.05 worker fatalities from radiological exposures. The increases in fatalities would be 0.12 (physical hazards) and 0.02 (radiological exposure). These increases are small.

The most limiting criteria air pollutant is CO emitted during construction. This is estimated to reach 39% of the standards, so CO emissions would increase to approximately 55%, which is well below the standards.

For infrastructure, required acreage would increase from 12.6 to 17.6 acres; water, wastewater, and power, which were estimated to be 1.2% or less of capacity, would increase to 1.7% or less; and job increases would be less than 0.01% of employment in the region. These increased requirements are all small.

Radionuclides: For disposal, radionuclides that increase at LLNL are not predicted to exceed water quality standards. Air emissions from treatment had predicted risks of cancer fatalities to the offsite MEI in excess of one in one million in the Draft WM PEIS (i.e., 3E–06); these risks could increase by a factor of 3.4 based upon increases in the radionuclide (tritium) that has the greatest contribution to risk. This has been noted in the risk sections of Chapter 6, Volume I. However, since the previous analysis also noted exceedances of one in one million for risk of fatality during treatment, requiring mitigation through management of tritium, no further quantitative reevaluation beyond disclosing this in the risk presentations was considered necessary.

Conclusions: No further evaluation is required for volume or radionuclide changes.

PANTEX

Volumes: LLMW volume increased by a factor of 3.2, which results in an increase in workers and resources of 2.3, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at Pantex in the Draft WM PEIS is 0.04 worker fatalities from treatment and disposal physical hazards and 0.0006 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.06 (physical hazards) and 0.0008 (radiological exposures). These increases are small.

The most limiting criteria air pollutants are NO_2 and particulates emitted during facility operations. These are estimated to reach 1% of the standards, so emissions would increase to approximately 3.2%, which is well below the standards.

For infrastructure, required acreage would increase from 3.6 to 8.3 acres; water, wastewater, and power, which were estimated to be 0.3% or less of capacity, would increase to 0.7% or less; and job increases would be less than 0.1% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). Radionuclides that increase at Pantex are not predicted to exceed water quality standards.

Conclusions: No further evaluation is required for volume or radionuclide changes.

PGDP

Volumes: LLMW volume increased by a factor of 1.67, which results in an increase in workers and resources of 1.43, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at PGDP in the Draft WM PEIS is 0.02 worker fatalities from treatment and disposal physical hazards and 0.0004 worker fatalities from radiological exposures. The increases in fatalities would be 0.02 (physical hazards) and 0.0002 (radiological exposure). These increases are small.

The most limiting criteria air pollutant is NO_2 emitted during construction operations. This is estimated to reach 7% of the standards, so NO_2 would increase emissions to approximately 10%, which is well below the standards.

For infrastructure, required acreage would increase from 2.3 to 3.3 acres; water, wastewater, and power, which were estimated to be 0.09% or less of capacity, would increase to 0.13% or less; and job increases would be less than 0.1% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). For disposal, there are no radionuclides that increase, so the more recent waste data are not predicted to cause an exceedance of water quality standards.

Conclusions: No further evaluation is required for volume or radionuclide changes.

RFETS

Volumes: LLMW volume increased by a factor of 1.09, which results in an increase in workers and resources of 1.06, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at RFETS in the Draft WM PEIS is 0.69 worker fatalities from treatment and disposal physical hazards and 0.003 worker fatalities from radiological exposures. The increases in risk of fatality fatalities would be 0.04 (physical hazards) and 0.0002 (radiological exposure). These increases are small.

The most limiting criteria air pollutant is CO emitted during construction operations. This is estimated to reach 169% of the standards, so CO would increase emissions to approximately 179% of standards. This increase is a small change to a value already well over standards.

For infrastructure, required acreage would increase from 32.9 to 34.9 acres; water, wastewater, and power, which were estimated to be 33.3% or less of capacity, would increase to 35.3% or less; and job increases would be less than 0.004% of employment in the region. These are all small changes.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). For disposal, there are no radionuclides that increase, so the more recent waste data are not predicted to cause an exceedance of water quality standards.

Conclusions: No further evaluation is required for volume or radionuclide changes.

SNL-NM

Volumes: LLMW volume increased by a factor of 1.8, which results in an increase in workers and resources of 1.51, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at SNL-NM in the Draft WM PEIS is 0.006 worker fatalities from treatment and disposal physical hazards and 0.0003 worker fatalities from radiological exposures. The increases in risk of fatality fatalities would be 0.003 (physical hazards) and 0.0002 (radiological exposure). These increases are small.

Criteria air pollutants are still 0% of the standards, so increases are negligible.

For infrastructure, required acreage would increase from 0.83 to 1.3 acres; water, wastewater, and power, which were estimated to be 0.3% or less of capacity, would increase to 0.45% or less; and job increases would be less than 0.1% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). In the Draft WM PEIS, concentrations of plutonium in the groundwater exceeded standards assuming unconstrained disposal; increases in plutonium reported for more recent data could increase the exceedance of groundwater standards by a factor of 2.0 in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage plutonium in disposal has been noted in the risk and water quality sections of Chapter 6, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

SRS

Volumes: LLMW volume increased by a factor of 1.85, which results in an increase in workers and resources of 1.54, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at SRS in the Draft WM PEIS is 0.43 worker fatalities from treatment and disposal physical hazards and 0.15 worker fatalities from radiological exposures. The increases in fatalities would be 0.23 (physical hazards) and 0.08 (radiological exposure). These increases are not considered so large as to require a reevaluation on the basis of volumes.

The most limiting criteria air pollutant is CO emitted during facility operations. This is estimated to reach 10% of the standards, so the CO would increase emissions to approximately 18%, which is well below the standards.

For infrastructure, required acreage would increase from 22.6 to 35 acres; water, wastewater, and power, which were estimated to be 1.5% or less of capacity, would increase to 2.3% or less; and job increases would be less than 0.16% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). In the Draft WM PEIS, concentrations of U-238 in the groundwater exceeded standards assuming unconstrained disposal; increases in U-238 reported for more recent data could increase the exceedance of groundwater standards by a factor of 4.2 in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage U-238 in disposal facilities has been noted in the risk and water quality sections of Chapter 6, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

WVDP

Volumes: LLMW volume increased by a factor of 4, which results in an increase in workers and resources of 2.6, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The estimate of worker risk at WVDP in the Draft WM PEIS is 0.005 worker fatalities from treatment and disposal physical hazards and 0.003 worker fatalities from radiological exposures (no LLMW was disposed of at WVDP). The increases in fatalities would be 0.008 (physical hazards) and 0.004 (radiological exposures). These increases are small.

Criteria air pollutants are still 0% of the standards, so increases are negligible.

For infrastructure, required acreage would increase from 1.5 to 3.9 acres; water, wastewater, and power, which were estimated to be 4% or less of capacity, would increase to 10% or less; and job increases would be less than 0.01% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of fatality from air emissions is less than one in one million (< 1.0E–06). Disposal was not evaluated for LLMW in the Draft WM PEIS because all LLMW at WVDP was categorized as alpha waste, which is transported to SRS for disposal in the Decentralized Alternative. In the more recent data, volumes of 3.6 cubic meters per year of nonalpha waste are listed for disposal. This quantity of LLMW was considered to be too small for analysis of a separate LLMW disposal facility; continued shipment to SRS with alpha LLMW was considered more reasonable.

Conclusions: No further evaluation is required for volume or radionuclide changes.

Table I.2–7. Sites Identified for Reanalysis Based on Changes in LLMW Volumes

Site	No Change	Decrease	Increase (Factor)	Reanalyze	Comment
ANL-E		●		●	**Very large decrease; impacts from Draft WM PEIS data are excessively large; reevaluate site.**
BNL		●			
FEMP			● (1)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
Hanford		●			
INEL			● (1.5)		Increases are for disposal volumes only.
LANL		●			
LLNL			● (1.7)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
NTS			● (7,500)	●	**Large increase—reevaluate site.**
ORR		●			
Pantex			● (3.2)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
PGDP			● (1.7)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
PORTS		●			
RFETS			● (1.1)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
SNL-NM			● (1.8)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
SRS			● (1.9)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
WVDP			● (4)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.

Table I.2-8. Sites Identified for Reanalysis Based on Changes in Radioactivity—Air Emissions as Indicators of Potential Changes in Health Risk

Site	Radioactivity Driver in Decentralized Alternative	Change (Factor)	Prior MEI Risk	Projected New MEI Risk	Reanalyze	Comment
	Total Alpha Radioactivity[a]					
ANL-E	U-238 Total alpha	-1.09 -1.1	7.2E-09	< 7.2E-09 < 7.2E-09		Projected new risk is < 1.0E-06
BNL	U-238 Total alpha	-7.7 -7.3	1.6E-10	< 1.6E-10 < 1.6E-10		Projected new risk is < 1.0E-06
FEMP	U-238 Total alpha	-1.09 -1.1	4.9E-10	< 4.9E-10 < 4.9E-10		Projected new risk is < 1.0E-06
Hanford	Pu-238 Total alpha	-1.7 -1.9	3E-08	< 3E-08 < 3E-08		Projected new risk is < 1.0E-06
INEL	Tritium Total alpha	3.9 3.6	6.5E-09	2.7E-08 2.5E-08		Projected new risk is < 1.0E-06
LANL	Tritium Total alpha	-1.9 -1.3	6.2E-08	< 6.2E-08 < 6.2E-08		Projected new risk is < 1.0E-06
LLNL	Tritium Total alpha	3.4 1.1	2.5E-06	8.5E-06 2.7E-06		Draft WM PEIS and more recent projections exceed E-06 as noted in Chapter 6, Volume I.
NTS	U-238 Total alpha	-2.1 -13	0	0		Projected new risk is < 1.0E-06
ORR	U-238 Total alpha	-4.2 -1.3	3.3E-08	< 3.3E-08 < 3.3E-08		Projected new risk is < 1.0E-06
Pantex	Tritium Total alpha	2.5 1.6	2.9E-09	7.3E-08 4.6E-08		Projected new risk is < 1.0E-06
PGDP	U-238 Total alpha	1.1 -1.02	1.3E-08	1.4E-08 1.3E-08		Projected new risk is < 1.0E-06
PORTS	U-238 Total alpha	-1.7 -1.7	3.4E-10	< 3.4E-10 < 3.4E-10		Projected new risk is < 1.0E-06
RFETS	Pu-238 Total alpha	1.2 1.3	9.1E-10	1.1E-09 1.2E-09		Projected new risk is < 1.0E-06
SNL-NM	Tritium Total alpha	4.4 2.0	5.4E-09	2.4E-08 1.1E-08		Projected new risk is < 1.0E-06
SRS	Tritium Total alpha	3.9 2.4	1.7E-08	6.6E-08 4.1E-08		Projected new risk is < 1.0E-06
WVDP	Pu-238 Total alpha	130 34	3.8E-12	4.9E-10 1.3E-10		Projected new risk is < 1.0E-06

[a] Radioactivity is for alpha-emitting radionuclides only. Tritium and other non-alpha emitting radionuclides are not included in this sum because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the health risk.

Table I.2–9. Sites Identified for Reanalysis Based on Changes in Radioactivity—Exceedances of Drinking Water Standards as an Indicator of Changes in Groundwater Impacts From LLMW Disposal

Site	Long-lived Radionuclides Increasing	Factor of Change	Groundwater Concentration as % of Drinking Water Standard (%)		Comment
			Draft WM PEIS	Projected New	
ANL-E	None	NA	NA	NA	No increases.
BNL	None	NA	NA	NA	No increases.
FEMP	Tc-99 Th-232 U-238	1.2 1.2 1.2	0 0 400	0 0 480	Will not exceed standards. Will not exceed standards. Draft WM PEIS concentrations exceeded standards in disposal alternatives — new values increase exceedance, but do not change basic results: U-238 would be managed to meet standards. Reevaluation not required.
Hanford	Ni-59 Decentralized Ni-59 Centralized U-238 Decentralized U-238 Centralized	9 1.86 9 1.5	0 0 400 10,000	0 0 3,600 15,000	Will not exceed standards. Will not exceed standards. Draft WM PEIS concentrations exceeded standards in every alternative — new values increase exceedance but do not change basic results: DOE would need to manage U-238 to meet standards. Reevaluation not required.
INEL	Ni-59 U-238	1.6 1.6	0 0	0 0	Will not exceed standards.
LANL	None	NA	NA	NA	No increases.
LLNL	U-238	1.5	0	0	Will not exceed standards.
NTS	None	NA	0	0	No increases.
ORR	U-238	2.2	5–10	11–22	Will not exceed standards.
Pantex	Ni-59	2.2	0	0	Will not exceed standards.
PGDP	None	NA	NA	NA	No increases.
PORTS	None	NA	NA	NA	No increases.
RFETS	None	NA	NA	NA	No increases.
SNL-NM	Ni-59 Pu-240	2.5 2.0	0 900	0 1,800	Will not exceed standards. Draft WM PEIS concentrations exceeded standards in Decentralized Alternative — new value increases exceedance, but Pu-240 would be managed to meet standards. Reevaluation not required.
SRS	Ni-59 U-238	3.7 4.2	0 600	0 2,520	Will not exceed standards. Draft WM PEIS concentrations exceeded standards in every alternative — new values increase exceedance. DOE would need to manage U-238 to meet standards. Reevaluation not required.
WVDP	NA	NA	NA	NA	No disposal evaluated; waste is proposed for shipment to SRS for disposal.

I.3 LLW Inventory Update

The IDB for 1992 (DOE, 1992) and its supporting electronic database, the Waste Management Information System (ORNL, 1992), were used in preparing the LLW analysis in the Draft WM PEIS. These sources contained LLW data reported throughout the DOE complex for 1991. This section presents data published in the IDB Report–1994 (containing data reported for 1994 [DOE, 1995b]) and compares these data to the data used in the Draft WM PEIS.

In 1995, the IDB updated the site-specific LLW characterization data, including generation rates and existing inventory (DOE, 1995b). These data are compared with data in the Draft WM PEIS in Table I.3–1. A comparison of the data reported in these two sources, the IDB Report–1994 and the Draft WM PEIS, indicates that waste generation rates decreased at most sites. Major LLW generating sites in 1994 were Hanford, Idaho National Engineering Laboratory (INEL), the K-25 Site (K-25), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Savannah River Site (SRS), Y-12 Plant (Y-12), West Valley Demonstration Project (WVDP), and the Naval Reactor (NR) sites, which include Bettis Atomic Power Laboratory (Bettis), Knolls Atomic Power Laboratory (KAPL) (all facilities), and the Naval Reactor Facility (NRF). Combined waste generation rates at these sites were decreased by a total of 45%, compared with the earlier estimates in the Draft WM PEIS. No LLW generation rates or inventories were reported for PGDP and PORTS in the IDB Report–1994. The waste at these sites falls under the Environmental Restoration (ER) Program.

DOE facilities with small quantities of LLW generated in 1994 included Ames Laboratory (Ames), Argonne National Laboratory-East (ANL-E), Brookhaven National Laboratory (BNL), Fermi National Accelerator Laboratory (Fermi), Inhalation Toxicology Research Institute (ITRI), Kansas City Plant (KCP), Lawrence Berkeley Laboratory (LBL), Lawrence Livermore National Laboratory (LLNL), Mound Plant (Mound), Nevada Test Site (NTS), Pantex Plant (Pantex), Pinellas Plant (Pinellas), Princeton Plasma Physics Laboratory (PPPL), Rocky Flats Environmental Technology Site (RFETS), Stanford Linear Accelerator Center (SLAC), and Sandia National Laboratories-California (SNL-CA).

The volumes of waste managed at different facilities under the various alternatives are represented by the "feedstock" volume. Feedstock volume is the amount entering the treatment or disposal system and is calculated in the WM PEIS as being equal to the waste inventory in storage at a given site plus the annual waste generation rate multiplied by 20 years of waste generation. Table I.3–2 presents total feedstock volumes in the Draft WM PEIS and those calculated from the IDB Report–1994.

Overall, the total reported feedstock volume of LLW decreased by 45%. Approximately one quarter of this decrease can be accounted for by the fact that both PORTS and PGDP did not report any LLW WM volumes in the IDB Report-1994, because wastes at PGDP and PORTS are ER wastes. Table I.3-2 also compares the total annual radionuclide activity of waste as reported in the Draft WM PEIS with that reported in the 1995 IDB. Here, reported complexwide treatment activities increased by about 80% overall.

I.3.1 Analysis of LLW Alternatives

For LLW, DOE used either the Decentralized Alternative or Regionalized Alternative 2 impact estimates as the best indicator of the effect of the more recent data on determining which sites should be reanalyzed (see Section I.1.3). However, five alternatives were used to compare estimates of disposal volumes using the more recent LLW data. LLW inventories, generation rates, and activities were entered into the WASTE_MGMT computational model (ANL, 1996a) to determine volumes and radionuclides disposed of under the Decentralized Alternative, three Regionalized Alternatives (Regionalized 2, 4, and 5), and Centralized Alternative 5. New waste treatability categories, volumes, and activities were developed from the IDB Report-1994. LLW radionuclide distributions were assumed to be similar to those used in the Draft WM PEIS; total activities were changed to reflect the updated information.

Updated disposal volumes at each site under the Decentralized Alternative are presented in Table I.3-3 and compared to those used in the Draft WM PEIS. The volumes represent disposal over the 10-year treatment and disposal time frame evaluated in the WM PEIS. No estimates of LLW for disposal at NTS, BNL, or WVDP were reported in the Draft WM PEIS analysis (this is reflected in the second column) because there was no waste on site and only onsite wastes were assumed to be disposed of at these sites under the Decentralized Alternative. Data for these sites were taken from the IDB Report-1994 for use in the Final WM PEIS analyses.

The complexwide decrease in disposal volumes of about 40%, using minimum treatment in the Decentralized Alternative, reflects the overall decrease in LLW generated and stored in the DOE complex as reported in the IDB Report-1994 and is comparable to the 45% decrease in treatment volumes. Disposal volumes under three Regionalized Alternatives (Regionalized 2, 4, and 5) and Centralized Alternative 5, calculated using the more recent data, are shown in Table I.3-4 and are compared with disposal volumes in the Draft WM PEIS. These particular alternatives represent maximum treatment of LLW using volume reduction technologies. The complexwide disposal volumes decrease by about 35% following volume reduction when the more recent data from the IDB Report–1994 are used, and this decrease is less than the 45% decrease in treatment volumes. The difference reflects not only changes in treatment volumes, but also changes in treatment categories, which can affect the amount of volume reduction occurring at a treatment site.

For LLW, conclusions about the need for reanalysis are based on either the Decentralized Alternative or Regionalized Alternative 2 impact estimates as the best indicator's of the effect of the more recent data. The Decentralized Alternative uses data reported by each site, without the averaging produced by consolidation of waste in the Regionalized or Centralized Alternatives. However, treatment with volume reduction, under Regionalized Alternative 2, would pose greater risks to the offsite population than the Decentralized Alternative, which utilizes minimum treatment. So Regionalized Alternative 2 is used to evaluate air emission impacts to the offsite population.

As noted in Table I.3–3, disposal volumes at sites under the Decentralized Alternative generally decrease. Accordingly, if these sites ship their waste to regionalized and centralized management sites, volumes would also generally decrease. Therefore, it is not anticipated that the more recent data would cause major new impacts or changes to the comparison of alternatives for the Regionalized or Centralized Alternatives. The exceptions are for volume reduction sites as shown in Table I.3–4. Using the more recent data, the percentage of waste suitable for volume reduction as compared with the percentage unsuitable for reduction has decreased at some sites, leading to larger disposal volumes—particularly at INEL and ORR, for some alternatives. Since the greater disposal volumes associated with the minimum treatment alternatives were evaluated at these same sites, impacts of the greater disposal volumes were analyzed in the Draft WM PEIS. Therefore there was no need to reevaluate Regionalized or Centralized Alternatives based upon larger disposal volumes. Costs and transportation impacts, which are calculated at the national level in the Draft WM PEIS for the purposes of comparison of alternatives, would similarly not increase, since volumes overall do not increase.

I.3.2 Radiological Profiles

Total activities of radionuclides disposed under the Decentralized Alternative, Regionalized Alternatives 2, 4, and 5, and Centralized Alternative 5 are shown in Tables I.3–5 and I.3–6. The total activity of radionuclides disposed of across the DOE complex increases by almost a factor of 2 when the more recent data are used.

The total activity (in curies) of long-half-life radionuclides (half-lives greater than 300 years) contained within disposed waste has the potential to cause future health risks after disposal. The activity of these radionuclides determines the potential risks to an individual or group of receptors using groundwater contaminated by disposal.

Activities for selected long-half-life radionuclides disposed under the Decentralized Alternative and Centralized Alternative 5, calculated by using the more recent data, are compared with the data used in the Draft WM PEIS in Tables I.3–7 and I.3–8. Centralized Alternative 5 assumes all wastes are treated and disposed of at Hanford; thus, disposal activities represent the aggregate total activity from disposal of all LLW. Changes at individual sites are evaluated in the Decentralized Alternative.

As shown by comparing values for the Decentralized Alternative in Tables I.3–5 and I.3–7 with values for Regionalized and Centralized disposal in Tables I.3–6 and I.3–8, analysis of sites using the Decentralized Alternative provides a representative estimate of potential impacts anticipated at most sites using more recent data. Exceptions are at ORR and Hanford, which have increased radioactivity in the Regionalized or Centralized Alternatives. As further discussed in Section I.3.3, ORR is reevaluated for this and other increases, while the increases causing exceedances at Hanford are discussed further in Chapter 7, Volume I.

Pantex has also been chosen for reevaluation of LLW impacts (see Section I.3.3). This selection was not predicated on changes in expected radionuclide concentrations but rather on substantial decreases in the expected volumes of waste needing treatment.

Table I.3–9 lists both the air emissions for the radionuclide that made the greatest contribution to risk in the Draft WM PEIS and the total emission to the air of alpha-emitting radionuclides for each site caused by treatment of LLW. This table compares the air emissions modeled by using the 1992 IDB and IDB Report–1994 data. Total complexwide radiological air emissions are predicted to increase by a factor of 1.7 when the more recent data are used. Analysis of air emissions in the Regionalized Alternative 2 provides estimates of impacts for more recent data at the sites that are most sensitive to air emissions, with the exception of sites affected by thermal treatment of tritium. For greater consolidation of waste in Regionalized and Centralized Alternatives, the increase in tritium-bearing waste, primarily at eastern sites, poses the only potential major increase in risks. This increase in tritium-bearing waste affects emissions at FEMP in Regionalized Alternative 2 and then transfers to PORTS in Regionalized Alternative 4 and Centralized Alternatives 3 and 4, to ORR in Regionalized Alternative 5, and to Hanford in Centralized Alternative 5. This is further discussed in Section I.3.3 and in the risk section of Chapter 7, Volume I.

Table I.3-1. Comparison of Site-Specific LLW Characterization Data

	Generation Rate (m^3/yr)		Inventory (m^3)	
Site	Draft WM PEIS Data[a]	More Recent Data[b]	Draft WM PEIS Data[a]	More Recent Data[b]
Ames	4	4.5	26	53.6
ANL-E	290	669	884	284
BNL[c]	--[d]	254	--	556
FEMP[e]	ER[f]	ER	ER	ER
Fermi	72	61.3	44.7	83.2
Hanford	4,450[g]	4,500	0	50.6
INEL[h]	5,091	3,200	3,520	14,100
KCP	1	18	4	116
LANL	7,480	1,900	0	0
LBL	62	14.6	53.1	19
LLNL	140	77	780	730
Mound	1,840	910	1,580	8,860
NR Sites[i]	1,516	1,050	0	0
NTS[c]	--	70.8	--	269
ORR[c]	10,200	12,600	48,000	19,000
PGDP	2,230	ER	5,270	ER
Pantex[c]	304	122	33,600	209
Pinellas	63	52.1	16	66
PORTS	4,790	ER	1,480	ER
PPPL	11	42.4	2.1	3
RFETS	1,930	503	2,350	5,320
RMI	2,410	--	2,540	--
SLAC	14	81.3	2,200	242
SNL-NM	92	31	680	51
SRS	25,200[j]	10,500	11,100	1,655
WVDP[c]	--	1,370	--	14,300
Total	68,100	38,000	114,000	65,000

Notes: Fermi = Fermi National Accelerator Laboratory; RMI = RMI Titanium Company; SNL-NM = Sandia National Laboratories-New Mexico.

[a] For LLW, Draft WM PEIS values calculated on the basis of data from 1992 IDB (DOE, 1992), WMIS (ORNL, 1992), and updates from some sites.

[b] For LLW, more recent values calculated on the basis of data from IDB Report-1994 (DOE, 1995b).

[c] These sites were evaluated in the Final WM PEIS using data from the IDB Report-1994.

[d] -- = no data reported.

[e] FEMP is an LLW treatment and shipping site. No WM LLW is currently reported there.

[f] ER = Environmental Restoration wastes not under Waste Management Program.

[g] Excludes Hanford grout waste stream.

[h] INEL data include ANL-W and NRF.

[i] NR sites are Bettis and KAPL (all facilities).

[j] Excludes SRS saltstone waste stream.

Sources: DOE (1992, 1995a); ORNL (1992).

Table I.3–2. Comparison of LLW Feedstock Volume and Annual Activity

Site	Inventory Plus 20-yr Generation (m^3)		Factor of Change[c]	Annual Activity (Ci/yr)		Factor of Change[c]
	Draft WM PEIS Data[a]	More Recent Data[b]		Draft WM PEIS Data[a]	More Recent Data[b]	
Ames	106	144	+1.4	0.02	0.0001	-20
ANL-E	6,680	13,700	+2.0	229	16	-14
BNL[d]	NR[e]	5,640	+[f]	NR	574	+
FEMP	ER[g]	ER	NA[h]	ER	ER	NA
Fermi	1,490	1,310	-1.1	1.11	6	+5.4
Hanford	89,000	90,000	+1.02	7,750	6,040	-1.3
INEL[i]	105,000	78,000	-1.3	138,000	270,000	+2.0
KCP	24	476	+19.8	0.11	0.23	+2.1
LANL	150,000	38,000	-3.9	385,000	9,690	-40
LBL	1,290	319	-4.1	1,600	120	-13
LLNL[j]	3,600	1,670	-1.9	24,500	3,650	-6.7
Mound	38,400	27,000	-1.4	6,060	1,400,000	+233
NR Sites[k]	30,300	21,000	-1.4	369,000	91,000	-4.1
NTS[d]	NR	1,690	+	NR	0.09	+
ORR[d,l]	252,000	271,000	+1.1	830	5,420	+6.5
PGDP	49,900	ER	NA	1.0	ER	NA
Pantex[d]	39,700	2,650	-15	19	NR	*[m]
Pinellas	1,280	1,110	-1.2	9,830	10,200	+1.04
PORTS	97,300	ER	NA	0.1	ER	*
PPPL	220	851	+3.8	0.119	9,560	+80,000
RFETS	41,000	15,400	-2.7	11	1.10	-10
RMI	50,700	NR	*	0.01	NR	*
SLAC	2,480	1,890	-1.3	0.01	0.1	0
SNL-NM[n]	2,520	670	-3.8	202	1.1	-180
SRS	515,000	211,000	-2.4	81,000	960	-82
WVDP[d]	NR	41,700	+	NR	NR	NA
Total	1,480,000	810,000	-1.8	1,023,000	1,804,000	+1.8

Footnotes appear on next page.

Table I.3-2. Comparison of LLW Feedstock Volume and Annual Activity —Continued

[a] For LLW, Draft WM PEIS values calculated on the basis of data from 1992 IDB (DOE, 1992), WMIS (ORNL, 1992), and updates from some sites.
[b] For LLW, more recent data are from IDB Report-1994 (DOE, 1995b).
[c] Factor of change is the ratio of more recent data (IDB Report-1994) to Draft WM PEIS data. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.
[d] These sites, NTS, BNL, WVDP, ORR, and Pantex, were analyzed in the Final WM PEIS by using the more recent data from the IDB Report-1994 (DOE, 1995b).
[e] NR = no data reported.
[f] + = the IDB Report-1994 reports a volume or activity, whereas no data were reported in the earlier data set used in the Draft WM PEIS.
[g] ER = Environmental Restoration wastes not under Waste Management Program.
[h] NA = not applicable; no data to compare.
[i] Includes ANL-W and NRF data.
[j] Includes SNL-CA data.
[k] NR sites include Bettis and KAPL.
[l] ORR = Oak Ridge Reservation and includes ORNL, K-25, Y-12, and ORISE.
[m] * = Draft WM PEIS data set reported a volume or activity where no data were reported in the IDB Report-1994 (DOE, 1995b).
[n] Includes ITRI.

Table I.3-3. Comparison of Disposal Volumes Under the Decentralized Alternative

Site	Disposal Volume (m^3)		Factor of Change[c]
	Draft WM PEIS Data[a]	More Recent Data[b]	
ANL-E	9,100	16,600	+1.8
BNL	NA[d]	5,760	+[e]
Hanford	94,400	96,800	+1.03
INEL	94,100	80,700	-1.2
LANL	163,000	51,600	-3.2
LLNL	8,320	4,850	-1.7
NTS	NA	1,830	+
ORR	243,000	294,000	+1.2
Pantex	40,000	2,910	-14
PGDP	53,800	528	-102
PORTS	231,000	80,000	-4.8
RFETS	45,000	16,900	-2.7
SNL-NM	2,750	733	-3.8
SRS	568,000	230,000	-2.6
WVDP	NA	49,500	+
Total	1,550,000	930,000	-1.7

[a] For LLW, Draft WM PEIS values calculated on the basis of data from 1992 IDB (DOE, 1992), WMIS (ORNL, 1992), and updates from some sites.
[b] For LLW, more recent data are from IDB Report-1994 (DOE, 1995b).
[c] Factor of change is the ratio of more recent data (IDB Report-1994) to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.
[d] NA = not applicable. No WM LLW was reported for these sites in the data set originally used. Data for these sites from the IDB Report-1994 were used in the Final WM PEIS analysis.
[e] + indicates that an LLW volume exists for this site in the IDB Report-1994 data set, whereas none was reported in the data set used in the Draft WM PEIS.

Table I.3–4. Comparison of Alternatives' Disposal Volumes

Site	Disposal Volume (m^3)														
	Decentralized			Regionalized 2			Regionalized 4			Regionalized 5			Centralized 5		
	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]
ANL-E	9,100	16,600	+1.8												
BNL	NA	5,760	+												
FEMP				0	0	No change									
Hanford	94,400	96,800	+1.03	20,700	24,000	+1.2	20,900	24,600	+1.2	20,900	24,600	+1.2	826,000	502,000	-1.6
INEL	94,100	80,700	-1.2	51,000	73,000	+1.4	51,000	73,000	+1.4	59,700	74,000	+1.3			
LANL	163,000	51,600	-3.2	50,900	32,300	-1.6	71,800	40,100	-1.8	63,700	38,900	-1.7			
LLNL	8,320	4,850	-1.7	6,200	2,090	-3.0									
NTS	NA	1,830	+	0	0	No change	6,180	1,970	-3.1	6,180	1,970	-3.1			
ORR	243,000	294,000	+1.2	49,100	133,000	+2.7	216,000	264,000	+1.2	214,000	264,000	+1.2			
Pantex	40,000	2,910	-14	7,890	2,910	-2.7									
PGDP	53,800	528	-102	41,500	525	-79									
PORTS	231,000	80,000	-2.9	123,000	130,000	+1.1									
RFETS	45,000	16,900	-2.7	12,000	4,590	-2.3									
SNL-NM	2,750	733	-3.8												
SRS	568,000	230,000	-2.5	455,000	100,000	-4.5	455,000	100,000	-4.5	455,000	100,000	-4.5			
WVDP	NA	49,500	+												
Total	1,550,000	930,000	-1.7	804,000	502,000	-1.6	809,000	502,000	-1.6	807,000	502,000	-1.6	812,000	502,000	-1.6

Note: Blanks indicate that site not used for disposal under this alternative.
[a] Factor of change is the ratio of more recent data (IDB Report–1994) to Draft WM PEIS data. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.

Table I.3-5. Comparison of Disposal Activities Under the Decentralized Alternative (Curies)

Site	Draft WM PEIS Data	More Recent Data	Factor of Change[a]
ANL-E	5.30E+03	4.60E+02	-12
BNL	NA[b]	1.21E+04	NA
Hanford[c]	1.55E+05	1.21E+05	-1.3
INEL	2.76E+06	7.60E+06	+2.8
LANL	7.72E+06	1.94E+05	-40
LLNL	6.37E+05	8.99E+04	-7.1
NTS	NA[b]	3.67	+
ORR	5.92E+04	1.27E+05	+2.2
PGDP	2.50E+01	5.97	-4.2
Pantex	2.47E+03	9.55E-01	-2,600
PORTS	7.51E+06	3.45E+07	+3.9
RFETS	2.33E+02	4.57E+01	-5.1
SNL-NM	5.12E+03	2.43E+01	-210
SRS[c]	1.79E+06	2.36E+05	-7.8
WVDP	NA[b]	1.44E+04	+
Total	2.06E+07	4.27E+07	+2.1

Note: NA = not applicable.

[a] Factor of change shows the factor of increase or decrease in disposal activity, comparing more recent data to data in the Draft WM PEIS. Positive values indicate that more recent data are greater than data in the Draft WM PEIS; negative values indicate that more recent data are less than data in the Draft WM PEIS.

[b] No WM LLW was reported for these sites in the data set originally used. Data for these sites and for ORR from the IDB Report-1994 were used in the Final WM PEIS analysis.

[c] Excludes Hanford grout waste and SRS saltstone waste streams.

Table I.3–6. Comparison of Disposal Activities Under the Regionalized and Centralized Alternatives

	Disposal Activity (Ci)											
	Regionalized 2			Regionalized 4			Regionalized 5			Centralized 5		
Site	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]	Draft WM PEIS Data	More Recent Data	Factor of Change[a]
ANL-E	--	--	--	--	--	--	--	--	--	--	--	--
BNL	--	--	--	--	--	--	--	--	--	--	--	--
Hanford[b]	1.55E+05	1.21E+05	-1.3	2.87E+05	2.11E+05	-1.4	2.87E+05	2.11E+05	-1.4	2.02E+07	4.21E+07	+2.1
INEL	2.76E+06	7.60E+06	+2.8	2.76E+06	7.60E+06	+2.8	2.76E+06	7.60E+06	+2.8	--	--	--
LANL	7.73E+06	1.94E+05	-40	7.73E+06	1.94E+05	-40	7.72E+06	1.94E+05	-40	--	--	--
LLNL	3.59E+05	8.99E+04	-4.0	--	--	--	--	--	--	--	--	--
NTS	0	0	None	2.27E+05	5.43E+01	-4,200	2.27E+05	5.43E+01	-4,200	--	--	--
ORR	5.92E+04	1.27E+05	+2.2	7.45E+06	3.45E+07	+4.6	7.45E+06	3.45E+07	+4.6	--	--	--
PGDP	2.50E+01	5.97	-4.2	--	--	--	--	--	--	--	--	--
Pantex	2.47E+03	9.55E+00	-2,600	--	--	--	--	--	--	--	--	--
PORTS	7.39E+06	3.45E+07	+4.7	--	--	--	--	--	--	--	--	--
RFETS	2.33E+02	4.57E+01	-5.1	--	--	--	--	--	--	--	--	--
SNL-NM	--	--	--	--	--	--	--	--	--	--	--	--
SRS[b]	1.79E+06	2.36E+05	-7.8	1.79E+06	2.29E+05	-7.8	1.79E+06	2.29E+05	-7.8	--	--	--
WVDP	--	--	--	--	--	--	--	--	--	--	--	--
Total	2.02E+07	4.21E+07	+2.1	2.02E+07	4.21E+07	+2.1	2.02E+07	4.21E+07	+2.1	2.02E+07	4.21E+07	+2.1

Note: NA = not applicable; -- = site not used for this alternative.

[a] Factor of change shows the factor of increase or decrease in disposal activity, comparing more recent data to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that more recent data are less than data in the Draft WM PEIS.
[b] Excludes Hanford grout waste and SRS saltstone waste streams.

Table I.3-7. Comparison of Disposal Activities—Selected Long-Half-Life Nuclides: Decentralized Alternative

Disposal Site/ Nuclide	Disposal Activity (Ci)		Factor of Change[a]
	Draft WM PEIS Data	More Recent Data	
ANL-E			
Ni-59	2.68	0.365	-7.3
Tc-99	1.62	0.103	-16
Th-232	0.00133	0.0105	+7.9
U-235	0.000125	0.000997	+8.0
U-238	9.79	1.87	-5.2
Pu-240	0.0282	0.00168	-18
Total	14.9	2.35	-6.2
BNL[b]			
Ni-59	ND[c]	6.06	d
Tc-99	ND	3.72	d
U-238	ND	22.1	d
Pu-240	ND	0.0605	d
Total	ND	33.8	d
Hanford			
Tc-99	3.44	2.94	-1.2
Th-232	0.434	1.65	+3.8
U-235	0.0410	0.156	+3.8
U-238	52.8	201	+3.8
Pu-240	2.29	1.96	-1.2
Total	59.0	208	+3.5
INEL			
Ni-59	5,500	14,300	+2.6
Tc-99	0.0896	13.1	+150
Pu-240	0.0597	8.75	+150
Total	5,500	14,300	+2.6
LANL			
Tc-99	115	3.02	-38
Th-232	26.8	56	+2.1
U-235	2.53	5.29	+2.1
U-238	3,260	6,830	+2.1
Pu-240	89.4	0.0474	-1,900
Total	12,300	6,900	-1.8
LLNL			
Tc-99	22.6	0.712	-31
U-235	0.00971	0	d
U-238	150	4.28	-35
Pu-240	0.181	2.07	+11
Total	184	7.41	-25

Table I.3-7. Comparison of Disposal Activities—Selected Long-Half-Life Nuclides: Decentralized Alternative—Continued

Disposal Site/ Nuclide	Disposal Activity (Ci)		Factor of Change[a]
	Draft WM PEIS Data	More Recent Data	
NTS[b]			
Tc-99	ND	0.00011	d
Pu-240	ND	0.0000734	d
Total	ND	0.000183	d
ORR[b]			
Tc-99	1.72	95.7	+56
Th-232	0.283	0.585	+2.1
U-235	0.0268	0.0553	+2.1
U-238	35	644	+18
Pu-240	1.09	1.05	None
Total	38.2	788	+21
PGDP			
Tc-99	0.0922	0.00652	-14
U-238	7.36	0.0396	-190
Np-237	0.0670	--[e]	d
Total	7.52	0.0494	-152
Pantex[b]			
Th-232	0.356	0.000130	-2,700
U-235	0.0336	0.0000123	-2,700
U-238	43.3	0.0159	-2,700
Total	43.7	0.0016	-2,700
Portsmouth			
Ni-59	14,700	1,410	-10
Tc-99	0.00481	0.00334	-1.4
Th-232	0.0122	0	d
U-235	0.00116	0	d
U-238	1.5	0	d
Pu-240	0.431	2.06	+4.8
Total	14,700	1,410	-10
RFETS			
Th-232	0.0579	0.00125	-46
U-235	0.00547	0.000118	-46
U-238	7.04	0.152	-46
Pu-240	1.48	0.317	-4.7
Total	8.58	0.470	-18

Table I.3-7. Comparison of Disposal Activities—Selected Long-Half-Life Nuclides: Decentralized Alternative—Continued

Disposal Site/ Nuclide	Disposal Activity (Ci)		Factor of Change[a]
	Draft WM PEIS Data	More Recent Data	
SNL-NM			
Tc-99	6.07	0.0291	-210
Th-232	0.00819	0	d
U-235	0.000774	0	d
U-238	37.9	0.177	-210
Pu-240	0.210	0	d
Total	47.2	0.221	-210
SRS			
Ni-59	1,790	12.8	-140
Tc-99	1,270[f]	0.192	-10,000
Th-232	1.37	5.11	+3.7
U-235	0.129	0.483	+3.7
U-238	299	622	+2.1
Pu-240	5.89	0.913	-6.8
Total	3,380	641	-5.3
WVDP[b]			
Tc-99	ND	0.423	d
Pu-240	ND	0.287	d
Total	ND	0.71	d

[a] Factor of change is the ratio of more recent data (IDB Report–1994) to Draft WM PEIS data. Positive values result when the more recent data are greater than the Draft WM PEIS data; negative values result when more recent data are less than the Draft WM PEIS data.
[b] More recent data were used for analysis of BNL, NTS, ORR, Pantex, and WVDP in the Final WM PEIS.
[c] ND = no data reported for this site.
[d] Either data set (IDB Report–1994 or Draft WM PEIS) showed zero for the indicated nuclide.
[e] Np-237 was not included in the radionuclide inventory for the more recent data comparison.
[f] SRS Tc-99 activities in the Draft WM PEIS Data column include activity in saltstone. Excluding this waste stream leaves 30 Ci of Tc-99 disposed at SRS. The change from Draft WM PEIS data to more recent is still greater than 1/100.

Table I.3-8. Comparison of Disposal Activities—Selected Long-Half-Life Nuclides: Centralized Alternative 5

Disposal Site/ Nuclide	Disposal Activity (Ci)		Factor of Change[a]
	Draft WM PEIS Data	More Recent Data	
Hanford			
Ni-59	22,100	16,100	-1.4
Ni-63	3,160,000	2,290,000	-1.4
Tc-99	179	120	-1.5
Sm-151	5,540	800	-7.0
Th-232	29.4	65.0	+2.2
U-235	2.78	6.15	+2.2
U-238	3,900	8,530	+2.1
Np-237	0.0670	0[b]	c
Pu-240	101	15.8	-6.4
Total	3,190,000	2,320,000	-1.4

[a] Factor of change is the ratio of more recent data (IDB Report-1994) to Draft WM PEIS data. Positive values result when the more recent data are greater than data in the Draft WM PEIS; negative values result when the more recent data are less than data in the Draft WM PEIS.
[b] Np-237 was not included in the radionuclide inventory for the more recent data comparison.
[c] Either data set (IDB Report-1994 or Draft WM PEIS) showed zero for the indicated nuclide.

Table I.3-9. Comparison of Radiological Air Emissions for LLW: Regionalized Alternative 2

Site	Radionuclide Contributing Greatest Risk / Total Alpha Radioactivity[a]	Draft WM PEIS Data[b] (Ci/yr)	More Recent Data[c] (Ci/yr)	Factor of Change[d]
ANL-E	U-238 Overall	4.1E-08 9.0E-08	2.2E-09 4.8E-09	-19 -19
BNL	U-238 Overall	NA	9.5E-08 2.0E-07	NA
FEMP	Tritium Total alpha	1.3E+04 9.4E-08	8.5E+04 1.3E-07	6.5 1.4
Hanford	Pu-238 Total alpha	3.0E-05 6.8E-05	3.3E-06 1.3E-05	-9.1 -5.2
INEL	Co-60 Total alpha	7.4E-02 1.9E-06	1.9E-02 2.2E-06	-3.9 1.2
LANL	U-238 Total alpha	9.4E-03 1.15E+02	1.9E-02 1.2E-01	2.0 -958
LLNL	Tritium Total alpha	2.8E+04 1.0E-04	1.4E+00 1.3E-06	-2.0E+04 -77
NTS	Pu-238 Total alpha	NA	6.5E-11 1.3E-10	NA
ORR	C-14 Total alpha	4.4E-03 3.8E-05	6.1E-03 1.3E-04	1.4 3.4
Pantex	Tritium Total alpha	2.5E-01 8.2E-06	1.3E+00 2.0E-10	5.2 -4.1E+04
PGDP	U-238 Total alpha	2.7E-06 8.1E-06	6.0E-18 1.8E-10	-4.5E+11 -4.5E+04
PORTS	Co-60 Total alpha	2.1E-01 6.0E-06	1.1E-03 1.2E-05	-190 2.0
RFETS	Pu-238 Total alpha	1.1E-05 4.2E-04	1.3E-06 4.7E-05	-8.5 -8.9
SNL-NM	U-238 Total alpha	4.3E-09 1.3E-07	NA	NA
SRS	Tritium Total alpha	3.8E+02 1.3E-03	3.6E-02 5.0E-03	-1.1E+04 3.8
WVDP	Pu-238 Total alpha	NA	1.4E-07 2.9E-07	NA

Footnotes appear on next page.

Table I.3-9. Comparison of Radiological Air Emissions for LLW: Regionalized Alternative 2—Continued

[a] The radioactivity is for alpha-emitting radionuclides only. Tritium and other non-alpha emitting radionuclides are not included because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the health risk.
[b] For LLW, Draft WM PEIS values calculated on the basis of data from the 1992 IDB (DOE, 1992).
[c] For LLW, more recent values calculated on basis of data from the IDB Report-1994 (DOE, 1995b).
[d] Factor of change is the ratio of more recent data (IDB Report-1994) to data in the Draft WM PEIS. Positive values indicate that the more recent data are greater than data in the Draft WM PEIS; negative values indicate that the more recent data are less than data in the Draft WM PEIS.

I.3.3 Conclusions About LLW Sites With Waste Load Increases

Five sites—BNL, NTS, WVDP, ORR, and Pantex—required reevaluation based on volume or radionuclide changes. These are discussed below.

Four additional sites with volume or radiological increases were reviewed and did not require further reevaluation—ANL-E, FEMP, Hanford, and SRS. However, the sections of Chapter 7, Volume I, that discuss risk were revised for FEMP, Hanford, and PORTS to note the requirement to mitigate potential air emission impacts if volume reduction using thermal treatment technologies is employed rather than other methods such as compaction. (Volume reduction is only employed at FEMP in Regionalized Alternative 2.) The health risk and water quality sections of Chapter 7, Volume I, were revised to note continuing management requirements for the disposal of uranium at the Hanford Site and SRS. The air quality section in Chapter 7 was revised for ANL-E to note that criteria air pollutants may approach air quality standards using the more recent data.

The more recent estimates of LLW volume at the other seven major LLW sites did not result in large impacts or risks or radiological changes that would cause exceedances of water quality standards or risks of cancer fatalities to the offsite MEI that exceeded one in one million.

Sites that are not major sites were not considered for evaluation. These sites are assumed to perform minimum levels of treatment and ship to other sites for more intensive treatment or disposal in every alternative. Therefore, impacts at these sites are not large. The radionuclides at these sites, however, were included in the radiological profiles of major sites that treat or dispose of their waste in the Decentralized and Regionalized Alternatives and were reviewed in evaluating these major sites.

The discussion of the sites which follows amplifies upon Tables I.3–10, I.3–11, and I.3–12, which are found at the end of Section I.3.3.2. The tables provide site comparisons showing the change for key parameters between the waste load data used for the Draft WM PEIS and newer waste load data, including:

1. Change in volumes (Table I.3–10). This discussion relies on the waste volume tables presented in this section.
2. Change in both the emission of the radionuclide that has the greatest contribution to risk in the Draft WM PEIS and the total radioactivity emission to the air for alpha-emitting radionuclides (Table I.3–11). As discussed in Section I.2, non-alpha-emitting radionuclides, such as tritium, are not included in the total radioactivity for the same reasons as for LLMW. If tritium or other non-alpha emitters pose a

significant potential risk at a particular site, they are listed separately in the table. The table also shows a projected new MEI risk by multiplying the MEI risk from the Draft WM PEIS by the factor of change for both the driving radionuclide and the total overall alpha radioactivity.

3. Increase in those long-lived radionuclides proposed for disposal at a site (Table I.3-12). The table also shows projected new concentrations in the groundwater for the long-lived radionuclides and discusses whether this concentration is likely to exceed water quality guidelines. The projected new concentrations are derived by multiplying the change factor by the previous concentrations in the groundwater. Since the water guidelines are risk-based, values lower than the guidelines are assumed to be protective of human health.

I.3.3.1 Sites Requiring Reevaluation

BNL, NTS, AND WVDP

Volumes: Previous data used in the Draft WM PEIS did not report LLW volume at BNL, NTS, or WVDP. More recent data for stored and projected generation of LLW at these sites are shown in Table I.3-1. This requires a new analysis to determine all LLW impacts at these sites.

Radionuclides: Radionuclide profiles are available for the more recent waste data, supporting an analysis for radiologically caused risks and impacts.

Conclusion: Reevaluate all LLW impacts at BNL, NTS, and WVDP, and revise the WM PEIS accordingly.

ORR

Volumes: LLW increased by a factor of 1.07, which results in an increase in workers and resources of 1.04, considering economy of scale. The Decentralized Alternative and Regionalized Alternative 2 were used to estimate effects from waste increases, depending on which caused greater impacts.

The existing estimate using Draft WM PEIS data of worker risk at ORR is 0.51 worker fatalities from physical hazards (Regionalized Alternative 2) and 0.52 worker fatalities from radiological exposures (Regionalized Alternative 2). The increases in fatalities based on the new data would thus be 0.02 fatalities for both physical hazards and radiological exposure. These increases are small.

The most limiting criteria air pollutant is NO_2 emitted during facility operations. This is estimated to reach 27% of the standards, so the increase would be approximately 2%, reaching 29% of standards.

For infrastructure, required acreage would increase from 81 to 84 acres; water, wastewater, and power, which were estimated to be 7% or less of capacity, would increase to 7.3% or less; and job increases would be less than 0.1% of employment in the region. These increases are all small.

Radionuclides: For more recent waste data, projected offsite MEI risk of cancer fatality from air emissions in Regionalized Alternative 2 is less than one in one million (< 1.0E–06). However, wastes causing increased tritium emissions noted at FEMP could pass to ORR in the Regionalized Alternative 5, potentially raising projected MEI risks at ORR. For disposal, most radionuclide increases reported for the more recent data are not predicted to cause exceedances of groundwater standards; however, concentrations of Tc-99, which increased by a factor of 56 in the more recent waste data, could cause groundwater standards to be exceeded. This constitutes a change in the impact situation at ORR and justifies reevaluation.

Conclusions: No further evaluation is required for impacts affected by volume changes. Impacts resulting from increased radionuclide concentrations were reevaluated. Volume data, which are also used for new risk calculations, were revised in Volume I to reflect more recent data for LLW at ORR.

PANTEX

Volumes: As shown in Table I.3–2, predicted 20-year volumes of LLW decreased at Pantex from 39,700 to 2,650 m^3—a factor of -15. This decrease is several-fold greater than for any other major site and had the potential for resulting in very inaccurate impact information. Although impacts predicted using the Draft WM PEIS data are conservative, the magnitude of the change justifies a reevaluation.

Radionuclides: Although radionuclide concentrations are not predicted to increase, the substantial decreases in volumes should also be reevaluated for their effect on risks.

Conclusions: Reevaluate all LLW impacts at Pantex, and revise WM PEIS accordingly.

I.3.3.2 Sites Not Requiring Reevaluation

ANL-E

Volumes: LLW volumes increased by a factor of 2.05, which adjusts to an increase in workers and resources of 1.65, considering economy of scale. The Decentralized Alternative was used to estimate effects from waste increases.

The existing estimate using Draft WM PEIS data of worker risk at ANL-E is 0.11 worker fatalities from physical hazards and 0.07 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.07 (physical hazards) and 0.05 (radiological exposures). These increases are small.

The most limiting criteria air pollutant is NO_2 emitted during construction of the new facilities. Nitrogen dioxide was previously estimated to reach 58% of the standards, so the waste increase could cause it to approach the standards at 96%. Since this increase is based on emissions from standard construction equipment and workers commuting to work on a typical construction project, it was not cause for a full reevaluation. A note was added to Chapter 7, Volume I, however, advising of the potential for equipment and vehicular emissions approaching guidelines at ANL-E.

Required acreage for infrastructure would increase from 4 to 6.8 acres; water, wastewater, and power, which were estimated to be 8% or less of capacity, would increase to 13% or less; and job increases would be less than 0.02% of employment in the region. These increases are all small.

Radionuclides: Since volume reduction treatment is not considered at ANL-E, air emissions are not a major source for risk using either previous or more recent waste data. For disposal, those radionuclides that increase at ANL-E using more recent data are not predicted to cause water quality standards to be exceeded in the groundwater.

Conclusions: No further evaluation is required for volume or radionuclide increases resulting from more recent waste data.

FEMP

Volumes: Volumes for waste generated at FEMP did not change using the more recent data; these volumes continue to be categorized as ER waste and are not evaluated in the WM PEIS. Volumes of waste shipped to FEMP for treatment decreased. Therefore, no reevaluation is required based upon volumes.

Radionuclides: There was no disposal of LLW evaluated at FEMP. Air emissions for volume reduction had predicted risks of cancer fatalities in excess of one in one million for the offsite MEI in the Draft WM PEIS (i.e., 4E–06); these risks could increase if volume reduction was pursued using thermal technologies and no mitigation, since both total radioactivity and the activity of the radionuclide with greatest contribution to risk increased in the more recent data by factors of 65 and 1.4, respectively. This potential increase in risk has been noted in the risk sections of Chapter 7, Volume I.

Conclusions: Because volume reduction of LLW is not a regulatory treatment requirement and because the previous data also noted exceedances of one in one million for risk of cancer fatality if volume reduction were employed, no further quantitative reevaluation beyond disclosing this in the risk presentations was considered necessary. No further evaluation is required for volume or radionuclide changes.

HANFORD

Volumes: LLW increased by a factor of 1.02, which adjusts to an increase in workers and resources of 1.014, considering economy of scale. The Decentralized Alternative and Regionalized Alternative 2 were used to estimate effects from waste increases, depending on which had caused greater impacts.

The existing estimate using Draft WM PEIS data of worker risk at Hanford is 0.44 worker fatalities from physical hazards (Regionalized Alternative 2) and 0.5 worker fatalities from radiological exposures (Regionalized Alternative 2). The increases in fatalities based on the new data would thus be 0.006 fatalities for physical hazards and 0.007 fatalities for radiological exposure. These increases are small.

The most limiting criteria air pollutants are NO_2 and particulates emitted during operation of the facilities. These were previously estimated to reach 1% of the guidelines, so the increase would not reach 2% of standards.

Required acreage for infrastructure would increase from 11.6 to 11.8 acres; water, wastewater, and power, which were estimated to be 5.5% or less of capacity, would increase to 5.6% or less; and job increases would be less than 0.01% of employment in the region. These increases are small.

Radionuclides: For more recent waste data, projected offsite MEI risk of cancer fatality from air emissions in the Regionalized Alternative 2 is less than one in one million (< 1.0E–06). However, overall increases in tritium emissions noted at FEMP could also increase tritium emissions at Hanford in the Centralized Alternative 5 when eastern waste is shipped to Hanford. When potential offsetting decreases from LLNL are considered, the current MEI risk of 2E–06 could increase to 4E–06. In the Draft WM PEIS, concentrations of U-238 in the groundwater exceeded standards assuming unconstrained disposal; increases in U-238 reported for more recent data could increase the exceedance of groundwater standards by a factor of 3.8 in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage tritium treatment and U-238 in disposal has been noted in the appropriate risk and water quality sections of Chapter 7, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

PORTS

Volumes: Volumes decreased; therefore no reevaluation is required.

Radionuclides: Radionuclide increases in the Decentralized Alternative and Regionalized Alternative 2 do not cause large increases in risk. However, the tritium emission increases at FEMP would pass to PORTS in the Regionalized Alternative 4 and Centralized Alternatives 3 and 4, potentially increasing the current MEI risk of 2E–06 to 2E–05.

Conclusions: The continuing requirement to carefully manage tritium emissions has been noted in the risk section of Chapter 7, Volume I.

SRS

Volumes: Volumes decreased at SRS; therefore no reevaluation is required.

Radionuclides: For more recent waste data, projected offsite MEI risk of cancer fatality from air emissions is less than one in one million (< 1.0E–06). In the Draft WM PEIS, concentrations of U-238 in the groundwater exceeded standards assuming unconstrained disposal; increases in U-238 reported for more recent data could increase the exceedance of groundwater standards by a factor of 2.1 in the absence of any mitigating measures.

Conclusions: The continuing requirement to carefully manage U-238 in disposal has been noted in the risk and water quality sections of Chapter 7, Volume I, of the Final WM PEIS. No further evaluation is required for volume or radionuclide changes.

Table I.3–10. Sites Identified for Reanalysis Based on Changes in LLW Volumes

Site	No Change	Decrease	Increase Factor	Reanalyze	Comment
ANL-E			● (2.05)		Increases in all worker fatalities <0.5. Priority air pollutants approach standards, noted in Chapter 7, Volume 1, on vehicular emissions; all infrastructure impact changes small. Reanalysis not warranted.
BNL			●	●	**Large increase - reevaluate site.**
FEMP	●				·
Hanford			● (1.02)		Increases in all worker fatalities <0.5. Criteria pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
INEL		●			
LANL		●			
LLNL		●			
NTS			●	●	**Large increase - reevaluate site.**
ORR			● (1.07)		Increases in all worker fatalities <0.5. Criteria air pollutants remain well below standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
Pantex		●		●	**Large decrease - Reevaluate site.**
PGDP		●			
PORTS		●			
RFETS		●			
SNL-NM	●				
SRS		●			
WVDP			●	●	**Large increase - reevaluate site.**

Table I.3-11. Sites Identified for Reanalysis Based on Changes in Radioactivity—LLW Air Emissions as Indicators of Potential Changes in Health Risk

Site	Radioactivity Driver in Regionalized Alternative 2	Change (Factor)	Old MEI Risk of Cancer Fatalities	Projected New MEI Risk of Cancer Fatalities	Reanalyze	Comment
	Total Alpha Radioactivity[a]					
ANL-E	U-238 Total alpha	-19 -19	1.4E-11	< 1.4E-11		Projected new risk is < E-06
BNL	NA	NA	NA	NA		NA
FEMP	Tritium Total alpha	6.5 1.4	4.4E-06	2.9E-05 6.2E-06		Draft WM PEIS and more recent projections exceed E-06 as annotated in Chapter 7, Volume I.
Hanford	Pu-238 Total alpha	-9.1 -5.2	7.3E-11	< 7.3E-11 < 7.3E-11		Projected new risk is < E-06
INEL	Co-60 Total alpha	-3.9 1.2	1.7E-10	< 1.7E-10 < 2.0E-10		Projected new risk is < E-06
LANL	U-238 Total alpha	2.0 -958	8.2E-07	1.7E-06 <8.2E-07		Draft WM PEIS and more recent projections exceed E-06 as annotated in Chapter 7, Volume I.
LLNL	Tritium Total alpha	-2E+04 -77	6.3E-06	< 6.3E-06 < 6.3E-06		Projected new risk is < E-06
NTS	NA	NA	NA	NA		NA
ORR	C-14 Total alpha	1.4 3.4	4.6E-10	6.4E-10 1.6E-09		Projected new risk is < E-06
Pantex	Tritium Total alpha	5.2 -4.1E+04	9.1E-12	4.7E-11 < 9.1E-12		Projected new risk is < E-06
PGDP	U-238 Total alpha	-4.5E+11 -4.5E+04	2.1E-10	< 2.1E-10 < 2.1E-10		Projected new risk is < E-06
PORTS	Co-60 Total alpha	-190 2.0	6.6E-09	< 6.6E-09 1.3E-08		Projected new risk is < E-06
RFETS	Pu-238 Total alpha	-8.5 -8.9	2.5E-09	< 2.5E-09 < 2.5E-09		Projected new risk is < E-06
SNL-NM	NA	NA	NA	NA		NA
SRS	Tritium Total alpha	-1.1E+04 3.8	5.7E-09	< 5.7E-09 < 2.2E-08		Projected new risk is < E-06
WVDP	NA	NA	NA	NA		NA

[a] Tritium and other non-alpha emitting radionuclides are not included in this overall sum because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the potential health risk.

Table I.3–12. Sites Identified for Reanalysis Based on Changes in Radioactivity—Exceedances of Drinking Water Standards as an Indicator of Changes in Groundwater Impacts From LLW Disposal

Site	Long-lived Radionuclides Increasing	Factor of Change	Groundwater Concentration as % of Drinking Water Standards (%)		Comment
			Draft WM PEIS	Projected New	
ANL-E	Th-232 U-235	7.9 8.0	0 0	0 0	Will not exceed standards.
BNL	NA	NA	NA	NA	**No previous data — reevaluate.**
FEMP	NA	NA	NA	NA	LLW disposal not evaluated.
Hanford	Th-232 Th-232 U-235 U-235 U-238 U-238	3.8 decentralized 2.2 centralized 3.8 decentralized 2.2 centralized 3.8 decentralized 2.1 centralized	0 0 1 7 600 9,000	0 0 3.8 15.4 2,280 18,900	Will not exceed standards for Th-232 or U-235. For U-238, Draft WM PEIS concentrations exceeded standards in every alternative; new values increase exceedance but do not change basic results: DOE would need to carefully manage U-238 to meet standards. Reevaluation not required.
INEL	Ni-59 Tc-99 Pu-240	2.6 150 150	0 0 0	0 0 0	Will not exceed standards.
LANL	Th-232 U-235 U-238	2.1 2.1 2.1	0 0 0	0 0 0	Will not exceed standards.
LLNL	Pu-240	11	0	0	Will not exceed standards.
NTS	None	NA	0	0	No increases.
ORR	Tc-99 Th-232 U-235 U-238	56 2.1 2.1 18	4 0 0 0	224 0 0 0	**Tc-99 increase causes standard exceedance — reevaluate site.**
Pantex	None	NA	NA	NA	No increases.
PGDP	None	NA	NA	NA	
PORTS	Pu-240	4.8	0	0	Will not exceed standards.
RFETS	None	NA	NA	NA	No increases.
SNL-NM	None	NA	NA	NA	No increases.
SRS	Th-232 U-235 U-238	3.7 3.7 2.1	0 0 700–900	0 0 1,470–1,890	Will not exceed standards. Will not exceed standards. Draft WM PEIS concentrations exceeded standards in every alternative; new values increase exceedance but do not change basic results: DOE would need to carefully manage U-238 to meet standards. Reevaluation not required.
WVDP	NA	NA	NA	NA	**No previous data — reevaluate site.**

I.4 TRUW Inventory Update

Potential health risks to workers and the general public from TRUW, as described in Chapter 8 of the Draft WM PEIS, were estimated on the basis of data on inventory and generation rates published during 1992 and 1993 (DOE, 1992, 1993). This section assesses the effect of using the more recent data (DOE, 1995b,c).

The more recent data were collected from each site that will store or generate TRUW. The data include estimates of the volumes of TRUW that DOE currently proposes to dispose of at WIPP and quantities of TRUW that DOE does not currently plan to dispose of at WIPP. TRUW not destined for WIPP under the proposed action in WIPP SEIS-II (DOE, 1996b) includes small quantities of nondefense TRUW from the ARCO Roy F. Weston Site, LBL, and WVDP, as well as TRUW contaminated with polychlorinated biphenyls and RH-TRUW (in excess of WIPP's disposal limits) at certain sites. Appendix B discusses the TRUW that would be generated from ER activities.

For updated wasteload information, DOE reviewed two databases that are now available containing information on TRUW: the MWIR 95 and the BIR-2. DOE also reviewed a third version of the *Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report* [WIPP BIR-3] (DOE 1996a), which was published in June 1996, and the IBD Report–1994 (DOE, 1995b), published September 1995. Although the radionuclide inventories at some sites are changed slightly, the waste volumes and hazardous constituent inventories in WIPP BIR-3 are unchanged from WIPP BIR-2. The WIPP BIR-3 and the IDB Report–1994 databases were not available at the time of the WM PEIS analysis; however, the changes in WIPP BIR-3 and the IDB Report–1994 are minor, and, therefore, WIPP BIR-2 data were considered sufficient for analytical purposes. Most of the new information was taken from MWIR 1995. MWIR 1995 contains information on waste as it currently exists, specifying treatability groups, and is therefore more relevant to the WM PEIS analyses for calculating impacts from consolidating or decentralizing treatment of TRUW throughout the DOE complex. The information on as-generated waste forms is readily available from MWIR 1995 but is not readily extracted from the BIR-2 data. Some of the BIR-2 data reflect some level of treatment at some sites, since they are intended to represent the volume of the wastes in the forms they might be disposed of at WIPP.[1] BIR-2 was used in the Final WM PEIS, however, for its radiological profiles and for more definitive waste volume estimates for the years that are not covered by MWIR.

[1] For impacts at potential treatment sites, the Draft WIPP SEIS-II scaled the analysis presented in the Draft WM PEIS to reflect BIR-2 and other more recent information, as explained in the Draft WIPP SEIS-II.

A comparison of MWIR 95 with more recent site information at Hanford for RH-TRUW (22,000 m^3 in BIR 2 vs 160 m^3 in MWIR 95) showed that it was more appropriate to use BIR-2 data for that site. The largest waste streams at Hanford will not be generated until after the 5-year period covered by MWIR 95 and, thus, do not appear in MWIR 95. The projected TRUW volume for Hanford was taken from BIR-2 and appropriately modified for a 20-year time period to give a value of 51,500 m^3. For all other sites DOE used information from MWIR 95 and the 20-year projection methodology developed for LLMW in the Draft WM PEIS. The total sitewide radiological profile for inventory waste was taken from BIR-2 for all sites, and it was assumed that projected wastes at each site would have the same radiological content (Ci/kg) as the site's inventory wastes.

The wastes at each site are divided into different treatment categories. The wastes in each category at a site are assumed to have an identical radiological content per kilogram. Note that this assumption can produce quite a different result than an assumption based on radiological content per cubic meter due to the large differences in the apparent densities of wastes in each waste category. The MWIR 95 database has the appropriate mass information for each waste stream to determine average radioactivity values (Ci/kg) for each treatment category of waste. These apparent densities are assumed to be independent of the site.

Table I.4–1 presents the latest estimated volumes of TRUW from waste management activities at sites where TRUW is currently located and expected to be generated that DOE plans to dispose of at WIPP. The new Departmentwide TRUW volume (using BIR-2 data for Hanford and MWIR 95 data for all other sites) is approximately 135,000 m^3 (i.e., 116,000 + 19,000 ≈ 135,000 m^3) compared with the previously reported 110,000 m^3 (i.e., 97,000 + 9,100 ≈ 110,000 m^3). The increase in volume mainly resulted from an overall increase in volume estimates for Hanford, LANL, and ORR. Table I.4–2 provides total volumes of TRUW to be treated under various site configurations.

The more recent data in MWIR 95 also includes more detailed information regarding the characteristics of TRUW for each waste stream. With this information, waste streams were grouped into categories to facilitate efficient treatment of the TRUW streams considered in the study. The waste categories include aqueous liquids, organic liquids, solid process residues, soils, debris, special, inherently hazardous, and unknown. For each waste treatment level, TRUW in each waste category would be treated in a specific treatment train that includes a series of treatment technologies, including solidification, shredding, thermal treatment, and packaging (see Figures 8.2–1 through 8.2–3).

The quantities of waste (waste load) to be processed in TRUW management facilities were calculated on the basis of the updated TRUW inventory and generation data. The waste categories of special, inherently hazardous, and unknown streams are not included in waste load calculations. These wastes are assumed to be set aside to await special processing and characterization. Releases of radionuclides were then evaluated, and the volume of treated TRUW requiring storage was estimated. Methods of the calculations were described in a supporting document for this study (ANL, 1996b).

I.4.1 Analysis of TRUW Alternatives

To assess how the more recent TRUW waste load data may affect the WM PEIS, potential changes to impacts under Regionalized Alternative 2 were analyzed at all sites except WIPP. Under Regionalized Alternative 2, treatment to meet land disposal restrictions generates higher impacts than the Decentralized Alternative or Regionalized Alternative 1, which involve less intensive treatment. For WIPP, the Centralized Alternative involves the greatest impacts and was the basis for the review of WIPP.

Volumes change by similar or equal percentages for sites treating under Regionalized Alternative 3, as for Regionalized Alternative 2 (or the Centralized Alternative at WIPP), as noted in Table I.4–2. Therefore, the review of sites under Regionalized Alternative 2, and of WIPP under the Centralized Alternative, is more sensitive to potential changes to impacts that might result from the new waste load data.

Costs and transportation impacts, which are tabulated in the WM PEIS at the national level, rather than at sites, for the purposes of comparison of alternatives, would not experience major changes, since overall volumes only increase by 27%.

I.4.2 Radiological Profiles

The releases of radionuclides were estimated by using the more recent data. For purposes of illustration, Table I.4–3 compares estimated profiles, using more recent data and the data used in the Draft WM PEIS, for contaminants released from treatment facilities at sites considered in the representative Regionalized and Centralized Alternatives.

Table I.4-1. Comparison of TRUW Treatment Volumes (m^3)

Site	Contact-Handled TRUW				Remote-Handled TRUW			
	Draft WM PEIS Data[a]	BIR More Recent Data[b]	MWIR 95 More Recent Data	Factor of Change[c]	Draft WM PEIS Data[a]	BIR More Recent Data[b]	MWIR 95 More Recent Data	Factor of Change
Ames*	NR	0.3	0.01	NA	NR	NR	NR	NA
ANL-E	960	100	140	-6.9	340	NR	NR	NA
BCL*	NR	NR	NR	NA	NR	480	95	NA
Bettis*	NR	90	78	NA	NR	4.8	1.1	NA
ETEC	0.02	1.7	1.7	+85	NR	0.9	0.4	NA
Hanford	19,000	36,000	13,100	+1.9	6,300	15,500	280	+2.5
INEL[d]	38,000	29,300	40,000	+1.1	610	1,100	300	-2.0
KAPL*	NR	NR	NR	NA	NR	NR	1.2	NA
LANL	11,000	16,300	17,000	+1.5	89	160	190	+2.1
LBL	1	NR	1	1	NR	NR	NR	NA
LLNL	1,700	740	670	-2.5	NR	NR	NR	NA
Mound	1,500	270	270	-5.6	NR	NR	NR	NA
NTS	610	630	620	+1.0	NR	NR	NR	NA
ORR	1,000	1,500	1,600	+1.6	1,700	2,800	1,900	+1.1
PGDP	14	1.4	1.5	-9.3	NR	NR	NR	NA
Pantex*	NR	0.6	0.6	NA	NR	NR	NR	NA
RFETS	6,200	3,800	3,000	-2.1	NR	NR	NR	NA
SNL-NM	1	14	6.2	+6.2	NR	NR	2	NA
SRS	17,000	7,700	16,600	1	NR	NR	21	NA
TBE*	NR	0.2	NR	NA	NR	NR	NR	NA
USAMC*	NR	2.5	NR	NA	NR	NR	NR	NA
UofMO	2	1	0.9	-2.2	NR	NR	NR	NA
WVDP	0.5	160	36	+72.0	NR	350	480	NA
Total	97,000	96,300	94,000		9,100	20,300	3,300	

Notes: Volume data are rounded; NR indicates that the volume is either zero or unreported in the database indicated. * = new sites; NA = not applicable; TBE = Teledyne Brown Engineering; USAMC = U.S. Army Materiel Command.
[a] Inventory + 20 years generation (DOE, 1992; 1993).
[b] Inventory + 20 years generation (adjusted from BIR-2 [DOE, 1995c] by scaling the projected waste generation).
[c] Factor of change is the ratio of MWIR 95 data to Draft WM PEIS data. Positive values result when MWIR 95 data are greater than data in the Draft WM PEIS; negative values result when MWIR 95 data are less than data in the Draft WM PEIS. For Hanford, the factor of change is the ratio of BIR data to the Draft WM PEIS data.
[d] Includes TRUW from Argonne National Laboratory-West.

Table I.4-2. Comparison of Total Volumes of TRUW to Be Treated in Various Site Configurations (m^3)

Site	16 Treatment Sites[a] (Decentralized Alternative)			6 Treatment Sites (Regionalized Alternative 2)			4 Treatment Sites (Regionalized Alternative 3)			3 Treatment Sites[c] (Centralized Alternative)		
	Draft WM PEIS Data	More Recent Data	Factor of Change[b]	Draft WM PEIS Data	More Recent Data	Factor of Change[b]	Draft WM PEIS Data	More Recent Data	Factor of Change[b]	Draft WM PEIS Data	More Recent Data	Factor of Change[b]
ANL-E	1,300	140	-9.3									
ETEC	0.02	2.1	+105.0									
Hanford	25,000	51,000	+2.0	27,000	52,000	+1.9	27,000	52,000	+1.8	7,000	16,000	+2.3
INEL	39,000	40,000	+1.0	40,000	41,000	+1.0	57,000	61,000	+1.1			
LANL	11,000	17,000	+1.5	11,000	17,000	+1.5						
LBL[d]	1		NA									
LLNL	1,700	670	-2.5									
Mound	1,500	270	-5.6									
NTS	610	620	+1.0									
ORR	2,700	3,500	+1.3	2,000	1,900	-1.1	2,000	1,900	-1.1	2,000	1,900	-1.1
PGDP	14	1.5	-9.3									
RFETS	6,200	3,000	-2.1	6,200	3,000	-2.1						
SNL-NM	1	8.2	+8.2									
SRS	17,000	16,600	NA	20,000	19,000	-1.1	20,000	19,000	-1.1			
UofMO	2	0.9	-2.2									
WVDP[e]	0.5		NA									
WIPP			NA							97,000	116,000	+1.2

Note: Blanks indicate that no treatment (other than aqueous treatment) occurs at a site. NA = not applicable. Draft WM PEIS Total Volumes are 106,000 m^3 and total volumes for more recent data are 135,000 m^3, including WVDP, for every alternative. Site totals may not add to these values due to rounding.

[a] LBL and WVDP, which have nondefense and commercial TRUW, are not included in this table.

[b] Factor of change is the ratio of MWIR 95 data to Draft WM PEIS data. Positive values result when MWIR 95 data are greater than data in the Draft WM PEIS; negative values result when MWIR 95 data are less than data in the Draft WM PEIS.

[c] One treatment site for contact-handled TRUW and two treatment sites for remote-handled TRUW.

[d] LBL is a nondefense TRUW site; its TRUW was not included in the more recent data.

[e] WVDP is primarily a nondefense TRUW site; its TRUW was not included in this table.

Table I.4-3. Comparison of Radiological Air Emissions for TRUW: Regionalized Alternative 2

Site	Radionuclide Contributing Greatest Risk / Total Alpha Radioactivity[a]	Draft WM PEIS Data[b] (Ci/yr)	More Recent Data[c] (Ci/yr)	Factor of Change[d]
Hanford				
CH	Pu-238	1.24E-03	9.69E-02	78
	Pu-239	1.58E-03	3.32E-02	21
	Total alpha CH	1.4E-02	2.1E-01	15
RH	Pu-241	1.5E-01	9.2E-05	-1,630
	Total alpha RH	7.4E-01	4.8E-03	-154
INEL				
CH	Am-241	2.84E-02	1.55E-01	5.5
	Total alpha	1.6E-01	5.0E-01	3.1
LANL				
CH	Am-241	1.25E-01	3.31E-02	-3.8
	Total alpha	8.7E-01	5.7E-01	-1.5
ORR				
RH	Cm-244	7.2E-03	1.8E-03	-4
	Total alpha	1.2E-02	3.1E-03	-3.9
RFETS				
CH	Am-241	5.6E-03	2.1E-02	3.7
	Total alpha	4.5E-02	1.5E-01	3.3
SRS				
CH	Pu-238	2.4E+00	1.6E-03	-1,500
	Total alpha	2.8E+00	2.8E-02	-100
WIPP				
CH	Pu-238	2.5E+00	5.3E-01	-4.7
	Total alpha	4.1E+00	1.6E+00	-2.6

[a] Radioactivity is for alpha-emitting radionuclides only. Tritium and other non-alpha emitting radionuclides are not included in this sum because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the health risk.
[b] For TRUW, Draft WM PEIS values are calculated on the basis of data from 1992 IDB (DOE, 1992) and 1993 MWIR (DOE, 1993).
[c] For TRUW, more recent values are calculated on the basis of data from MWIR 95 (DOE, 1995b) except for Hanford, which uses data from the BIR-2.
[d] Factor of change is the ratio of more recent data (MWIR 95) to data in the Draft WM PEIS. Positive values result when the more recent data are greater than data in the Draft WM PEIS; negative values result when the more recent data are less than data in the Draft WM PEIS.

I.4.3 Conclusions About TRUW Sites With Waste Load Increases

Three sites—Hanford, SRS, and WIPP—required reevaluation based on volume or radionuclide changes. These are discussed below.

Six additional sites with volume or radiological increases were reviewed and did not require further reevaluation—INEL, LANL, ORR, RFETS, SNL-NM, and WVDP. However, the pertinent TRUW risk sections of Chapter 8, Volume I, were revised to note the continuing requirement to carefully manage TRUW at INEL and RFETS for air emissions if treatment to meet Land Disposal Restrictions is employed. The other major TRUW sites did not experience volume increases that caused significant new impacts or risks or radiological changes that would cause risks of cancer fatality to the offsite MEI to exceed one in one million.

Sites other than the major sites were not reviewed; however, the radionuclides at these sites were included in the radiological profiles at major sites reviewed in Regionalized Alternative 2, and at WIPP in the Centralized Alternative. Corrections to the total volume of TRUW ($\approx$110,000 m^3) analyzed in the Draft WM PEIS for the three sites undergoing reanalysis for TRUW yield a total volume of about 132,000 m^3, very near the new Departmentwide estimate for TRUW of 135,000 m^3.

The discussion of the sites which follows amplifies upon Tables I.4–4 and I.4–5, which are found at the end of Section I.4.3.2. The tables provide site comparisons showing the change for key parameters between the data used for the Draft WM PEIS and more recent data, including:

1. Change in volumes (Table I.4–4). These changes are based on the waste volume tables presented in this section.
2. Change in both the radionuclide in the air emissions which contributed the highest risk to the offsite MEI for the analyses in the Draft WM PEIS and for the total air emission radioactivity from alpha-emitting radionuclides (Table I.4–5). The table also shows a projected new offsite MEI risk by multiplying the offsite MEI risk from the Draft WM PEIS by the factor of change for both the radionuclide that has the greatest contribution to risk and the total overall alpha radioactivity.

I.4.3.1 Sites Requiring Reevaluation

Hanford

Volumes: Contact-handled and remote-handled TRUW at Hanford, both of which would be treated at Hanford in the Regionalized Alternatives, increased by a factor of 1.9 and 2.5, respectively, for an average increase of 2.04. This results in an increase in workers and resources of 1.65, considering economy of scale.

The existing estimate in the Draft WM PEIS data of worker risk for Hanford is 0.51 worker fatalities from physical hazards and 0.13 worker fatalities from radiological exposures. The increases in fatalities based on the new data would thus be 0.33 for physical hazards and 0.08 for radiological exposure. These increases are not considered so large as to require a reevaluation based upon volumes.

The most limiting criteria air pollutants are NO_2 and particulates emitted during operation of the facilities. These were previously estimated to reach 2% of the standards, so the increase would reach 4% of standards.

For infrastructure, required acreage would increase from approximately 25 to 41 acres; water, wastewater, and power, which were estimated to be 7.8% or less of capacity, would increase to as much as 13%; and job increases would be less than 0.25% of employment in the region. These increases are all small.

Radionuclides: The radionuclide that makes the greatest contribution to cancer risk to the offsite MEI from air emissions increased by a factor of 78, leading to a predicted increase in risk in excess of one in one million (i.e., 3E–06) from a previous risk considerably less than one in one million. Therefore the impacts related to the radiological content of the waste should be reevaluated.

Conclusion: Reevaluate risks based on large radionuclide increases. Volume data, which are also used for new risk calculations, were revised in Volume I to reflect more recent data for Hanford.

SRS

Volumes: There were no changes in predicted 20-year volumes; therefore, a reevaluation based upon volumes is not required.

Radionuclides: A very large decrease in the offsite radionuclide contributing the highest risk to the offsite MEI (factor of -1,500), at a site that had high risks to the offsite MEI and the offsite population, justifies a reevaluation.

Conclusion: Reevaluate risks based on large radionuclide decreases.

WIPP

Volumes: Contact-handled TRUW, which is treated at WIPP in the Centralized Alternative, increased by a factor of 1.20, which results in an increase in workers and resources of 1.14, considering economy of scale. The Centralized Alternative was used to estimate effects from waste increases.

The existing estimate in the Draft WM PEIS data of worker risk for WIPP is 0.44 worker fatalities from physical hazards and 0.16 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.09 (physical hazards) and 0.03 (radiological exposures). These increases are small.

The most limiting criteria air pollutant is particulates emitted during facility operations. This is estimated to reach 25% of the standard, so the more recent data would increase particulate emissions to just 30% of the standard.

For infrastructure, required acreage for treatment facilities would increase from approximately 8 to 10 acres; and infrastructure capacity for water, wastewater, and power, which were estimated to potentially require as much as 82% of current capacity (for wastewater treatment capacity), could increase to 98%. Job increases would be less than 0.06% of employment in the region. These changes for infrastructure are to be expected for a site that would require new facilities if a new mission such as TRUW treatment is implemented. However, the changes from volume increases in the more recent data are not large in comparison to those already disclosed in the WM PEIS. Consequently, they do not warrant a more detailed reevaluation in the programmatic document.

Radionuclides: A very large decrease in the radionuclide contributing the highest risk to the offsite MEI at SRS (factor of -1,500) carries over to WIPP as a factor of 4.7 decrease in the Centralized Alternative despite increases that occurred at Hanford. WIPP had high risks to the offsite MEI and to the offsite population using the Draft WM PEIS data; this change justifies a reevaluation.

Conclusion: Reevaluate risks based on large radionuclide decreases. The new volume data, which are used for risk calculations, were revised to reflect more recent data for WIPP.

I.4.3.2 Sites Not Requiring Reevaluation

INEL

Volumes: Contact-handled TRUW treated at INEL in the Regionalized Alternatives increased by a factor of 1.05, which results in an increase in workers and resources of 1.034, considering economy of scale. Regionalized Alternative 2 was used to estimate effects from waste increases.

The existing estimate in the Draft WM PEIS data of worker risk for INEL is 1.6 worker fatalities from physical hazards and 0.3 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.05 (physical hazards) and 0.01 (radiological exposures). These increases are small.

The most limiting criteria air pollutant is particulates emitted during facility operations. This is estimated to reach 10% of the standard, so the more recent data would increase particulate emissions to just 11% of the standard.

For infrastructure, required acreage would increase from 28 to 29 acres; water, wastewater, and power, which were estimated to be 6.6% or less of capacity, would increase to 6.8% or less; and job increases would be less than 0.03% of employment in the region. These increases are all small.

Radionuclides: The radionuclide contributing the greatest risk to the offsite MEI increased by a factor of 5.5, leading to predicted risk of cancer fatalities for the more recent data in excess of one in one million (5.0E–06). The previously predicted risk to the offsite MEI using data in the Draft WM PEIS was slightly below one in one million (9.1E–07). This increase was not sufficient to require a quantitative reevaluation, because the risks were already predicted to be essentially at one in one million; however, this increase has been noted in the pertinent sections in Chapter 8, Volume I, to highlight the need for management of air emissions if intensive treatment of TRUW is employed.

Conclusion: No further evaluation is required for volume or radionuclide changes.

LANL

Volumes: Contact-handled TRUW treated at LANL in the Regionalized Alternative 2 increased by a factor of 1.55, which results in an increase in workers and resources of 1.36, considering economy of scale. The Regionalized Alternative 2 was used to estimate effects from waste increases.

The existing estimate in the Draft WM PEIS data of worker risk for LANL is 0.84 worker fatalities from physical hazards and 0.14 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.30 (physical hazards) and 0.05 (radiological exposures). These increases are not considered so large as to require a reevaluation based upon volumes.

The most limiting criteria air pollutant is particulates emitted during facility operations. This is estimated to reach 5% of the standard, so the more recent data would increase particulate emissions to 7%, which is well below the standard. One additional air quality concern would be radionuclides, which were at 134% of the standard using the Draft WM PEIS data. Radionuclide concentrations would vary based upon radiological characteristics rather than volume, however. As noted in the table for TRUW air emissions, total curies for radionuclides in air emissions decreased; therefore air quality for radionuclides would improve. The conclusion is that a reevaluation based upon volumes as they affect air impacts is not required.

For infrastructure, required acreage would increase from 15 to 20 acres; water, wastewater, and power, which were estimated to be 1.2% or less of capacity, would increase to 1.6% or less; and job increases would be less than 0.18% of employment in the region. These increases are all small.

Radionuclides: Curies for radionuclides making the highest contribution to risk and air quality decreased; therefore a reevaluation based on radionuclides is not required.

Conclusion: No further evaluation is required for volume or radionuclide changes.

ORR

Volumes: Remote-handled TRUW treated at ORR in the Regionalized Alternatives increased by a factor of 1.12, which results in an increase in workers and resources of 1.08, considering economy of scale. The Regionalized Alternative 2 was used to estimate effects from remote-handled TRUW increases. Increases of contact-handled TRUW, which is shipped to other sites for treatment, would not cause large impacts at ORR and were not further evaluated.

The existing estimate in the Draft WM PEIS data of worker risk for ORR is 0.21 worker fatalities from physical hazards and 0.09 worker fatalities from radiological exposures. The increases in fatalities would thus be 0.02 (physical hazards) and 0.004 (radiological exposures). These increases are small.

The most limiting criteria air pollutant is NO_2 emitted during facility operations. This is estimated to reach 1% of the standard, so the more recent data would increase NO_2 emissions to just 1.1% of the standard.

For infrastructure, required acreage would increase from 6 to 7 acres; water, wastewater, and power, which were estimated to be 0.09% or less of capacity, would increase to 0.1% or less; and job increases would be less than 0.01% of employment in the region. These increases are small.

Radionuclides: For more recent waste data, projected offsite MEI risk from air emissions is less than one in one million (< 1.0E-06).

Conclusion: No further evaluation is required for volume or radionuclide changes.

RFETS

Volumes: Volumes decrease at RFETS; therefore no additional evaluation is required.

Radionuclides: The radionuclide contributing the greatest risk to the offsite MEI increased by a factor of 3.7, leading to predicted offsite risk using the more recent data in excess of one in one million (5.6E-06). The previously predicted risk to the offsite MEI using data in the Draft WM PEIS was already above one in one million (1.5E-06). This increase was not sufficient to require a quantitative reevaluation, since the risks were already predicted to be above one in one million; however, this has been noted in the pertinent sections in Chapter 8, Volume I, to highlight the need for management of air emissions if treatment to meet Land Disposal Restrictions of TRUW is employed.

Conclusion: No further evaluation is required for volume or radionuclide changes.

SNL-NM and WVDP

Volumes: Previously estimated small volumes of contact-handled TRUW (1 m^3 at SNL-NM and 0.5 m^3 at WVDP) are now estimated at 6.2 m^3 and 36 m^3, respectively. In addition, 480 m^3 of remote-handled TRUW are now reported at WVDP; none appeared in the Draft WM PEIS data. However, the West Valley Demonstration Project Act (42 U.S.C. 2021a) defines TRUW as "material contaminated with [transuranic] elements . . . in concentrations of 10 nanocuries per gram or in such other concentrations as the [Nuclear Regulatory] Commission may prescribe." One of the agreements in the Stipulation of Compromise Settlement between DOE and the Coalition on West Valley Nuclear Wastes and the Radioactive Waste Campaign (U.S. District Court, Western District of New York, May 27, 1987) is that DOE will seek a determination from the NRC as to whether WVDP waste containing material with an atomic number greater than 92 in concentrations greater than 10 nanocuries per gram is TRUW based on the definition in the WVDP Act. The West Valley Completion EIS (DOE, in preparation) indicates that, in the event that an alternative which includes on-premises disposal of this waste is ultimately selected, DOE will request a determination from NRC that a major portion of the material currently managed as TRUW can be classified as LLW. Since these sites are only considered for storage until another site is available, after which TRUW would be packaged and shipped, impacts are small for managing these new wastes and will not affect the comparison of alternatives. For example, the total worker risk at PGDP, which stores and packages for shipment volumes of contact-handled TRUW comparable to those now predicted at SNL-NM and WVDP, is 0.01 fatalities. Management of remote-handled TRUW at ANL-E, which involves volumes similar to those now predicted for WVDP, entails total worker risk estimates of 0.1 fatalities. DOE determined that these new waste estimates at SNL-NM and WVDP did not affect the programmatic comparison of alternatives and would not present major new impacts. Consequently, these sites were not selected for reevaluation.

Radionuclides: Radionuclides do not cause large risks at sites where only packaging and shipping are conducted.

Conclusion: No further evaluation is required for volume or radionuclide changes.

Table I.4–4. Sites Identified for Reanalysis Based on Changes in TRUW Volumes

Site	No Change	Decrease	Increase (Factor)	Reanalyze	Comment
ANL-E		●			
Hanford			● (CH 1.9; RH 2.5)		Increases in all worker fatalities < 0.5. Criteria air pollutants well within standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
INEL		● (RH)	● (CH1.05)		Increases in all worker fatalities < 0.5. Criteria air pollutants well within standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
LANL			● (CH 1.55; RH 2.1)		Increases in all worker fatalities < 0.5. Criteria air pollutants well within standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
LLNL		●			
NTS	●				
ORR			● (CH 1.6; RH 1.12)		ORR ships CH TRUW to other sites for treatment - change does not affect alternatives and has minor effect on impacts for RH TRUW. Increases in all worker fatalities < 0.5. Criteria air pollutants well within standards. Negligible increases in infrastructure impacts. Reanalysis not warranted.
PGDP		●			
RFETS		●			
SNL-NM			● (6.2)		TRUW is packaged and shipped in all alternatives; changes do not affect decisions.
SRS	●				
WVDP			● (CH 72; RH >480)		TRUW is packaged and shipped in all alternatives; changes do not affect decisions.
WIPP			● (1.13)		

Table I.4–5. Sites Identified for Reanalysis Based on Changes in Radioactivity—TRUW Air Emissions as Indicators of Potential Changes in Health Risk

Site	Radioactivity Driver in Regionalized Alternative 2 Total Alpha Radioactivity[a]	Change (Factor)	Prior MEI Risk	Projected New MEI Risk	Reanalyze	Comment
Hanford CH RH	Pu-238 Pu-239 Total alpha CH Pu-241 Total alpha RH	78 21 15 -1,630 154	9.4E-08 CH 1.3E-07 RH	7.0E-06 2.0E-06 1.4E-06 < 1.3E-07 < 1.3E-07	●	**Large change - reevaluate site**
INEL CH	Am-241 CH Total alpha	5.5 3.1	9.1E-07	5.0E-06 2.8E-06		Draft WM PEIS and new projections exceed E-06, as annotated in Chapter 8.
LANL CH	Am-241 Total alpha	-3.8 -1.5	6.7E-05	2.5E-06 1.0E-05		Risk is lower than in prior estimate; retain prior analysis
ORR RH	Cm-244 Total alpha	-4 -7	1.4E-06	5.6E-07 9.8E-07		Projected new risk is < 1.0E-06
RFETS CH	AM-241 Total alpha	3.7 3.3	1.5E-06	5.6E-06 5.0E-06		Draft WM PEIS and new projections exceed E-06, as annotated in Chapter 8.
SRS CH	Pu-238 Total alpha	-1,500 -100	2.4E-05	3.8E-08 2.4E-07	●	**Large decrease; site previously had largest risk - reevaluate risks**
WIPP CH	Pu-238 Total alpha	-4.7 -2.6	6.7E-05	3.2E-06 1.7E-05	●	**SRS decrease transfers to WIPP, which had elevated risk - reevaluate risks**

Notes: CH = contact-handled waste; RH = remote-handled waste.

[a] Radioactivity is for alpha-emitting radionuclides only. Tritium and other non-alpha emitting radionuclides are not included in this sum because of the small size of their dose conversion factor. Tritium and other nuclides are included separately in this table at sites where they contribute significantly to the potential health risk.

I.5 References

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DOE. *See* U.S. Department of Energy.

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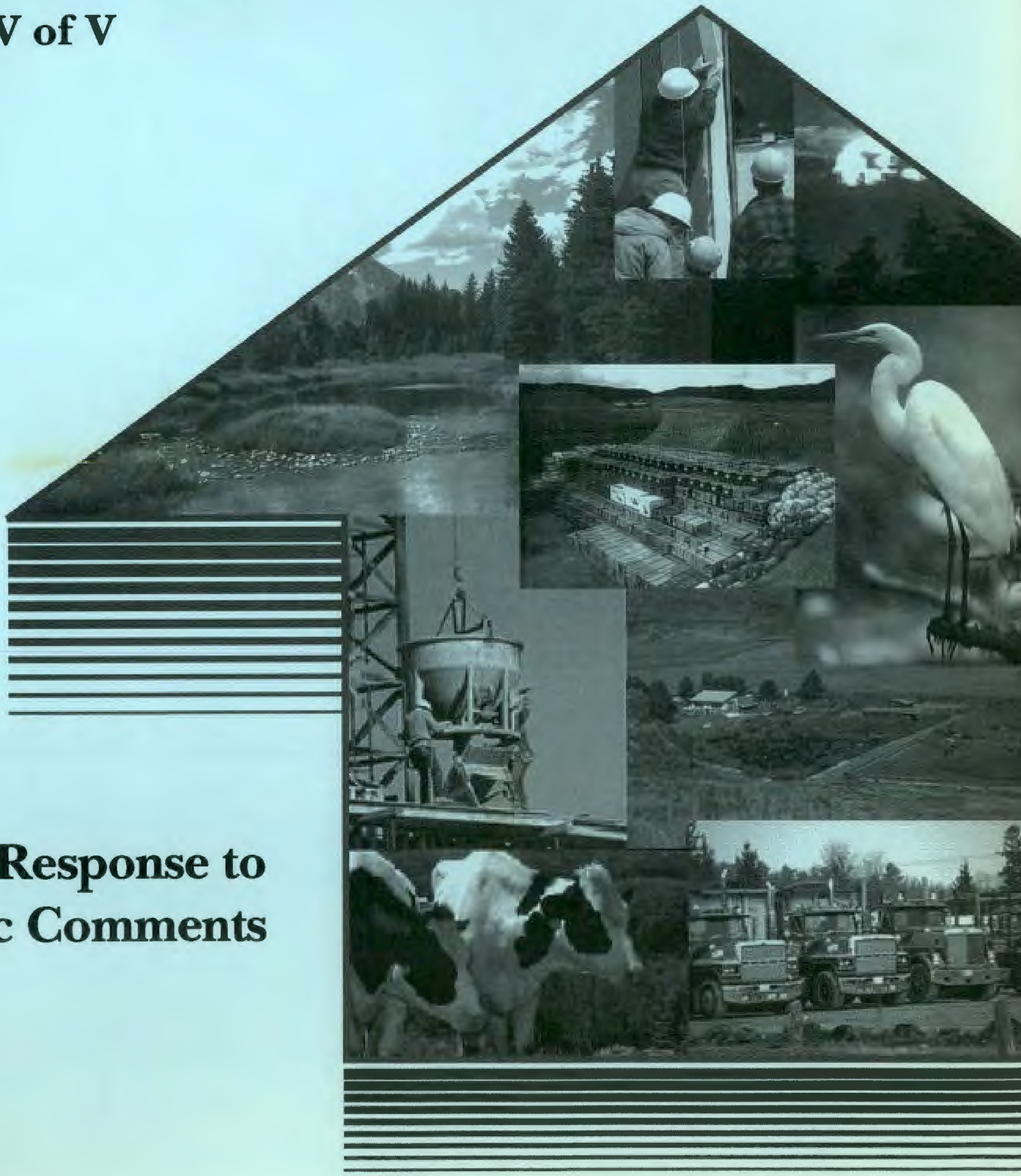
Final Waste Management Programmatic Environmental Impact Statement

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

DOE/EIS-0200-F

Volume V of V



Response to Public Comments

DOE/EIS-0200-F

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

Volume V of V

Response to Public Comments

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

COVER SHEET

RESPONSIBLE FEDERAL AGENCY: U.S. Department of Energy

TITLE: Final Waste Management Programmatic Environmental Impact Statement

CONTACT: For further information about this Environmental Impact Statement, contact:

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ABSTRACT: The Final Waste Management Programmatic Environmental Impact Statement (WM PEIS) examines the potential environmental and cost impacts of strategic management alternatives for managing five types of radioactive and hazardous wastes that have resulted and will continue to result from nuclear energy research and the development, production, and testing of nuclear weapons at a variety of sites around the United States. The five waste types are low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste. The WM PEIS provides information on the impacts of various siting alternatives, which the Department of Energy (DOE) will use to decide at which sites to locate additional treatment, storage, and disposal capacity for each waste type. This information includes the cumulative impacts of combining future siting configurations for the five waste types and the collective impacts of other past, present, and reasonably foreseeable future activities.

The selected waste management facilities being considered for these different waste types are treatment and disposal facilities for low-level mixed waste; treatment and disposal facilities for low-level waste; treatment and storage facilities for transuranic waste in the event that treatment is required before disposal; storage facilities for created (vitrified) high-level waste canisters; and treatment of nonwastewater hazardous waste by DOE and commercial vendors. In addition to the No Action Alternative, which includes only existing of approved waste management facilities, the alternatives for each of the waste-type configurations include Decentralized, Regionalized, and Centralized Alternatives for using existing and operating new waste management facilities. However, the siting, construction, and operations of any new facility at a selected site will not be decided until completion of a sitewide or project-specific environmental impact review.

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Introduction

This volume of the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (WM PEIS) summarizes the comments on the Draft PEIS that the U.S. Department of Energy (DOE) received during the public comment period, and provides DOE responses to those comments.

The Draft WM PEIS was issued for public review and comment on September 22, 1995. In response to requests from the public, DOE extended the original 90-day comment period (September 22 to December 21, 1995) to February 19, 1996 (a total of 150 days).

During the 150-day public comment period, which included 13 public hearings in 18 cities across the United States, DOE received over 5,000 comments from more than 1,200 individuals, agencies, and organizations. Approximately 4,000 individuals cosigned letters or signed petitions.

How DOE Considered Public Comments in the NEPA Process

In compliance with the provisions of the National Environmental Policy Act (NEPA) (42 USC 4321 *et seq.*) and regulations of the President's Council on Environmental Quality (CEQ) (40 CFR 1500-1508), DOE assessed and considered public comments on the Draft WM PEIS, both individually and collectively. Some comments led to PEIS modifications; others resulted in a response to explain or communicate DOE policy, to clarify the scope of the WM PEIS, to explain the relationship of this PEIS to other related NEPA documentation, to refer commentors to information in the PEIS, to answer technical questions, to further explain technical issues, or to correct readers' misinterpretations.

Public input contributed to the development of decision factors and criteria, defined as desirable attributes or characteristics that measure the relative acceptability of alternatives, which were used to identify candidate preferred alternatives These factors and criteria include, but are not limited to, human health risk, environmental impacts, regulatory compliance, DOE and site waste management missions, technology development, transportation, cost, and mitigation. Volume I, Section 1.7.3, describes the factors and criteria DOE used to select preferred alternatives, which are identified or described in Volume I, Section 3.7, of the Final WM PEIS.

Public comments also provided valuable suggestions for improving the WM PEIS. A brief summary of public comments and resulting changes to the PEIS is provided in Volume I, Section 1.7.2. Responses to public comments given in this volume (Volume V) identify specific WM PEIS changes made as a result of the comments.

How to Find Individual Comments and Responses

The table at the back of this volume provides the guide to locating comments provided by individuals and organizations, as well as summaries of comments provided at public hearings. Individuals are listed first, alphabetically; organizations are listed second, alphabetically; and public hearings are listed last, alphabetically, by the city in which the hearing was held. To find each comment and DOE's response, locate the commentor's name (individual or organization) in the guide and turn to the index locations listed. The numbers in parentheses following the index numbers identify comments/responses. These are tracking numbers used in the WM PEIS comment/response computer database. In this comment/response volume, these numbers are in numerical order within each section, which permits commentors to locate their comments. The guide includes the entries "Anonymous" and "Illegible." Anonymous entries include comments provided in documents that did not identify the commentor or an organization. Illegible indicates names that were unreadable.

Comments that were the same or very similar to others were grouped and summarized and a single DOE response is provided. Thus, commentors might not read their exact words, but the essence of each comment is captured in the grouping. If an individual or organization is listed more than once in the guide, this indicates that DOE received more than one letter from the commentor, each containing different comments.

Public hearing participants who asked to have their comments specifically attributed to them are included in the list of individuals. Petitions are attributed to the first person who signed the petition or to the person who mailed the petition, if identified. The remaining petitioners are not listed individually. Be assured, however, that all petitions, written comments, and public hearing comments are accounted for and responded to in this volume. DOE also received a number of letters that did not contain comments (requests for copies of the PEIS, change of address notifications, etc.). These persons are not listed in the guide to comments and responses.

A "reverse index" to public comments is available in the DOE WM PEIS public reading rooms. The reverse index can be used by readers to identify the individual(s) attributed to each of the comments.

Supporting Documents and Technical References

Many of the responses to public comments in this volume refer to supporting technical reports, databases, DOE Orders, Federal laws and regulations, and other DOE EISs. DOE has not included these on the list of references provided at the back of this volume because they are listed and described in Volume I, Sections 1.4 and 1.8 cited as appropriate in Volumes I, II, III, and IV, and listed as references at the back of chapters and appendices. The Volume V list of references includes only references unique to Volume V.

List of Acronyms and Abbreviations

AED	Aerodynamic Equivalent Diameter
Ames	Ames Laboratory
ALARA	As Low as Reasonably Achievable
ANL-E	Argonne National Laboratory - East
AQCR	Air Quality Control Region
AQRV	Air Quality Related Values
ARAM	Automated Remedial Action Methodology
BACT	Best Available Control Technology
BEIR	Biological Effects of Ionizing Radiation
BEMR	Baseline Environmental Management Report
Bettis	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	Contact-handled
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CY	Calendar Year
D&D	Decontamination and Decommissioning
DARHT	Dual-Access Radiographic Hydrodynamic Test
DCF	Dose Conversion Factors
DNAPL	Dense, Nonaqueous-Phase Liquids
DNFSB	Defense Nuclear Facility Safety Board
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DUST	Disposal Unit Source Term
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ETEC	Energy Technology Engineering Center
FEMP	Fernald Environmental Management Project
Fermi	Fermi National Accelerator Laboratory
FFCAct	Federal Facility Compliance Act
FR	Federal Register
FTE	Full-time Equivalent
FY	Fiscal Year
GTCC	Greater-Than-Class C
Hanford	Hanford Site

List of Acronyms and Abbreviations

INEL	Idaho National Engineering Laboratory
IRIS	Integrated Risk Information System
K-25	Oak Ridge K-25 Site
LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LLMW	Low-Level Mixed Waste
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level Waste
MEI	Maximally Exposed Individual
MEPAS	Multimedia Environmental Pollutant Assessment System
Mound	Mound Plant
MWMF	Mixed Waste Management Facility
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
Norfolk	Norfolk Naval Shipyard
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PAEC	Potentially Adverse Effects Concentrations
Pantex	Pantex Plant
PEIS	Programmatic Environmental Impact Statement
PGDP	Paducah Gaseous Diffusion Plant
Pinellas	Pinellas Plant
PLC	Potentially Life-Threatening Concentration
PM_{10}	Particulate matter of aerodynamic diameter less than 10 micrometers
SEIS-I	WIPP Supplement Environmental Impact Statement
SEIS-II	WIPP Disposal Phase Supplemental Environmental Impact Statement
SNF	Spent Nuclear Fuel
SNL-CA	Sandia National Laboratories (California)
SNL-NM	Sandia National Laboratories (New Mexico)
SRS	Savannah River Site
STP	Site Treatment Plan
TLV	Threshold Limit Values
TRUW	Transuranic Waste
TSCA	Toxic Substances Control Act

List of Acronyms and Abbreviations

VOC	Volatile Organic Compound
WIPP	Waste Isolation Pilot Plant
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WVDP	West Valley Demonstration Project
Y-12	Oak Ridge Y-12 Plant

List of Acronyms and Abbreviations

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1. Purpose and Need for Action

Comment (3036)
Protection of the environment should be an element of the WM PEIS purpose and need and should be reflected throughout the PEIS.

Response
Protecting the environment is an important goal of DOE's waste management activities. DOE revised Volume I, Section 2.2, of the WM PEIS to include enhanced protection of the environment, as well as protection of public health and safety, as part of the WM PEIS purpose and need statement. This goal is also reflected throughout the PEIS. For example, Volume I, Section 1.1, states that the PEIS will help DOE continue to protect workers, public health and safety, and the environment.

Each waste-type chapter in the PEIS (Chapters 6 through 10 in Volume I) discusses the health risks and environmental impacts specific to one of the five waste types considered in the WM PEIS. Chapter 12 identifies ways DOE could mitigate potential adverse impacts.

Comment (3331)
DOE intends to use this WM PEIS as a *tool* to help select sites for waste management activities, but the PEIS does not select any specific location. Isn't this the U.S. Department of Energy? Isn't this the agency responsible for managing 54 U.S. sites? Isn't this the agency that is supposed to be sure all sites are meeting the criteria today? Doesn't this document address the treatment, storage, and disposal of radioactive and hazardous waste? Isn't this the agency the American people empowered by Congressional Act? Then why was this document written?

Response
The WM PEIS evaluates the potential environmental consequences of alternative configurations of a nationwide program for managing radioactive and hazardous waste, as discussed in Volume I, Section 1.1. Based on the factors and criteria identified in Section 1.7.3 DOE has identified preferred alternatives and a configuration of sites for each of the five waste types considered in the document. The results of the WM PEIS will provide input on environmental topics which, combined with other considerations (e.g., budget constraints, national priorities, site agreements with States), will contribute to the final decision on a national waste management configuration to be identified in Records of Decision. The WM PEIS will also provide a general point of reference for site-specific NEPA documents prepared to support decisions and locating waste management facilities on particular sites (see Volume I, Section 1.8).

1. Purpose and Need for Action

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2. Proposed Action

Comment (3352)
The Draft WM PEIS states that DOE needs to improve the management of its current and anticipated volumes of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste in order to comply with all laws and to protect public health and safety. Implicit in this statement is that the current management system does not protect human health and the environment as well as it could and is possibly not in compliance with applicable laws. Yet, by DOE's own admission, the facilities that are going to *improve* this situation are not going to be in operation for at least 10 years, and probably longer. That means that the current situation of unacceptable release levels will continue a decade or more. Therefore, the situation for the next 10 to 20 years could have a significant impact on the environment. Yet this impact is not analyzed in the PEIS.

Response
DOE revised the text cited in the comment (Section 2.2) to clarify that DOE will manage its current and anticipated waste volumes in order to comply with all applicable Federal and State laws, to protect public health and safety, and to enhance protection of the environment.

DOE is committed to operating its hazardous and radioactive waste management activities in compliance with applicable regulations and in a way that protects human health and the environment. For purposes of the programmatic analysis the WM PEIS provides, DOE made the generalizing assumption that all waste management facilities necessary to implement a given alternative would be constructed in an initial 10-year period, followed by a 10-year operations period. Exceptions to this assumption would include a full 20-year operations phase (i.e., construction phase not applicable) for the No Action Alternative, and the site-specific operational periods for high-level waste storage facilities, which are discussed in Chapter 9 in Volume I of the WM PEIS. The WM PEIS analysis is highly conceptual and DOE recognizes that construction of actual facilities could occur within a much shorter time period and that waste will begin to be processed at some facilities before construction at all facilities is completed. Nevertheless, DOE believes that the WM PEIS provides a reasonable and conservative estimate of environmental impacts sufficient to support programmatic decisionmaking.

As required by NEPA, the WM PEIS includes an analysis of the impacts of a No Action Alternative. In this PEIS, "no action" is defined as a continuation of current programs. As a part of current programs, some facility upgrades would be necessary to continue to comply with applicable regulations in an efficient, cost-effective manner. Continuing current programs would not result in chronic unacceptable releases because existing DOE waste management facilities routinely meet all regulatory requirements for releases to the environment and would continue to do so. Thus, DOE does not expect significant adverse impacts to the environment from ongoing activities during the period before new waste management facilities begin to operate.

Comment (3539)
The issues addressed in EISs should not be limited to potential problems for which there are practical near-term solutions. EISs "should not be used as tools to sell the development of a piece of property."

Response
The WM PEIS is a national study that examines the environmental impacts of managing DOE's radioactive and hazardous wastes. This strategy is expanding waste management horizons by developing new waste management options and analytical approaches to ensure safe and efficient

management of DOE's radioactive and hazardous wastes, to comply with all applicable Federal and State laws, to protect public health and safety, and to protect the environment.

The PEIS expands existing options and looks into the future to find long-term management solutions for the waste types considered in the document, especially in light of the long-term hazards posed by certain waste materials. The PEIS analyzes candidate DOE sites for the management of its radioactive and hazardous wastes, but is not intended to be used as tools to "sell the development of a piece of property."

3. Waste Management Alternatives

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(No comments were received for this section)

3.1 General Comments, Not Waste-Type Specific

Comment (13)
What will actually be done with DOE wastes?

Response
DOE will manage its wastes by some combination of treatment, storage, and disposal, depending on the waste type. DOE has made no final decisions about how and where to treat, store, and dispose of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste. Rather, DOE is developing a Department-wide strategy for managing these wastes. This WM PEIS evaluates the environmental impacts and costs of management at alternative DOE sites, for the five types of waste. It will be part of the basis for decisions about how and where to manage the waste. Decisions will be announced in Records of Decision (RODs) to be published in the *Federal Register* following publication of the Final PEIS.

Comment (36)
Why would DOE build more storage facilities under the No Action Alternative?

Response
The No Action Alternative represents the status quo of DOE waste management operations, and includes existing or planned waste management facilities. For low-level mixed waste and transuranic waste, current practice is to store waste until treatment and disposal capability is available. The PEIS continues this practice, adding storage capacity at each site to accommodate the additional waste generated during the next 20 years. Impacts for construction and operation of the additional storage are evaluated. For low-level waste, waste is shipped for disposal at one of six currently operating disposal sites. Thus, there is no requirement for additional storage. For high-level waste, additional storage is approved for SRS and Hanford; this was evaluated as planned facilities under the No Action Alternative. No additional storage was assumed for hazardous waste.

Comment (197)
Allow DOE sites to manage and monitor all the Nation's wastes and to be continually scrutinized by the public and government agencies.

Response
DOE is responsible for managing its wastes in accordance with all applicable laws and regulations. The management of non-DOE wastes (e.g., from commercial reactors) is outside the scope of the WM PEIS.

DOE strongly believes that its programs benefit from open exchange and coordination with the public, and with other government agencies. DOE welcomes public input to further improve its waste management activities.

Comment (220)
DOE should factor into the WM PEIS analysis the possibility that it will have an additional waste burden from failed commercial facilities. The analysis should factor in any change in "economy of scale" from DOE-generated waste processing to waste generated elsewhere.

Response
DOE is not responsible for radioactive waste from commercial facilities. Therefore, such waste is beyond the scope of the WM PEIS. The U.S. Nuclear Regulatory Commission (NRC) or a State delegated by NRC to manage radioactive waste (NRC Agreement State) is responsible for regulating commercial facilities.

Comment (391)
DOE needs to examine waste management issues across the complex to gain a national "big picture."

Response
DOE believes that the WM PEIS provides the national "big picture" that will help with long-term planning efforts and be part of the basis for future decisions concerning the configuration of DOE's waste treatment, storage, and disposal complex.

Comment (487)
If a waste program is not safe it should not be in anyone's backyard.

Response
The purpose of this WM PEIS is to enhance, on a national level, the management of DOE's current and anticipated volumes of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste in order to ensure safe and efficient management of these wastes, to comply with applicable laws and regulations, and to protect public health and safety and the environment. This study provides information on the impacts to alternative DOE sites. DOE will use this information in deciding where to locate additional treatment, storage, and disposal facilities for each waste type.

The WM PEIS analyzes impacts to human health and the environment for the proposed waste management alternatives. It also considers the cumulative impacts when the waste management actions are added to other past, present, and reasonably foreseeable future actions. If a particular site is chosen for a new waste management operation as a result of the PEIS analysis, additional sitewide or project-level NEPA documentation would be prepared.

Comment (542)
The project [Department-wide waste management as described in the WM PEIS] is consistent with the goals and objectives of the State of South Carolina, Grant Services Unit.

Response
Thank you for your comment.

Comment (1147)
We prefer alternatives that minimize transportation of these waste products as much as practicable.

Response
WM PEIS decision criteria and factors, which DOE used to select preferred alternatives, include favoring selection of alternatives and sites to minimize adverse environmental impacts and balancing the number of shipments with potential environmental risks, safety consequences, public concerns, mission needs, and costs. These criteria and factors are described in Volume I, Section 1.7.3.

3.1 General Comments, Not Waste-Type Specific

The PEIS includes a detailed assessment of risks associated with accidents from both rail and truck transportation, including low probability/high consequence and high probability/low consequence accidents. DOE found that risks from transportation accidents would be low under all alternatives. The Decentralized Alternative, however, would minimize transportation, while the Regionalized and Centralized Alternatives involve increased transportation.

Section 3.7 in Volume I of the WM PEIS provides DOE's preferred alternatives and the reasons they are preferred.

Comment (1288)
The impact of importing wastes to Livermore is an issue within the community.

Response
Lawrence Livermore National Laboratory (LLNL) is included in some of the proposed waste management alternatives evaluated in the WM PEIS for low-level mixed, low-level, and transuranic wastes, as described in Sections 6.3, 7.3, and 8.3 in Volume I, respectively. DOE analyzed the potential human health risks and environmental impacts associated with management activities at LLNL for each of these waste types and found that under all the alternatives risks and impacts would be small.

Comment (1570)
The WM PEIS only addresses the alternative of waste storage in perpetuity; it should address the alternative of storage predicated on total elimination of the wastes.

Response
The WM PEIS evaluates storage, treatment, and disposal of low-level mixed waste and low-level waste; treatment and storage of transuranic waste; and treatment of hazardous waste. However, because of DOE's large waste inventories and the wastes generated by ongoing operations, complete elimination of radioactive and hazardous waste does not appear feasible, even under the most effective pollution prevention plans. Volume IV, Appendix G, of the WM PEIS describes DOE's Pollution Prevention Program, DOE's waste reduction goals, and how waste management activities could be affected by pollution prevention efforts.

Comment (1638)
DOE's waste management system should reflect that the environmental management mission is dynamic and changing with time; hybrid and/or evolving configurations of management systems might be required.

Response
DOE is not constrained to select the specific configurations analyzed in the alternatives in the WM PEIS. It can select hybrid configurations as long as the impacts of alternatives analyzed in the WM PEIS include the impacts of the hybrid alternative. DOE has revised the text in Volume I, Section 3.4, of the WM PEIS to clarify how a hybrid alternative approach might be used. DOE's preferred waste management alternatives, and the reasons they are preferred, are identified in Section 3.7 in Volume I of the Final PEIS.

3.1 General Comments, Not Waste-Type Specific

Comment (1762)
All waste types and waste volumes should be on the table for the public to strategize about. Transuranic waste and low-level mixed waste are pulled out of the decisionmaking process because of WIPP and the Federal Facility Compliance Act.

Response
The PEIS addresses the management of five waste types: low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste. For transuranic waste, the PEIS analyzes potential locations for treatment and storage. DOE is analyzing the level of treatment for disposal and whether to dispose of transuranic waste at WIPP in the WIPP SEIS-II. For low-level mixed waste, the PEIS analyzes treatment and disposal decisions, but not storage because DOE assumes that it will store low-level mixed waste on the sites where it is generated until treatment and disposal. The low-level mixed waste alternatives were developed in parallel with the Federal Facility Compliance Act Site Treatment Plans. DOE's preferred alternatives for managing the five waste types and the reasons they are preferred are discussed in Section 3.7 in Volume I.

Comment (1937)
Clarify if ANL-E waste would be shipped to Idaho National Engineering Laboratory (INEL).

Response
None of the 36 alternatives analyzed in the WM PEIS include wastes generated at ANL-E being shipped to INEL. Chapters 6 through 10 in Volume I of the PEIS provide more detail on the alternatives analyzed.

Comment (2113)
None of the proposed alternatives are acceptable; rather, a moral change in DOE is required.

Response
Thank you for your comment.

Comment (2148)
Store the waste in an aboveground, monitorable facility.

Response
DOE assessed waste storage under the WM PEIS No Action Alternative. Most of this waste is stored in aboveground monitored facilities. As a matter of policy, DOE views waste storage as a temporary solution that would only defer a decision on disposal.

Comment (2306)
Assume that there will be onsite treatment. That is part of minimizing transportation.

Response
As identified in Volume I, Section 2.1, of the Final WM PEIS, DOE's proposal includes improving treatment of low-level mixed waste, low-level waste, transuranic waste preparatory to geologic disposal, and nonwastewater hazardous waste.

3.1 General Comments, Not Waste-Type Specific

Alternatives evaluated in the WM PEIS generally incorporate some type of onsite treatment. This treatment varies from the minimum treatment required to transport the waste, to treatment to meet Resource Conservation and Recovery Act (RCRA) land disposal restrictions for low-level mixed waste, for example. In general, transportation of waste offsite for treatment would be least under the Decentralized Alternatives. Note, however, that some types of treatment (e.g., solidification) actually increase the volume of waste that would need to be transported. This is because a solidifying agent such as cement might be added to the waste. U.S. Department of Transportation regulations require that some types of waste be solidified before they are transported.

DOE will consider transportation requirements in its WM PEIS evaluations (see Volume I, Sections 6.4.2, 7.4.2, 8.4.2, 9.4.2, and 10.4.2, and Volume IV, Appendix E). DOE will need to balance the number of shipments with potential environmental risks, safety consequences, public concerns, mission needs, and costs.

Comment (2317)
DOE should store nuclear waste as safely as possible near where it is generated and stop creating nuclear wastes.

Response
One of the four broad categories of alternatives analyzed in the WM PEIS is the Decentralized Alternative. Under this alternative, wastes would be managed as close to their point of origin as possible.

Radioactive and hazardous wastes were and are generated by DOE during national security and energy research facility, decontamination and decommissioning, and environmental restoration. However, DOE is strongly committed to pollution prevention. Appendix G (Volume IV) of the WM PEIS describes DOE's Pollution Prevention Program, waste reduction goals, and the implications of these activities for DOE's waste management strategy.

Comment (2416)
The various waste management alternatives for the different waste types do not, in some cases, cover a reasonable range of alternatives. A review of the list of choices, the preferred alternatives, and the tables showing treatment, storage, and disposal locations suggest that the real range of alternatives that makes sense is much narrower than the total range of alternatives analyzed.

Response
As discussed in Volume I, Section 3.2, the CEQ regulations implementing NEPA require Federal agencies to include a discussion of reasonable alternatives and provide sufficient information for each alternative so that reviewers can evaluate the comparative merits of those alternatives. Sections 1.7.3 and 3.5 in Volume I discuss the methodology for identifying alternatives. The WM PEIS analyzes four broad categories of alternatives that represent reasonable alternatives where DOE can manage its waste. These are No Action, Decentralized, Regionalized, and Centralized. CEQ regulations require that the No Action Alternative be analyzed. The sites identified in alternative configurations were chosen for evaluation based on the volume of waste they currently have in inventory, the amount of waste they expect to generate over the next 20 years, the waste's origin and treatment requirements, the waste treatment facilities at each site, and the requirements for transportation. DOE believes that application of this methodology produced a set of reasonable alternatives of the broadest range.

3.1 General Comments, Not Waste-Type Specific

Comment (2655)
Has the possibility of returning the majority of the waste back to the original mining sites been evaluated, since they are already radioactive?

Response
The CEQ regulations implementing NEPA require an EIS to evaluate all reasonable alternative actions or, where there are potentially a very large number of alternatives, a reasonable number of examples covering the full spectrum of alternatives. In general, mining sites are not necessarily located where existing geologic factors would help to contain wastes onsite. Furthermore, the characteristics of wastes are vastly different from those of the original materials that were extracted from the mines and might often be mixed with hazardous substances. Placing low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste in mining sites is not a reasonable alternative for these reasons.

Comment (3268)
The WM PEIS should not base alternatives on the viability of facilities that might or might not ever be available, and for which the future safety and effectiveness are questionable. Rather, DOE should base alternatives on long-term, monitored, and retrievable storage options. Such storage options should allow for upgrades or replacements. Disposal cannot realistically be considered as an alternative when adequate technology for disposal does not exist.

Response
DOE does not agree that the alternatives analyzed in the WM PEIS should be limited to long-term, monitored and retrievable storage options. Waste storage is considered to be a temporary solution and DOE believes decisions on disposal need to be made. The WM PEIS analysis considered the impacts of four categories of alternatives. With the exception of the No Action alternatives, the analysis considered the risk, impacts, and cost associated with the construction of treatment, storage, and disposal facilities suitable to meet the capacity requirements at each proposed site. These facilities would be constructed to meet EPA and DOE requirements, assuming best available technologies. Data for these technologies are generally based on actual operating experience; thus, adequate technology is considered to be available. Technologies and treatment processes are discussed for each waste type, other than high-level wastes, in Sections 6.2.2, 7.2.2, 8.2.2, and 10.2.2. The high-level waste analysis only considers storage of high-level waste that has already been treated. Under the No Action alternatives, minimal construction was assumed necessary. This allows for comparison of the other alternatives to the No Action, which helps to serve as a baseline.

Comment (3332)
None of the alternatives presented in the WM PEIS are good enough. Recycling is the only good alternative. DOE, you will not reprocess and reclaim plutonium. It wastes our tax dollars and creates huge quantities of "ominous" wastewater.

Response
The DOE Pollution Prevention Program encompasses those activities that involve source reduction and recycling of all waste and pollutants. Volume IV, Appendix G, of the WM PEIS provides a description of DOE's Pollution Prevention Program and a discussion of how DOE's pollution prevention efforts and practices could affect the waste volume that waste management facilities receive and, consequently, the need for such facilities.

3.1 General Comments, Not Waste-Type Specific

The processing or reclamation of plutonium is not part of the scope of this PEIS. DOE will make decisions on plutonium based on other EISs including the Fissile Materials PEIS, the Stockpile Stewardship and Management PEIS, the Pantex Sitewide EIS, the Plutonium Vault EIS, and the Plutonium Residues EIS.

Comment (3338)
While one alternative seems in the abstract to show benefits in one area (e.g., the economy), it shows increased risk in another (e.g., transportation risks or potential impacts to groundwater). For example, the Decentralized Alternatives put more groundwater at risk, while lessening transportation risks. Clean, healthy water is essential to survival on the planet, and since this is all the water we have, keeping it safe is paramount.

Response
As pointed out by the commentor, the selection of different alternatives would result in different impacts. For example, the magnitude of the transportation-related activities varies with each alternative, ranging from minimized transportation of waste for Decentralized Alternatives to significant transportation of waste for some Centralized Alternatives.

To the extent possible, the WM PEIS analyzes groundwater resources impacts as well as transportation risks. DOE considered these and other impacts in its identification of preferred alternatives for each waste type. Actual programmatic decisions will be documented in Records of Decision published in the *Federal Register*. When selecting locations for waste management facilities on selected sites, DOE will consider the results of existing relevant and required new sitewide or project-level NEPA reviews.

Comment (3349)
NEPA requires an EIS to present the impacts of the proposal, alternatives to the proposal, and preferred alternatives. DOE did not identify a preferred alternative for low-level waste treatment or disposal, transuranic waste treatment, or low-level mixed waste disposal. It is impossible to accurately comment on the proposals if we do not know exactly what is being proposed.

Response
The CEQ regulations that implement NEPA require that preferred alternatives be identified in Final EISs. Preferred alternatives need only be identified in draft EISs if the agency has a preference at the time the draft is prepared.

DOE's proposed action is the improved management of five types of waste. In the Draft WM PEIS, DOE outlined four broad categories of alternatives for managing these waste types, and identified preferred alternatives for low-level mixed waste, high-level waste, and hazardous waste. DOE sought public comments on the alternatives and also invited members of the public to identify their preferences for waste management alternatives and provide input on decision criteria to assist DOE in selecting preferred alternatives. DOE's preferred alternatives for all waste types and the reasons they are preferred are identified in Section 3.7 in Volume I of the Final WM PEIS.

3.1 General Comments, Not Waste-Type Specific

Comment (3350)
Commentors are concerned that DOE will present "hybrid" alternatives in the Final WM PEIS that were not proposed in the draft. This would violate NEPA and would deprive commentors of the opportunity to be fully informed concerning the proposals.

Response
NEPA requires DOE to analyze reasonable alternatives. The WM PEIS alternatives were developed and defined to incorporate all possible actions of DOE concerning waste management. As described in Volume I, Section 3.4, of the WM PEIS, the waste management configuration that DOE ultimately selects for a particular waste type is not necessarily limited to one of the alternatives presented. A hybrid alternative could be developed that would incorporate components from one or more of the alternatives analyzed. For example, DOE may choose to treat a particular waste type on a regionalized basis and dispose of it at a centralized location. Another example would be to select a disposal site analyzed under a centralized alternative and additionally select a second disposal site analyzed under a regionalized alternative.

The preferred alternatives are identified in Volume I, Section 3.7, of the Final WM PEIS. The waste-type chapters provide the impacts for the preferred alternatives. (See Volume I, Sections 6.16, 7.16, 8.16, 9.16, and 10.16, of the Final WM PEIS.)

Comment (3351)
All of the WM PEIS alternatives are limited to treating, storing, or disposing of waste. This organization of the PEIS is questionable. All alternatives basically propose to do the same thing, but in different places. The PEIS should present the environmental impacts of the proposal and the alternatives in comparative form, and sharply define the issues and provide a clear basis for choosing among options. By lumping all of the potential activities under three broad terms, DOE robs the public of information about the sharp differences in all of the reasonable alternatives of what can be done with the waste. For example, what about the alternative of detoxification? Is this a reasonable alternative? If detoxification is not a reasonable alternative, then DOE should explain why.

Response
DOE designed the WM PEIS to assist in the formulation of a broad national waste management strategy, including the future configuration of the DOE waste management complex. Although the configuration is analyzed on the basis of impacts related to treatment, storage, and disposal operations using generic technologies, the study does not focus on specific technologies or technology selection (e.g., detoxification). Appendix H in Volume IV of the WM PEIS describes several technologies that might be used to properly manage these wastes once the sites and configuration are selected. Hazardous waste and low-level mixed waste could contain toxic constituents. These types of waste are treated and disposed of in accordance with RCRA requirements.

Comment (3552)
The WM PEIS analyzes too many alternatives. The decision to develop multiple options unique to each waste type results in an unmanageable number of alternatives. It is not clear how the different alternatives represent a range of environmental, cultural, human health, and socioeconomic impacts.

3.1 General Comments, Not Waste-Type Specific

Response
The four broad categories of alternatives considered in the WM PEIS are the No Action, Decentralized, Regionalized, and Centralized Alternatives. However, the number of possible alternatives under these broad categories is vast, because five waste types, three management activities (treatment, storage, and disposal), and 17 major sites are evaluated. Thus, there are many possible combinations for the numbers and locations of DOE sites for treatment, storage, and disposal facilities. To narrow these combinations to a level that would permit meaningful analysis, DOE selected representative alternatives for analysis under each category.

DOE developed and defined the alternatives based on waste origin, and character; current and projected volumes and locations within the DOE complex; existing facilities and capabilities; and specialized treatment and disposal requirements. Evaluation of each alternative included impacts from the alternatives, such as human health risks; environmental, cultural, transportation and socioeconomic impacts; and costs associated with the range of waste treatment, storage, and disposal activities available to DOE.

Comment (4053)
The weapons and nuclear fuel complexes continue to produce tons of liquid and solid radioactive wastes that require temporary storage at the sites where they are generated. After a few years, these sites will inevitably evolve into permanent waste storage facilities that will be used to take in wastes from other facilities or civilian generators, whether local communities accept this outcome or not. The WM PEIS does not offer the public genuine alternatives to the continued environmental destruction of this country by further weapons research, development, and testing.

Response
This WM PEIS is a nationwide examination of the potential environmental impacts of managing five types of radioactive and hazardous wastes that result primarily from nuclear defense activities--the development, production, and testing of nuclear weapons at a variety of sites located around the United States. DOE needs to enhance its capability for managing its current and anticipated volumes of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste in order to ensure continued safe and efficient management of these wastes, to comply with all applicable Federal and State laws, and to protect public health and safety and the environment. For each waste type, facilities are needed to treat, store, and dispose of the waste. For the first time, DOE has attempted not only to examine in an integrated fashion the impacts of Department-wide waste management decisions for each waste type, but also the cumulative impacts for all the waste facilities at a given site.

Comment (4442)
The WM PEIS Summary document should explain why Regionalized and Centralized Alternatives involving sites that do not have the largest volumes of waste were eliminated. This could involve quantitative sensitivity analyses of the tradeoffs between transportation risks (assuming maximum use of trains for waste transportation) and any differences in the risk to the maximally exposed individual (and to the population for the general public versus workers), if a given amount of waste is treated at one site versus another. The Draft WM PEIS did not provide definitive analysis showing that siting alternatives involving sites with the largest volumes of waste correspond to those that minimize impacts on the general public and the environment. This issue should be evaluated.

Response
Section 3.5 in Volume I of the WM PEIS states that in order to determine reasonable proposed sites for waste management facilities, DOE determined where the largest waste volumes are located and where transportation requirements would be minimized. However, waste volume was not the sole criterion used to identify sites for analysis. The character of the waste, specialized treatment requirements, and existing facilities were also taken into account. For example, some wastes that require special treatment, such as remote-handled low-level mixed waste (LLMW), alpha-contaminated low-level waste, and remote-handled transuranic waste, were analyzed separately, and treatment sites were chosen for analysis based on the volumes requiring special treatment, rather than on total volumes. In some cases, treatment facilities could be used for more than one waste type. Therefore, some sites were evaluated as candidate sites even where the volume of a particular waste type was not among the largest.

An advantage of regionalizing or centralizing waste management at the sites with the largest waste volumes is that these are generally larger sites with large buffer zones between the waste management facilities and the site boundaries. However, the Final PEIS now includes the results of a collective offsite population impacts analysis based on hydrology and site size/population density factors (Section 5.4.1.2.3 in Volume 1). This analysis indicates that sites like Hanford, NTS, INEL, LANL, and Pantex might be better suited for disposal than other sites.

3.2 General Comments, Waste-Type Specific

Comment (2870)
Why is there no preferred alternative for transuranic waste, since most of the transuranic waste is mixed waste and subject to the Site Treatment Plans, as is the low-level mixed waste? Note also, low-level mixed waste and transuranic waste alternatives should reflect the recent court decision, and DOE commitment to build a mixed waste processing facility at INEL.

Response
Approximately 60% of transuranic waste is mixed waste. However, for purposes of the WM PEIS analysis, all transuranic waste was considered to be mixed waste. The uncertainties associated with the treatment of transuranic waste and the WIPP facility at the time the Draft WM PEIS was developed did not allow for selection of a transuranic waste preferred alternative. While the Draft WM PEIS did not provide a preferred alternative for transuranic waste, the Final WM PEIS, consistent with the requirements of NEPA, identifies the preferred alternative for transuranic waste treatment and storage in Volume I, Section 3.7.

NEPA requires DOE to analyze all reasonable alternatives, even those that may not necessarily reflect" court decisions. Low-level mixed waste treatment at INEL was considered in the alternatives analyzed. DOE assumes the court decision referred to in the comment is the Consent Order based on the settlement agreement of October 1995 that resolved litigation between the State of Idaho and DOE and the Department of the Navy. DOE issued an amended Record of Decision for the SNF/INEL EIS to reflect the provisions of this Consent Order, which includes the requirements for DOE to commence building and operating a mixed waste treatment facility at INEL.

3.2.1 Low-Level Mixed Waste

Comment (2436)
There is essentially no range of alternatives for the treatment and disposal of remote-handled low-level mixed waste. In all alternatives, this waste is treated and disposed of at Hanford, INEL, ORR, and SRS.

Response
Remote-handled wastes often require specific technologies for safe treatment and disposal that are not routinely available at all sites. Because of concern for public health and safety and because transporting remote-handled waste is very costly, DOE is also committed to reducing the amount of remote-handled wastes transported between facilities. The WM PEIS analyzed remote-handled low-level mixed waste at the four sites where the waste currently exists--Hanford, INEL, ORR, and SRS. Because such wastes often require specific technologies for safe treatment and disposal, it would be unreasonable to consider transporting remote-handled wastes to other sites that have little, if any, experience with these wastes.

Comment (3017)
DOE should evaluate the low-level mixed waste alternative that replicates the Federal Facility Compliance Act (FFCAct) activities that the sites and states have committed to in consent agreements.

Response
To ensure that any possible configurations in the Site Treatment Plans are included in the WM PEIS analysis, DOE evaluated seven broad alternatives for management of low-level mixed waste (see Volume I, Chapter 6). Volume I, Section 3.7, of the Final WM PEIS provides the preferred alternative for low-level mixed waste management, along with the supporting rationale.

3.2.2 Low-Level Waste

Comment (1672)
For the Hanford Site and NTS, costs are similar for the centralized disposal of all low-level waste without treatment when rail or truck transportation is used. The next most cost-competitive option is $2 billion more expensive. The most cost-effective Regionalized Alternative would probably be disposal facilities at NTS and Hanford, but this alternative was not included.

Response
To the extent possible, the Regionalized Alternatives were selected to include sites that were centrally located in the regions analyzed. Therefore, the two-site Regionalized Alternatives incorporated an eastern site and a western site. This logic is supported by the waste volumes. According to Volume I, Figure 7.1-1, 981,300 cubic meters of low-level waste are located in the east and 345,100 cubic meters are located in the west.

As described in Section 7.14, the total costs of low-level waste Regionalized Alternative 7 (disposal at SRS and NTS) would be $13.9 billion--$2.8 billion more than the $11.1 billion Centralized Alternative 2 (disposal at NTS). Truck transport costs for Regionalized Alternative 7 would be $0.67 billion; for Centralized Alternative 2 they would be $2.25 billion. Assuming that approximately 60% of the $1.56 billion difference in truck transportation costs is due to shipping the eastern sites' wastes to a western site (NTS), similar shipping charges would result, regardless of whether wastes were shipped to NTS or Hanford. Therefore, an alternative that regionalizes disposal at NTS and Hanford is likely to cost more than an alternative that allows regionalized disposal at SRS and NTS or Hanford. Of course, if the geographic distribution of waste volumes changed substantially, these relationships could also change.

Comment (2048)
A commentor at the Brookhaven National Laboratory (BNL) public hearing stated that the Low-Level Radioactive Waste Siting Commission has prohibited the siting of disposal sites for radioactive wastes over a sole-source aquifer.

Response
DOE will comply with all applicable Federal and State regulations when siting waste management facilities. The WM PEIS identifies the lower aquifer system (Magothy and Raritan Formations) and the Pleistocene Upper Glacial Aquifer as sole-source aquifers and as part of the affected environment for BNL. The existence of these sole-source aquifers is, therefore, considered in the WM PEIS analysis.

Comment (2867)
In Volume I, Chapter 7, the alternatives listed do not analyze the impacts of the importation, treatment, and disposal of an intermediate amount of low-level waste to INEL. In the footnotes for all low-level waste alternatives except No Action, alpha low-level waste would be treated and disposed of at the closest of five sites. The alpha low-level waste stored at INEL is considered to be low-level mixed waste and will be treated along with the transuranic waste stored there, and both disposed of in the WIPP facility. In addition, the low-level waste waste acceptance criteria for the current disposal facility prohibits the disposal of low-level waste containing more than 10 nanocuries per gram of transuranic radionuclides.

Response

DOE used standard definitions for each of the waste types addressed in the WM PEIS that do not reflect the subtleties of site-specific definitions or waste characteristics. Additionally, the programmatic nature of the WM PEIS did not allow for the inclusion of site-specific waste acceptance criteria.

3.2.3 Transuranic Waste

Comment (39)
It does not seem reasonable to ship transuranic waste (TRUW) from INEL to the Hanford Site or to the Oak Ridge Reservation (ORR) for treatment and then to ship it back to New Mexico for storage, when INEL is one of the four sites with the largest volume of transuranic waste.

Response
Under the Decentralized Alternative and all Regionalized Alternatives, INEL would treat its own contact-handled TRUW and then transport the treated waste to WIPP for disposal. INEL has more contact-handled TRUW than any other DOE site. However, the Hanford Site is estimated to have approximately 10 times more remote-handled TRUW than INEL; thus, the Regionalized Alternatives assume that INEL would transport its remote-handled TRUW to the Hanford Site for treatment prior to disposal at WIPP. Different facilities are used for treatment of remote-handled TRUW and contact-handled TRUW, and the consolidation of treatment of remote-handled TRUW at the site with the greatest quantity of that waste type (Hanford) is a reasonable alternative. Under none of the TRUW alternatives described in Volume I, Section 8.3, does INEL ship TRUW to ORR for treatment.

Comment (190)
DOE should modify the transuranic waste No Action Alternative to (1) include storing plutonium-238 onsite until radioactive decay decreases the high exposure potential during treatment and handling and (2) include transporting plutonium-239 directly to WIPP, the designated repository for transuranic waste, thereby reducing treatment and handling costs.

Response
The WM PEIS alternatives include a No Action Alternative under which transuranic waste would be stored onsite under the assumption that WIPP will not be available during the 20-year period of analysis. Shipment of plutonium-contaminated transuranic waste would not be consistent with the definition of the No Action Alternative. Storage of plutonium-contaminated transuranic waste is consistent and was evaluated under the No Action Alternative for the 20-year period of analysis. The impacts of storage beyond 20 years are analyzed as part of the No Action Alternatives in the WIPP SEIS-II. Other alternatives consider the impacts of treating transuranic waste to various treatment levels and at various sites prior to shipment to WIPP for final disposal. Finally, under the Centralized Alternative, DOE evaluated the impacts of shipping all of the contact-handled transuranic waste to WIPP for both treatment and disposal. Some level of treatment was assumed at each site for all alternatives involving transportation, to ensure safe shipment of the transuranic waste and to meet regulatory requirements for transportation, as well as to meet acceptance criteria at WIPP. Therefore, for example, some treatment of plutonium-238 is assumed in every alternative with transportation. DOE did not single out individual radionuclides for separate management at each site; this level of complexity was beyond scope of this analysis for purposes of the programmatic decisions being considered. However, such management decisions would be appropriate for each site, and the WM PEIS notes that plutonium-238 would require special mitigation measures beyond those considered in the WM PEIS.

Comment (915)
DOE's preference for transuranic waste treatment and storage sites is not clear.

Response
The Draft WM PEIS did not identify a preferred alternative for transuranic waste. NEPA and CEQ regulations only require the agency to identify a preferred alternative in a draft EIS if the agency has a preference at the time the draft is released for a public review. However, the agency must identify a preferred alternative in its final EIS. DOE identifies its preferred alternative for transuranic waste treatment and storage and the reasons it was designated the preferred alternative can be found in Volume I, Section 3.7, of the Final PEIS.

Comment (1564)
A commentor is concerned that the Centralized Alternative for transuranic waste treatment at WIPP was not previously evaluated.

Response
The PEIS includes a Centralized Alternative for transuranic waste, under which contact-handled transuranic waste would be treated at the location of final disposition. DOE assumed this would be WIPP. DOE identifies its preferred alternative for transuranic waste treatment and the reasons it was designated the preferred alternative can be found in Volume I, Section 3.7, of the Final PEIS. Selection of the Centralized Alternative for transuranic waste would necessitate a project-level NEPA review for the treatment facility.

Comment (2385)
DOE should analyze more fully the treatment options considered [e.g., as presented for the transuranic waste (TRUW) Centralized Alternative]. The WM PEIS fails to address the feasibility of safe shipments of untreated plutonium-238 combustible wastes from the Savannah River Site (SRS) and Los Alamos National Laboratory (LANL) to an offsite facility.

Response
Volume I, Section 8.3.4, describes the TRUW Centralized Alternative. Under this alternative, SRS would ship all of its TRUW to WIPP for treatment to meet land disposal restrictions and for disposal. No onsite treatment of TRUW is assumed at SRS under this alternative. LANL would ship its contact-handled TRUW to WIPP for treatment to meet land disposal restrictions and for disposal. LANL would ship its remote-handled TRUW to Hanford for treatment and then to WIPP for disposal. Treatment to meet land disposal restrictions would include thermal treatment of combustibles.

As described in Volume I, Section 8.2.3, DOE assumed that facilities would be made available at sites requiring retrieval, characterization, treatment, repackaging, and shipment of TRUW to meet U.S. Department of Transportation or RCRA transportation regulations, and to meet State shipping and receiving requirements. Therefore, DOE assumed that plutonium-238 combustible wastes would be treated, if necessary, and, therefore, would meet all shipping requirements and be safe to ship.

Comment (2405)
Section 6.2 of the WM PEIS Summary document states that SRS would receive transuranic waste from other sites under some alternatives. Please describe what SRS will be asked to take and from where.

Response
Volume I, Section 8.3, of the WM PEIS presents details of the transuranic waste alternatives evaluated, including the Regionalized Alternatives that involve shipment of waste from other sites to SRS for

3.2.3 Transuranic Waste

treatment. Under the Regionalized Alternatives, SRS would treat contact-handled transuranic waste from six other sites: ANL-E, the Mound Plant, ORR, Paducah Gaseous Diffusion Plant (PGDP), the University of Missouri, and West Valley Demonstration Project (WVDP). The contact-handled transuranic waste from these sites would comprise about 17% of the transuranic waste to be treated at SRS under these alternatives. Under the No Action, Decentralized, and Centralized Alternatives, no transuranic waste would be shipped to SRS.

Comment (3146)
The WM PEIS does not provide an adequate basis for proceeding with WIPP, nor does it consider the range of reasonable alternatives to WIPP. Although the number of fatalities and costs suggest implementing the No Action Alternative for transuranic waste (TRUW), DOE is still committed to begin emplacement of wastes at WIPP, reasoning that extended storage under the No Action Alternative is not in compliance with RCRA. The WM PEIS must analyze alternatives for storage that would comply with RCRA.

Response
DOE believes that the WM PEIS includes reasonable alternatives sufficient to support programmatic decisions on TRUW treatment and storage. The No Action Alternative does evaluate, for the period of analysis (20 years), the impacts if there is a delay in the receipt of TRUW at WIPP and waste continues to be stored at the generating sites. As described in Volume I, Section 1.1, the WM PEIS analyzes alternatives for treating and storing TRUW preparatory to proposed disposal at WIPP. The WM PEIS does not study the repository itself, nor will it be used to support decisions on TRUW disposal at WIPP.

The decision of whether to store TRUW or treat TRUW for disposal is contingent on the DOE disposal decision for WIPP, not on whether continued TRUW storage would comply with RCRA. The disposal impacts from operating WIPP as a TRUW repository are addressed in the WIPP SEIS-II, which analyzes the potential environmental impacts associated with the operation of WIPP and the minimum level of TRUW treatment needed. The WIPP SEIS-II No Action Alternatives, in part, evaluate the continued management of TRUW at the generator and/or treatment sites, and decommissioning of the WIPP facility, if TRUW were not disposed of at WIPP. A discussion of the relationship between the WM PEIS and the WIPP SEIS-II is provided in Volume I, Section 1.8.1.

Comment (3148)
The WM PEIS contains no discussion of storage and disposal alternatives for the volumes of retrievably stored transuranic wastes that do not meet the WIPP waste acceptance criteria or for other reasons could not be sent to WIPP.

Response
For purposes of analysis, the WM PEIS assumes that all transuranic waste shipped to WIPP for disposal will meet the WIPP waste acceptance criteria. Once the waste acceptance criteria are finalized, this could mean that certain transuranic waste would have to be treated to meet these criteria. Only the wastes that meet final WIPP waste acceptance criteria will be accepted for disposal at WIPP, if WIPP becomes operational as a transuranic waste repository.

3.2.3 Transuranic Waste

Comment (3150)
The WM PEIS does not include a reasonable Centralized Alternative for transuranic waste, because the Centralized Alternative considered assumes that TRUW would be treated at WIPP, even though the WIPP Land Withdrawal Act does not authorize such an activity.

Response
Under the Centralized Alternative, DOE would not ship all transuranic waste to WIPP for treatment. DOE would ship all contact-handled transuranic waste to WIPP for treatment to meet land disposal restrictions and for disposal and remote-handled transuranic waste would be shipped to the Hanford Site and ORR for treatment to meet land disposal restrictions prior to disposal at WIPP. Consolidation of remote-handled transuranic waste at one site for treatment was not considered because a large number of trips would be required, and most remote-handled transuranic waste requires extensive treatment (but not necessarily to meet land disposal restrictions) before it can be shipped.

Agencies are required under NEPA to analyze reasonable alternatives, even if the alternatives are not within the agency's jurisdiction (e.g., in conflict with current law). While the WIPP Land Withdrawal Act does not make provision for treatment activities at WIPP, for purposes of analysis and compliance with NEPA, DOE considered WIPP to be a reasonable WM PEIS siting alternative. Consideration as a siting alternative in the WM PEIS does not mean a site will be selected to perform waste management activities.

Comment (3212)
The WM PEIS does not analyze options to WIPP as the national repository for transuranic waste. WIPP might not open, and even if it does, it will not hold all of the transuranic waste in the DOE complex (this includes transuranic waste that is currently buried, plus waste that will be generated from remediation efforts). DOE should analyze all options for transuranic waste, including other disposal sites, extended monitored retrievable storage at the point of generation, regionalized and centralized storage, and the adequacy of current treatment standards (WIPP waste acceptance criteria) for such storage. The impacts of transporting waste to WIPP, and other options, should be analyzed in the WM PEIS.

Response
DOE believes that the WM PEIS includes reasonable alternatives to support programmatic decisions on national transuranic waste treatment and storage configurations. The WM PEIS does not however, analyze the environmental impacts of disposal at WIPP or alternative locations for a geologic repository. For purposes of analysis, DOE assumed that WIPP will become operational. Although the WM PEIS does not evaluate WIPP or its suitability for disposal, the No Action Alternative does evaluate for the period of analysis (20 years) the impacts if there is a delay in the receipt of transuranic waste at WIPP and waste continues to be stored at the generating sites.

DOE is analyzing impacts of disposal and continued storage of transuranic waste in the WIPP SEIS-II and will make both disposal and transuranic waste treatment decisions based on the WIPP SEIS-II analysis. The WIPP SEIS-II No Action Alternatives evaluate the continued management of transuranic waste at the generator and/or treatment sites, and decommissioning of the WIPP facility. These alternatives analyze environmental impacts if transuranic waste were not disposed of at WIPP. The WM PEIS will provide a basis for decisions on where any transuranic waste treatment and storage facilities would be sited.

3.2.3 Transuranic Waste

It is true that during the 35-year planned operational life of WIPP, the amount of transuranic waste projected to be available for disposal could exceed the statutory capacity of WIPP. DOE is in the early planning stages of evaluating options for disposal of this excess transuranic waste.

Comment (3609)
Legally, can WIPP be used as the central treatment location? Can liquids go to WIPP? Even if they are grouted? Can soils go to WIPP? Even if they are grouted or organically solidified?

Response
Agencies are required under NEPA to analyze reasonable alternatives, even if the alternatives are not within the agency's jurisdiction (e.g., in conflict with current law). While the WIPP Land Withdrawal Act does not provide for treatment activities at WIPP, for purposes of analysis and compliance with NEPA, DOE considered WIPP to be a reasonable WM PEIS siting alternative. Consideration as a siting alternative in the WM PEIS does not mean a site will be selected to perform waste management activities.

Current planning basis WIPP waste acceptance criteria would limit liquid waste forms at WIPP to less than 1% per container. Grouted or organically solidified transuranic waste forms would be acceptable at WIPP if they met the other requirements of the waste acceptance criteria. The WIPP SEIS-II evaluates what types of transuranic waste, if any, would be disposed of at WIPP and what type of treatment would be required for disposal of waste at WIPP.

Comment (3620)
If the repackaging of transuranic waste has or will commence under the No Action Alternative, then we find the characterization of the No Action Alternative unsatisfactory as well as an abuse and violation of NEPA requirements. Repackaging is in itself a major action that could significantly effect the environment. Also, if repackaging of transuranic waste has or will commence under the No Action Alternative, then the only difference between the No Action Alternative and the other alternatives is simply transportation of the wastes.

Response
As described in Section 8.3.1, the No Action Alternative evaluates treatment to WIPP-WAC only for future transuranic waste and does not assess the impacts of removing transuranic waste from retrievable storage. However, as stated in WM PEIS Section 8.14, under the No Action Alternative, DOE would only treat waste that required urgent repackaging to prevent leakage at the site. The packaging would not be sufficient to allow transportation to other sites.

Comment (3633)
In Section 8.3.5, why not calculate the cross-country trips for remote-handled transuranic waste shipments for extensive treatment to be able to compare with the other alternatives. This is another example of DOE's selective calculations to show only what outcome DOE wants.

Response
DOE did not calculate cross-country trips for remote-handled transuranic waste shipments because a single-site Centralized Alternative for remote-handled transuranic waste treatment was not considered to be a reasonable alternative for detailed analysis in the WM PEIS. Because so much remote-handled transuranic waste would have to be shipped across the country under such an alternative, an

unreasonable amount of pretreatment cost would have to be incurred to ensure acceptable transportation risks. Much lower costs and limited transportation risks were expected to accrue in the consolidation alternative that is analyzed, under which DOE would treat remote-handled transuranic waste at the two sites - the Hanford Site and ORR - where approximately 90% of current and projected inventory is located.

3.2.4 High-Level Waste

Comment (2256)
I do not believe that this is a document that can lead to waste management decisions, particularly in the case of the high-level radioactive waste. It is based on privatization plans that might be able to get underway, that might be able to build a facility, that might be able to vitrify. It is premature to include in this PEIS information about how the vitrified waste will be stored.

Response
DOE believes that the WM PEIS will be a useful tool in the waste management decisionmaking process. Treatment of high-level waste is not analyzed in the WM PEIS, but is analyzed in other sitewide or project-level NEPA documents. Disposal of high-level waste will be analyzed in the Geologic Repository EIS. The WM PEIS, thus, looks only at the impacts of storing vitrified high-level waste.

The PEIS has been modified (see Volume I, Section 1.7.4) to acknowledge the potential use of privatized facilities for the management of the five waste types considered, including high-level waste. The WM PEIS does not preclude the use of waste management facilities constructed and operated by private entities on DOE sites at DOE's direction. Proposals to use commercial or privatized facilities for waste management decisions would be analyzed in sitewide or project-specific NEPA documents.

Both the Defense Waste Processing Facility at SRS and the West Valley Demonstration Project began vitrifying high-level waste in 1996. Vitrification at these facilities is supported by existing site-specific NEPA documentation. DOE will store the canisters containing the vitrified waste until a geologic repository is ready to accept them for final disposal.

Comment (2407)
The scheduled date of 2015 for availability of the high-level waste geologic repository seems early. Include a few sentences on selection of this date for the WM PEIS and what contingency planning is available if a later date is needed and what contingency planning exists for the lack of a repository. The WM PEIS should include analysis of the impacts of a delayed date for the repository (for example, 2035 or 2050) due to the uncertainties associated with the opening date.

Response
As stated in Volume I, Section 9.2.2, of the WM PEIS, although a geologic repository for the permanent disposal of high-level waste is scheduled to begin accepting DOE-managed high-level waste in 2015, for purposes of the WM PEIS analysis, DOE also analyzed high-level waste canister storage requirements should the opening of the repository occur after 2015. For example, Table 9.4-4 presents risk results for the scenario of an opening after 2015 as incremental annual storage risks.

3.2.5 Hazardous Waste

Comment (41)
Referencing the Draft PEIS Summary document, Section 8.2.2, the commentor asked, "Why start incineration of hazardous wastes at LANL, ORR, and SRS and stop at INEL? LANL currently does no onsite treatment. The discussion states a preference for expansion of current treatment sites versus building new ones. Also, the PEIS generally states that it is cheaper to transport wastes than to build new facilities.

Response
For the Decentralized Alternative, DOE assumed thermal treatment at three sites with existing or planned incinerators--LANL, ORR, and SRS. To account for the decision to retire the Controlled Air Incinerator at LANL and the decision to continue operation of the Waste Experimental Reduction Facility at INEL, DOE has revised the WM PEIS (see Section 8.2.2 of the Summary document and Section 10.3.2 in Volume I) to replace LANL with INEL as a candidate for onsite treatment of hazardous waste under the Decentralized Alternative.

Comment (2034)
The WM PEIS hazardous waste analysis is based on the estimate that 90% of the total hazardous waste in a given year is generated by 11 or fewer DOE sites (Volume I, Section 10.1.2). However, the WM PEIS also states that the 11 sites are not always the same every year. Because of the variability, is the selection of the 11 sites from one particular year appropriate for the analysis of impacts, rather than the sites that have contributed 90% of the waste for the entire time period of data accumulation?

Response
The objective of the WM PEIS hazardous waste evaluation was to determine impacts for a policy of greater onsite treatment versus continued reliance on commercial vendors. This evaluation used representative sites and treatment technologies. Based on a review of RCRA uniform hazardous waste shipping manifests, facility reports, and hazardous waste generation and disposal information dating back to 1984, 11 sites typically account for 90% of DOE hazardous waste, but the sites differ from year to year. Thus, DOE selected the 11 sites for the WM PEIS analysis based on 1991 and 1992 data, which were the most current data when the PEIS analysis began. DOE believes that recent waste generation rates are more likely to reflect future trends than rates from the 1980s. Thus, DOE believes that its selection of 11 hazardous waste sites based on the 1991 and 1992 waste generation rates is adequate for the programmatic decisions it must make.

Comment (2036)
Under the No Action Alternative, 3% of the hazardous waste would be treated at two DOE sites and the remainder would be treated at commercial facilities. Under the Decentralized Alternative, 11% would be treated at three DOE sites, and the remainder sent offsite. The differences in the two options are so small that they were discussed together. We do not believe there is enough difference in the two alternatives to justify calling the Decentralized Alternative a meaningful option.

Response
The WM PEIS hazardous waste analysis is designed to evaluate the impacts from onsite treatment of waste, with emphasis on organic wastes requiring thermal destruction. The alternatives were selected to provide representative results for the range of onsite options. For the Final PEIS analysis, the alternatives evaluate treatment onsite of 3%, 9%, 50%, and 90%, respectively, of the DOE RCRA waste (excluding wastewater). The Decentralized Alternative uses three sites that have exciting or

3.2.5 Hazardous Waste

planned thermal treatment facilities. DOE recognizes that the differences in hazardous waste volumes between the No Action and Decentralized Alternatives are small. However, evaluating both alternatives is consistent with the overall framework of the four broad categories of alternatives. DOE added text to Volume I, Section 10.3, to better explain the alternatives.

Comment (2039)
Under Regionalized Alternative 1, clarify how DOE determined the assumption that two-thirds of the hazardous waste would be sent to the regional hubs and the other one-third sent to commercial incinerators.

Response
Section 10.3.3 in Volume I describes Regionalized Alternative 1 for hazardous waste treatment. Under this alternative, hazardous waste (other than wastewater) generated by 11 major DOE sites that could be treated through organic removal/recovery technologies (such as incineration) would be sent to five regional centers--Hanford, INEL, LANL, ORR, and SRS--for treatment.

The regional centers would treat two-thirds of the received hazardous waste and send the other one-third to a commercial facility. The two-thirds/one-third split in waste treatment discussed above is an analytic assumption used to mathematically achieve the 50% onsite treatment for Regionalized Alternative 1. Approximately 75% of the waste being treated (excluding wastewater) is incinerable; thus, to achieve a 50% onsite treatment rate for both incinerable and non-incinerable waste, two-thirds of the incinerable waste must be treated onsite.

Comment (2040)
A centralized alternative was not explored because the current policy is the use of decentralized or regionalized commercial facilities. The decision was, therefore, not to use an alternative that could not be compared to current practice. Considering that Regionalized Alternative 2 uses only two DOE facilities to treat 90% of the hazardous waste, going to one centralized site does not appear to be a major difference. DOE's current practice should not preclude it from exploring a centralized option.

Response
Section 10.3.4 in Volume I of the WM PEIS states that a Centralized Alternative for hazardous waste management was not considered because for hazardous waste the decision of concern is whether DOE should continue to use commercial treatment facilities or construct its own. Since the hazardous waste analysis is designed to evaluate the level of onsite DOE versus offsite commercial treatment, only alternatives representative of various onsite treatment capacities were needed. DOE selected four representative alternatives to account for both the effects of site consolidation and a range of waste volumes (3%, 9%, 50%, and 90%, respectively, of non-wastewater treated onsite). These representative alternatives were considered adequate to evaluate the policy option of increased onsite treatment. DOE has added text to Volume I, Section 10.3.4, to better explain why the Centralized Alternative was not evaluated.

Comment (2860)
Volume I, footnote b to Tables 4-1 and 4-2, states that other sites also manage hazardous waste but were not analyzed in the WM PEIS. On what arbitrary basis can other hazardous waste generators be excluded? If any site manages any quantity of hazardous waste it should be included and noted in the WM PEIS. Furthermore, the WM PEIS must state the preferred alternative for handling hazardous

wastes from those sites currently excluded from the analysis, particularly BNL. In addition, the WM PEIS should state that any quantity of hazardous waste generated by BNL shall be transported offsite.

Response

DOE estimates that more than 90% of the total hazardous waste in a given year is generated by 11 sites. DOE focused its hazardous waste analysis on the 11 largest DOE generator sites, which are listed in Table 10.1-1 in Volume I of the WM PEIS. The 90% cutoff is appropriate to support programmatic decisions on hazardous waste, which would apply to BNL as well as the other generator sites. Because BNL is not one of those 11 largest generator sites, the PEIS does not specifically analyze hazardous waste at BNL, but the PEIS analysis is representative of DOE sites in general. DOE's preferred alternative for managing nonwastewater hazardous waste and the reason it is preferred is identified in Volume I, Section 3.7 of the WM PEIS.

3.3 Public Preferences for or Opposition to Management Alternatives

Comment (141)
A very small percentage (less than 4%) of the WM PEIS public comments expressed a preference for or opposition to a specific waste management alternative. Of those, about one-third were preferences for the Decentralized Alternative and about one-fifth were preferences for the No Action Alternative. The remaining expressions of preference or opposition were spread among the alternatives or combinations of alternatives.

Most of these commentors gave reasons for their support or opposition, some did not. Some commentors viewed and commented on the alternatives in a programmatic sense, without reference to a specific site. Most often, however, commentors expressed support for or opposition to an alternative from a site-specific perspective. That is, commentors were most expressive about alternatives in terms of what the alternatives would mean for their site, and not for the Nation as a whole. A few commentors identified preferences for alternatives to manage specific waste types; most did not. Public preferences for or opposition to specific waste management alternatives are summarized below. Note that public comments opposing the siting of new waste management facilities and activities at specific sites are addressed in Sections 3.5.1 through 3.5.17 in this volume.

No Action Alternative

Commentors who expressed a preference for the No Action Alternative, in general or for their site, gave one or more of the following reasons: It would "keep things the way they are;" waste would not be added to sites by bringing it from other sites; therefore sites and the general public would not be subjected to the potential for additional risks associated with transporting and receiving additional wastes. It would cost less than other alternatives. Additional wastes would not be brought to sites in seismically active areas, or areas subject to severe weather or flooding. Under other alternatives, leaks could impact drinking water, agriculture, and other resources. Moving wastes away from some sites might cause people to lose their jobs. The waste is "OK" where it is. "Nothing has happened yet"; if DOE tries to change the way it is currently managing waste, it "might mess up." "More bad than good" would come out of doing anything else. Sites already have enough wastes and communities do not want them to have more. Incineration is dangerous. There is not enough information in the PEIS to proceed with any other alternative.

Some commentors prefer the No Action Alternative specifically for management of high-level, transuranic, and hazardous waste types. Some commentors prefer the No Action Alternative for BNL because the site would continue treatment of wastewater and ship other wastes offsite.

Of the few commentors who oppose the No Action Alternative, some stated that they want change or they are concerned that waste will continue to accumulate, making the problem harder to solve.

Decentralize Alternative

Commentors who expressed a preference for the Decentralized Alternative, in general or for their site, gave one or more of the following reasons: It would reduce the risks and costs of large-scale transportation of wastes. It would be safer than other alternatives. It would present fewer risks to the environment. It would not involve any additional lands. Wastes would be managed where they are generated and additional wastes would not be taken away from or brought to sites. It would avoid increased risks that would result from bringing additional wastes to some sites. It would create jobs at some sites, improve local economies, and bring additional revenues to local governments. Additional wastes would not be brought to sites in areas that are subject to earthquakes, severe weather (e.g., tornadoes), or other dangerous events (e.g., floods). Waste would not "pile up" in one place. It might cause sites to be more careful about what wastes they generate and concentrate on minimizing or eliminating the generation of waste. It would cause fewer negative impacts to local communities.

Many of the commentors who prefer the Decentralized Alternative stated that they do not want PGDP to be a decentralized site. One commentor prefers Decentralized or Regionalized Alternatives for treatment of low-level mixed waste and low-level waste at PGDP because it would increase benefits with minimal or no additional risks, and the experienced workforce at PGDP would be available to support treatment of these wastes.

A few commentors prefer the Decentralized Alternative specifically for the management of transuranic waste. One commentor prefers either the Decentralized or Regionalized Alternative for low-level waste because they appear to be the best compromise between cost and environmental protection.

Some commentors oppose the Decentralized Alternative for PGDP because it would cost too much and incineration would cause air pollution and health impacts. Some commentors oppose the Decentralized Alternative for ANL-E because it would cost too much; it would increase the risk of more accidents and leakage; more than 2,000 residents around ANL-E have signed a petition opposing this alternative, and this item should be put to a voter referendum in November. Some commentors oppose Decentralized Alternatives specifically for management of low-level mixed waste and low-level waste at BNL because of ongoing restoration efforts to remediate groundwater resources contaminated from past disposal of radioactive wastes.

Regionalized Alternatives

Several commentors prefer the Regionalized Alternatives, but not for PGDP. Reasons given for the preference were that regionalization "only hurts a few spots in the country;" PGDP already has enough nuclear waste; and waste should be removed from PGDP because of the potential impacts of an earthquake. One commentor suggested regionalizing the waste and distributing it evenly among the 37 locations, with a few exceptions (e.g., PGDP and LLNL) because of the potential for earthquakes. Conversely, some commentors prefer a Regionalized Alternative for PGDP because it would create jobs, put money into the local economy, and the site should be responsible for the waste it generates.

Some commentors prefer a Regionalized Alternative for ANL-E because it makes more sense from a cost perspective and a safety issue. Some commentors prefer a Regionalized Alternative because it would manage wastes at sites that have the largest volumes. Some commentors prefer Regionalized Alternatives specifically for management of low-level mixed waste and/or low-level waste (some specified because it would result in low fatalities and low estimated life-cycle costs). Some commentors prefer Regionalized Alternatives specifically for management of transuranic waste. Some commentors prefer the Regionalized and Centralized Alternatives for BNL because radioactive wastes should be stored in areas remote from biological habitats, highly populated areas, or a sole-source aquifer. One commentor prefers Regionalized or Centralized Alternatives at BNL specifically for management of low-level mixed waste, low-level waste, and hazardous waste.

3.3 Public Preferences for or Opposition to Management Alternatives

Commentors who expressed opposition to the Regionalized Alternatives, in general or for their site, gave one or more of the following reasons: There would greater danger from emissions from a leak. There would be risks from earthquakes at some sites; there are too many people living, working, going to school, etc., around some of the sites. Transportation risks are too great. Sites already have enough waste. People at some sites would lose their jobs. Regionalizing waste management would harm more places. If there are already impacts at a site, a Regionalized Alternative would add more impacts.

Centralized Alternatives

Some commentors prefer the Centralized Alternative. Most commentors who preferred the Centralized Alternative specified that they do not want waste to be centralized at their site or that they want waste removed from their site. One commentor supports centralization, but not at locations around water sources or near active fault lines. Another recommended that under the Centralized Alternative, separate sites be designated for management of low-level and high-level wastes. Those who prefer the Centralized Alternative gave one or more of the following reasons for the preference: There would be security advantages. Centralizing at one or two sites reduces the number of populated areas that could be affected by a spill. It would reduce the number of people exposed to radiation. It would be easier to monitor and control the waste if it is centralized. It would be easier to control a spill if waste is centralized. It would reduce the risk of an accident. Existing risks (human health risks, environmental contamination, etc.) associated with waste located at multiple sites would be eliminated. Some sites are in seismically active areas; removing wastes from these sites would eliminate the concern over radioactive releases that could be caused by earthquakes. Much of the waste is already concentrated at a few sites. It is worth the risk of a transportation accident to get the waste moved from multiple sites to one or two sites.

Commentors who expressed opposition to the Centralized Alternative, in general or for their site, gave one or more of the following reasons: transportation of wastes would present substantial risks to workers, the public, and the environment; a centralized site might become "overstocked" with wastes; and there could be impacts to those living near sites where waste is centralized.

One commentor stated that the Centralized Alternative is the least likely to work because attempts over the last 20 years to centralize wastes have failed. One commentor opposed the Centralized Alternative specifically for management of transuranic waste.

Response
DOE appreciates the public's response to its request for comments on the WM PEIS alternatives. Although DOE does not respond specifically to each point offered in these comments, DOE did consider these comments, and many other factors, in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3 of the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document.

DOE's final decisions will be based on this PEIS and other considerations such as regulatory compliance, budget constraints, schedules, compliance with site agreements with States, national priorities, and other DOE studies. Decisions will be announced in Records of Decision to be published in the *Federal Register*. If DOE selects a site for a waste management operation that prompts the need for new or expanded facilities, DOE would consider the results of relevant existing or required new sitewide or project-level NEPA reviews which examine potential environmental impacts in more detail.

Comment (530)
One commentor pointed out that many of the alternatives considered in the WM PEIS proposed shipment of offsite wastes to INEL. Such waste movement must be consistent with State of Idaho offsite waste principles as established in the Federal Facility Compliance Act (FFCAct) Site Treatment Plan (STP) Consent Order and with requirements mutually agreed upon in the Spent Nuclear Fuel Court Order of October 1995. Another commentor stated that the management of low-level mixed waste at INEL is effectively ruled out by those documents. Another commentor stated that DOE should know that the proposals within the WM PEIS and the Agreement with the State of Idaho are good, and that it is appropriate to handle spent nuclear fuel separately from other wastes at INEL.

Response
NEPA requires DOE to analyze reasonable alternatives. The mixed waste treatment alternatives described in the Draft WM PEIS are broad enough to envelop the potential environmental impacts of the configuration that results from the FFCAct process. The WM PEIS and the FFCAct STPs were developed in parallel, ensuring consistency and integration. The PEIS, which broadly analyzes DOE's waste management activities, provides the analysis of potential environmental impacts of the STPs developed for site-level mixed waste treatment decisions.

DOE revised Section 1.4 in Volume I of the WM PEIS to clarify that its compliance with applicable laws and regulations would necessarily include compliance with applicable site-specific plans, agreements and consent orders.

DOE considered these comments, along with many other comments and decision criteria and factors, in its selection of preferred alternatives to manage the five WM PEIS waste types. Section 3.7 in Volume I identifies DOE's preferred alternatives and the reasons they are preferred. However, these are not final decisions. Final decisions will be based on this PEIS and other considerations such as budgets, schedules, national priorities, and other DOE studies. Decisions will be documented in Records of Decision published in the *Federal Register*.

Comment (1760)
Until DOE develops a comprehensive national strategy, all wastes should be stored at the point of generation.

Response
Although the WM PEIS does not make actual programmatic waste management decisions, it analyzes and identifies preferred programmatic alternatives to manage wastes across the DOE complex, including the storage of wastes at the point of generation. Current DOE waste management activities are not confined to storage activities. DOE is pursuing other activities such as treatment and disposal.

DOE considered this and other public comments in its selection of WM PEIS preferred alternatives (see Volume I, Section 3.7).

3.3 Public Preferences for or Opposition to Management Alternatives

Comment (1899)
Onsite disposal may be cheapest in the long run because most sites are already large enough and meet government standards.

Response
The selection of the Decentralized Alternative, as advocated in this comment, would result in DOE management of waste where it is or where it will be generated, treated, or disposed of in the future. For low-level mixed waste and low-level waste disposal, the Decentralized Alternative is evaluated for the siting, construction, and operation of disposal facilities at 16 sites, including 10 sites that do not currently have low-level mixed waste or low-level waste disposal. The evaluation results indicate that costs are greatest for this alternative and decrease as the number of disposal sites decreases through the efficiencies realized from economies of scale. The Decentralized Alternative would require less transportation of wastes than the other alternatives, however, facility costs are greater than transportation costs. Low-level mixed waste costs are presented in Section 6.14 and low-level waste costs are presented in Section 7.14 in Volume I of the WM PEIS. An approach such as Decentralization might offer other particular economic benefits, such as jobs and income at many sites, but DOE must base its final decision on diverse environmental, economic, and regulatory issues.

Comment (2258)
We must not accept no action. Nuclear waste must be dealt with. DOE should have a comprehensive strategic plan that identifies all EISs and the decisions that will result. There has to be a cooperative approach.

Response
NEPA requires an EIS to include a discussion of a No Action Alternative. While such a "status quo" alternative could result in non-compliance with applicable laws and regulations, analysis of the No Action Alternative provides an environmental baseline against which the impacts of other alternatives can be compared. As evidenced by this PEIS, DOE is placing a high priority on "dealing" with its radioactive and hazardous wastes through a Department-wide strategy for safe and efficient management of these wastes.

The WM PEIS preferred alternatives and the reasons they are preferred are identified in Section 3.7 in Volume I of the Final PEIS. Actual programmatic waste management decisions will be announced in Records of Decision published in the *Federal Register*.

The decisions to be made subsequent to the Final WM PEIS will result in a comprehensive strategic plan for the management of the five waste types analyzed. DOE has coordinated the preparation of the WM PEIS with other EISs being prepared on similar proposals for strategic management of nuclear materials within DOE Section 1.8.1, Waste Management PEIS Relationship to Other Actions and Programs, has been updated to reflect the relationship and status of these other studies. To the extent the information was available for incorporation, Chapter 11 in Volume I of the PEIS addresses cumulative impacts resulting from other programs.

Comment (2328)
Incineration of low-level mixed waste at ORR under a Regionalized alternative, if properly carried out, is not an objectionable method. The destruction of nonradioactive organic contaminants is particularly

attractive, in contrast to burying them in landfills from which they might eventually leak into the environment.

Response
DOE agrees. Properly designed and operated incinerators are as or more effective than other treatment technologies, and DOE does not preclude their use at any site. EPA's combustion strategy states, "If properly designed and operated in compliance with regulatory standards, combustion is a technology that provides sound management of hazardous waste." Fact sheets on radioactive and mixed waste incineration published jointly by EPA and DOE (EPA 402-F-95-004 through 007, January 1996) recognize the effectiveness of incineration as part of the DOE Waste Management Program.

Comment (2345)
I prefer the No Action Alternative for hazardous waste rather than have DOE incinerate hazardous waste because of the vapors and secondary chemicals produced in the process. Has DOE considered their effects?

Response
Thank you for expressing this preference. NEPA requires DOE to analyze reasonable alternatives. DOE identifies its preferred waste management alternatives in Volume I, Section 3.7, of the WM PEIS.

DOE did evaluate the effects of the incineration emissions from treatment of hazardous waste, including combustion products. See Volume I, Chapter 10.

Comment (3201)
Please explain why the WM PEIS does not select a preferred alternative for the low-level waste. In selecting the preferred alternative from the alternatives proposed in the WM PEIS, DOE should select the alternative that minimizes the number of fatalities, including transportation fatalities.

Response
DOE did not have a preferred alternative for treatment and disposal of low-level waste when the Draft WM PEIS was issued in September 1995. NEPA does not require the identification of a preferred alternative in a draft environmental impact statement if such an alternative is not known at that point in time. In accordance with the requirements of NEPA, after consideration of the analyses presented in the WM PEIS, the decision criteria in Volume I, Section 1.7.3, and all public comments in the Draft WM PEIS, DOE has identified preferred alternatives for each waste type, including low-level waste, in Volume I, Section 3.7, of the Final WM PEIS. As described in Volume I, Section 1.7.3, DOE favors alternatives which reduce human health risk, including the number of vehicle accidents expected to occur during transportation of waste.

Comment (3556)
One commentor prefers the Decentralized Alternative for low-level mixed waste because LANL and Sandia National Laboratories-New Mexico (SNL-NM) would treat and dispose of their own low-level mixed waste and none would be brought to New Mexico from other sites. If SNL-NM is unable to site a protective disposal unit, the commentor's second choice for low-level mixed waste is Regionalized Alternative 1 because LANL would receive waste only from SNL-NM. If LANL is unable to site additional protective disposal units, the commentor's third choice is Regionalized Alternative 3, under which all low-level mixed waste and low-level waste would be disposed of at NTS.

3.3 Public Preferences for or Opposition to Management Alternatives

Response
DOE considered this, and many other comments and factors, in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3, of the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document.

The preferred alternatives are not final decisions. Final decisions will be based on this PEIS and other considerations such as regulatory compliance, budget constraints, schedules, compliance with site agreements with States, national priorities, and other DOE studies. Decisions will be announced in Records of Decision published in the *Federal Register*. If DOE selects a site for a waste management operation that prompts the need for new or expanded facilities, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews which examine potential environmental impacts in more detail.

Comment (3557)
A commentor prefers the Decentralized Alternative for treatment and disposal of low-level waste because LANL and SNL-NM would treat and dispose of their own low-level waste, and none would be brought to New Mexico from other sites. If SNL-NM is unable to site a protective disposal unit, the commentor prefers as a second choice Regionalized Alternative 2 because LANL would dispose of low-level waste only from SNL-NM. This commentor believes that the preferred alternative should be the same for low-level mixed waste and low-level waste because both wastes could be disposed of together once the hazardous component of low-level mixed waste is treated. The commentor does not understand why the No Action and Decentralized Alternatives for low-level mixed waste differ from those for low-level waste.

Response
The alternatives differ for low-level mixed waste and low-level waste because RCRA land disposal restrictions still apply to low-level mixed waste even after its hazardous components have been treated. Treated low-level mixed waste must be disposed of in a RCRA-permitted disposal facility. Since these restrictions do not apply to low-level waste, other or different alternatives are reasonable to be analyzed in the EIS.

DOE considered this, and many other comments and factors in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3 of the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document.

The preferred alternatives are not final decisions. Final decisions will be based on this PEIS and other considerations such as regulatory compliance, budget constraints, schedules, compliance with site agreements with States, national priorities, and other DOE studies. Decisions will be announced in Records of Decision published in the *Federal Register*. If DOE selects a site for a waste management operation that prompts the need for new or expanded facilities, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews which examine potential environmental impacts in more detail.

3.3 Public Preferences for or Opposition to Management Alternatives

Comment (3559)
For transuranic waste, a commentor prefers a modified Decentralized Alternative, under which SNL-NM would treat and store contact-handled transuranic waste and LANL would treat and store contact-handled and remote-handled transuranic waste; thus, SNL-NM would be added as an additional storage site.

Response
As shown in WM PEIS Volume I, Tables 8.3-1 and 8.3-2, SNL-NM is considered as a transuranic waste storage site under the No Action Alternative and a transuranic waste treatment site under the Decentralized Alternative.

DOE considered this, and many other comments and factors, in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3, of the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document.

Final decisions will be based on this PEIS and other considerations such as regulatory compliance, budge constraints, schedules, compliance with site agreements with States, national priorities, and other DOE studies. Decisions will be announced in Records of Decision published in the *Federal Register*. If DOE selects a site for a waste management operation that prompts the need for new or expanded facilities, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews that examine potential environmental impacts in more detail.

Comment (3958)
A commentor prefers the No Action Alternative for treatment, storage, and disposal of hazardous waste. Although not mentioned in the Draft WM PEIS, both LANL and SNL-NM are permitted under RCRA to treat hazardous waste.

Response
DOE considered this, and many other comments and factors, in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3, of the WM PEIS. As identified by the commentor, LANL and SNL-NM are permitted for hazardous waste treatment. However, neither is currently incinerating hazardous waste, the generic treatment technology used in the WM PEIS.

3.4 Waste Management Sites

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(No comments were received for this section)

3.4.1 General Comments

Comment (30)
DOE's draft preferred alternatives will not have adverse environmental impacts for the Hampton Roads region.

Response
Thank you for your comment. DOE has identified preferred alternatives, and the reasons they are preferred, for all waste types in Volume I, Section 3.7, of the Final WM PEIS.

Comment (31)
Do not store, treat, or dispose of wastes in metropolitan areas, such as the Hampton Roads region, or in environmentally sensitive areas.

Response
None of the 17 "major" sites evaluated for waste management activities are located in the Hampton Roads region, although the Decentralized Alternative for management of low-level mixed waste would result in treatment and storage at Norfolk Naval Shipyard.

DOE appreciates the public's response to its request for comments on the WM PEIS alternatives. DOE considered this, and many other comments and factors, in its selection of preferred alternatives to manage the five types of waste considered in the WM PEIS. The decision criteria and factors used in the selection of preferred alternatives are described in Volume I, Section 1.7.3, of the WM PEIS. DOE's preferred alternatives and the reasons they are preferred are described in Volume I, Section 3.7, and in the Summary document.

Comment (71)
Commentors suggested that DOE locate waste treatment, storage, and disposal activities in sparsely populated or unpopulated areas, or in areas that are remote and isolated. Many suggested desert areas; others suggested ocean or space disposal.

Response
DOE prefers to avoid introduction of radioactive waste at DOE and other Federal sites where none exists. In turn, the proximity of a waste management site to populated areas is only one factor in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements. Although selecting sites for waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in Volume I lists and describes examples of the factors DOE will consider in the decisionmaking process.

NEPA requires DOE to analyze reasonable alternatives. Neither ocean nor deep space disposal are considered feasible. Because of ongoing concerns over polluting the marine environment, and in accordance with U.S. law and international agreements (the London Dumping Convention of 1975, as amended), EPA no longer issues permits for ocean dumping or disposal of radioactive materials. As for launching the material into space, the costs and accident risks associated with such an approach would likely be significantly higher than those associated with the alternatives evaluated in the WM PEIS.

3.4.1 General Comments

Comment (528)
The public needs to be aware that INEL operations are generally safe; DOE should get on with making its decisions with the use of care and good science.

Response
DOE intends to proceed, as it has done to date, using care and good science in making waste management decisions across the Department and on a site-specific or project-level basis. The WM PEIS, which is a national decisionmaking tool, has been prepared to help DOE enhance the management of its current and anticipated volumes of radioactive and hazardous wastes in order to ensure safe and efficient management of these wastes, to comply with all applicable Federal and State laws, and to protect public health and safety and the environment.

Comment (917)
A commentor supports the DOE preference to store high-level waste at INEL, the Hanford Site, and SRS until disposal in a geologic repository becomes a reality.

Response
Thank you for your comment.

Comment (1650)
DOE has not done too bad a job at NTS, despite mistakes, and deserves full support.

Response
Thank you for your comment.

Comment (1826)
It is possible that the inflated waste generation data are part of a misdirected, yet intentional effort to maintain Argonne National Laboratory (ANL-E) on a national list of potential disposal sites. The PEIS does not sufficiently reflect reasonable present and future conditions to allow one to draw conclusions about the impacts of the proposed actions at ANL-E.

Response
The waste volumes identified in the Draft WM PEIS were based on the best data available at the time the analysis was performed. The Draft WM PEIS presented a "snapshot in time" of the waste volumes and projections. Since the Draft PEIS was published, DOE has updated information on several types of waste. Appendix I of the Final WM EIS addresses how newly available data on low-level waste, low-level mixed waste, and transuranic waste might affect the analyses of alternatives in the PEIS.

Section 1.6.1 in Volume I of the WM PEIS explains how DOE identified sites for analysis. Identification as a "major site" does not mean the site will be selected for waste management activities. The concept of the major site is intended to facilitate the WM PEIS analysis in terms of alternatives considered and to allow for meaningful comparison of programmatic waste management options.

As described in Section 4.4.1 in Volume I of the WM PEIS, the information on current conditions in terms of the affected environment at ANL-E was obtained largely from reports prepared in 1990 through 1994. More detail is provided in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final PEIS.

3.4.1 General Comments

The characterization of the affected environment establishes the baseline conditions from which the impacts of the various WM PEIS alternatives can be assessed.

Comment (1869)
DOE should investigate the feasibility of using other agencies' sites (e.g., the U.S. Department of Agriculture research facility in Clay Center, Nebraska) for disposal.

Response
Volume I, Section 3.10, of the WM PEIS explains that DOE does not consider the use of other Federal agencies' sites for waste management activities to be reasonable. However, the WM PEIS does consider, at a conceptual level, the use of commercial and privatized waste management facilities, including those at sites that might be purchased or leased from other Federal agencies. Although DOE committed during the scoping process to avoid introduction of radioactive waste at DOE and other Federal sites where none exists, this does not preclude the use of privatized or non-DOE-owned facilities for management of DOE waste, as discussed in Section 1.7.4.

Comment (1926)
There are not enough safeguards to give communities a sense of security. The potential impacts of a waste disposal facility at ANL-E were not shown to the surrounding communities.

Response
Only the Decentralized Alternatives for low-level waste and low-level mixed waste would involve *disposal* actions at ANL-E. The potential impacts of such disposal actions (as well as from possible waste treatment and storage) are provided in Chapters 6 and 7 in Volume I. To supplement the quantitative estimates of individual disposal risks presented in Sections 6.4.1.6 and 7.4.1.7 of the WM PEIS, DOE also performed semi-quantitative analyses of the *potential* for offsite population risk. ANL-E was determined to be intermediate among the 16 proposed disposal sites in its potential vulnerability to offsite population risks from disposal. Additional detail on potential impacts at ANL-E is provided in Section 2 in Volume II of the WM PEIS. Furthermore, Site Summaries for each of the 17 major sites analyzed in the WM PEIS (including ANL-E) have been added to the back of the PEIS Summary document.

Comment (1986)
The WM PEIS states that low-level mixed waste will be stored on the sites where it is generated until treatment and disposal. This does not take into consideration the Naval Nuclear Propulsion program sites that were required to complete Mixed Waste Site Treatment Plans in accordance with the Federal Facility Compliance Act of 1992. Mixed waste from Naval Nuclear Propulsion Program sites undergoing base closure will be stored at projected treatment sites. This should be reflected in the Final WM PEIS.

Response
Because this is a programmatic analysis, DOE made broad assumptions applicable to all sites, including the assumption that low-level mixed waste would be stored where it is generated until treatment and disposal. This assumption was not meant to restrict site-specific operations and exceptions where they would not prejudice programmatic analysis or decisions. DOE added this clarification to Volume I, Section 1.6.

3.4.1 General Comments

All of the Naval Nuclear Propulsion Program sites listed in Volume I, Table 6.1-1, have relatively small inventories and projected generation of low-level mixed waste. None of the sites are evaluated in detail. The Final WM PEIS considers updated waste inventory data, including low-level mixed waste inventories at Naval Nuclear Propulsion Program sites undergoing base closure in Volume IV, Section I.2. DOE concluded that pretreatment storage at different sites would not significantly affect decisions stemming from the WM PEIS.

Comment (2105)
BNL is a good neighbor and should continue to do world-class research. BNL's mission has always been primarily research oriented and has not included waste disposal. Identifying waste disposal sites across the country will erode DOE's credibility and impact funding for BNL and DOE.

Response
Potential waste management activities would not alter BNL's mission as an important research facility within DOE's configuration of sites.

NEPA requires DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at BNL is a reasonable programmatic waste management alternative. BNL is one of 17 reasonable candidate sites ("major sites") for programmatic waste management activities. Note that BNL would manage only its own low-level mixed waste and low-level waste and could take advantage of private-sector waste management resources. BNL would dispose of low-level mixed waste and low-level waste only under the Decentralized Alternative. BNL would not dispose of any offsite wastes. The newest low-level mixed waste and low-level waste volumes for BNL are provided for in Volume IV, Appendix I, of the WM PEIS.

Comment (2193)
The commentor stated that he was quoting from page 34 of the final Site Treatment Plan. "...Battelle has decided to withdraw its application for the Part B permit, as a recommendation under a corporate cost reduction program." In order to save $250,000 for a private entity you have decided to rip up all the advisory board's advice, and the multi-site principles, and ship it to Hanford for disposal. Well, our values are not being factored in here and we are not going to let you do that.

Response
DOE assumes that the commentor was referring to the Battelle Columbus Site Treatment Plan. The commentor infers that Hanford has agreed to disposal of Battelle waste to save Battelle Columbus the expense of obtaining a RCRA Part B permit. This inference is not true on several counts. Battelle Columbus is not a "private entity," but a DOE-funded facility and the waste is DOE waste. The waste codes which result from decontamination and decommissioning activities at Battelle Columbus were never included in the permit application to begin with; nor was onsite treatment ever part of the permit request. Hanford was chosen as a primary site for treatment and storage of Battelle's radioactive waste based on historical ties. The impacts of using Hanford were assessed in an Environmental Assessment, which was shared with the State of Washington.

Battelle Columbus withdrew its RCRA Part B permit after meeting with EPA, the State of Ohio, and local stakeholders. Battelle made a decision to act as a 90-day waste generator, which means that waste can only be stored onsite for a maximum of 90 days. The decision to withdraw the RCRA Part B permit application did save money and also allows Battelle to meet all regulatory requirements.

3.4.1 General Comments

The Battelle Site is sending low-level mixed waste to the Hanford Site for treatment only. After treatment at the Hanford Site, the low-level mixed waste will be shipped offsite for disposal. The agreement to treat one of Battelle's waste streams at Hanford was negotiated between Battelle Columbus, the Ohio EPA, the State of Washington Department of Ecology, DOE-Headquarters, and the Richland Office, in accordance with the Federal Facility Compliance Act.

Comment (2417)
The WM PEIS portrays waste management taking place at "greenfields," but does not recognize that most of the proposed locations have significant problems with environmental contamination. Because of the severity of some of these problems, it is not necessarily appropriate to correlate inventory with preferability for a particular alternative.

Response
DOE is committed to managing its wastes in an environmentally acceptable manner. New treatment and disposal facilities would be subject to project-level NEPA reviews that would address potential environmental impacts from those projects. DOE's preferred alternative for a project would not necessarily correlate with the inventory location of the waste to be managed, although inventory location would clearly be an important factor in the facility location decision.

DOE recognizes that other activities on DOE sites have environmental impacts and that these other activities should be accounted for. Volume I, Chapter 11, of the WM PEIS discusses the combined impacts of waste management alternatives for the five types of waste analyzed in the WM PEIS for each of the 17 major sites. Chapter 11 then presents these combined impacts, added to the impacts of other past, present, and reasonably foreseeable future actions external to the WM PEIS in (cumulative impacts). CEQ and DOE regulations require consideration of cumulative impacts.

Comment (2847)
Volume I, Section 6.3.5, states that Knolls Atomic Power Laboratory was eliminated because it is a Navy site. Yet a similar site, Bettis, was eliminated because of terrain and geology. According to Section 4.5, both sites have the same mission and ownership and are jointly managed by DOE and the Navy. It is not clear why the Navy site status should eliminate one or the other. Descriptions of these sites in Section 4.5 should be clarified to explain who has direct responsibility and authority (ownership) for these sites.

Response
DOE revised Section 6.3.5 to state that Bettis was eliminated because of sloping terrain and unstable geology, and because it is a Navy site. In addition, DOE revised Chapter 4 in Volume I to clearly indicate the affiliations of the sites.

Comment (2949)
ORR is considered for treatment and disposal of low-level mixed waste. Where on the site would DOE dispose of these wastes?

Response
ORR is considered as a candidate site for treatment and disposal of low-level mixed waste under several alternatives in the WM PEIS, which DOE has prepared as part of its effort to develop an overall national strategy on which to base waste management decisions. However, the WM PEIS does

3.4.1 General Comments

not propose locations within site boundaries for facilities. Facility locations will be determined after DOE announces WM PEIS decisions and considers the results of existing or new sitewide or project-level NEPA reviews.

Comment (3782)
The public needs to understand the specific reasons why populated areas are being considered for waste management facilities, rather than the desert southwest and plains where it is least likely to harm people.

Response
To identify reasonable proposed sites for waste management facilities, DOE determined where the largest volumes of waste are and where transportation requirements would be minimized. Other site-selection criteria included the characteristics of the waste, specialized treatment requirements, and existing facilities.

Sites that are less densely populated were considered for waste treatment, storage, and disposal. Although storage and disposal in less populated regions may lessen some impacts, the risks from transporting waste to these remote areas would increase. These trade-offs are described in the WM PEIS and are important factors that will be considered in the decision process. The remoteness and low population density of a location for a waste management site constitutes only one factor in evaluating alternatives. Other criteria include the construction or modification of facilities and increased transportation requirements.

Comment (4394)
A commentor suggested that DOE consider the Savanna Army Depot, located approximately 130 miles west of ANL-E in the northwest corner of Illinois for the following reasons as the site for a government waste storage facility: (1) the government already owns the property and it has already been used as a storage site for similarly hazardous materials, (2) it is located within only a few hours of not only Argonne, but also Fermi National Accelerator Laboratory and Ames Laboratories, (3) it is a rural site with very little nearby population, (4) the citizens of the communities around the depot would be receptive to the idea of having this facility nearby because of the positive effect it would have on the local economy, and (5) it is in the same State as two of the three proposed waste generators and so would avoid any potential problems with transporting waste across State lines. Another commentor stated that there are large tracts of Federal lands, Federal facilities, commercial facilities, and possibly Indian Reservations where DOE could store, treat, and/or dispose of its waste.

Response
As stated in the WM PEIS, Volume I, Section 1.6, DOE limited its scope to the 54 sites for which DOE has some management responsibility. Of those 54, 40 contained one or more of the waste types considered in the PEIS, and only 17 contain the bulk of those wastes. DOE limited the scope of the WM PEIS to these 54 sites, focusing most specifically on the major 17 sites identified in Table 1.6-2. However, Section 1.7.4 in Volume I discusses the concept of using commercial facilities.

3.4.2 Identification of 17 Major Sites

Comment (520)
The WM PEIS discusses 17 "major" sites associated with transuranic and other wastes. Other public documentation lists 27 sites. The PEIS should discuss the other 10 sites and explain why they were not included in the analysis. Taxpayers are concerned about the total picture.

Response
For purposes of the programmatic level of analysis in the WM PEIS, DOE identified 17 "major" sites because they contain the bulk of the five waste types, have the capability for the future disposal of low-level mixed waste and low-level waste, or have existing or planned major waste management facilities. These 17 sites are the focus of this PEIS because they are candidates to either receive wastes generated at other sites, to host disposal facilities, to manage high-level waste, or were included to be consistent with the Federal Facility Compliance Act process. DOE revised Section 1.6.1 in Volume I to expand the explanation of how these 17 sites were identified as candidates for waste management activities.

The 10 additional sites referred to in the comment have waste volumes compared to the volumes at the 17 major sites. DOE did not expect those small waste volumes to measurably affect the programmatic alternatives evaluated in the WM PEIS. Therefore, the sites were not included in the impacts analysis. The additional sites would principally package and ship wastes, rather than support major waste treatment or disposal facilities; therefore, waste management impacts at these sites are expected to be small.

Comment (1665)
Screening criteria used for selection of disposal sites are "woefully inadequate." DOE should expand its screening criteria to consider (1) the exclusion of sites that are located in large region of influence population areas, and (2) transportation impacts, as well as issues of distance to where most of the wastes to be disposed of are currently located.

Response
As described in Volume I, Section 6.3.5, 16 candidate low-level mixed waste disposal sites were selected for evaluation in the WM PEIS based on screening performed by DOE in coordination with the States under the Federal Facility Compliance Act (FFCAct). For consistency, the same 16 sites were also evaluated for low-level waste disposal. The screening process determined which DOE sites could be eliminated from consideration for disposal without further evaluation.

In the WM PEIS risk analyses, DOE did not attempt to predict risks to current or future offsite populations from the disposal of low-level waste and low-level mixed waste. Estimating these risks requires knowing the exact location of disposal facilities on a site with respect to existing aquifers and the populations that might use them. Since the PEIS does not attempt to make decisions about locations of disposal facilities on sites, quantitative estimates of collective dose and risk are not attempted.

However, to supplement the quantitative estimates of maximally exposed individual disposal risks presented in Sections 6.4.1.8 and 7.4.1.7 in Volume I, DOE performed semi-quantitative analyses of the potential for offsite population risk in Section 5.4.1.2.3 of the Final PEIS. These analyses produced estimates of relative population vulnerability of the sites, rather than quantitative estimates of person-rem doses and cancer fatalities. For these analyses, DOE used simple statistical methods and information about site characteristics known or expected to be associated with the potential for offsite population disposal risk to develop "risk vulnerability" groupings of the sites. ROI population was one

3.4.2 Identification of 17 Major Sites

of the factors used in the analysis. The sites within each of the three vulnerability groups developed in this analysis have similar potential for offsite population health risk from disposal.

DOE used minimization of waste transportation as a criterion in developing alternatives. The WM PEIS analyzes transportation impacts. Detailed analyses are presented in the waste type and cumulative impacts chapters of Volume I of the WM PEIS. In addition, Appendix E in Volume IV of the WM PEIS is dedicated to transportation.

Comment (1744)
Provide a list of the 16 sites selected as disposal sites and explain how and why the WM PEIS differs from the *Performance Evaluation of the Capabilities of DOE Sites for Disposal of Mixed Low Level Waste*.

Response
Section 6.3.5 in Volume I of the WM PEIS lists and describes how DOE identified the 16 sites evaluated for potential disposal of low-level waste and low-level mixed waste (i.e., ANL-E, BNL, FEMP, Hanford, INEL, LANL, LLNL, NTS, ORR, PGDP, Pantex, Portsmouth, RFETS, SNL-NM, SRS, and WVDP) were identified. In addition, Section 1.8.2 discusses the relationship of the WM PEIS with the efforts of the DOE Disposal Workgroup.

Although the Federal Facility Compliance Act does not specifically address disposal of treated mixed wastes, both DOE and the States have recognized that disposal issues are an integral part of treatment discussions. A process was established by the DOE Disposal Workgroup in conjunction with State representatives and the National Governors Association to evaluate and discuss the issues related to the potential disposal of the residuals from the treatment of DOE low-level mixed waste at the sites subject to the Federal Facility Compliance Act. The results of this analysis are presented in the report entitled *Performance Evaluation of the Capabilities of DOE Sites for Disposal of Mixed Low Level Waste*.

The focus of this process has been to identify sites that are suitable for further evaluation of their potential as disposal sites from among the sites that currently store or are expected to generate mixed waste. The evaluation is intended to increase understanding of the strengths and weaknesses of a site's potential for disposal, but is not a site-selection process. Ultimately, the identification of sites that might receive low-level mixed waste for disposal will follow State and Federal regulations for siting and permitting, and will include appropriate public involvement.

The sites identified through the Disposal Workgroup process reflect the same set analyzed for low-level mixed waste disposal in the WM PEIS, except that the WM PEIS analysis includes BNL, which has been categorized by the DOE Disposal Workgroup as low in priority for a mixed waste disposal mission.

Comment (2240)
The WM PEIS alternatives are not adequate because they have been preselected and look at the West as a dumping ground.

Response
All alternatives except the Centralized Alternatives consider disposal facilities in the East as well as in the West. Volume I, Section 3.5, describes how DOE selected the alternatives. To identify reasonable

proposed sites for waste management facilities, 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.

However, total volumes of waste were not the sole criterion used to select sites. The character of the waste, specialized treatment requirements, and existing facilities were also taken into account. For example, some wastes that require special treatment were analyzed separately, and treatment sites were selected for analysis based on the volumes requiring special treatment rather than on total volumes. In some cases, treatment facilities could be used for more than one waste type. Therefore, some sites were evaluated as candidate sites even if the volume of a particular waste type at that site was not among the largest.

This process was not biased toward the West. In fact, 8 of the 16 sites considered for disposal of low-level mixed waste and low-level waste are east of the Mississippi River. For transuranic waste and high-level waste, the candidate repository sites at Carlsbad, New Mexico (WIPP), and NTS (Yucca Mountain) were used for transportation calculations; however, they were not evaluated for disposal, which is beyond the scope of the WM PEIS.

Comment (3243)
DOE's criteria for selecting candidate waste treatment and disposal sites should be reevaluated so as to question or dismiss sites with: (1) large region of influence (ROI) population densities, (2) high seismic risk, (3) transport routes connecting to waste generating sites that have the highest percentage of travel in urban areas (high population densities, traffic congestion and delays), and (4) sites where offsite contamination is already posing substantial environmental and health risks to the surrounding communities.

Response
The points specified by the commentor are addressed in the WM PEIS environmental impacts analysis in the waste-type and cumulative impacts chapters. The 17 "major" waste management sites contain the bulk of the five waste types, have the capability for future disposal of low-level mixed waste and low-level waste, or have existing or planned major waste management facilities. These 17 sites are the focus of this PEIS because they are candidates to receive wastes generated elsewhere, to host disposal facilities, to manage high-level waste, or were included to be consistent with the Federal Facility Compliance Act process. The PEIS refers to these sites as major sites, and considers in detail environmental impacts that could arise from treating, storing, and disposing of wastes at these sites.

Comment (3921)
DOE needs to explain why 37 of 54 sites were removed from the list. DOE is too limited in its site selections. For example, let's send the waste to Washington, D.C. Let the Government have it.

Response
Section 3.5 in Volume I of the WM PEIS describes how DOE selected the alternatives. Section 3.10 describes alternatives not evaluated in detail in the WM PEIS. Of the 54 DOE sites that generate or have in inventory identifiable quantities of radioactive or hazardous waste, 17 were considered "major" sites because they contain the bulk of the waste and are candidates to receive waste from other sites for treatment, storage, or disposal. The other 37 sites have relatively small amounts of waste and DOE

3.4.2 Identification of 17 Major Sites

eliminated them as candidate sites for receiving waste from other sites. Under various alternatives, these 37 sites are candidates for managing the wastes that are generated onsite.

3.5 Public Preferences for or Opposition to Siting Waste Management Activities/Facilities

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(No comments were received for this section)

3.5.1 Argonne National Laboratory-East

Comment (209)

Of those commentors opposing the siting of programmatic waste management activities at ANL-E, some gave no reason for their opposition and others expressed one or more of the reasons listed below:

- The overall risks to public health and safety, worker health and safety, and the quality of the environment from normal operations, operations accidents, and truck and rail transportation accidents;

- Specific Risks: Risks to surrounding residential communities and farmland; risks to sensitive habitat (such as Waterfall Glen Forest Preserve); risks due to possible earthquakes, tornadoes, and flooding; potential air, groundwater and drinking water contamination; potential negative impacts on the local economy, including decreased real estate values, business opportunities, and tax revenues; potential negative impacts to the overall quality of life in the area; safety risks in the event of a terrorist attack;

- Factors: The population density, including many children, around the site; the "higher-than-average" cancer rates in surrounding communities, especially among children, and potential dangers to future generations; existing contamination at the site; the longevity of the waste and the lack of long-term accountability and guarantees of safety in the future; the site's proximity to major highways; construction costs, and potential clean-up costs in the event of a release of radioactivity; potential evacuation problems in case of an accident; the potential for lawsuits and waste of tax dollars;

- Opinions: That there are more viable and cost-effective storage and disposal alternatives than ANL-E, which should only be used for research and development; that proposed waste management activities at ANL-E conflict with existing treatment plans and Federal Facility Compliance Act agreements; that construction and processing operations would contribute non-hazardous wastes to an already overburdened system; that wastes could be shipped to less-densely populated, remote or desert areas, and the cost would be minimal compared to the risk of contamination; that there is a lack of communication and adequate public input to waste management decisions; that there is a lack of confidence in DOE's ability to properly manage past, existing or future wastes, as well as its ability to prevent environmental damage; that DOE is proposing to use unproven thermal treatment technologies; and that ANL-E does not have adequate facilities and equipment to become a permanent waste facility.

Response

NEPA requires DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at ANL-E was analyzed as a reasonable option under some of the WM PEIS waste management alternatives. ANL-E is one of 17 "major" sites analyzed in the WM PEIS, which is a nationwide study to help DOE make programmatic, Department-wide decisions about how it will manage the five waste types considered in the PEIS. Major sites are those candidate locations that might either receive wastes generated offsite, manage high-level waste, host disposal facilities, or were included to be consistent with the Federal Facility Compliance Act process. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role. Under 3 of the 36 alternatives evaluated (Decentralized Alternatives for low-level mixed waste, low-level waste, and transuranic waste), DOE would construct new facilities to manage wastes at ANL-E. These facilities would manage wastes generated at ANL-E, a small quantity of low-level mixed waste generated at Ames Laboratory, and low-level waste generated at Ames and Fermi Laboratories. No transuranic wastes from off the site would be managed at ANL-E. Under the Regionalized and Centralized Alternatives, all ANL-E waste would be treated and disposed of at other DOE sites.

The WM PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Chapter 5 and Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be minimal. For those impacts that would not be minimal, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. The subsequent Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from those provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decision.

DOE used data from the 1990 U.S. Census to estimate that about 7,940,000 people live within 50 miles from the center of ANL-E. This population could possibly be exposed to emissions released to the atmosphere from waste treatment facilities. Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS (Volume I, Sections 6.4, 7.4, and 8.4). Offsite population human health risks and offsite maximally exposed individual health risks are also cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.3). The health risk analyses suggest that adverse health effects to both adults and children from the operation of waste treatment facilities located at ANL-E would be negligible.

In response to requests from the residents of Lemont, Illinois, the Illinois Department of Public Health initiated a study of the cancer incidence among children in the Township. The Division of Epidemiologic Studies prepared a study based on hospital reports found in the Illinois State Cancer Registry for the years 1986 through 1993 (Illinois Department of Health, 1995). Seventeen cases of childhood cancer were observed in the study area, four cases more than the 13 that would be statistically expected. The most frequently reported childhood cancer type was leukemia, with six cases observed and three cases statistically expected. The report finds that those differences are not statistically significant. More details on the survey can be obtained from the study.

The WM PEIS evaluates the potential impacts of several types of accidents at treatment and storage facilities (e.g., fires, explosions, earthquakes, aircraft crashes). The PEIS also includes a detailed assessment of the risks of a complete range of credible transportation accidents for both rail and truck transportation. The analyses were designed to address the potential impacts of acts of terrorism or sabotage. DOE provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested by local agencies. Because health and safety consequences could possibly result from an accident involving radioactive or other hazardous material, DOE has allocated resources and

3.5.1 Argonne National Laboratory-East

has established emergency response training under the overall Federal Emergency Response Program to investigate the effects of such an accident.

DOE is concerned with health and safety and the need for emergency preparedness in and around its sites. Emergency response plans are required on sites and in the surrounding communities by Federal, State, and local authorities that deal with emergency situations such as earthquakes, floods, tornadoes, and other natural or man-made disasters. These plans are regularly updated and their review coordinated with DOE, the U.S. Department of Transportation, the Federal Emergency Management Agency, and State and local authorities.

Properly designed and operated thermal treatment technologies (incinerators), have been shown to be as or more effective than other proven treatment technologies and DOE will not preclude their use at any site. DOE compared impacts from incineration with non-thermal treatment technologies and identified little or no difference in treatment risks to human health; DOE documented these findings in a technical report. (M/B SR-03, September, 1995). DOE has an aggressive technology development program exploring alternatives to incineration. Alternatives would be tested and deployed depending on their potential to safely and effectively treat wastes.

As to the other specific risks cited by the commentors, refer to the following sections of the PEIS: air quality (Sections 6.5, 7.5, and 8.5); water resources (Sections 6.6, 7.6, and 8.6); and ecological resources (Sections 6.7, 7.7, and 8.7). Risks to local agriculture are not considered in the PEIS as a specific impact parameter; however, as environmental risks would be small, there is no reason to believe that there would be any negative impact to local agriculture. Further, site facilities are outside the probable 500-year maximum floodplain, and seismic analyses indicate there is little or no risk from earthquakes.

While implementing programmatic waste management decisions could entail construction of new and/or modification of existing facilities, the WM PEIS does not propose locations on sites for actual waste management facilities. If ANL-E is selected for a waste management role, DOE would consider site-specific conditions analyzed in existing or new sitewide or project-level NEPA reviews. DOE is aware of the sensitive ecological resources associated with ANL-E and would locate any new waste management facilities to minimize or avoid impacts to nearby wetlands and other sensitive habitats.

A major focus of the WM PEIS is to help DOE establish a Department-wide program to safely and efficiently manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts are more appropriately evaluated in sitewide or project-level studies. Impacts of existing actions and other missions related to radiological and hazardous waste are included in the cumulative impacts chapter of the WM PEIS, Volume I, Chapter 11.

The WM PEIS and the Federal Facility Compliance Act Site Treatment Plans were developed in parallel, ensuring consistency and integration. The PEIS provides the analysis of environmental impacts to support the Site Treatment Plans developed for site-level mixed waste treatment decisions. Pre-existing site-specific plans and agreements will be considered by decisionmakers to the extent possible; however, it is possible that some site-specific NEPA decisions might need to be revisited as a result of decisions made based on the WM PEIS.

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DOE recognizes that the siting of waste management activities may be perceived negatively by some persons. DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The WM PEIS will help DOE make sound waste management decisions.

The proximity of a waste management site to populated areas is only one of many factors in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements, and the PEIS presents alternatives that would minimize waste transportation (Decentralized Alternatives) or that would maximize waste transportation (Centralized Alternatives). Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Actual decisionmaking will consider a range of decision criteria and factors, including viability and cost-effectiveness. Section 1.7.3 in Volume I lists and describes examples of the factors and criteria DOE will consider in the decisionmaking process.

DOE must comply with all applicable laws and regulations. DOE believes that the WM PEIS meets the requirements of NEPA and CEQ regulations. The Final WM PEIS incorporates corrections to errors that affected the final analysis, which were identified in the Draft WM PEIS by public commentors, DOE, and its contractors. DOE believes the Final WM PEIS is technically sufficient to make programmatic waste management decisions. By carefully studying and planning long-term waste management strategies at the national and site levels, DOE hopes to correct past waste management practices to ensure protection of the public, workers, and the environment in the future.

DOE welcomes the level of interest in its waste management decisions, and has considered all comments offered during the public comment period. A well-informed and involved citizenry can provide valuable insight into what the public feels DOE should consider in its decisionmaking. However, DOE must, by law, actually make decisions, and is held accountable by the public and its regulators for safely implementing those decisions.

Comment (458)
The State of Illinois prefers a combination of alternatives not listed in the WM PEIS charts and considers a Regionalized Alternative that designates ANL-E as a treatment site for low-level waste but not a disposal site as the most preferable scenario. Since such an alternative is not presented in the WM PEIS, the State requests that DOE reevaluate the alternatives under consideration, and rewrite the WM PEIS and associated alternatives to incorporate this input.

Response
DOE assumes that the State of Illinois is referring to low-level mixed waste and not low-level waste due to the low-level mixed waste Site Treatment Plan for ANL-E that proposes to treat low-level mixed waste onsite, but dispose of residues offsite.

The WM PEIS analyzes 36 alternatives under four broad categories. In accordance with NEPA and CEQ regulations, these alternatives include the impacts that might be envisioned. Under the WM PEIS

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analysis, low-level mixed waste treatment and disposal at ANL-E is considered only under the Decentralized Alternative.

Section 3.7 in Volume I of the WM PEIS identifies the preferred configuration alternative for low-level mixed waste treatment and disposal and the reason it is preferred. The preferred treatment and disposal site(s) will be identified at a later date with appropriate public notification before a decision is made. The preferred alternatives identified in the WM PEIS will provide input into the Records of Decision process, which will culminate in programmatic waste management decisions. In this context, NEPA allows combining specific configurations analyzed in the WM PEIS, as suggested in the comment, when selecting a "DOE preferred alternative." Further, NEPA allows DOE, in making its decisions, to consider partial alternatives or combinations of alternatives, as long as they fall within the bounds of the alternatives considered in the EIS. (See Volume I, Section 3.4.) An alternative encompassing treatment at ANL-E without disposal could be selected without further analysis. DOE will explain in the Records of Decision how and why it made its decisions, and how the decisions relate to the alternatives analyzed in the Final EIS.

Comment (465)
Decisions for the siting, construction, and operation of a waste disposal facility at ANL-E should not be made until site-specific characteristics and potential impacts are evaluated. Also, DOE should outline how it will handle waste at the proposed disposal facility for ANL-E once that facility is filled; whether ANL-E will continue to receive waste; whether the disposal facility will be expanded; and whether another facility will be sited and started at ANL-E.

Response
The environmental impacts from construction and operation of generic waste disposal facilities are identified in the WM PEIS to provide relative comparisons to aid in decisionmaking. However, the WM PEIS did consider many site-specific characteristics at ANL-E, including population, weather, and geology and water resources. Even more detailed site characteristics would be considered in sitewide or project-level NEPA reviews.

DOE believes that it would be speculative to consider the disposition of wastes beyond the 30-year projected life of the new waste management facilities being considered in the PEIS. Therefore, these activities are outside the scope of the WM PEIS, but could be considered in future NEPA documentation.

Comment (471)
DOE should clarify whether ANL-E will be designated a regional site.

Response
DOE does not consider ANL-E a candidate site for a regional disposal facility for any of the five waste types addressed in the WM PEIS. DOE will announce the site's role in the final waste management configuration in Records of Decision published in the *Federal Register* following the publication of the Final WM PEIS.

Comment (1066)
ANL should not be considered as a future waste disposal site for radioactive materials because the community has already suffered enough. When DOE dropped the research on shortening the

radioactive life and reuse of radioactive materials, it lead to major employment cutbacks. The best place to store this material is in Washington, D.C.

Response
DOE evaluated 36 alternatives in the WM PEIS. DOE did not consider Washington, D.C., as a management site because it does not meet the criteria for a major site given in Section 1.6.1 in Volume I. Only under three alternatives (Decentralized Alternatives for low-level mixed waste, low-level waste, and transuranic waste) would new facilities be constructed to manage wastes at ANL-E. These facilities would manage wastes generated at ANL-E and a small quantity of low-level mixed waste generated at Ames Laboratory and low-level waste generated at Ames and Fermi Laboratories. Under the Regionalized and Centralized Alternatives, all ANL-E wastes would be managed at other DOE sites. DOE recognizes that some commentors disagree with the reasonable alternatives being considered in this PEIS for management of radioactive waste. The WM PEIS human health risk assessment and ecological risk assessment examined potential Waste Management Program effects on humans and the environment near ANL-E. DOE found that impacts to public health and the environment would be small at ANL-E under all waste management alternatives.

DOE is committed to research and will defend its programs. However, budget levels for DOE, as well as implementation guidance, are established by Congress. Thus, some DOE programs are experiencing cutbacks, which does impact employment in some areas.

Comment (1295)
The communities do not want any more waste of any kind brought to Argonne because of (1) the high residential population; (2) the already existing cleanup problems; (3) the legacy of Site A and Plot M; (4) already contaminated French drains; (5) incidents with uranium working its way up to the top of the ground; (6) past closures of drinking wells due to ANL-E ground contamination; and (7) already enough bad experiences.

Response
DOE evaluated 36 alternatives in the WM PEIS. Only under three alternatives (Decentralized Alternatives for low-level mixed waste, low-level waste, and transuranic waste) would new facilities be constructed to manage wastes at ANL-E. These facilities would manage wastes generated at ANL-E and a small quantity of low-level mixed waste generated at Ames Laboratory and low-level waste generated at Ames and Fermi Laboratories. Under the Regionalized and Centralized Alternatives, all ANL-E wastes would be managed at other DOE sites.

The WM PEIS human health risk assessment and ecological risk assessment examined potential Waste Management Program effects on humans and the environment near ANL-E. DOE found that impacts to public health and the environment would be small at ANL-E under all waste management alternatives.

Site A (which was decommissioned in 1956) and Plot M are not located on the ANL-E site. Moreover the drinking wells, also located offsite, were closed due to contamination at Site A. However, ANL-E continues a groundwater monitoring program at the site. The WM PEIS considered existing contamination at ANL-E and the region of influence surrounding the ANL-E Site as the baseline condition as discussed in Section 4.4.1 in Volume I and in the WM PEIS Affected Environment Technical Report. The need for additional remedial action at Site A and Plot M (a small parcel of land

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used for radioactive waste disposal) will be determined when the characterization activity has been completed. All such remedial action is part of the Environmental Restoration Program and therefore is beyond the scope of the WM PEIS analysis.

DOE's environmental restoration activities are governed, to a large extent, by the Comprehensive Environmental Response, Compensation, and Liability Act, and the Resource Conservation and Recovery Act. The objective of these laws is to provide for response to and remediation of past environmental contamination. DOE encourages the citizens to be proactive and report issues of environmental contamination to Federal, State, and local authorities.

Comment (1831)
There are important combinations of alternatives that were not evaluated in the WM PEIS. Specifically, DOE did not evaluate ANL-E for a treatment site under the low-level mixed waste Regionalized Alternatives.

Response
DOE analyzed 36 alternatives in four broad categories in the WM PEIS. These alternatives encompass the reasonable combinations of options that might be envisioned. In designing these alternatives, DOE used the principle of minimizing waste transportation to select the sites to host treatment and disposal facilities. Accordingly, in going from decentralized treatment to centralized treatment, the sites with the smallest amount of waste were the first to be eliminated as treatment centers. Of all the sites that would treat waste under the Decentralized Alternative, ANL-E was among the first six sites to be eliminated because it was among the six sites with the smallest volume of low-level mixed waste inventory plus 20 years of projected generation.

Under all alternatives, sites were assumed to treat their own wastewaters. Furthermore, sites not treating their waste to its final form would need to treat their wastes sufficiently to meet transportation requirements.

Comment (1833)
ANL-E is clearly not a major site. By WM PEIS definition, a major site is a candidate to receive wastes generated offsite, to host disposal facilities, or to manage high-level radioactive wastes. There is no technical basis for including ANL-E in this study. We are also not aware that ANL is scheduled to play a significant role in the management of DOE's high-level radioactive waste. If there are additional reasons for ANL-E being classified as a major site, such as projected waste volumes, make them clear in the PEIS.

Response
Volume I, Section 1.6.1, describes DOE's basis for selecting candidate sites for waste management activities and explains the designation "major site." Major sites are candidates to receive wastes generated at other sites, to host disposal facilities, or to manage high-level waste, or they are sites that were included in the study to be consistent with the Federal Facility Compliance Act process.

Within the alternatives evaluated in the WM PEIS, ANL-E is not considered for management of high-level waste. It is a candidate to receive wastes generated at other sites and to host low-level waste or low-level mixed waste disposal facilities.

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Comment (1835)
If DOE is seriously considering ANL-E as a prospective site for disposal of low-level mixed waste, it should discontinue that approach for lack of an adequate technical basis. Factors such as demographics, local geology, groundwater resources, and ANL-E's waste volume, if properly considered, will prevent DOE from concluding that ANL-E is a suitable disposal location site.

Response
DOE's preferred alternative for low-level mixed waste treatment is a combination of parts of the Decentralized and several Regionalized Alternatives (see Volume I, Section 3.7, for the rationale for this selection). DOE decisions about waste disposal will be based on all available information, including the WM PEIS analysis and current technical information (including up-to-date waste volume information). Section 1.7.3 identifies environmental impacts as a criterion DOE used to screen, evaluate, and narrow the number of alternatives and sites and to select preferred alternatives.

Comment (1838)
Consideration of ANL-E for disposal of waste is a proposed action that we will continue to oppose. Its significance could easily influence the finalization of the agreement between the State of Illinois and DOE under the Federal Facility Compliance Act.

Response
The fact that ANL-E is analyzed as a major site in the WM PEIS does not automatically entail selection of that site for a given waste management role. Rather, it means that potential impacts from conceptual waste management activities were analyzed. DOE evaluated 36 alternatives in the WM PEIS. Only under two alternatives (Decentralized Alternatives for low-level mixed waste and low-level waste) would facilities be constructed to dispose of wastes at ANL-E. These facilities would dispose of wastes generated at ANL-E and small quantities of low-level mixed waste generated at Ames and low-level waste generated at Ames and Fermi. Under the Regionalized and Centralized Alternatives, all ANL-E wastes would be managed at other DOE sites.

Section 1.8.3 in Volume I of the WM PEIS discusses the relationship of the document with other programs. The Federal Facility Compliance Act directs DOE to address the treatment of mixed waste that DOE generates or stores by requiring the development of mixed waste Site Treatment Plans. These plans identify how DOE will provide the necessary mixed waste treatment capacity, including schedules for bringing new treatment facilities into operation. The WM PEIS and the Site Treatment Plans were developed in parallel, ensuring consistency and integration. The mixed waste treatment alternatives described in the WM PEIS are broad enough to envelope the potential environmental impacts of the configuration that results from the Federal Facility Compliance Act process.

Although the Act does not specifically address disposal of treated mixed wastes, both DOE and the States have recognized that disposal issues are an integral part of treatment discussions. A process was established by the DOE Disposal Workgroup in conjunction with State representatives and the National Governor's Association to evaluate and discuss the issues related to the potential disposal of the residuals from the treatment of DOE low-level mixed waste at the sites subject to the Act. The focus of this process has been to identify sites that are suitable for further evaluation of their potential as disposal sites from among the sites that currently store or are expected to generate mixed waste. The evaluation is intended to increase understanding of the strengths and weaknesses of a site's potential for disposal, but is not a site-selection process. Ultimately the identification of sites that might receive

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mixed waste for disposal will follow State and Federal regulations for siting and permitting, and will include appropriate public involvement.

Information obtained through the Disposal Workgroup will be considered with information contained in the WM PEIS during the development of Records of Decision. Following the publication of WM PEIS decisions, DOE may (1) initiate site-specific NEPA reviews for new proposed disposal facilities; (2) initiate performance assessment analyses for compliance with DOE Order 5820.2A; and (3) initiate processes for permitting disposal facilities. Coordination with the States and stakeholders will continue to ensure stakeholder input and to resolve concerns at the earliest possible stage.

Comment (1885)
Commentors strongly oppose the selection of ANL-E as a potential site for storage of radioactive waste, because it takes more than 15 years to clean up a contaminated site and the cost to do so is substantial, with no guarantee that the funds will be available when needed.

Response
The WM PEIS is intended to provide environmental information to help DOE determine at which sites it should modify existing waste management facilities or construct new facilities. DOE evaluated 36 alternatives in the PEIS. Only under three alternatives (Decentralized Alternatives for low-level mixed waste, low-level waste, and transuranic waste) would new facilities be constructed to manage wastes at ANL-E. These facilities would manage wastes generated at ANL-E and a small quantity of low-level mixed waste and low-level waste generated at Ames.

The Environmental Restoration Program has been established to clean up environmental contamination at the sites where research, development, test, and production of nuclear weapons took place. Environmental cleanup is not within the scope of the WM PEIS, DOE's programmatic waste management study, because of the site-specific nature of environmental restoration decisions.

DOE receives funds through Congressional appropriations. Thus, environmental restoration, as well as waste management and other programs, are subject to prevailing budget policies.

Comment (1934)
A commentor opposes "another nuclear waste dump" at ANL-E and suggested cleaning up "the mess at Red Gate Woods" before planning a new facility.

Response
No uncontrolled dumping is permitted by current waste disposal regulations. If ANL-E were selected to host a disposal facility, the facility would be designed, constructed, operated, and maintained in compliance with all applicable regulations. This facility would be an engineered waste disposal facility with comprehensive waste acceptance criteria to ensure that performance objectives would be attained.

Site A and Red Gate Woods are environmental restoration sites that are being addressed by site-specific remedial actions and, therefore, are outside the scope of the WM PEIS. Stakeholder meetings are being planned for later this year to update constituents about the decisions on future environmental restoration actions for Site A and Red Gate Woods. DOE has searched the National Archives extensively looking for records detailing the wastes buried at Plot M, which is in the forest preserves outside the ANL-E boundaries. To date, DOE has been unable to find any records on what was put into Plot M between May 1944 and its closure in July 1949. DOE is continuing to look for any records on what was disposed of in this area. The comment has been forwarded to the Argonne Group Office.

Comment (2650)
The region is already at risk from ANL-E experiments and potential problems at nuclear generating stations of Commonwealth Edison.

Response
Section 11.3 in Volume I of the WM PEIS identifies cumulative impacts for ANL-E and the existing baseline risk. These impacts and risks are generally minor. However, risks associated with activities outside of DOE's control, such as those from commercial nuclear generating stations, are not within the scope of the WM PEIS.

The WM PEIS decision process will not result in the selection of specific locations for waste management facilities on DOE sites. Before DOE selects locations for facilities on sites, it will consider the results of relevant existing or required new NEPA analyses, which would include detailed site-specific cumulative impacts.

Comment (2654)
Shipping methods must consider the safety of the community. Waste should not be transported by any means to ANL-E.

Response
The WM PEIS provides an analysis that allows for relative comparison of the possible risks due to waste transportation, which could be mitigated through careful planning and safety measures. DOE has always maintained that the risks of transporting its waste are very low, but no form of transportation is without some risk. The WM PEIS analysis is based on overall traffic statistics, which do account for the special measures DOE takes when transporting waste.

Because health and safety consequences could possibly result from an accident involving radioactive or other hazardous material, DOE has allocated resources and has established training on emergency response under the overall Federal Emergency Response Program to investigate the effects of such an accident. The mitigating measures that DOE takes include careful choice of the route used, the packaging and transportation methods used, and other considerations.

No one has ever been killed or seriously injured in an accident involving radioactive materials because of the nature of the cargo. In a 23-year observation period, 307 highway and 20 rail accidents occurred. Radioactive materials that could have serious consequences if released are packaged to withstand hypothetical accident conditions during shipping. Accidents involving these packages have resulted in no release of radioactive materials.

Shipping radiological and other hazardous material to interstate highways or rail terminals is described for each site in the WM PEIS Affected Environment Technical Report, which is referenced in the WM PEIS and is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the WM PEIS. In addition, transportation-related impacts are presented in Sections 6.4.2, 7.4.2, 8.4.2, 9.4.2, and 10.4.2 in Volume I, and Appendix E in Volume IV.

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In the transportation technical reports supporting the WM PEIS, which are available in the DOE public reading rooms listed in Section 1.9 in Volume I, estimates of shipments by truck and rail are given. It is estimated that Ames would send two truck shipments or one rail shipment of low-level waste; Fermilab would send 43 truck shipments or one rail shipment of low-level waste; and Ames would send one rail and one truck shipment of low-level mixed waste. Truck shipments would use Interstate 55 to minimize risks to the community. Thus, there would be less than one shipment a week for alternatives calling for shipments of waste to ANL-E.

Comment (2760)
Keep the neighborhood around ANL-E safe; remove the waste stored there illegally.

Response
DOE policy is to conduct its operations to protect the environment and ensure the safety and health of onsite workers and offsite residents. DOE will continue to comply with all applicable environmental and safety statutes and regulations with regard to its waste management activities at ANL-E and other DOE sites.

Comment (3752)
As a person living about one mile from the site, I drink the water from a well nearby. I am a cancer survivor and have greatly benefited by the diagnostic results of ANL. As an ANL employee, I have tried to maintain my objectivity about the WM PEIS, however, I oppose the permanent placement of the LLW and LLMW for a few reasons. (1) This is a densely populated (over 7 million people) area; thousands live just a few miles from the site. (2) As per President Clinton's speech [the commentor claims that President Clinton said in the State of the Union Address given on January 23, 1996, it was his objective to not store nuclear waste near densely populated areas with children], why are we considering it here? (3) I am concerned about drinking water. (4) I am concerned about accidental releases and radiation exposures.

Response
The proximity of a waste management site to populated areas is only one factor in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements. Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in Volume I of the WM PEIS lists and describes a range of decision criteria and factors that DOE will consider in its programmatic waste management decisions. Minimization of risks to public health, and public preferences, will continue to play a crucial role in this process.

In his State of the Union Address of January 23, 1996, President Clinton identified the challenge "to leave our environment safe and clean for the next generation," given that "10 million children under 12 will live within four miles of a waste dump," a "third of us breathe air that endangers our health," and "in too many communities the water is not safe to drink." The WM PEIS represents DOE's national planning tool to enhance the management of its radioactive and hazardous waste in order to ensure safe and efficient management of these wastes, to comply with all applicable laws, and to protect public health and safety and the environment.

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The WM PEIS analysis estimates that risks from drinking water impacts and accident (treatment and storage facilities, transportation) would be small under all PEIS alternatives. More detail is provided in Sections 6.6.2, 7.6.2, 8.6.2, 9.6.2, and 10.6.2 in Volume I of the PEIS (water quality), and Appendices E and F (transportation, including accidents; facility accidents) in Volume IV.

Comment (3915)
Discount most of the public meeting participants and what they have said. ANL-E has not been involved in nuclear weapons production. Public safety and air quality are monitored. The people in this area should be concerned with the refinery and the chlorine tankers on the railroads. Property values are exploding, not declining.

Response
Thank you for your comment. It is DOE's policy to consider and respond to public comments and to factor public input into its decisions.

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Comment (330)
When deciding whether to store waste at BNL or ship it to a safer location, DOE should compare the difficulties, expenses, and safety concerns (especially drinking water at BNL) associated with those alternatives.

Response
BNL is considered for the management of low-level mixed waste and low-level waste. The site is not considered a potential candidate to receive wastes from other sites, and under all the Regionalized and Centralized Alternatives, BNL would ship its waste offsite for proper treatment and disposal. Under the No Action and Decentralized Alternatives the impacts of storing, treating, and disposing of low-level mixed waste and low-level waste onsite were analyzed and are reported. Chapters 6 and 7 in Volume I of the WM PEIS provide details of the full impact analysis for managing low-level mixed waste and low-level waste across the DOE complex.

The environmental impacts of managing low-level waste and low-level mixed wastes at BNL will be considered in making any treatment, storage, and disposal decisions concerning the BNL wastes. Other factors in the decisions will be impacts on DOE's mission and costs. In arriving at its decisions, DOE attempts to balance its waste management activities supporting site and Department-wide cleanup and ongoing site operations with the desires of the communities within which it operates.

Comment (400)
The Federal Facility Compliance Act Brookhaven Mixed Waste Matrix, which creates separate streams for each waste category and has a limited number of disposal facilities, is the most responsible option.

Response
DOE's low-level mixed waste is subject to the Site Treatment Plans required under the Federal Facility Compliance Act. The Final WM PEIS preferred alternative for low-level mixed waste is a combination of parts of the Decentralized and Regionalized Alternatives, and is intended to be consistent with the configuration established through the Federal Facility Compliance Act. The preferred alternatives, and the reasons they are preferred, are described in Section 3.7 in Volume I of the WM PEIS.

Comment (541)
Commentors oppose the siting of programmatic waste management activities at BNL. Some commentors gave no reason for their opposition; others expressed one or more of the reasons listed below.

- The overall risks to public health and safety and the quality of the environment from proposed waste management activities
- Specific Risks: Risks to endangered species; risks to sensitive habitat (such as the Long Island Pine Barrens and coastal ponds); potential groundwater and drinking water contamination
- Factors: The population density around the site; the "high rate" of breast cancer on Long Island; the site's location over a sole-source aquifer; existing water and air pollution
- Opinions: That DOE could find a better site; that the sum of legal impediments and environmental factors makes BNL extremely inappropriate for disposal of mixed and/or low-level wastes; that the

land at BNL is unsuitable for disposal of wastes; that in light of BNL's successful waste source reduction program, DOE should continue to focus on cleaning up existing contamination rather than bringing in new wastes from other sites; and that there is no guarantee that onsite treatment of waste is less damaging to the environment than shipping the waste to another facility.

Response

BNL is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role. Under two of the 36 alternatives in the PEIS (Decentralized Alternatives for low-level mixed waste and low-level waste), DOE would construct new facilities for BNL to manage its own waste. BNL would not dispose of any offsite wastes. Under the remaining alternatives, BNL's low-level mixed waste and low-level waste would be disposed of at other DOE sites.

The WM PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Volume III, Section C.4.1.2.3, for analysis methods. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts, and where applicable, to comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at BNL would have a significant negative impact on public health and safety or the natural environment.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. Records of Decision published in the *Federal Register* will announce DOE's decisions and the reasons for the decisions if they differ from those provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decisions.

The WM PEIS addresses water resources as site-specific impact parameters. Major surface-water features associated with BNL include the onsite Peconic River and its intermittent tributary. Onsite streams and the Peconic River receive treated wastewater. Discharge monitoring in 1991 showed that all concentrations were within applicable standards, except for trichloroethylene. The lower aquifer system (Magothy and Raritan Formations) and the Pleistocene Upper Glacial Aquifer, which are all considered sole-source aquifers, are the major groundwater units at BNL. Groundwater monitoring in 1991 showed that eight parameters exceeded New York State Drinking Water Standards. Some groundwater contamination has migrated offsite, and concentrations have been found to exceed drinking water standards. However, as described in Sections 6.6.2 and 7.6.2 in Volume I, the WM PEIS water quality analysis indicated that disposal of low-level mixed waste and low-level waste at BNL would not cause groundwater concentrations to exceed drinking water standards that were used as an indication of acceptable groundwater quality.

3.5.2 Brookhaven National Laboratory

BNL is located in the Central Pine Barrens and within the Peconic Estuary system. One Federally listed endangered species (the Peregrine Falcon) and several State-listed species have been observed on or near the site. DOE is aware of the sensitive ecological resources associated with BNL, and would locate new waste management facilities to avoid impacts to threatened and endangered species, nearby wetlands, and other sensitive habitats.

DOE used data from the 1990 U.S. Census to estimate that about 5,740,000 people live within 50 miles from the center of BNL. This population could possibly be exposed to emissions released to the atmosphere from waste treatment facilities. Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS (Volume I, Sections 6.4, 7.4, and 8.4). Offsite population human health risks and offsite maximally exposed individual health risks are also cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.2). The health risk analyses suggest that adverse health effects from the operation of waste treatment facilities located at BNL would be small. Public health impacts from disposal would similarly be small after implementation of mitigation measures necessary to ensure that DOE would not exceed radionuclide- and/or chemical-specific limits. Further, waste management facilities are not expected to contribute to radiation exposure of the general public or result in radiation emissions to the environment.

A major focus of the WM PEIS is to help DOE establish a Department-wide program to safely and efficiently manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup and pollution prevention efforts are more appropriately evaluated in sitewide or project-level studies.

While DOE understands and appreciates individual concerns, some alternative must be selected in light of the considerable amount of existing radioactive and hazardous wastes. Be assured that DOE is committed to managing its wastes to protect human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The WM PEIS will help DOE make sound waste management decisions.

The proximity of a waste management site to populated areas is only one of many factors in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements, and the PEIS presents alternatives that would minimize waste transportation (Decentralized Alternatives) and that would maximize waste transportation (Centralized Alternatives). Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in Volume I lists and describes examples of the criteria and factors DOE will consider in the decisionmaking process.

DOE prepared the WM PEIS as a part of its effort to develop an overall national strategy on which to base waste management decisions. After DOE announces its decisions and before selecting specific locations for waste management facilities on sites, DOE will consider the results of existing relevant or required new NEPA reviews, which would include more detailed evaluations of the potential for environmental impacts based on site-specific conditions.

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Comment (2090)
BNL is located in the Long Island Nassau-Suffolk Aquifer System, and WVDP is located in the Cattaraugus Creek Aquifer System. These have been designated as sole-source aquifers pursuant to the Safe Drinking Water Act. The sensitivity and importance of these sole-source aquifers should be considered in the selection of the sites. Specifically, site-specific NEPA documentation should include a detailed assessment of the potential groundwater impacts. A copy of EPA's guidance for conducting groundwater analyses in sole-source aquifers is available upon request.

Response
Volume I, Chapter 4, and Volume III, Section C.4.3.5, of the WM PEIS identify DOE sites, including BNL and WVDP, that are located over EPA-designated sole-source aquifers. DOE decisionmakers will consider the locations of sites in relation to sole-source aquifers when determining future waste management configurations. The minimization of environmental impacts is a decision criterion. See Volume I, Section 1.7.3.

In addition, before selecting locations for facilities on sites, DOE will consider the results of existing relevant or required new NEPA reviews, which would include detailed assessments of potential groundwater impacts. DOE will follow applicable guidelines, including those from EPA, in conducting its groundwater analyses.

Comment (2109)
Siting multiple disposal sites around the country would be poor waste management strategy and would play into the hands of those who would close the lab [BNL] and DOE as the lab's major funder.

Response
NEPA and CEQ regulations require the action agency to include a discussion of reasonable alternatives to a proposed action in an EIS. The agency must provide sufficient information for each alternative so that reviewers can evaluate the comparative merits of those alternatives. Four broad categories of alternatives encompass the reasonable alternatives available to DOE for siting of facilities for the five waste types that are considered in the WM PEIS. The No Action Alternative, Decentralized Alternatives, Regionalized Alternatives, and Centralized Alternatives. However, under each category of alternatives, there are many possible combinations for the number and location of DOE waste management sites. To narrow these combinations to a level where meaningful analysis could occur, DOE selected representative alternatives for analysis under each category.

Implementation of the waste management programmatic strategy could entail consolidation, or downsizing, of waste management activities at some sites or upgrading in more regionalized or centralized approaches. The PEIS does not *make* those decisions; rather, it makes recommendations. Decisions will be based on this PEIS, regulatory compliance, budgets, schedules, compliance with site agreements with States, national priorities, and other DOE studies. Decisions will be announced in Records of Decision to be published in the *Federal Register*.

Comment (2813)
A commentor stated that BNL is inappropriate for hazardous wastewater treatment, and is concerned that DOE believes sewage or wastewater treatment processes are appropriate for liquid hazardous wastes at BNL. BNL received a permit from New York State in 1995 for a hazardous waste management facility. The permit was solely to allow BNL to store hazardous wastes onsite prior to

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shipment for appropriate disposal. However, [the commentor] "is shocked" to discover that DOE considers shipment of liquid hazardous wastes to be inappropriate and requested that DOE amend the WM PEIS concerning the generic treatment of hazardous wastes at DOE facilities to reflect a policy that is truly applicable complex-wide.

Response
The continued treatment of hazardous wastewater onsite at DOE facilities is one of the assumptions identified in Volume I, Section 10.2.3, of the WM PEIS. For purposes of analysis the WM PEIS considers hazardous waste at the 11 sites which collectively produce 90% of that waste type. Due to the programmatic nature of the document, the WM PEIS analysis is generic in character and based on assumptions to allow for meaningful comparison of programmatic management options. DOE believes conclusions would not change, programmatically, if all sites (including BNL) were specifically analyzed. All sites, however, will be subject to the decision made based on the WM PEIS.

Most DOE hazardous waste consists of wastewater that contains less than a 1% concentration of organic materials. DOE currently treats hazardous wastewater onsite and will continue to do so in the future because wastewater is not difficult to treat, but it is difficult and expensive to transport to an offsite treatment facility. DOE believes that hazardous wastewater can be treated onsite within regulatory limits. DOE complies with all applicable statutes and regulations in treating hazardous waste onsite at BNL. DOE does not treat nonwastewater liquid hazardous waste with its sewage.

The focus of the PEIS alternatives is on the RCRA-defined nonwastewater hazardous waste that is used for fuel burning onsite or shipped offsite for incineration. This nonwastewater hazardous waste, predominantly solvents and cleaning agents, is about 1% of the DOE hazardous waste.

DOE revised Section 1.5.6 in Volume I of the WM PEIS to explain that non-hazardous and nonradioactive sanitary waste, non-hazardous solid waste, and hazardous and low-level process wastewater are not included in the PEIS analysis. They raise site-specific issues and, therefore, not appropriately addressed in a programmatic EIS.

Comment (2815)
BNL has very little low-level mixed waste waste and no low-level waste. BNL should not receive any offsite wastes because it does not produce a significant quantity of its own.

Response
Table 6.1-1 in Volume I of the WM PEIS is based on the 1994 Mixed Waste Inventory Report, which indicates that BNL has 190 cubic meters of estimated inventory plus 20 years generation of low-level mixed waste. The 1992 Integrated Data Base, the source of LLW data for the Draft WM PEIS, did not provide LLW data for BNL. Thus, the evaluation in the Draft PEIS for BNL did not include impacts from management of LLW. However, Tables 1.6-2 and 7.1-1 in Volume I of the Final PEIS show that the inventory plus the 20-year projected LLW volume at BNL is 5,600 cubic meters. The updated data were obtained from the 1995 version of the Integrated Data Base. Consideration of updated LLW estimates for BNL are included in Appendix I in Volume IV of the Final PEIS. Appendix I addresses the issue of how updated waste projections affect PEIS conclusions.

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BNL would manage only its own low-level mixed waste and low-level waste, and would dispose of such wastes onsite only under the Decentralized Alternatives. BNL would not dispose of any offsite wastes.

Comment (2850)
BNL and its surrounding area are too environmentally sensitive for "indefinite storage." Materials should be shipped off this site even under the No Action Alternative.

Response
The No Action Alternative can be characterized as the status quo alternative. Wastes would continued to be treated, stored, and/or disposed of at each site using only existing or planned facilities. The No Action Alternative for BNL means the following: for low-level mixed waste, BNL would treat wastewater only and store BNL low-level mixed waste onsite; BNL would ship low-level waste to Hanford for disposal. Note that RCRA Subtitle C implementing regulations governing low-level mixed waste, prohibit "indefinite storage" of waste that requires treatment.

As to the environmental sensitivity of the BNL area, DOE found that the construction of waste management facilities would entail a limited loss of acreage. DOE should be able to locate new waste management facilities in a manner to minimize adverse impacts to sensitive ecological resources. Actual waste management facilities will be analyzed in future sitewide or project-level NEPA reviews.

Comment (2856)
The WM PEIS states that Regionalized Alternatives are preferred for low-level mixed waste. There are blank spaces in Table 3.4-1 for the Regionalized Alternatives under BNL. If this means that BNL would not become a regional treatment and disposal site for low-level mixed waste, that low-level mixed waste would be shipped from BNL off Long Island, and that no low-level mixed waste would be shipped from offsite locations to BNL, the commentor supports this preferred alternative.

Response
DOE's preferred alternative for treatment of low-level mixed waste is a combination of parts of the Decentralized and Regionalized Alternatives. At BNL, the preferred treatment alternative is regionalized treatment, under which DOE would ship its low-level mixed waste offsite for treatment; although, some low-level mixed waste could be treated onsite, consistent with the Site Treatment Plan. All BNL low-level mixed waste would be disposed of offsite under the preferred alternative. Note, however, that these are not final decisions. Decisions will be announced in Records of Decision published in the *Federal Register* following publication of the Final WM PEIS.

Comment (2869)
As BNL is not an appropriate site to consider for the disposal of hazardous and/or radioactive wastes, BNL should be deleted from all of the tables in Chapters 4, 6, and 7.

Response
NEPA requires DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, BNL was analyzed as a reasonable potential waste management site for its own low-level mixed waste and low-level waste. For this reason, BNL is listed in the tables in Chapters 4, 6, and 7 in Volume I of the WM PEIS.

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Comment (2965)
The No Action Alternative for hazardous and/or radioactive waste is completely inappropriate for BNL. Because BNL is in a very environmentally sensitive area, there should be no treatment or storage of low-level mixed waste at this site.

Response
NEPA requires Federal agencies to include a discussion of reasonable alternatives in an environmental impact statement. DOE must provide sufficient information for each alternative so that reviewers may evaluate the comparative merits of those alternatives.

Under the WM PEIS alternatives, BNL would manage only its own low-level mixed waste and low-level waste. BNL would dispose of such wastes onsite only under the Decentralized Alternative. It would not dispose of any offsite wastes.

Although the Final WM PEIS does identify preferred alternatives for each waste type, actual programmatic decisions will be announced in Records of Decision. Moreover, the WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules and national priorities, as well as other DOE studies, will be considered in moving to Records of Decision. The minimization of environmental impacts, e.g., on ecological resources, is a decision criterion.

3.5.3 Fernald Environmental Management Project

Comment (1761)
The WM PEIS lists the Fernald Environmental Management Project (FEMP) as a possible disposal facility for other sites' waste. However, DOE, EPA, and the State of Ohio have already accepted the citizens' recommendation explicitly rejecting the idea that any offsite wastes come to FEMP for disposal.

Response
As described in Chapters 6 and 7 in Volume I of the Final WM PEIS, the alternatives for low-level mixed waste and low-level waste (the waste types considered for management at FEMP) do not include disposal at FEMP of waste generated offsite. Table 7.3-4 in Volume I of the Draft WM PEIS was misleading in identifying waste from sites other than FEMP (Ames, ANL-E, Fermi, Mound) being disposed of at FEMP. This table has been corrected in the Final WM PEIS.

Comment (2339)
Regionalized Alternative 2 is a good choice for low-level waste because it includes FEMP in the process. However, this choice could be precluded because of the preexisting agreements between FEMP and NTS.

Response
Historically, FEMP's low-level radioactive waste has been shipped to NTS for shallow land burial. FEMP ships this waste to NTS in accord with direction from DOE Headquarters and Nevada Defense Waste Acceptance Criteria NVD-325. There are no binding agreements between FEMP and NTS that would preclude the Regionalized 2 Alternative.

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Comment (1148)
We prefer that high-level waste from WVDP be stored at the Hanford Site rather than at SRS.

Response
Thank you for commenting. DOE's preferred alternative for managing high-level waste, and the reason it is preferred, is identified in Section 3.7 in Volume I of the WM PEIS. Programmatic decisions will be announced in Records of Decision published in the *Federal Register*. Budgets, schedules and national priorities, as well as other DOE studies will be factored into the decisionmaking process.

Comment (1952)
Of those commentors opposing the siting of programmatic waste management activities at the Hanford Site, some commentors gave no reason for their opposition and others expressed one or more of the reasons listed below:

- The overall risks to public health and safety (including Native Americans) and the quality of the environment from normal operations, facility accidents, and transportation accidents; including the potential contamination of water from buried waste;

- Contamination of critical sage-brush habitat in violation of the Endangered Species Act;

- That waste should be kept where it is, and DOE should not be allowed to import to Hanford and bury mixed radioactive and hazardous wastes from other nuclear weapons plants at Hanford;

- That Hanford facilities be used to treat mixed waste or low-level waste from other nuclear weapons plants only if there is no impact to Hanford cleanup schedules and if the wastes are not stored at Hanford before or after treatment for prolonged periods (a few commentors also expressed the opposite view);

- Seismic activity at Hanford was not considered with regard to long-term impacts of the treatment and storage of high-level waste; such site-specific analyses must be conducted at Hanford before any irreversible or irretrievable commitment of resources;

- That Hanford is not suitable for receiving additional wastes, as it is a Superfund site and existing wastes are not being properly stored or dealt with; Hanford cleanup needs to happen, not more dumping; modifications to the Hanford Site Tri-Party Agreement would be opposed; all waste should be kept in aboveground monitored storage; DOE should not create any more nuclear waste; and that DOE needs to determine the real total costs of these actions.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at the Hanford Site was analyzed as a reasonable option under some WM PEIS waste management alternatives. Hanford is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites.

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Radioactive and hazardous wastes are generated at DOE facilities from the development, production, testing, and disassembly of nuclear weapons; from basic and applied research; and from energy research activities. DOE will continue to perform these and other functions within its mission until directed otherwise by the President and Congress.

The Hanford Site is being analyzed in the PEIS as a candidate location for management of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste.

For low-level mixed waste, DOE evaluated seven separate alternatives. Under five of these alternatives, Hanford would serve as a disposal site for its own low-level mixed waste. Under the Decentralized Alternative and Regionalized Alternative 1, Hanford would also receive low-level waste from two small sites amounting to less than 1% of the total volume disposed of at Hanford. For Regionalized Alternatives 2 and 4, Hanford would receive small volumes of wastes from six other sites amounting to 7% of the total onsite disposal at Hanford. For Regionalized Alternative 3, all Hanford low-level mixed waste would be shipped to other sites for disposal. Only under the Centralized Alternative would the Hanford Site be responsible for disposing of a substantial quantity of waste other than its own (86% of the total volume disposed of would be received from other sites).

For low-level waste, DOE evaluated 14 separate alternatives, 12 of which considered Hanford as a potential site for disposal. Under No Action, Hanford would continue to treat and dispose of low-level waste generated onsite, as well as offsite wastes that would amount to 68% of the total volume disposed of at Hanford. For the Decentralized Alternative and Regionalized Alternatives 1, 2, and 3, Hanford would only dispose of the wastes generated on the site. For Regionalized Alternatives 4 and 5 and Centralized Alternatives 3 and 4, Hanford would dispose of its own waste, as well as offsite wastes amounting to 8% of the total volume disposed of. Hanford would dispose of a greater amount of wastes generated off the site under Regionalized Alternative 6 (80%) and Centralized Alternatives 1 and 5 (both 94%), in addition to disposing of its own waste.

Under the transuranic waste management alternatives, Hanford would treat transuranic waste, and up to 10% of the total volume that it treats would come from other sites. However, no transuranic waste disposal would take place at Hanford.

Hanford currently stores high-level waste on the site. Under each of the alternatives for managing this waste type, all of the existing and planned high-level waste being stored at Hanford would eventually be transported off the site. Under Regionalized Alternative 2, Hanford would also receive and temporarily store high-level waste from WVDP prior to its shipment to a permanent storage location.

Under three of the four alternatives proposed for hazardous waste management, the Hanford Site would continue to ship all hazardous waste off the site for treatment either at a commercial facility or at another DOE "hub" site (INEL). For the remaining alternative (Regionalized Alternative 1), Hanford would serve as a hub site managing its own waste and hazardous waste received from LLNL. Under this alternative, Hanford would treat some of the hazardous wastes onsite, with any remaining waste being shipped off the site for treatment at a commercial facility.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, including

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most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives for all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts. Therefore, there is no reason to believe that waste management activities at Hanford would have a significant negative impact on the natural environment or public health and safety.

DOE used data from the 1990 U.S. Census to estimate that about 378,000 people live within a 50-mile radius of the existing 200-Areas waste management facilities at Hanford. This population could possibly be exposed to emissions released to the atmosphere from waste management activities. Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS (Volume I, Sections 6.4, 7.4, and 8.4). Offsite population human health risks and offsite maximally exposed individual health risks are also cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.6). The health risk analyses indicate that there is a potential for increased adverse health effects from the operation of waste treatment or disposal facilities located at Hanford. However, if DOE decides to site a new waste management facility at Hanford, it would establish design and operational limitations to ensure that releases from the facility would be maintained below regulatory limits. Appendix D in Volume III describes in more detail waste management facility human health risk estimates.

The PEIS also includes a detailed assessment of risks associated with accidents from both rail and truck transportation, including low-probability/high-consequence and high-probability/low-consequence accidents. DOE found that risks from transportation accidents would be low under all alternatives. DOE provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested by local agencies.

Section 4.4.4 in Volume I of the WM PEIS states that the seismicity of the Columbia Plateau is relatively low, although shallow, low intensity earthquakes occur throughout the Hanford Site area, although quakes of greater magnitude have occurred in the plateau region. Section 2.2.1.1 of the WM PEIS Affected Environment Technical Report further discusses the existing known faults within the Hanford area and the seismic history of the Columbia Plateau. The technical report is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS.

Groundwater monitoring at Hanford in 1992 showed that 14 parameters exceeded comparison criteria. Preliminary investigations have identified four major groundwater contaminant plumes, which have been found to enter the Columbia River in at least three locations. However, any future waste management facilities at Hanford would be appropriately designed and constructed to minimize the potential for leaks affecting groundwater.

The PEIS ecological risk assessment found that environmental risks from treatment would be low at Hanford under all waste management alternatives, and environmental risk from disposal would be low after implementation of radionuclide- and/or chemical-specific limits.

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Sections 6.14, 7.14, 8.14, 9.14, and 10.14 of the WM PEIS compare potential costs by alternative for each waste type. In addition, Volume II of the PEIS contains data tables that include cost information for each site.

As evidenced by this PEIS, DOE does not intend to "dump" waste in the ground. DOE intends to properly manage the wastes to protect human health and the environment. The opinion that waste should be managed where it is generated most closely matches the No Action and Decentralized Alternatives (see Volume I, Chapter 3), which are carefully evaluated in this PEIS. Further, no wastes would be shipped to Hanford for treatment until suitable treatment facilities become available.

Other sites are being analyzed to take large quantities of Hanford transuranic waste and high-level waste for disposal. When decisions are made based on the WM PEIS, Hanford could be asked to take some or all of the low-level waste and low-level mixed waste in the DOE complex. Decisions will be based on impacts evaluated in the WM PEIS, as well as other criteria. Certainly, public input and equity will be considered in the final decisions.

DOE recognizes that the siting of waste management facilities may be perceived negatively by some people. DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decisions.

The WM PEIS uses generic treatment and disposal technologies and a number of conservative assumptions to develop its programmatic evaluations of the relative impacts of different waste management alternatives. The results of these impact analyses are screening-level estimates; prior to implementing any decisions and committing resources, DOE would develop more precise estimates of potential impacts. Issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts will be evaluated at the site level.

DOE prepared the PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. This strategy includes compliance with all laws that govern protection of the environment, including the Endangered Species Act. Based on projected land requirements, DOE considered the potential for proposed waste management activities to affect sensitive habitats and species. Because the land required for the construction of waste management facilities would be a small fraction of available nonsensitive lands, DOE would be able to avoid direct impacts to sensitive lands. Further, DOE would have enough flexibility to avoid indirect impacts, such as those that could result from building access roads. If DOE selects Hanford for a specific waste management role, it would consider in greater detail potential impacts to endangered species and natural resources.

Preexisting site-specific plans and agreements, such as the Tri-Party Agreement, will be considered by decisionmakers. However, it is possible that some compliance agreements might need to be revisited as a result of decisions made based on the WM PEIS.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets,

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schedules, and national priorities, as well as other DOE studies will be considered in developing Records of Decision.

Comment (2181)
Washington State voters passed a law, by an 84% margin, stating that we are not going to be your high level nuclear dump, not for temporary storage, nor for an underground repository. The WM PEIS does not examine alternatives to Yucca Mountain. Since Yucca Mountain is not likely to open on time, or at all, or have enough room for DOE wastes, Hanford would become a permanent waste dump.

Response
While the WM PEIS analyzes impacts from the storage and transportation of canisters that contain vitrified high-level waste, high-level waste treatment and disposal are outside the scope of the PEIS. High-level waste treatment is addressed through sitewide or project-level NEPA reviews identified in Sections 9.1.2.1 through 9.1.2.4 in Volume I of the PEIS.

The Nuclear Waste Policy Act, as amended in 1987 (Public Law 100-23), designated that a repository for high-level waste and spent nuclear fuel be developed and that deep geologic disposal be at Yucca Mountain, the only option studied for the disposal of high-level waste. Although the law does not require that the repository be at Yucca Mountain in Nevada, it identifies only Yucca Mountain for the site characterization activities that would precede the selection of a repository location. Potential environmental consequences of constructing and operating a high-level waste repository at the site is being evaluated in the Yucca Mountain Repository EIS. If the high-level waste repository is not established at Yucca Mountain, DOE would have to reevaluate long-term plans for disposition of high-level waste.

As described in Section 9.3.5 in Volume I, the WM PEIS does examine the environmental impacts of long-term storage of high-level waste canisters at Hanford if the repository does not open on time. The impacts of long-term *storage* of vitrified high-level waste at Hanford would be small.

Comment (2238)
The WM PEIS should include Chapter 5 of the Hanford Remedial Action EIS, including the land-use-based and health-risk-based alternatives.

Response
The WM PEIS is a national and programmatic study to help DOE develop a strategy to manage the radioactive and hazardous wastes for which the Waste Management Program is responsible. The alternatives in the Hanford Remedial Action EIS deal primarily with environmental restoration, not waste management, activities at Hanford. Environmental restoration activities are not within the scope of the WM PEIS. However, the PEIS does evaluate how the comparison among waste management alternatives could be affected by estimated volumes of environmental restoration waste that could be transferred to Waste Management Program responsibility (see Volume III, Appendix B). In addition, Section 1.8 in Volume I describes the relationship of this PEIS to other actions and programs, including the Hanford Remedial Action EIS.

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Comment (2260)
The workforce at Hanford is demoralized by no action. We need to identify the opportunities that exist from the legacy of the past. We cannot tolerate delays. We will never have all the answers; we will have to make decisions on incomplete information.

Response
The WM PEIS does not qualitatively analyze environmental restoration wastes ("the legacy of the past"), nor does the scope of the WM PEIS include environmental restoration alternatives. Section 1.7.1 in Volume I of the PEIS explains the change in scope of the WM PEIS, which removed environmental restoration alternatives from the analysis, primarily because of the site-specific nature of environmental restoration activities and the uncertainty about the characteristics of environmental restoration waste at many DOE sites.

Section 1.8.1 in Volume I does include descriptions of other Hanford NEPA documents and their relationship to the WM PEIS. Among these documents is the Hanford Remedial Action Draft EIS, which analyzes the impacts of remediating past-practice waste sites that are DOE's responsibility. It will help establish future land-use objectives to assist DOE in developing a remediation strategy for the Columbia River, Central Plateau, and all other geographic areas of the Hanford Site.

Section 11.6.2 in Volume I of the WM PEIS notes that the impacts of actions addressed in the Hanford Remedial Action Draft EIS are included in the cumulative impacts analysis for Hanford.

Comment (3088)
Since the State of Nevada indicates it does not want the high-level waste, Hanford could become a permanent centralized storage site under the Centralized Alternative, which would affect and require a modification to the Tri-Party Agreement. All of WVDP's 300 canisters would be shipped to Hanford because WVDP would generate all of its canisters prior to 2015; if acceptance of the high-level waste at the geologic repository is delayed past 2015, all canisters from WVDP, SRS, and INEL could be shipped to Hanford for storage prior to shipping to Yucca Mountain. Nevada might never accept these canisters, leaving Hanford a permanent storage site.

Response
As described in Section 9.3.5 in Volume I, the WM PEIS examines the environmental impacts of long-term storage of high-level waste canisters at Hanford if the repository designated by the Nuclear Waste Policy Act, as amended in 1987 (Public Law 100-23), does not open on time. The impacts of long-term storage of vitrified high-level waste at Hanford would be small.

Comment (3166)
One commentor stated that the State of Washington and the U.S. EPA should not allow DOE or the U.S. Department of Defense to transfer to the Hanford Site any hazardous and radioactive waste unless the following criteria are met. Transport of offsite waste to Hanford for treatment will require careful planning of routes and consideration of weather emergencies to minimize the likelihood of an accident. Emergency preparedness for minimizing the impacts from an accident will require financial support from DOE to State, Tribal and local involvement, including adequate equipment and training. When materials are shipped, timely notification should be provided to transportation agencies.

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Response

Sections 4.3.10 in Volume I and E.9 in Volume IV of the WM PEIS describe the transportation planning and route selection processes used by DOE. Transportation planning includes considerations of emergency planning and shipment notification requirements.

DOE requirements for emergency response preparedness are contained in DOE Order 151.1, *Comprehensive Emergency Management Systems and Planning for Preparedness for Operational Emergencies*. Emergency preparedness for transport of radioactive wastes is a vital part of the transportation planning process.

As a shipper of radioactive materials, DOE is responsible for complying with the regulations applicable to the safety of its shipments. This includes assisting State, Tribal, and local emergency responders if an accident occurs. DOE's Transportation Emergency Preparedness Program includes initiatives on planning and training, exercises, and technical assistance to State, Tribal, and local governments. DOE further provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested. DOE's Radiological Assistance Program teams are administered by eight Regional Coordinating Officers.

Comment (3421)

DOE's low-level radioactive waste is not regulated. At Hanford, it is buried in unlined, unregulated trenches that do not meet commercial standards and lack appropriate monitoring. DOE now wants to bury in Hanford's unlined and unregulated low-level radioactive waste trenches waste that has been considered mixed toxic or carcinogenic dangerous waste under the Washington State Dangerous Waste Law. Quantities of these wastes and corresponding risks and impacts (e.g., health, water, wildlife, and air) of having these wastes in the same unlined, unregulated burial trenches as radioactive wastes are not disclosed in the WM PEIS.

Response

Assuming that the comment might refer to low-level mixed waste after treatment, it is important to note that the disposal facilities for treated low-level mixed waste would be designed to comply with the applicable Dangerous Waste Regulations of Washington State.

Quantities of low-level mixed wastes and hazardous waste, including those referred to by the commentor, and the corresponding impacts analyses are found in Chapters 6 and 10, respectively, in Volume I of the PEIS. Further information is provided in Appendix I in Volume IV of the PEIS, and in technical reports available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final PEIS.

Comment (3715)

Even without considering environmental restoration and decontamination wastes, the Centralized Alternative for low-level mixed waste and hazardous waste could cause adverse air quality impacts, pose health risks along transportation corridors, make Hanford a sacrifice zone, and impact air and water resources and transportation corridors by treating/incinerating mixed waste from other sites at privatized facilities now planned by Hanford. In addition, if DOE chooses the Centralized Alternative for disposal of all DOE low-level mixed waste at Hanford, Hanford would get 6.3 times more waste than it already has plans to dispose of.

3.5.4 Hanford Site

Site Treatment Plans for other weapons plants include plans to ship mixed waste to Hanford for long-term storage/disposal in violation of Hanford Advisory Board advice, Joint States' principles, and DOE's own promises. Why do we have to worry about DOE choosing the Centralized Alternative for disposing of all of the Nation's low-level mixed waste at Hanford? Because DOE's cost estimate for the Centralized Alternative is $5 billion less than for the Decentralized Alternative.

Response
DOE analyzed the Centralized Alternatives for low-level mixed and hazardous waste to compare reasonable alternatives, as required by the CEQ regulations for implementing NEPA. Potential impacts that were analyzed included air quality, health risks from transportation, ecological resources, and land requirements. Cost was only one item among many analyzed. As waste is consolidated at fewer sites, costs for waste management facilities decrease. DOE identifies its preferred waste management alternatives and the reasons they are preferred in Volume I, Section 3.7, of the Final PEIS.

The WM PEIS provides the NEPA basis for the Federal Facility Compliance Act low-level mixed waste treatment configuration. The initial Site Treatment Plans were based on discussions among States, EPA, Tribal Governments, and the public. The implementing Compliance Orders can be modified to reflect technical, schedule, and other additional inputs as the treatment configuration and needs evolve.

Comment (3743)
If DOE chooses the Centralized Alternative for disposal of all low-level waste at the Hanford Site, even without consideration of Hanford's own cleanup waste requirements, the site's total wastewater treatment capacity would be exceeded.

Response
As noted in Section 1.7.3 in Volume I, in accordance with NEPA, the Final WM PEIS identifies a preferred alternative for each waste type. As noted in Section 1.7.3 in Volume I, DOE selected these preferred alternatives based on factors and criteria that include public input; favoring strategies that further DOE mission objectives; ensuring alternatives are consistent with site capabilities and availability of technologies; etc. Preferred alternatives and the reasons they are preferred are discussed in Section 3.7 in Volume I. DOE will announce its decisions in Records of Decision to be published in the *Federal Register*. Before selecting locations for waste management facilities on sites, DOE will consider the results of existing relevant or required new NEPA reviews, which would address in more detail potential environmental impacts based on site- specific conditions, including wastewater treatment capacity. If an alternative selected by DOE would result in the Hanford Site's total wastewater treatment capacity being exceeded, expanded wastewater treatment capacity would be among the new facilities required by that alternative.

3.5.5 Idaho National Engineering Laboratory

Comment (537)
DOE needs to understand that the disposal of low-level waste over an aquifer will not be a preferred alternative for Idaho; this would be a non-preferred alternative.

Response
Low-level waste would be disposed of at INEL under the No Action, Decentralized, and Regionalized 1 through 5 Alternatives. The WM PEIS analysis of the impacts to water quality from disposal showed that low-level waste disposal at INEL would not cause groundwater concentrations to exceed or even approach relevant drinking water standards under any of the low-level waste alternatives. More detail on water quality impacts from low-level waste management is provided in Section 7.6.2 in Volume I of the WM PEIS. DOE would conduct disposal unit performance assessments before siting disposal facilities at INEL or any site. Siting of disposal facilities will not occur before DOE has considered the results of sitewide or project-level NEPA reviews.

Comment (2583)
The WM PEIS states that INEL was eliminated from consideration as a Regionalized Alternative site for high-level waste because it has no existing or approved storage facilities. In that case, why is INEL appropriate for other alternatives?

Response
Four DOE sites either store or manage high-level waste: the Hanford Site, INEL, SRS, and WVDP. The WM PEIS analyzes the impacts of stored vitrified high-level waste. However, high-level waste at INEL is not vitrified; rather, it is in liquid or calcined forms pending future processing to a final waste form, and no high-level waste canister storage facility exists or is approved for INEL.

Because the site is not authorized to treat high-level waste to a final waste form acceptable for disposal in the candidate repository, the No Action Alternative assumes no canister production at INEL. INEL is also assumed to have no canister storage facilities under the No Action Alternative.

For all alternatives other than No Action, an average annual production rate of 48 canisters per year is assumed for INEL. Under the Decentralized Alternative, storage capacity would be constructed at the site equal to the anticipated total production of high-level waste canisters at INEL.

The Regionalized Alternatives for high-level waste address transporting the relatively small number of WVDP high-level waste canisters to either the Hanford Site or SRS, both of which have existing or planned storage facilities that could accept these canisters in the near term. In contrast, INEL was eliminated from consideration as a storage site *for WVDP canisters* under the Regionalized Alternatives because it has no existing or approved storage facilities for high-level waste. However, adequate storage capacity would be constructed at INEL under the Regionalized Alternatives for managing high-level waste canisters produced onsite.

Comment (2881)
The State of Idaho supports those alternatives proposing to construct or operate waste treatment facilities on INEL consistent with requirements of the Spent Nuclear Fuel Court Order of 1995, the Federal Facility Compliance Act, and the INEL Site Treatment Plan. The State opposes any proposed alternative specifying the siting and operation of any waste disposal facility over the Snake River Plain

sole-source aquifer. Because of the State's dependence on the aquifer, it also opposes any alternatives under which large amounts of offsite waste would be brought to INEL for disposal.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at INEL was analyzed as a reasonable option under some of the WM PEIS waste management alternatives. INEL is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites.

INEL is analyzed in the WM PEIS as a candidate location for management of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste.

For low-level mixed waste, DOE evaluated seven separate alternatives. Under four of these alternatives, INEL would serve as a disposal site for low-level mixed waste. Under the Decentralized Alternative, INEL would only dispose of its own low-level mixed waste. For Regionalized Alternatives 1 and 2, INEL would also receive wastes from other sites that would amount to 10% and 9%, respectively, of the total volume disposed of at INEL. Only under Regionalized Alternative 4 would INEL receive and dispose of a substantial amount of low-level mixed waste from other sites (76% of the total volume disposed of at INEL). Conversely, under Regionalized Alternative 3 and the Centralized Alternative, all INEL low-level mixed waste would be shipped off the site to another location for disposal.

For low-level waste, DOE evaluated 14 separate alternatives, 7 of which considered INEL as a potential site for disposal. For the No Action, Decentralized, and Regionalized 1, 2, 3, and 4 Alternatives, INEL would only dispose of its own waste. Under Regionalized Alternative 5, INEL would receive and dispose of low-level mixed waste from other sites (69% of the total volume disposed of at INEL). Under Regionalized Alternatives 6 and 7, and the five Centralized Alternatives, INEL low-level waste would be shipped off the site to another location for disposal.

Under several of the transuranic waste management alternatives, INEL would treat transuranic waste, and up to 31% of the total volume that it treats could come from other sites. However, no transuranic waste disposal would take place at INEL.

INEL currently stores high-level waste onsite. Under the alternatives for managing this waste type (with the exception of No Action), the existing and planned high-level waste stored at INEL would eventually be transported off the site to a permanent storage location. Under the No Action Alternative, current onsite storage and management practices for high-level waste would continue.

Four alternatives were analyzed for hazardous waste management. Under the Decentralized Alternative, all INEL hazardous wastes would be shipped off the site for commercial treatment. Under No Action and Regionalized Alternative 1, INEL would continue to treat some hazardous wastes produced on the site, with any remaining waste being shipped off the site for treatment at a commercial facility. For Regionalized Alternative 2, INEL would also serve as a "hub" location for receiving hazardous wastes from several western region sites prior to onsite or offsite treatment.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see

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Volume III, Appendix C, for analysis methods. The affected environment at each major site was considered in the PEIS analysis. The analysis considered potential impacts from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at INEL would have a significant negative impact on the natural environment or public health and safety.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decision. Similarly, the position and comments from the State of Idaho will be considered by decisionmakers in selecting alternatives for implementation.

The PEIS addresses water resources as site-specific impact parameters. The major groundwater unit at INEL is the Snake River Plain Aquifer, which is considered a sole-source aquifer for area wells. Although groundwater monitoring for radioactive and nonradioactive parameters have shown elevated levels of some contaminants at onsite wells, no contaminants were found to exceed established EPA levels in offsite wells.

Actual design, siting, construction, and operation of disposal facilities will require additional analyses, such as performance assessments, and would be in compliance with all existing site-specific requirements, such as the INEL Land Use Plan. The Site Treatment Plans were developed in accordance with the Federal Facility Compliance Act for treatment of DOE low-level mixed waste. The DOE Disposal Workgroup and the National Governors Association have developed a process to identify sites subject to Site Treatment Plans that are suitable for further evaluation of their potential as disposal sites. Information obtained through this process will be considered in developing Records of Decision for the WM PEIS. Further information on this process is provided in Volume I, Section 1.8.2, of the PEIS.

DOE recognizes that the siting of waste management facilities may be perceived negatively by some people. DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decisions.

DOE prepared the PEIS as a part of its effort to develop an overall national strategy on which to base waste management decisions. Before selecting locations for waste management facilities or sites, DOE will consider the results of existing or require new sitewide or project-level NEPA reviews, which will evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities.

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Comment (1488)
Do not bring wastes to LANL from other sites. It is not an appropriate site for waste treatment, storage, or disposal.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action. In this case, the potential for siting some waste management activities at LANL is a reasonable option under some of the WM PEIS alternatives. LANL is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation of a major site does not mean the site will be selected for a programmatic waste management role.

LANL is analyzed in the WM PEIS as a candidate location for management of low-level mixed waste, low-level waste, transuranic waste, and hazardous waste.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at LANL would have a significant negative impact on the natural environment or public health and safety.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies will be considered in developing Records of Decision.

DOE prepared the PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. Before selecting locations for waste management facilities on sites, DOE will consider the results of existing required new sitewide or project-level NEPA reviews, which will evaluate in greater detail the design of specific facilities and the potential for environmental impacts at sites selected for programmatic waste management activities.

Comment (1490)
Keep low-level waste onsite at LANL.

Response
DOE considered managing LANL's low-level waste onsite under the No Action, Decentralized, and Regionalized 1, 2, 3, and 4 Alternatives. Under the Regionalized 5, 6, and 7, and Centralized Alternatives, LANL would ship some or all of its low-level waste to other sites. The low-level waste alternatives are detailed in Section 7.3 in Volume I. DOE is required to evaluate reasonable

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alternatives. This allows decisionmakers to make meaningful comparisons of waste management alternatives. The preferred alternatives and the reasons they are preferred are described in Section 3.7 in Volume I of the WM PEIS. While the WM PEIS presents national strategy options, actual programmatic decisions will be announced in Records of Decision, which will be published in the *Federal Register*. Budgets, schedules and national priorities, as well as other DOE studies (e.g., Baseline Environmental Management Report, Risk Reports, Site Treatment Plans) will be factored into the decisionmaking process.

Comment (1566)
Bringing hazardous waste into the community for incineration is not a good idea. The controlled air incinerator planned for LANL just lost funding. DOE needs to consider other options for treatment. The Final WM PEIS needs to discuss incineration in more detail.

Response
For the Final WM PEIS, DOE modified the Decentralized Alternative for hazardous waste and eliminated LANL as a candidate for onsite treatment of such waste. LANL remains as a candidate site for onsite treatment under Regionalized Alternative 1 (see Section 10.3.3).

Also for this analysis, DOE used generic treatment technologies (incineration and fuel burning) to determine representative impacts. However, DOE will not use the PEIS to select technologies. Volume IV, Section H.3.2, of the PEIS discusses the technical issues, schedule, cost, and public acceptability associated with the incineration of DOE waste.

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Comment (123)
If those commentors opposing the siting of programmatic waste management activities at LLNL, some commentors gave no reason for their opposition and others expressed one or more of the reasons listed below:

- The overall risks to public health and safety and the quality of the environment from normal operations, facility accidents, and transportation accidents;
- Specific Risks: Seismic risks associated with the location of Site 300 on an earthquake fault; potential groundwater and drinking-water contamination; and the dangers of transporting wastes over congested freeways that have "millions of commuters and frequent accidents";
- Factors: The prevailing winds in the area; the population density around the site; the potential cancer rates associated with programmatic waste management activities; that Site 300 is located only a few miles from the California aqueduct; and consistency with land-use and growth-planning issues;
- Opinions: That the thermal treatment technology is unproven; that Site 300 is currently a Superfund site, and as such DOE should not "dump" more waste there; that waste should be sent to unpopulated areas; that siting waste management activities at LLNL would cause property values to decrease; and that more studies are needed on possible health, safety, environmental, and economic impacts.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at LLNL is a reasonable option under some WM PEIS management alternatives. LLNL is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role.

DOE considered the management of low-level mixed waste, low-level waste and transuranic waste at LLNL. Under 5 of the 36 alternatives in the PEIS (the Decentralized Alternative and Regionalized Alternative 1 for low-level mixed waste; the Decentralized Alternative and Regionalized Alternatives 1 and 2 for low-level waste), would DOE construct new disposal facilities to manage wastes at LLNL. These facilities would manage wastes generated at LLNL and at as many as six other sites. LLNL would receive offsite low-level mixed waste that would amount to 11% of the total low-level mixed waste volume disposed of at LLNL; it would receive offsite low-level waste that would constitute 56% of the total low-level waste volume disposed of at LLNL. Under the Centralized Alternative, all LLNL wastes would be managed at other DOE sites. For transuranic waste, LLNL would treat and store its own waste under the No Action and Decentralized Alternatives. No transuranic waste disposal would take place at LLNL.

The WM PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Volume III, Appendix C for analysis methods. The affected environment at each major site, including existing land use (such as, for LLNL, the City of Tracy Comprehensive Plan) was considered in the

3.5.7 Lawrence Livermore National Laboratory

PEIS analysis. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at LLNL would have a significant negative impact on the natural environment, public health and safety, or property values.

DOE recognizes that LLNL is one of the sites with the highest potential for being impacted by seismic effects (see Volume I, Section 4.3.4). Nonetheless, LLNL was included as a candidate site because it passed all of the screening criteria, one of which was that candidate sites could not be within 200 feet of an active fault. Major faults in the area are the San Andreas, Hayward, Calaveras, and Greenville Faults. However, local faults have the greatest potential for damaging earthquakes (see Section 4.4.6). The potential effects of accidents initiated by earthquakes at treatment facilities were calculated in the PEIS, assuming generic facility characteristics, and were estimated to produce minimal risks.

As to the other specific risks cited by commentors, refer to the following sections of the PEIS: water resources (Sections 6.6, 7.6, and 8.6) and air quality (Sections 6.5, 7.5, and 8.5). The PEIS also includes a detailed assessment of risks associated with accidents from both rail and truck transportation, including low-probability/high-consequence and high-probability/low-consequence accidents (Volume IV, Appendix E). DOE found that risks from transportation accidents would be low under all alternatives. DOE provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested by local agencies.

DOE used data from the 1990 U.S. Census to estimate that about 6,325,000 people live within 50 miles from the center of LLNL. This population could possibly be exposed to emissions released to the atmosphere from waste treatment or disposal facilities.

Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS (Volume I, Sections 6.4, 7.4, and 8.4). Offsite population human health risks and offsite maximally exposed individual health risks are also cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.8). The health risk analyses indicate that there is a potential for increased adverse health effects from the operation of waste treatment or disposal facilities located at LLNL. However, if DOE decides to site a new waste management facility at LLNL, it would establish design and operational limitations to ensure that releases from the facility would be maintained below regulatory limits. Appendix D in Volume III describes in more detail waste management facility human health risk estimates.

Properly designed and operated incinerators have been shown to be as or more effective than other proven treatment technologies and DOE does not preclude their use at any site. DOE compared impacts from incineration with non-thermal treatment technologies and identified little or no difference in treatment risks to human health, DOE documented these findings in a technical report (M/B SR-03, September, 1995). DOE has an aggressive technical development program exploring alternatives to incineration. Alternatives will be tested and deployed depending on their potential to safely and effectively treat wastes.

As evidenced by the PEIS, DOE does not intend to "dump" waste in the ground. A major focus of the PEIS is to help DOE establish a Department-wide program to safely and efficiently manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts are more appropriately evaluated in sitewide or project-level studies.

DOE recognizes that the siting of waste management facilities might be perceived negatively by some. DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decisions.

The proximity of a waste management site to populated areas is only one of many factors in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements, and the PEIS presents alternatives that would minimize waste transportation (Decentralized Alternatives) or maximize waste transportation (Centralized Alternatives). Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in Volume I lists and describes examples of the criteria and factors DOE will consider in the decisionmaking process.

DOE prepared the WM PEIS as a part of its effort to develop an overall national strategy on which to base waste management decisions. The development of this strategy took into consideration the actions addressed in related DOE NEPA documentation (see Volume I, Section 1.8.2), including the EIS for Continued Operations of Lawrence Livermore National Laboratory and Sandia National Laboratories. Additional sitewide or project-level NEPA studies will evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities and will provide a basis for selecting treatment and disposal technologies.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decision.

Comment (1597)
There are no alternative routes for commuters in the LLNL area and transporting waste through here would be a problem. DOE should consider other places for waste disposal that are not near heavily populated areas.

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Response
The WM PEIS does consider and analyze sites other than LLNL as potential disposal sites. Criteria for selecting candidate sites included the characteristics of the waste, specialized treatment requirements, and existing facilities. The remoteness and lack of population density of a location for a waste management site constitutes only one factor in evaluating alternatives. Other criteria would include construction/modification of facilities, and increased transportation requirements.

The same roads are used whether DOE ships waste to or from a particular site. Should DOE decide to dispose of waste in less-densely populated areas (i.e., not LLNL), generally speaking, more waste would be transported from LLNL than would have been transported to LLNL. Specifically, more low-level mixed waste would be transported in the LLNL area if DOE decides not to dispose of waste at LLNL and about the same amount of low-level waste would be transported.

The PEIS includes a detailed assessment of risks associated with accidents from both rail and truck transportation, including low-probability/high-consequence and high-probability/low-consequence accidents. DOE provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested by local agencies.

Comment (1603)
The Draft WM PEIS states that for low-level mixed waste under the Regionalized Alternative, LLNL is the preferred option. DOE should explain where it will transport waste for disposal after it is brought to LLNL for treatment.

Response
As described in Section 6.3.3 in Volume I of the WM PEIS, the WM PEIS analyzes four regionalized alternatives for low-level mixed waste. Only under Regionalized Alternative 1 would LLNL serve as a regional treatment and disposal site. Under this alternative, low-level mixed waste treated at LLNL would be disposed of at LLNL or shipped to NTS. Section 3.7 in Volume I of the Final WM PEIS identifies DOE's preferred alternatives and the reasons they are preferred. The specific disposal location on a particular site will not be determined on the basis of the WM PEIS analysis, but rather, would be selected on the basis of subsequent NEPA analyses.

Comment (4048)
Based on the WM PEIS, DOE is considering plans to convert many of its facilities to what will, for many, become a permanent form of land use: nuclear waste dumps. LLNL is an example of this emerging pattern of conversion. LLNL has no permanent disposal options for the large quantities of mixed waste it generates. The WM PEIS forecasts within the preferred alternative that two regional waste management facilities at LLNL will be developed: (1) the Main Site will house a regional mixed waste management facility, which is now to begin construction without the benefit of a facility-specific EIS; and (2) Site 300, a more rural area adjacent to Tracy that generally has been used to conduct high-explosives tests, will become a low-level waste dump.

Response
The WM PEIS assumes generic treatment and disposal facilities to manage low-level and low-level mixed wastes. For purposes of analysis, the disposal units at LLNL were assumed to be located at Site 300. DOE has not proposed the locations for specific facilities on specific sites. DOE would make

those decisions only after considering the results of NEPA reviews that consider site-specific conditions in greater detail.

Note that DOE has canceled its plans for the Mixed Waste Management Facility at LLNL.

LLNL is considered in the WM PEIS for low-level mixed waste disposal facilities under the Decentralized Alternative and one of four Regionalized Alternatives. This site is also a candidate site for low-level waste disposal facilities under the Decentralized Alternative and two of seven Regionalized Alternatives. The combined and cumulative impacts of siting waste management facilities at LLNL are addressed in Section 11.8 in Volume I of the WM PEIS. DOE has identified its preferred alternatives, and the reasons they are preferred, for management of low-level mixed waste and low-level waste in Section 3.7 in Volume I of the WM PEIS. If DOE ultimately selected the alternatives involving LLNL in Records of Decision, actual siting and construction of waste management facilities at LLNL would not occur before completion of sitewide or project-level NEPA reviews.

Comment (4062)
Any efforts to develop the LLNL Main Site or Site 300 as regional waste management centers must include site-specific environmental review and analysis.

Response
The WM PEIS has been prepared to assist DOE decisionmaking on waste management at a broad, programmatic level. Should LLNL be selected for regional treatment, storage, or disposal, DOE will consider the results of sitewide and project-level NEPA reviews, which would include detailed analyses of potential environmental impacts based on site-specific conditions.

3.5.8 Nevada Test Site

Comment (109)
A commentor opposes transportation of radioactive waste through southern Utah to the Nevada Test Site.

Response
DOE believes the risks associated with transportation of radioactive waste through southern Utah to the NTS would be small, as indicated in tables with the total impact by alternative in Appendix E in Volume IV of the WM PEIS. The WM PEIS analysis enables a relative comparison of possible risks due to the transportation of waste among sites, which DOE could mitigate through careful planning and safety measures.

Comment (225)
Of those commentors opposing the siting of programmatic waste management activities at NTS, some commentors gave no reason for their opposition and others expressed one or more of the reasons listed below:

- The overall risks to public health and safety and the quality of the environment from potential waste management operations, considering "the known soil, surface water, and groundwater contamination" from past nuclear testing and related experiments;

- The State of Nevada does not produce any nuclear wastes, is rapidly growing, and should not be used as a nuclear waste "dump" for other sites;

- Sites outside Nevada, including in Canada and Mexico, should also be considered for managing this waste.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at NTS was analyzed as a reasonable option under some WM PEIS waste management alternatives. NTS is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role. Foreign countries, such as Canada and Mexico, in light of the lack of U.S. Government jurisdiction and the criteria described in Section 4.2.1, do not presently appear to be reasonable siting alternatives for waste management activities.

NTS is analyzed in the WM PEIS as a candidate location for management of low-level mixed waste, low-level waste, and transuranic waste.

For low-level mixed waste, DOE evaluated seven separate alternatives. NTS would serve as a disposal site under five of these alternatives. Under Regionalized Alternatives 2 and 4, NTS would only dispose of the low-level mixed waste generated on the site. Under the Decentralized Alternative and Regionalized Alternatives 1 and 3, NTS would dispose of low-level mixed waste, nearly all of which would be generated off the site. Under the Centralized Alternative, all NTS low-level mixed waste would be shipped off the site to another location for disposal.

3.5.8 Nevada Test Site

For low-level waste, DOE evaluated 14 separate alternatives, 10 of which considered NTS as a potential site for disposal. For the Decentralized Alternative and Regionalized Alternatives 1 and 2, NTS would dispose of its own low-level waste. Under the No Action Alternative, Regionalized Alternatives 3, 4, 5, and 7, and Centralized Alternatives 2 and 4, NTS would receive wastes from several other sites that would constitute the majority of the total volume disposed of at NTS. Under the remaining four alternatives, all NTS low-level waste would be shipped off the site to another location for disposal.

Under the transuranic waste management alternatives, NTS would treat only its own transuranic waste, and would receive none from other sites. Similarly, no transuranic waste disposal would take place at NTS.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10 for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at NTS would have a significant negative impact on the natural environment or public health and safety.

DOE used data from the 1990 U.S. Census to estimate that about 14,300 people live within a 50-mile radius of an existing waste disposal facility at NTS. This population could possibly be exposed to emissions released to the atmosphere from waste management activities. However, the risk analyses in the PEIS suggest that the adverse health effects, if any, from the operation of waste treatment facilities at NTS would be small (see Volume I, Sections 6.4, 7.4, and 8.4).

Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS. Offsite population human health risks and offsite maximally exposed individual health risks are cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.10). The health risk analyses suggest that adverse health effects from the operation of waste treatment facilities located at NTS would be small. Public health impacts from disposal would similarly be small after implementation of mitigation measures necessary to ensure that DOE would not exceed radionuclide- and/or chemical-specific limits. Volume III, Appendix D, describes in more detail waste management facility human health risk estimates.

The NTS waste management sites are currently undergoing extensive investigation for the purpose of determining the sites' ability to isolate the wastes from the environment. Further studies are ongoing to determine the potential that disposal of wastes may have of commingling with any other contamination that might exist on the surface or underground. All indications at this point are that no commingling occurs. An evaluation of all the interacting source terms will also be conducted.

Groundwater monitoring at NTS in 1991 showed that eight parameters exceeded comparison criteria at onsite wells. However, any future waste management facilities would be appropriately designed and constructed to minimize the potential for leaks affecting groundwater.

3.5.8 Nevada Test Site

DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decision.

DOE intends to properly manage the wastes to protect human health and the environment. DOE considered equity in selecting the PEIS preferred alternatives, and DOE decisionmakers will consider equity issues when developing Records of Decision. As indicated in Section 1.7.3, DOE favors alternatives that distribute waste management facilities in ways that are equitable. Although storage and disposal in less populated regions may lessen some impacts, the risks from transporting waste to these remote areas would increase. These trade-offs are described in the WM PEIS and are important factors that will be considered in the decision process.

A major focus of the PEIS is to help DOE establish a Department-wide program to efficiently and safely manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts are more appropriately evaluated in sitewide or project-level studies. The potential disposal of wastes in a geologic repository at Yucca Mountain is not within the scope of the WM PEIS. Possible environmental impacts from the construction, operation, and eventual closure of a potential repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain will be addressed in a separate EIS.

DOE prepared the WM PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. Before selecting locations for waste management facilities on sites, DOE will consider the results of sitewide or project-level NEPA analyses, which would evaluate in greater detail the design of specific facilities and the potential for environmental impacts at sites selected for programmatic waste management activities.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decision.

Comment (1551)
People who work at NTS consider it a great national resource, and it should be used more.

Response
Thank you for your comment. While certain WM PEIS Centralized or Regionalized Alternatives might offer particular benefits to a local community or region over another approach, DOE must base its waste management strategy on the diverse national needs and issues that affect many sites and regions.

DOE has prepared a sitewide EIS for NTS that addresses the environmental impacts of alternatives for the continued operations of NTS and other DOE activities in the State of Nevada. DOE proposes to continue managing NTS and its resources in a manner that meets evolving DOE missions and responds to stakeholder concerns, as well as those of affected and interested individuals and agencies. The NTS sitewide EIS examines existing and potential impacts to the environment that have resulted, or could result, from current and future DOE operations in southern Nevada. The EIS analyzes the impacts from DOE programs at NTS, the Tonopah Test Range, portions of the Nellis Air Force Range Complex, the Central Nevada Test Area, and the Project Shoal Area. These programs include ongoing activities for the stewardship of the Nation's nuclear weapons stockpile, management of radioactive waste, nondefense research and development, work for others, and environmental restoration. The EIS also examines newer programs such as the proposed Solar Enterprise Zone sites at NTS, Dry Lake Valley, Eldorado Valley, and Coyote Spring Valley, in accordance with the NTS mission of demonstrating the capability to provide alternative energy sources, including solar energy, to meet power needs for the southwestern United States. A copy of the Final NTS EIS, which was published in November 1996, can be reviewed at the DOE Nevada Operations Office public reading room located at 2621 Losee Road, Building B-3, Las Vegas, Nevada.

Comment (1588)
Apart from being considered for waste disposal actions, NTS should also be considered for treatment facilities because the latter bring the benefits of research and development, as well as employment.

Response
NTS is considered a candidate site for treatment of low-level mixed waste and transuranic waste. For low-level waste, all sites, including NTS would do "minimum treatment," which consists of solidification of liquids and powdered materials, packaging, and shipment. NTS is not considered in the WM PEIS as a candidate site for additional low-level waste treatment activities (e.g., thermal organic destruction, size reduction, and compaction followed by solidification) because it has a small volume of low-level waste compared to other DOE sites and has no existing treatment facilities.

Comment (1627)
Yucca Mountain as a permanent geologic repository has been studied for a long time without any answers. Nevada does not need aboveground storage of wastes at NTS that could last forever.

Response
The potential disposal of high-level wastes in a geologic repository at Yucca Mountain is not within the scope of the WM PEIS. DOE is preparing a Yucca Mountain Repository EIS and has established a tentative date of 2000 for the Record of Decision.

Under five alternatives, the WM PEIS analyzes the impacts of high-level waste canister storage options pending disposal. DOE analyzes five alternatives (No Action, Decentralized, Regionalized, and Centralized). For each alternative, DOE assumed that a geologic repository would begin accepting DOE-managed high-level waste in 2015 at the rate of 800 canisters per year. For purposes of analysis, DOE also evaluated a scenario that assumed that there would be a delay in acceptance of DOE-managed high-level waste at a repository until after 2015, but at the same rate of acceptance of 800 canisters per year. Under no alternative would NTS store vitrified high-level waste.

Comment (1759)
The WM PEIS does not include an adequate discussion for a national strategy for waste management.

Response
The WM PEIS is a nationwide study that examines the environmental impacts of management alternatives for DOE radioactive and hazardous wastes. The PEIS analyzes a range of broadly defined

3.5.8 Nevada Test Site

waste management alternatives that could affect environmental resources across the country. The analysis will help decisionmakers make quantitative comparisons between the alternatives that will lead, in turn, to a national strategy and decisions on waste management.

The waste management alternatives described in this PEIS could affect a number of environmental resources (human health and safety, socioeconomic conditions, etc.). For this PEIS, DOE developed an approach for the characterization of these resources in relation to the affected environments at sites across the country. In addition, the PEIS provides general and cumulative information on the affected environments at DOE sites that can be used in future sitewide or project-level NEPA analyses.

Comment (1803)
As noted in the WM PEIS, NTS is one of only two sites assessed as a potential regional and/or centralized waste disposal location for large volumes of defense low-level and low-level mixed radioactive waste.

Response
NTS is considered as a disposal location under four of the seven low-level waste Regionalized Alternatives. Of those, under three alternatives (Regionalized Alternatives 3, 4, and 5), NTS is one of six disposal locations, and under the fourth, it is considered as one of two possible disposal sites.

Comment (2337)
My choice for low-level mixed waste is Regionalized Alternative 1; Site Treatment Plans enhance this choice. NTS has been chosen as a candidate for storage because of a pending permit. Without knowing the contents or conditions of said permit, I question whether Nevada can accommodate the increased volume. Under RCRA, *any* State accepting low-level mixed waste requires a permit. Therefore, arbitrarily choosing NTS *because* of a pending permit is invalid.

Response
The rationale and criteria for selecting candidate disposal sites for low-level mixed waste are described in Volume I, Section 6.3.5, of the WM PEIS. NTS was added as a candidate disposal site for low-level mixed waste because it has an interim-status low-level mixed waste disposal facility. As pointed out by the commentor, NTS has applied to EPA for a permit under RCRA for the disposal facility. This application requires that the waste be treated to meet RCRA's land disposal restrictions. The application is for a facility with built-in liners and a leachate collection system, but will be amended to have an alternative design, as provided for in the design and operating requirements for landfills found in 40 CFR 264.301(d). The application is pending. In summary, the potential availability of a disposal facility, not the filing of a permit application, was important in selecting NTS for analysis.

DOE's preferred alternative for low-level mixed waste disposal, and the reasons they are preferred, is provided in Section 3.7 in Volume I of the Final PEIS. The selection of this alternative was based on the decision criteria and factors described in Section 1.7.3 in Volume I of the PEIS.

Comment (3311)
According to Table 7.1-2, several of the largest inventories [of low-level waste] are at sites that have very little capacity (e.g., SRS, ORR, and the Portsmouth Plant) and are a long distance from NTS. The Hanford Site's current and planned disposal capacity will be absorbed by its own projected

inventory. Therefore, we conclude that NTS, the only site in addition to Hanford that accepts wastes generated off the site, is the current candidate for disposal of offsite, low-level waste.

Nonetheless, even with 449,000 cubic meters disposal capacity, NTS could not dispose of the inventory from even the five largest generators. NTS would have to double its low-level waste disposal capacity to accept the projected inventory from the five largest sites. It would have to triple its capacity to accept the projected waste from the 27 sites evaluated in the WM PEIS. And again, this does not include environmental restoration waste. How would the various treatments affect the volumes (reference p. 7-3) requiring disposal? Would additional treatment significantly reduce the curies disposed, and if so, by how much?

Response
DOE used the existing and planned low-level waste facilities and capacities listed in Volume I, Table 7.1-2, to establish the baseline capacities for treatment and disposal and to determine the need for new or expanded facilities. Planned facilities include only the facilities for which a conceptual design has been completed.

The WM PEIS analysis assumes use of existing and planned facilities until their capacities are met. If additional capacity is needed, use of new generic facilities is assumed. These conceptual facilities provide the difference in treatment, storage, and disposal capacity between the baseline reported in Table 7.1-2 and what is necessary to manage the waste a given site would receive under any given alternative. Conceptual facilities are based on generic designs with set impacts (e.g., cost, performance/efficiency). Where necessary for analysis, DOE assumed that the impact of existing facilities essentially reflects the impact of generic facilities.

Ten sites conduct different degrees of low-level waste treatment using existing facilities. Size reduction and compaction facilities typically used to reduce the total volume of waste requiring disposal are the most prevalent existing facilities for low-level waste treatment. Six DOE sites have operating low-level waste disposal facilities. Of these, three (INEL, LANL, and ORR) accept only onsite wastes, one (SRS) accepts small amounts of waste from several small generators, and two (the Hanford Site and NTS) accept large quantities of waste from other DOE sites.

Treatment can reduce the volume of waste disposed of and can increase the stability of the disposal waste form; however, the activity (curie content) of the waste depends on the concentration of radionuclides. Treatment that changes only the physical and chemical form of the waste does not affect the concentration of radionuclides and, therefore, does not reduce the curies in the disposed of waste. Radionuclides can be destroyed through nuclear transmutation; however, the feasibility of nuclear transmutation as a treatment technology on an industrial scale is currently speculative.

Comparison of disposal volumes between minimum treatment alternatives and volume reduction alternatives for low-level waste in Appendix I in Volume IV, show how treatment can reduce disposal volumes by nearly a factor of two. The curies would remain the same.

3.5.9 Oak Ridge Reservation

Comment (1693)
Regionalizing has been done before. Major environmental problems have occurred as a result of the last effort to regionalize disposal. In reviewing the *Performance Evaluation of the Capabilities of DOE sites for Disposal of Mixed Low Level Waste*, it is apparent that ORR is technically one of the least favorable disposal sites for low-level mixed waste (LLMW). Under the regionalized alternatives, ORR would be a prime candidate for treating, storing, and disposing of LLMW. Explain how the PEIS will be modified to more closely match the capabilities of sites to handle specific waste types.

Response
The document entitled *Performance Evaluation of the Capabilities of DOE Sites for Disposal of Mixed Low-Level Waste* is a report developed for the DOE Federal Facility Compliance Act Disposal Workgroup. The report provides simple, conservative representations of site-specific performance assessments using site-specific data and consistent analyses. This evaluation found that ORR had more limited capability for the disposal of some long-lived radionuclides, such as uranium, than other DOE sites evaluated. A site-specific performance assessment at ORR was not included as part of the performance evaluation and might produce different results.

Under the LLMW Regionalized Alternatives evaluated in the WM PEIS, ORR would dispose of only its own LLMW under Regionalized Alternative 1, dispose of its own waste as well as LLMW generated at other sites under Regionalized Alternatives 2 and 4, and ship LLMW offsite for treatment and disposal under Regionalized Alternative 3. Offsite waste accounts for 35% and 38%, respectively, of the amount of LLMW proposed for disposal at ORR under Regionalized Alternatives 2 and 4.

The results of the LLMW disposal risk analysis presented throughout Section 6.4.1 of the PEIS suggest that the disposal of LLMW at ORR under Regionalized Alternatives 2 and 4 would require more controls than those used in the generic assessment. Estimated groundwater concentrations of technetium-99 could exceed drinking water standards under the assumed conditions of the conceptual disposal scenario used in the analysis.

In the actual design of a disposal facility at ORR or any DOE site, more detailed site-specific analyses would be conducted in accordance with the requirements of DOE Order 5820.2A. The implementation of the requirements of the Order might involve (1) modifying the engineering design of the disposal facility (e.g., adding a clay liner to increase contaminant adsorption or a concrete cap to reduce water filtration); (2) modifying the form of the waste to be disposed of (e.g., changing from grout or polymer to a vitrified waste form); and (3) imposing waste acceptance criteria (i.e., restricting the amounts of radionuclides or hazardous chemicals allowed in a given disposal facility).

If DOE selects a particular site for a new waste management treatment, storage, and disposal operation as a result of the PEIS analysis, additional sitewide or project-level NEPA reviews will be needed before a facility could be sited.

Comment (1697)
The capability of ORR to dispose of LLMW is limited. It appears from Volume I, Table 3.4-1, that Regionalized Alternative 3 is the only viable Regionalized Alternative for ORR.

Response
The WM PEIS alternatives reflect different national configurations of particular sites evaluated for waste management. In order to determine reasonable proposed sites for regionalized waste management facilities, DOE determined where the largest waste volumes are located and where transportation requirements would be minimized. The character of the waste and existing facilities were also taken into account.

A population risk vulnerability analysis to compare low-level mixed waste and low-level waste disposal alternatives using measures that characterize their relative potential to cause disposal risk to offsite populations was added to the Final WM PEIS. Table 5.4-2 in Volume I of the WM PEIS indicates that ORR is in the highest risk vulnerability group.

DOE considered public comments and other factors (e.g., existing environmental conditions) in its selection of preferred alternatives to manage the five waste types considered in the WM PEIS. Section 3.7 in Volume I identifies DOE's preferred alternatives and the reasons they are preferred.

Comment (1871)
The Governor of Tennessee and others strongly oppose any attempt by DOE to "site" large waste management activities in Oak Ridge, Tennessee. They oppose alternatives in the WM PEIS that consider disposal of low-level mixed waste and low-level waste at ORR.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at ORR is a reasonable option under some WM PEIS management alternatives. ORR is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role.

For low-level mixed waste, DOE evaluated seven separate alternatives. Under four of these alternatives, ORR would serve as a disposal site for low-level mixed waste. For the Decentralized Alternative and Regionalized Alternative 1, ORR would only dispose of its own waste. Under Regionalized Alternatives 2 and 4, ORR would also receive wastes from several other sites that would amount to 35% and 38%, respectively, of the total volume disposed of at ORR. Under Regionalized Alternative 3 and the Centralized Alternative, all ORR low-level mixed waste would be shipped offsite to another location for disposal.

For low-level waste DOE evaluated 14 separate alternatives, 7 of which considered ORR as a potential site for disposal. For the No Action, Decentralized, and Regionalized Alternatives 1 and 2, ORR would only dispose of its own waste. Under Regionalized Alternatives 3, 4, and 5, ORR would receive wastes from several other sites that would amount to 52% of the total volume disposed of at ORR. Under the remaining 7 alternatives, ORR low-level waste would be shipped offsite to another location for disposal.

Under the transuranic waste management alternatives, ORR would treat transuranic waste, and up to 17% of the total volume that it treats would come from other sites. However, no transuranic waste disposal would take place at ORR.

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For each of the alternatives proposed for hazardous waste management, ORR would treat some of the hazardous wastes produced onsite, with any remainder being shipped offsite for treatment at a commercial facility. Under two of the four alternatives analyzed, ORR would also receive and treat hazardous wastes from as many as four other DOE sites.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10, for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives considered in the PEIS would be small. For impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at ORR would have a significant negative impact on the natural environment or public health and safety.

DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decisions.

A population risk vulnerability analysis to compare low-level mixed waste and low-level waste alternatives using measures that characterize their relative potential to cause disposal risk to offsite populations was added to the Final WM PEIS. As shown in Table 5.4-2 in Volume I, ORR is in the highest risk vulnerability group.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. It should be noted that the WM PEIS will not be the only basis for ultimately making waste management decisions; budgets, schedules, and national priorities, as well as other DOE studies, will be considered in developing Records of Decision.

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Comment (369)
Of those commentors opposing the siting of programmatic waste management activities at PGDP, some commentors gave no reason for their opposition and others gave one or more of the reasons listed below:

- Overall risks to public health and safety and the quality of the environment from normal operations, operations accidents, and truck and rail transportation accidents. DOE's questionable ability, according to one commentor, to adequately characterize potential releases of toxic substances into streams, soil, air and groundwater, the size of the potentially affected population around PGDP, and what the commentor believes are the harmful effects of suspected past releases by DOE;

- Specific risks: Earthquake hazards; the potential for groundwater and drinking-water contamination; the potential for pollution of the Ohio River and local surface water systems; the potential for disruption of ecological resources; airborne radioactivity that would result from an incinerator; potential impacts to local agriculture;

- Factors: The site is on low ground in the floodplain of the Tennessee River; there are many people living near the site; there is a "high" cancer incidence in western Kentucky; the site has a "poor" waste management history; the Ohio River is currently polluted; the technology for dealing with waste is "in its infancy"; the public opposes storing waste at the site; the Governor of Kentucky has declared that there will be no nuclear waste dumps in Kentucky;

- Opinions: That more "poisons" should not be dumped into the ground; the characteristics of these wastes are unclear; waste should be stored where it is generated; waste should be taken to unpopulated, desolate, or desert areas; wastes should not be stored in barrels that could leak and need to be replaced after 20 years; efforts should focus on cleaning up existing "pollution" and ridding PGDP of its own waste; restaurants will close because food would get poisoned.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case; PGDP was analyzed as a reasonable potential waste management site for its own low-level mixed waste, low-level waste, and transuranic waste. PGDP is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role.

PGDP currently does not have an inventory of high-level waste, nor is it considered a major generator of hazardous waste. Under five of the 36 alternatives in the PEIS (the Decentralized Alternative and Regionalized Alternative 1 for low-level mixed waste, and the Decentralized Alternative and Regionalized Alternatives 1 and 2 for low-level waste) DOE would construct new disposal facilities to manage wastes at PGDP. These facilities would manage low-level mixed and low-level wastes generated at PGDP, and a small quantity of low-level mixed waste (less than 1%) and low-level waste (less than 1%) generated offsite. Under the other Regionalized Alternatives and Centralized Alternatives for these waste types, all PGDP waste would be managed at other sites. The characteristics associated with these waste types are discussed in Volume I, Section 1.5.

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The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10, for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at PGDP would have a significant negative impact on the natural environment, public health and safety, or the local economy.

DOE recognizes that PGDP is one of the sites with the highest potential for being impacted by seismic effects (see Volume I, Section 4.3.4). However, PGDP was included as a candidate site because it passed all of the screening criteria, one of which was that candidate sites could not be within 200 feet of an active fault (see Volume I, Section 6.3.5). The site is near two active seismic zones--the New Madrid Fault zone and the Wabash Valley Fault zone (see Section 4.4.10). The potential effects of accidents initiated by earthquakes at treatment facilities were calculated in the PEIS, assuming generic facility characteristics, and were shown to be minimal. However, it should be emphasized that no decision would be made to locate new facilities for waste treatment, storage, or disposal at PGDP until DOE has considered the results of sitewide or project-level NEPA reviews. Any new waste management facility would be built to conform to Federal criteria that take into account the somewhat higher seismic risk at PGDP relative to some of DOE's other sites.

As to the other specific risks cited by the commentors, refer to the following sections of the PEIS: air quality (Sections 6.5, 7.5, and 8.5); water resources (Sections 6.6, 7.6, and 8.6); and ecological resources (Sections 6.7, 7.7, and 8.7). Risks to local agriculture are not considered in the PEIS as a specific impact parameter; however, as environmental risks would be small, there is no reason to believe that there would be any negative impact to local agriculture. Further, although the site is near the Ohio River, it would not be affected by the probable 500-year maximum flood.

The PEIS used generic treatment and disposal technologies and a number of conservative assumptions to develop its programmatic evaluations of the relative impacts of different waste management alternatives. The results of these impact analyses are screening-level estimates; more precise estimates of potential impacts can be better developed through sitewide or project-level NEPA reviews.

For example, the PEIS analysis indicates that DOE should carefully control the disposal of low-level waste at PGDP to prevent potential groundwater contamination (see Volume I, Section 7.6.2). DOE Order 5820.2A requires DOE to conduct a detailed performance assessment before it can develop a low-level waste facility. This assessment would require more detailed site-specific information to identify the precise location and design of any proposed facility. The facility design, in turn, would require a number of mitigating factors to help limit potential groundwater contamination.

DOE used data from the 1990 U.S. Census to estimate that about 500,000 people live within 50 miles from the center of PGDP. This population could possibly be exposed to emissions released to the atmosphere from waste treatment facilities. However, the WM PEIS risk analysis suggests that adverse health effects, if any, from the operation of waste treatment facilities at PGDP would be small (Volume I, Sections 6.4, 7.4 and 8.4).

Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS. Offsite population human health risks and offsite maximally exposed individual health risks are cumulative impact parameters addressed in the PEIS (See Volume I, Section 11.12). The health risk analysis suggests that adverse health effects from the operation of waste treatment facilities located at Paducah would be small. Public health impacts from disposal would similarly be small after implementation of mitigation measures necessary to ensure that DOE would not exceed radionuclide- and/or chemical-specific limits. Volume III, Appendix D, describes in more detail waste management facility human health risk estimates.

A major focus of the PEIS is to help DOE establish a Department-wide program to safely and efficiently manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts are more appropriately evaluated in sitewide or project-level studies. Likewise, the specific types and characteristics of containers and packages that would be used in managing the different waste forms are not discriminating factors that would affect the programmatic decisions supported by the PEIS, and it is more appropriate that such factors be addressed in site-level analyses.

Properly designed and operated incinerators have been shown to be as or more effective than other proven treatment technologies and DOE does not precluding their use at any site. DOE compared impacts from incineration with non-thermal treatment technologies and identified little or no difference in treatment risks to human health; DOE documented these findings in a technical report. (M/B SR-03, September, 1995). DOE has an aggressive technical development program exploring alternatives to incineration. Alternatives will be tested and deployed depending on their potential to safely and effectively treat wastes.

DOE recognizes that the siting of waste management facilities may be perceived negatively by some persons. DOE is committed to protecting human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The PEIS will help DOE make sound waste management decisions.

As evidenced by this PEIS, DOE does not intend to "dump" waste in the ground. DOE intends to properly manage the wastes to protect human health and the environment. The opinion that waste should be managed where it is generated most closely matches the No Action and Decentralized Alternatives (see Volume I, Chapter 3), which are carefully evaluated in this PEIS.

The proximity of a waste management site to populated areas is only one of many factors in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements, and the PEIS presents alternatives that would minimize waste transportation (Decentralized Alternatives) or that would maximize waste transportation (Centralized Alternatives). Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in

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Volume I lists and describes examples of the criteria and factors DOE will consider in making its decisions.

DOE prepared the PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. When selecting locations for waste management facilities on sites, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews, which will evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities.

A population risk vulnerability analysis to compare low-level mixed waste and low-level waste alternatives using measures that characterize their relative potential to cause disposal risk to offsite populations was added to the Final WM PEIS. As shown in Table 5.4-2 in Volume I, PGDP is in the highest risk vulnerability group.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules and national priorities, as well as other DOE studies, will be considered in developing Records of Decision. Similarly, the position and comments of the Governor of Kentucky will be factored into the decisionmaking process.

Comment (2180)
Will any foreign waste be brought to PGDP?

Response
Assuming that the commentor refers to waste from outside the United States, the WM PEIS does not consider the receipt of "foreign waste" at any DOE site. Volume I, Section 1.8.1, does discuss the Foreign Research Reactor Spent Nuclear Fuel EIS, and its relationship to the WM PEIS. DOE does not plan to manage any of the foreign research reactor spent nuclear fuel (which is not considered "waste") at PGDP. The Record of Decision for the Foreign Research Reactor Spent Nuclear Fuel EIS was issued in May 1996. The decision allows for acceptance of spent nuclear fuel from 1996 to 2009 with management of the spent fuel to occur at the Savannah River Site or Idaho National Engineering Laboratory.

Assuming that the commentor refers to waste from outside Kentucky, under five of the 36 alternatives in the PEIS (the Decentralized Alternative and Regionalized Alternative 1 for low-level mixed waste, and the Decentralized Alternative and Regionalized Alternatives 1 and 2 for low-level waste) DOE would construct new waste management facilities at PGDP. These facilities would manage low-level mixed and low-level wastes generated at PGDP, and a small quantity of low-level mixed waste (less than 1%) and low-level waste (less than 1%) generated offsite. Under the other Regionalized Alternatives and Centralized Alternatives for these waste types, all PGDP waste would be managed at other sites. The characteristics associated with these waste types are discussed in Volume I, Section 1.5.

Comment (2228)
A commentor prefers a modified No Action Alternative for PGDP and to treat waste onsite or store it aboveground until onsite technologies are available. Supporting reasons are: (1) earthquakes,

(2) community safety, (3) contamination of other communities, (4) transportation accidents, and (5) worker safety.

Response
The WM PEIS human health risk assessment and the ecological risk assessment examined the potential effects on humans and the environment of waste management activities at PGDP. DOE found that public health and environmental risks would be low at PGDP under all alternatives. Health risks due to seismic events (earthquakes) are evaluated in the PEIS. PGDP site has been recognized as one of the sites with the highest potential for being impacted by seismic effects (Section 4.3.4). The site is near two active seismic zones: the New Madrid Fault zone; and the Wabash Valley Fault zone (Section 4.4.10). Accidents initiated by earthquakes at treatment facilities were included in the PEIS, assuming generic facility characteristics, and were shown to produce minimal risks. Any new waste management facility would be built to conform to Federal criteria that take into account the somewhat higher seismic risk at PGDP relative to some of DOE's other sites.

The PEIS includes a detailed assessment of risks associated with accidents from both rail and truck transportation, including low-probability/high-consequence and high-probability/low-consequence accidents. DOE found that risks from transportation accidents would be low under all alternatives. DOE provides for Radiological Assistance Program teams consisting of trained experts equipped and prepared to quickly respond to an accident and assist local emergency response personnel, if requested by local agencies. These teams will help mitigate the remaining risks associated with transportation accidents.

DOE is concerned with health and safety and the need for emergency preparedness in and around its sites. Emergency response plans are required for sites and in their surrounding communities by Federal, State, and local authorities that deal with emergency situations such as floods, tornadoes, and other natural or man-made disasters. These plans are continually updated. DOE, the U.S. Department of Transportation, and the Federal Emergency Management Agency are available to assist State and local authorities with their emergency plan reviews.

Comment (3180)
A commentor opposes disposal of either low-level waste or low-level mixed waste at PGDP. The shallow depth to groundwater and high annual rainfall would produce adverse environmental consequences if PGDP were chosen as a disposal site. PGDP is close to the Ohio River and the area has a high infiltration rate, which makes PGDP unsuitable as a disposal site.

Response
For low-level mixed waste, Section 6.2.3 in Volume I of the WM PEIS provides assumptions for facilities and disposal. The document analyzes two types of disposal: engineered disposal and shallow land burial. However, when disposing of smaller quantities of waste (i.e., less than 700 cubic meters per year) aboveground silos were assumed. Both types of low-level mixed waste disposal facilities were assumed to be designed to meet all applicable RCRA disposal requirements. Before locating a disposal facility on a site, DOE will conduct a performance assessment and define waste acceptance criteria.

Section 7.2.3 in Volume I of the PEIS identifies assumptions for facilities and disposal for low-level waste at sites with shallow groundwater and high precipitation rates. Engineered concrete structures

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are typically used for disposal to reduce potential radionuclide migration. DOE assumed the use of aboveground engineered concrete structures for sites located in the eastern United States, including PGDP.

Section 1.8.2 in Volume I of the PEIS identifies other programs and their relationship to the WM PEIS. One of these is the DOE Disposal Workgroup, which has discussed disposal of low-level mixed waste and is comprised of both DOE staff and State representatives. Section 1.8.2 states that information from the DOE Disposal Workgroup process will be considered in the WM PEIS decisionmaking process, and that identification of sites that might dispose of low-level mixed waste will follow State and Federal siting and permitting regulations.

A population risk vulnerability analysis to compare low-level mixed waste and low-level waste alternatives using measures that characterize their relative potential to cause disposal risk to offsite populations was added to the Final WM PEIS. As shown in Table 5.4-2 in Volume I, PGDP is in the highest risk vulnerability group.

Comment (4570)
A commentor asked several questions: (1) What is this comment period all about and why is the comment period so short? (2) What types of wastes were analyzed? (3) What are the half-lives of the wastes? (4) What are the waste management options for PGDP? (5) How dangerous are the options to the ecosystem? (6) When will the PGDP operating contractor answer all these questions?

Response
NEPA requires that EISs be released in draft for public review and comment to ensure that the public has the opportunity for meaningful participation in the NEPA process. NEPA requires a comment period of at least 45 days; DOE's comment period for the Draft WM PEIS totaled 150 days.

The WM PEIS analyzes management alternatives for low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste. The characteristics of these wastes are addressed in the individual waste-type chapters (Chapters 6 through 10 in Volume I).

Half-lives of radionuclides in the waste range from fractions of seconds to thousands of years. The consideration of half-lives is implicit in DOE's waste classification system. For example, transuranic waste contains more than 100 nanocuries of alpha-emitting radionuclides with half-lives greater than 20 years and an atomic number greater than that of uranium (92). Section 1.5 in Volume I describes the four classes of radioactive wastes (low-level mixed waste, low-level waste, transuranic waste, and high-level waste) evaluated in the WM PEIS. Of these, low-level mixed waste, low-level waste, and transuranic waste were evaluated at PGDP.

The radionuclide content (activities) of the various radioactive wastes are described in detail in the supporting technical reports. These reports are listed in Section 15.2 in Volume I and are available in the DOE public reading rooms listed in Section 1.9 in Volume I.

The waste management alternatives are discussed in Chapter 3. Tables 3.4-1, 3.4-2, and 3.4-3 identify the proposed waste management actions at DOE sites under the alternatives for low-level mixed, low-level, and transuranic wastes, respectively. PGDP would undertake waste management activities under some alternatives for these waste types. The impacts of all alternatives on ecological resources are discussed in the individual waste-type chapters.

In accordance with NEPA, DOE (and not the operating contractor for PGDP) is responsible for answering all comments on the WM PEIS.

3.5.11 Pantex Plant

Comment (3236)
Pantex should be excluded from any consideration as a candidate low-level radioactive mixed waste, low-level waste, or hazardous waste disposal site because (1) all hazardous waste generated at Pantex is scheduled for treatment and disposal off the site; (2) the National Governors Association Task Force and Site Treatment Plan efforts involve only treatment units (as opposed to disposal) possibly being brought to Pantex; and (3) because Pantex is located directly above the sole-source Ogallala Aquifer, the primary source of water for the multi-billion dollar agricultural industry in the Panhandle.

Response
NEPA and CEQ implementing regulations require DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for the Pantex Plant to serve as a disposal site is a reasonable option under some of the WM PEIS alternatives. Pantex is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation of a major site does not mean the site will be selected for a programmatic waste management role.

DOE considered the management of low-level mixed waste and low-level waste at the Pantex Plant. Under five of the 36 alternatives in the PEIS (the Decentralized Alternative and Regionalized Alternative 1 for low-level mixed waste; the Decentralized Alternative and Regionalized Alternatives 1 and 2 for low-level waste) DOE would construct new disposal facilities to manage wastes at Pantex. The Pantex Plant is not considered a potential centralized waste management facility in the WM PEIS and would not receive wastes from other sites under any of the alternatives. Conversely, all Pantex hazardous waste would be shipped off the site for treatment and disposal either at commercial facilities or at other DOE sites.

Waste management alternatives considered in this WM PEIS are waste-type specific. Thus, a strategy relative to hazardous waste does not necessarily apply to other waste streams. The Site Treatment Plans were developed in accordance with the Federal Facility Compliance Act for treatment of DOE low-level mixed waste. The DOE Disposal Workgroup and the National Governors Association have developed a process to identify sites subject to Site Treatment Plans that are suitable for further evaluation of their potential as disposal sites. Information obtained through this process will be considered in developing Records of Decision for the WM PEIS. Further information on this process is provided in Volume I, Section 1.8.2, of the WM PEIS.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6, 7, and 10 for discussions of specific impacts at the Pantex Plant; see Volume III, Appendix C, for analysis methods. In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at Pantex would have a significant negative impact on the natural environment or public health and safety. Risks to local agriculture are not considered in the PEIS as a specific impact parameter; however, as environmental risks would be small, it is not anticipated that there would be any negative impact to local agriculture. As described in Section 4.4.11 in Volume I, although the Ogallala Aquifer is the major source of water for the Pantex region, EPA has not classified the Ogallala as a sole-source aquifer.

DOE is committed to properly managing its waste to protect human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its Waste Management Program that provides human health and safety assurance to the public.

DOE prepared the WM PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. Before locating waste management facilities on sites, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews, which will evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities.

Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules and national priorities, as well as other DOE studies, will be considered in developing Records of Decision.

3.5.12 Portsmouth Gaseous Diffusion Plant

Comment (2076)
Will incineration or thermal treatment occur at the Portsmouth Plant? We do not want to be considered for thermal treatment.

Response
Thermal treatment was used as a generic technology in the WM PEIS analysis to allow a relative comparison of potential impacts across sites. DOE compared impacts from incineration with an alternative treatment technology and identified little change in the total risks to human health from treatment and disposal. DOE documented these findings in a technical report, that is available in the DOE public reading rooms listed in Volume I, Section 1.9, in the WM PEIS.

Properly designed and operated incinerators are as or more effective than other treatment technologies, and DOE does not preclude their use at any site. EPA's combustion strategy states, "If properly designed and operated in compliance with regulatory standards, combustion is a technology that provides sound management of hazardous waste." Fact sheets on radioactive and mixed waste incineration published jointly by EPA and DOE (EPA 402-F-95-004 through 007, January 1996) recognize the effectiveness of incineration as part of the DOE Waste Management Program and that alternatives are not entirely comparable. Optimal operation of incinerators in conjunction with existing pollution control technologies, can minimize generation of dioxins and furans and radiation releases.

DOE prepared the PEIS as a part of its effort to develop an overall national strategy on which to base waste management decisions. Before locating waste management facilities on sites, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews, which would evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities and will provide a basis for selecting treatment technologies.

Comment (2093)
DOE needs to consider the transuranic elements in Building 333 at the Portsmouth Plant.

Response
In Volume I, Section 8.1.2, DOE acknowledges that there are small amounts of transuranic waste that were not assessed in the WM PEIS. These small amounts of transuranic waste would not affect programmatic results. Radioactive waste having concentrations greater than 100 nanocuries per gram of transuranic elements with half-lives greater than 20 years is considered and included as transuranic waste in the WM PEIS.

Comment (2715)
The issue of allowing additional waste to be stored on the Portsmouth Plant should consider the following factors: (1) legally right is not always morally right, as evidenced by use by the Plant of the exemption contained in 40 CFR 264 and relative to earthquake consequences for areas east of the Mississippi River, although newer data and seismic history, compounded by deep-injection processes, suggest a moral obligation to consider earthquake hazards; (2) local risk should not be increased by offsite waste just because of the economics of the region; (3) the cost to public health and the environment should always be factored into the equation when calculating the cost of a project; and (4) people already live with the constant hazard presented by leaking, corroded drums and toxics.

Response
DOE must comply with all applicable laws and regulations. NEPA and CEQ regulations require DOE to analyze the potential environmental consequences related to its proposed actions and to prepare a detailed statement on the consequences, alternatives to the proposed action, and measures that could avoid or minimize adverse impacts. The Portsmouth Plant is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role.

DOE considers Portsmouth a potential site for the management of low-level and low-level mixed wastes. At present, the Portsmouth Plant manages its own low-level and low-level mixed wastes. Under the Decentralized Alternative and some Regionalized Alternatives, Portsmouth is a candidate for managing not only its own low-level and low-level mixed wastes, but also wastes from other DOE sites. Under the Centralized Alternative, the Portsmouth Plant is one of seven DOE sites that would receive wastes from other sites for treatment prior to disposal.

The WM PEIS analysis calculates the potential effects of accidents initiated by earthquakes at treatment facilities. While deep-injection processes could impact seismic activity, there are no geologic faults in the Portsmouth region of influence. The potential for damage from seismic activity is small.

Eleven impact parameters were evaluated in the WM PEIS, including human health risks, economic, social, and cost impacts. Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS. Offsite population human health risks and offsite maximally exposed individual health risks at Portsmouth are cumulative impact parameters addressed in the PEIS (see Volume I, Section 11.14). The health risk analysis suggests that adverse health effects from the operation of waste treatment facilities located at the Portsmouth Plant would be small. Public health impacts from disposal would similarly be small after implementation of mitigation measures necessary to ensure that DOE would not exceed radionuclide- and/or chemical-specific limits. Volume III, Appendix D, describes in more detail waste management facility human health risk estimates. As to socioeconomic impacts at Portsmouth, the data presented in Volume II, Section 13.0, of the PEIS shows the socioeconomic impacts for treatment and disposal.

Chapters 6 and 7 in Volume I discuss the estimated impacts to selected sites from the management of low-level and low-level mixed wastes, and Chapter 11 discusses cumulative impacts from the various alternatives and from existing and planned programs. These discussions do not express potential impacts in terms of cost, but the impact analysis presented will be an important factor in the WM PEIS decisionmaking process.

A major focus of the PEIS is to help DOE establish a Department-wide program to safely and efficiently manage radioactive and hazardous wastes. However, issues regarding existing pollution, a site's waste management record, and actual site cleanup efforts are more appropriately evaluated in sitewide or project-level studies. Likewise, the specific types and characteristics of containers and packages that would be used in managing the different waste forms are not discriminating factors that would affect the programmatic decisions supported by the PEIS, and it is more appropriate that such factors be addressed in site-level analyses.

3.5.13 Rocky Flats Environmental Technology Site

Comment (1764)
A commentor believes that most members of the public would not favor a No Action Alternative for RFETS, but might consider an enhanced No Action Alternative that includes a state-of-the-art treatment facility for processing wastes.

Response
The WM PEIS analyzes 36 alternatives in four categories, and DOE believes these alternatives provide a sufficient base of information on which decisionmakers can determine DOE's waste management strategy. Volume I, Section 3.7, identifies DOE's preferred alternatives and the reasons they are preferred. NEPA allows DOE to select partial alternatives or combinations of alternatives, as long as they fall within the bounds of the alternatives considered in the PEIS. In these cases, DOE would explain in the Records of Decision how and why it made its decisions, and how the decisions related to the alternatives analyzed in the Final PEIS.

Comment (1778)
Do not bury low-level waste at RFETS. We need monitorable retrievable storage.

Response
The WM PEIS analysis finds that impacts from disposal of low-level waste at RFETS (under the Decentralized, Regionalized 1, and Regionalized 2 Alternatives) would be small. Disposal facilities would be designed and sited only after additional analyses required by the DOE performance assessment process. Facilities would be constructed and operated in compliance with applicable regulations. These actions should further minimize the potential for contamination.

DOE has identified the preferred alternative for low-level waste disposal for sites such as RFETS in Volume I, Section 3.7, of the Final WM PEIS.

Comment (2578)
Why is RFETS excluded from treating offsite transuranic waste?

Response
Based on inventory and expected generation rates, RFETS houses or is expected to generate approximately 6,200 cubic meters of transuranic waste over the next 20 years. DOE developed the transuranic waste treatment configurations to present reasonable alternatives, considering a No Action Alternative and Decentralized Alternatives under which each site would treat only its own transuranic waste. Of the three Regionalized Alternatives in which transuranic waste is consolidated at two to five sites, RFETS would treat its own waste under two alternatives, and ship its wastes off the site under the third. Under the Regionalized Alternatives, the rationale was that transuranic waste treatment should be consolidated at the four largest sites where approximately 80% of the waste is located or expected to be generated over the 20-year analytical period. RFETS does not fall into this category.

Comment (3218)
Commentors oppose the siting of programmatic waste management activities at RFETS because of the location of the site near an urban environment; bringing materials onsite for treatment and burial is not acceptable to the surrounding community; and DOE should have long-term responsibility for storing the waste rather than disposing of it.

3.5.13 Rocky Flats Environmental Technology Site

Response

NEPA and CEQ implementing regulations require DOE to consider and evaluate all reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at RFETS was analyzed as a reasonable option under some WM PEIS alternatives. RFETS is one of 17 "major" sites analyzed in the PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites. However, designation as a major site does not mean the site will be selected for a programmatic waste management role.

DOE evaluated 36 alternatives in the PEIS. Under 12 alternatives (Decentralized and Regionalized Alternatives for low-level mixed waste and transuranic waste; Decentralized, Regionalized, and Centralized Alternatives for low-level waste) new facilities would be constructed to manage wastes at RFETS. These facilities would manage wastes generated primarily at RFETS; wastes received from offsite under any of the alternatives considered would be less than 1% of the total volume of that waste type disposed of at RFETS. Under certain Regionalized and Centralized Alternatives, RFETS wastes would be managed at other DOE sites.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities. See Volume I, Chapters 6 through 10, for results; see Volume III, Appendix C, for analysis methods. The analysis considered potential impacts, including most of the impacts that concern commentors, from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives at all sites considered in the PEIS would be small. For those impacts that would not be small, DOE would incorporate mitigation measures to reduce or eliminate the impacts and, where applicable, comply with regulatory requirements. Therefore, there is no reason to believe that waste management activities at RFETS would have a significant negative impact on the natural environment or public health and safety.

Specifically, the PEIS human health risk assessment and ecological risk assessment examined potential Waste Management Program effects on humans and the environment near RFETS. DOE found that public health and environmental risks from treatment would be low at RFETS under all waste management alternatives. Public health and environmental risk from disposal would be low after implementation of mitigation measures to ensure that DOE would not exceed radionuclide- and/or chemical-specific limits.

Disposal of waste is preferable to a long-term storage for several reasons. First, disposal involves placement of treated waste in facilities that will effectively remove the material from contact with human or environmental receptors for very long periods of time. For example, disposal of treated transuranic waste and high-level waste in geological repositories will isolate these materials for the long periods of time they are expected to remain hazardous. If these materials were kept in long-term storage facilities they could be subject to potential releases as a result of continued processing (repackaging), facility accidents, or natural disasters. Second, fewer resources are required to dispose of treated materials than to store them for indefinite periods of time. For example, operation of disposal facilities is expected to require only security and monitoring functions after emplacement of the wastes, whereas storage in aboveground facilities would have higher operational costs.

3.5.13 Rocky Flats Environmental Technology Site

DOE is committed to protecting health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The WM PEIS will help DOE make sound waste management decisions.

The proximity of a waste management site to populated areas is only one of the factors in evaluating alternatives. DOE must consider and balance other factors to achieve its objective of safe and efficient treatment, safe and secure storage, and ultimate disposal of each waste type. For example, DOE must consider waste transportation requirements, and the PEIS presents alternatives that would minimize waste transportation (Decentralized Alternatives) or that would maximize waste transportation (Centralized Alternatives). Although siting waste management activities in less-densely populated or remote areas could reduce the potential for some impacts, the risks of transporting wastes over longer distances to reach remote sites would increase the potential for other impacts. Section 1.7.3 in Volume I lists and describes examples of the factors and criteria DOE will consider in the decisionmaking process.

DOE prepared the PEIS as part of its effort to develop an overall national strategy on which to base waste management decisions. Before selecting locations for waste management facilities on sites, DOE will consider the results of existing relevant or required new sitewide or project-level NEPA reviews, which would evaluate in greater detail the potential for environmental impacts at sites selected for programmatic waste management activities.

Section 3.7 in Volume I of the WM PEIS identifies DOE's preferred alternatives and the reasons they are preferred. These are not final decisions. The Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS. The WM PEIS analysis will not be the only basis for ultimately making waste management decisions; budgets, schedules and national priorities, as well as other DOE studies, will be considered in developing to Records of Decision.

Comment (3260)
The WM PEIS Summary document, Section 6.2.1, states that all sites are assumed to have adequate capabilities to package and store future-generated transuranic waste (TRUW). It is not clear that this is the case at RFETS.

DOE should clarify to what extent this assertion is true for RFETS and all assumptions underlying this assertion. To what degree does the proximity of RFETS to a large metropolitan area figure into the selection of alternatives to package and store future-generated TRUW?

Response
To establish the existing capacities for TRUW treatment and identify the need for new or expanded facilities, DOE compiled a list of existing and planned TRUW facilities. Total capacities of these identified facilities are presented in Table 8.1-2, Volume I. Six sites, including RFETS, have existing or planned treatment facilities. These facilities are each capable of performing different aspects of treatment including aqueous treatment, shredding, solidification, thermal treatment, and repackaging. DOE also assumed that the basic capabilities to package and store TRUW are available at every site that would generate TRUW in the future. This includes 11 sites projected to generate contact-handled

TRUW and 5 sites with projected remote-handled TRUW, as shown in Table 8.1-1 in Volume I of the WM PEIS.

Based upon its current and projected waste volumes, RFETS is considered as a candidate site for TRUW treatment and storage under two alternatives and treatment only under two additional alternatives. Criteria, such as risk to nearby populations are included in the risk and impacts analyses, as described in Volume I, Chapter 8, of the WM PEIS. Impacts to RFETS would be small.

Comment (3267)
The WM PEIS contains alternatives within each category that would allow for shipment of waste to RFETS for treatment. Some alternatives also call for onsite disposal of materials at RFETS. The WM PEIS should not consider alternatives that require materials to be imported to RFETS, nor those that require onsite disposal at RFETS.

Response
NEPA requires DOE to analyze reasonable alternatives. RFETS is a large site that currently generates or is projected to generate three of the waste types analyzed in the PEIS. Inventoried and projected volumes indicate that RFETS has the fifth largest low-level mixed waste and transuranic waste volumes, and eighth largest low-level waste volume of the 54 DOE sites considered. Although the volumes are relatively small compared to total waste within the complex, it is reasonable to consider RFETS as a candidate treatment, storage, and disposal site under some alternatives.

3.5.14 Sandia National Laboratories-New Mexico

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3.5.15 Savannah River Site

Comment (182)
DOE needs to clarify the role of the SRS Consolidated Incineration Facility as a potential Regionalized Alternative for the acceptance of low-level mixed waste (LLMW).

Response
The WM PEIS evaluated both on- and offsite waste to be treated at the SRS Consolidated Incineration Facility. Volume I, Section 6.3.3, identifies sites that would ship LLMW to SRS for treatment under the Regionalized Alternatives. The Consolidated Incineration Facility is considered only for non-alpha LLMW; therefore, it would only treat waste from the Charleston Naval Shipyard, the Norfolk Naval Shipyard, and the Pinellas Plant. However, alpha LLMW treatment is also evaluated for SRS, with any alpha LLMW at Bettis Atomic Power Laboratory, the Mound Plant, the University of Missouri, and WVDP sent to SRS for treatment. The maximum percent of offsite LLMW to be treated at SRS under any alternative would be approximately 1%, with the remaining 99% originating at SRS. Additional alpha LLMW treatment capacity would be required to accommodate the treatment of on- and offsite alpha LLMW at SRS.

Comment (1682)
A commentor opposes the use of SRS for dumping, storage, or disposal of radioactive waste because of the past history of environmental neglect at the site and the risk of an increased incidence of cancer in area.

Response
NEPA requires DOE to consider and evaluate reasonable alternatives to a proposed action; in this case, the potential for siting some waste management activities at the SRS is a reasonable programmatic waste management alternative. SRS is one of 17 "major" sites analyzed in the WM PEIS. See Volume I, Section 4.2.1, for a full description of how DOE identified major sites.

SRS was analyzed as a candidate location for management of low-level mixed waste, low-level waste, transuranic waste, high-level waste, and hazardous waste. For low-level mixed waste, DOE evaluated nine separate alternatives. Under four of these alternatives, SRS would serve as a disposal site for its own low-level mixed waste, and would also receive wastes from seven smaller sites that would amount to only 1% of the total volume disposed of at SRS.

For low-level waste, DOE evaluated 14 separate alternatives, 7 of which considered SRS as a potential site for disposal. Under the No Action, Decentralized, and Regionalized 1, 2, 3, 4, and 5 Alternatives, SRS would dispose of its own waste and a small quantity (less than 1%) of waste generated offsite. Under Regionalized Alternatives 6 and 7, SRS would receive wastes from several other sites that would amount to 51% of the total volume disposed of at SRS. Under the five Centralized Alternatives, SRS low-level waste would be shipped offsite to another location for disposal.

Under the transuranic waste management alternatives, SRS would treat transuranic waste, and up to 17% of the total volume that it treats would come from other sites. However, no transuranic waste disposal would take place at SRS.

SRS currently stores high-level waste onsite. Under each of the alternatives for managing this waste type, all of the existing and planned high-level waste being stored at SRS would eventually be transported

3.5.15 Savannah River Site

offsite. Under Regionalized Alternative 1, SRS would also receive and temporarily store high-level waste from WVDP prior to its shipment to a permanent storage location.

Four alternatives were analyzed for hazardous waste management. Under the No Action Alternative, SRS would continue to ship hazardous waste offsite for commercial treatment. Under the Decentralized and Regionalized 1 Alternatives, SRS would treat some of the hazardous wastes produced onsite, with any remainder being shipped offsite for treatment at a commercial facility. Under Regionalized Alternative 2, all SRS hazardous wastes would be shipped to another DOE "hub" site (ORR) for treatment.

The PEIS analyzes for each candidate site the potential for environmental impacts resulting from programmatic waste management activities (see Volume I, Chapters 6 through 10 for results; see Volume III, Appendix C, for analysis methods). The analysis considered potential impacts from normal operations, operations accidents, incident-free transportation, and transportation accidents. In addition, the PEIS estimates cumulative impacts from past, present, and reasonably foreseeable future actions (see Volume I, Chapter 11). In general, the environmental impacts associated with waste management activities under all alternatives considered in the PEIS would be small. For those impacts that are not small, DOE would incorporate mitigation measures to reduce or eliminate the impacts. Therefore, there is no reason to believe that waste management activities at SRS would have a significant negative impact on the natural environment or public health and safety.

Human health risks (e.g., cancer) constitute a site-specific impact parameter analyzed in the PEIS (Volume I, Sections 6.4, 7.4, 8.4, 9.4, and 10.4). Offsite population human health risks and offsite maximally exposed individual health risks are also cumulative impact parameters addressed by the PEIS (see Volume I, Section 11.17). The health risk analyses indicate that there is a potential for increased adverse health effects from the operation of waste treatment or disposal facilities located at SRS. However, if DOE decides to site a new waste management facility at SRS, it would establish design and operational limitations to ensure that releases from the facility would be maintained below regulatory limits. Appendix D in Volume III describes in more detail waste management facility human health risk estimates.

Recent studies, as summarized in Appendix E of the Tritium Supply and Recycling PEIS (DOE, 1995), indicate no excess cancer incidence or mortality in the general public in the vicinity of the SRS, although evidence of an excess number of leukemia deaths has been reported in workers at the SRS. These reports of excess cancers are being investigated.

The WM PEIS examines potential radiation exposure to offsite populations resulting from implementation of the waste management alternatives. In addition, in the evaluation of cumulative impacts, estimates of annual radiation doses from existing activities and other ongoing actions at the sites are considered. Historical site-specific radiation doses have not been addressed because the availability of this information is limited. However, estimated offsite population risks from the proposed waste management actions generally would add little incremental risk to whatever the historical radiation exposures might be at the various sites.

DOE is committed to managing its waste to protect human health and the environment. DOE takes its responsibility and accountability for waste management decisions seriously and intends to select a configuration for its waste management complex that provides human health and safety assurance to the public. The WM PEIS will help DOE make sound waste management decisions.

Section 3.7 in Volume I of the WM PEIS, identifies DOE's preferred alternatives and the reasons they are preferred. The subsequent Records of Decision will announce DOE's decisions and the reasons for the decisions if they differ from the preferred alternatives provided in the Final PEIS.

3.5.16 Waste Isolation Pilot Plant

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3.5.17 West Valley Demonstration Project

Comment (555)
Why didn't DOE consider disposal of low-level mixed waste and low-level waste at WVDP, which already has two disposal facilities?

Response
DOE considered WVDP a candidate site for disposal of its own low-level mixed waste and low-level waste. WVDP was not considered as a candidate site for disposal of wastes from other DOE sites. All reported WVDP low-level mixed waste was categorized as alpha low-level mixed waste. WVDP has no disposal facilities for disposal of alpha low-level mixed waste and all of that waste is currently shipped to SRS for disposal. In addition, DOE anticipates that WVDP has and will generate only a small amount of low-level mixed waste (55 cubic meters), as compared to other DOE sites. See Figure 6.1-1 in Volume I of the WM PEIS. For these reasons, and because the West Valley Demonstration Act likely precludes management of waste generated elsewhere, WVDP was not considered as a candidate disposal site for low-level mixed waste from other sites.

With respect to low-level waste, WVDP was considered as a candidate disposal site for low-level waste generated onsite under the Decentralized Alternative. DOE did not analyze disposal at WVDP of low-level waste generated at other sites because of the relatively low volume of low-level waste at WVDP (42,000 cubic meters), as compared to other DOE sites. See Figure 7.1-1. Further, because of the interrelationship between low-level waste and low-level mixed waste, DOE used the same treatment and disposal locations for low-level waste and low-level mixed waste.

As described in Section 1.8.1, DOE and the New York State Research and Development Authority are currently preparing an EIS for Completion of the WVDP and Closure or Long-Term Management of Facilities that is being closely coordinated with the WM PEIS and will access the site-specific impacts of future waste management at WVDP.

Comment (4444)
WVDP would not be a good regional site, as it already has problems with waste leaching.

Response
DOE considered the management of low-level mixed waste, low-level waste, transuranic waste, and high-level waste at WVDP. DOE would construct new treatment and/or disposal facilities to manage wastes at WVDP under 3 of the 36 alternatives considered in the WM PEIS (the Decentralized Alternatives for low-level mixed, low-level, and transuranic wastes). Under these alternatives, WVDP would only treat and/or dispose of waste generated onsite. WVDP is not considered a potential regionalized or centralized waste management site and would not receive wastes from other sites. Under the Regionalized Alternatives, low-level mixed waste and low-level waste would be shipped off the site for treatment and/or disposal, transuranic waste would be shipped off the site for treatment pending disposal, and high-level waste would be shipped off the site for storage pending disposal in a geologic repository.

As discussed in PEIS Volume I, Section 4.4.17, groundwater monitoring at WVDP in 1991 showed that all parameters except gross beta and tritium were within comparison criteria. However, monitoring at 10 offsite residential wells indicated no evidence of contamination by activities at WVDP. Sitewide or project-level NEPA analyses will evaluate in greater detail the design of specific facilities and the potential for environmental impacts at sites selected for programmatic waste

3.5.17 West Valley Demonstration Project

management activities. Issues such as containment structures to prevent waste leaching would be addressed in such analyses. DOE and the New York State Energy Research and Development Authority have prepared a draft EIS for completion of the WVDP and closure or long-term management of the Western New York Nuclear Service Center that is being closely coordinated with the WM PEIS and will assess the site-specific impacts of future waste management at WVDP.

3.6 Geologic Repositories

Comment (143)
A commentor is not convinced that Yucca Mountain is a satisfactory storage site.

Response
The question of whether Yucca Mountain is a suitable disposal site is outside the scope of the WM PEIS. DOE is investigating the suitability of the Yucca Mountain site as the Nation's first licensed geologic repository for spent nuclear fuel and high-level radioactive waste. DOE is preparing a Yucca Mountain Repository EIS and has established a tentative date of 2000 for the Record of Decision. Because the Yucca Mountain site is the only candidate repository site currently being studied, DOE used its location to analyze the impacts of transporting high-level waste to a potential disposal facility.

Comment (196)
DOE needs to consider what assurances there are that WIPP will open and what conditions are associated with that assumption.

Response
For analytical purposes, DOE assumed that WIPP will operate as a transuranic waste repository. However, the No Action Alternative does evaluate the impacts if there is a delay in the receipt of transuranic waste at WIPP for disposal and waste continues to be stored at the generating sites for the 20-year period of analysis. DOE has prepared the WIPP SEIS-II to evaluate the impacts associated with transuranic waste disposal at WIPP. The WIPP SEIS-II No Action Alternatives evaluate the continued management of transuranic waste at the generator and/or treatment sites, and decommissioning of the WIPP facility.

Comment (1140)
The WM PEIS inappropriately continues to exclude consideration of high-level and transuranic waste disposal sites. The PEIS must include waste disposal alternatives other than Yucca Mountain and WIPP because one or both of those sites may never become operational. Even if they become operational, Yucca Mountain could not handle all high-level waste and WIPP cannot handle all transuranic wastes.

Response
Because the environmental evaluation process for geologic high-level waste (HLW) disposal was established by the Nuclear Waste Policy Act, the WM PEIS does not analyze the environmental impacts of disposal at Yucca Mountain or alternative locations for a geologic repository. The WM PEIS does analyze the environmental impacts of longer-term storage of treated HLW in the event that the construction and operation of a national geologic repository for HLW is delayed. Yucca Mountain is currently being studied for its suitability as a potential site for a geologic repository. If Yucca Mountain is found suitable, the Secretary of Energy will recommend the site to the President, at which time Yucca Mountain will be the proposed site for the first geologic repository. If the HLW repository is not established at Yucca Mountain, DOE would have to reevaluate its long-term plan for disposition of HLW.

The WM PEIS analysis of high-level waste storage includes consideration of high-level waste canister storage requirements if a permanent geologic repository does not open until after 2015. Under this scenario, which is analyzed as part of the Centralized Alternative, all canisters would be shipped to Hanford for storage until a geologic repository begins accepting high-level waste. Impacts are

3.6 Geologic Repositories

evaluated on an incremental annual basis. For the purposes of analysis, DOE assumes that WIPP will become operational. Although the WM PEIS does not evaluate WIPP or its suitability for disposal, the No Action Alternative does evaluate the impacts if there is a delay in the receipt of transuranic waste (TRUW) at WIPP and waste continues to be stored at the generating sites.

DOE has already examined alternatives to geologic disposal at WIPP in previous NEPA documents. Moreover, the disposal impacts from operating WIPP as a TRUW repository are addressed in the WIPP SEIS-II. The WIPP SEIS-II No Action Alternatives evaluate the continued management of TRUW at the generator and treatment sites, and decommissioning of the WIPP facility. These alternatives analyze environmental impacts if the waste were not disposed of at WIPP.

The capacity of WIPP is limited by the WIPP Land Withdrawal Act (Public Law 102-579) and by the Consultation and Cooperation Agreement with the State of New Mexico. Under these limits, as analyzed in the WIPP SEIS-II, WIPP would not be able to accommodate all of DOE's defense remote-handled transuranic waste.

Comment (1513)
The public is concerned about accepting more waste into the State of New Mexico at WIPP. The people of the State of New Mexico do not want WIPP to open. The Mayor of Carlsbad, New Mexico, might want WIPP, but the citizens do not.

Response
The decision of whether to operate WIPP as a transuranic waste repository is outside the scope of the WM PEIS. Rather, as identified in Volume I, Section 1.1, the WM PEIS analyzes alternative locations for treatment and storage sites. However, for purposes of analysis, DOE assumed WIPP would be operational as a transuranic waste disposal facility.

As described in Volume I, Section 1.8.1, DOE has prepared the WIPP SEIS-II to evaluate the potential environmental impacts of transuranic waste disposal at WIPP. This information will be used to support DOE's decision on whether to operate WIPP as a transuranic waste disposal facility.

In addition, disposal of transuranic waste cannot begin until DOE meets the requirements imposed under the WIPP Land Withdrawal Act and other applicable regulations.

Comment (1621)
A commentor supports the use of Yucca Mountain for storage of high-level waste.

Response
Thank you for your comment.

Comment (1636)
DOE should consider other sites besides Yucca Mountain for high-level waste (HLW) storage.

Response
Because the environmental evaluation process for geologic disposal was established by the Nuclear Waste Policy Act, the WM PEIS does not analyze environmental impacts of disposal at Yucca Mountain or alternative locations for a geologic repository. However, the WM PEIS does analyze the

environmental impacts of the longer term storage of treated HLW in the event that the construction and operation of a national geologic repository is delayed.

The total HLW volume of 378,000 (inventory plus generation within the next 20 years) is equivalent to an estimated 21,600 canisters of vitrified HLW. Under the No Action Alternative and Decentralized Alternative, the Hanford Site, INEL, SRS, and WVDP would store HLW canisters. Under Regionalized Alternatives 1 and 2, the Hanford Site, INEL, and SRS would store HLW canisters. Under the Centralized Alternative, the Hanford Site would store HLW canisters.

DOE is addressing possible environmental impacts from the construction, operation, and eventual closure of a potential repository for spent nuclear fuel and HLW at Yucca Mountain in a separate EIS.

Comment (2215)
I am getting sick of hearing about Yucca Mountain. I believe in Santa Claus more than I believe in Yucca Mountain.

Response
Thank you for your comment.

Comment (3214)
The WM PEIS does not analyze alternatives to the Yucca Mountain repository. DOE should examine all alternatives for management of high-level waste, including other disposal sites, extended storage at the point of generation, and regionalized and centralized storage. The impacts of transporting waste to Yucca Mountain, and for all other alternatives, should be examined.

Response
Because the environmental evaluation process for geologic disposal was established by the Nuclear Waste Policy Act, the WM PEIS does not analyze environmental impacts of disposal at Yucca Mountain or alternative locations for a geologic repository. However, the WM PEIS does analyze the environmental impacts of the longer term storage of treated high-level waste in the event that the construction and operation of a national geologic repository is delayed. A separate EIS will be prepared as part of the evaluation of the Yucca Mountain site as a repository.

If the high-level waste repository is not established at Yucca Mountain, DOE would have to reevaluate its long-term plan for the disposition of high-level waste. The PEIS does analyze the environmental impacts of longer term storage of treated high-level waste in the event of a delay in the construction and operation of a national geologic repository for high-level waste. It also addresses regionalized and centralized storage of vitrified high-level waste and transportation of the vitrified waste to the storage location.

The potential impacts of transporting high-level waste to Yucca Mountain for disposal will be evaluated in the Repository EIS. Transportation-related impacts for the alternatives considered in the WM PEIS are discussed for each waste type under health risks, air quality, and environmental justice (e.g., for low-level waste, see Sections 6.4, 6.5, and 6.10 respectively), and in Volume IV in Appendix E.

3.6 Geologic Repositories

Comment (3333)
The Waste Management Program supposes a licensed geologic repository, although WIPP is unsuitable because of (1) its failure to meet EPA standards; (2) questionable deals cut between DOE and EPA to weaken oversight; (3) the presence of dangerous gases that cannot be monitored; and (4) the presence of tritium, which also threatens the Ogallala Aquifer.

Response
The WM PEIS does not analyze the environmental impacts of disposal at WIPP or alternative locations for a geologic repository. Rather it evaluates all reasonable programmatic alternatives for transuranic waste treatment and storage configurations. For purposes of analysis, DOE assumed that WIPP will become operational. Although the WM PEIS does not evaluate WIPP or its suitability for disposal, the No Action Alternative does evaluate for the period of analysis (20 years) the impacts if there is a delay in the receipt of transuranic waste at WIPP and waste continues to be stored at the generating sites.

The disposal impacts from operating WIPP as a transuranic waste repository are addressed in the WIPP SEIS-II. The WIPP SEIS-II No Action Alternatives will in part evaluate the continued management of transuranic waste at the generator and/or treatment sites, and decommissioning of the WIPP facility. These alternatives will be analyzed to provide a baseline for environmental impacts if transuranic waste were not disposed of at WIPP. This information will be used to support DOE's decision of whether to operate WIPP as a transuranic waste disposal facility.

Comment (3599)
The WM PEIS continues the saga of the DOE asserting that it is going to prove that waste will not migrate beyond the WIPP boundary within the 10,000-year statutory requirement, regardless of the gas generation problem. We understand that the WM PEIS is a document based on changing processes and decisions that impact the document. Nonetheless, it is difficult to take the assumptions and petitions for exemptions seriously because the underlying focus is not the health and safety of the environment and the people and animals that live within the area, but to get the waste out of sight and out of mind as quickly as possible. The assumption of non-defense waste at WIPP and the no-migration petition are two examples of that focus.

Response
As described in Section 1.8.1 in Volume I of the WM PEIS, which highlights a number of DOE NEPA documents that are related to the WM PEIS, the impacts of disposal of transuranic waste (TRUW) at WIPP, including the types of TRUW to be disposed of and the long-term performance of the repository, are evaluated in the WIPP SEIS-II. The WM PEIS assumes, for analytical purposes only, that WIPP will operate as a TRUW disposal facility, but also analyzes the impacts of no TRUW disposal at WIPP and continued storage at the generating sites.

Since publication of the Draft WM PEIS, the 1997 Defense Authorization Act, which contains amendments to the WIPP Land Withdrawal Act, was signed into law on September 23, 1996. The amendments exempt waste to be disposed of at WIPP from RCRA's provisions regarding land disposal restrictions, thus eliminating the need to obtain a No Migration Determination prior to commencing proposed disposal operations. The Final WM PEIS reflects this change in requirements.

3.6 Geologic Repositories

Comment (3931)
Several commentors stated that the WM PEIS assumption that Yucca Mountain will be licensed as the nation's permanent geologic repository is unrealistic, especially in light of Secretary O'Leary's indications that there is only a 50% chance of this occurring. Some commentors further indicated that DOE must fully address Yucca Mountain in a credible programmatic EIS, including industry-known problems concerning the site such as exceedance of dose limits and inadequate disposal capacity.

Response
The WM PEIS does not evaluate disposal of high-level waste or spent nuclear fuel because this issue (and associated dose limit and capacity concerns) is not within the scope of DOE's proposed action. The facility at Yucca Mountain would have space for at least a portion of the high-level waste canisters if it is developed. As stated in Volume I, Section 1.8.1, DOE is preparing a separate EIS for disposal of high-level waste and spent nuclear fuel at Yucca Mountain. Because the environmental evaluation process for geologic disposal was established by the Nuclear Waste Policy Act, the WM PEIS does not analyze environmental impacts of disposal at Yucca Mountain or alternative locations for a geologic repository. However, the WM PEIS does analyze the environmental impacts of the longer-term storage of treated high-level waste in the event that construction and operation of a national geologic repository is delayed. In addition, because the Yucca Mountain site is the only candidate repository site being studied at this time, DOE used this location to analyze the impacts of transporting high-level waste to a potential disposal facility.

Two different timing scenarios were evaluated in the WM PEIS to determine the impacts of storing vitrified high-level waste prior to disposal in a geologic repository. In the first scenario, DOE assumed that the geological repository would begin accepting DOE-managed high-level waste in 2015. In the second scenario, acceptance of DOE-managed high-level waste at the repository is assumed to be delayed past 2015. For the latter case, impacts of high-level waste storage are presented on an annualized or incremental basis to account for variability in the length of any potential delays. If DOE is unsuccessful in obtaining regulatory approval for Yucca Mountain, it would have to reevaluate its long-term plans for disposal of high-level waste.

Comment (3940)
Does DOE plan to site the WIPP, near Carlsbad, New Mexico, regardless of the results of site characterization and feasibility studies presently being conducted?

Response
Since 1970, DOE has stored all of its transuranic waste, including transuranic waste containing hazardous components that are subject to RCRA. DOE could decide to dispose of this post-1970 retrievably stored transuranic waste in the WIPP geologic repository near Carlsbad, New Mexico, after the completion of appropriate NEPA analyses and if acceptable disposal performance can be demonstrated and regulatory requirements can be met. Several studies are underway to characterize and more fully understand the potential long-term behavior of the disposal of transuranic waste at WIPP. One of these studies is the WIPP Disposal Phase Supplemental EIS (SEIS-II), which has been prepared by DOE to evaluate the environmental impacts of disposing of transuranic wastes at WIPP. Based on the results of these studies and independent of the WM PEIS, DOE will determine whether to dispose of transuranic waste at WIPP and the extent to which transuranic waste must be treated before disposal. However, to reduce the potential for delays in future transuranic waste disposal at WIPP,

3.6 Geologic Repositories

DOE will use the WM PEIS analysis to support the decision(s) about where to treat and store transuranic waste before it is disposed of at WIPP.

Comment (4045)
The timelines for both WIPP and Yucca Mountain have been extended as new regulatory and environmental issues emerge related to these facilities. Therefore, DOE should not assume that WIPP and Yucca Mountain will be available in the future. The PEIS should give greater weight to alternatives that are not based on a reasonably foreseeable centralized geologic repository.

Response
The evaluation of transuranic waste treatment and storage alternatives in the WM PEIS, which provides advance planning information on transuranic waste even if the operation of WIPP is delayed, also required that transportation to a repository location be assessed. For the WM PEIS analysis, WIPP was chosen as the final destination for evaluation of transportation impacts; operation of the WIPP repository was not evaluated.

DOE has prepared the WIPP SEIS-II to evaluate the environmental impacts of disposing of transuranic waste at WIPP. As part of the WIPP SEIS-II, the No Action Alternatives evaluate the continued management of transuranic waste at the generator facilities and decommissioning or other disposition of the WIPP facility. These alternatives will evaluate environmental impacts if the waste were not disposed of at WIPP. The WM PEIS transuranic waste No Action Alternative also evaluates the impacts of continued storage of transuranic waste at the generator sites for the period of analysis (20 years).

Section 9.1.1 describes why Yucca Mountain was used in the high-level waste analyses. In part, this section states that since Yucca Mountain is the only site that is required to be evaluated as a high-level waste repository by the Nuclear Waste Policy Act, Yucca Mountain was assumed, for purposes of analysis, to be the location of the high-level waste repository. Impacts from the construction, operation, and closure of a geologic repository at Yucca Mountain will be examined in the Yucca Mountain Repository EIS, although the Nuclear Waste Policy Act, as amended, does not require DOE to examine alternative locations. The WM PEIS does analyze the environmental impacts of the longer term storage of treated high-level waste in the event that the construction and operation of a national geologic repository is delayed.

4. Site Characteristics and Affected Environments

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(No comments were received for this section)

4.1 Environmental Resources and Conditions

Comment (251)
Referring to the "unusually high incidence of breast cancer in the county," a commentor stated that DOE lacks information and understanding of the human element that makes up the local environment around Argonne National Laboratory-East (ANL-E).

Response
The WM PEIS health risk analysis addresses the potential risks from the construction and operation of new waste treatment, storage and disposal facilities. Volume I, Section 5.4.1, of the WM PEIS provides a description of the methods used to assess health risks. The results for each waste type are presented in Chapters 6 through 10. In addition, Chapter 11 summarizes the risks of the waste management actions for a combination of the applicable waste types at each site. Chapter 11 also addresses, by site, the cumulative health impacts of the proposed waste management actions, the existing conditions, and other proposed actions at the site.

Note that the WM PEIS health risk analysis considers site baseline risk only as a component of cumulative impacts. In Chapter 11, baseline risk is considered as the potential effect of existing site-related actions on population exposure and risk. The analysis does not include regional epidemiological or health statistics information, such as the breast cancer incidence in the counties surrounding ANL-E. The estimated risks of the proposed waste management actions at ANL-E should be considered as excess latent cancer incidence or fatality risks that would be added to the existing baseline. The estimated incremental risks from the proposed treatment and disposal of low-level mixed waste and low-level waste at ANL-E are presented in Section 6.4 and 7.4 in Volume I, respectively, and in the Volume II Site Data Tables. For both waste types, less than one additional cancer incidence is estimated in the offsite population living within a 50-mile radius of the site as a result of the proposed treatment actions. Probabilities of cancer fatality for the offsite maximally exposed individual are less than 1 in 1 million. Disposal risks for the hypothetical farm family maximally exposed individual are less than 1 in 1 million for low-level mixed waste and 3 in 100,000 for low-level waste.

Comment (1554)
The Hanford Site map in Figure 4.4-4 contains numerous deficiencies in labeling, and an inaccurate site boundary. The NTS map also has inaccurate borders. It should include Area 51, and not include Pahute Mesa.

Response
The Hanford Site map (Figure 4.4-4 in Volume I) was corrected for the Final WM PEIS to provide accurate labeling and site boundaries.

The borders of the NTS map shown in Figure 4.4-8 in Volume I of the WM PEIS have also been revised. However, the WM PEIS Affected Environment Technical Report indicates that Pahute Mesa is managed as part of NTS. The NTS boundaries are designated by four Public Land Orders and a Memorandum of Understanding with the Air Force for the Pahute Mesa area. Land withdrawn under Public Land Order 1662 is not considered under any alternative for use by DOE and, therefore, is not addressed in the WM PEIS.

Comment (1644)
The PEIS should address the issue of air quality in Nevada.

4.1 Environmental Resources and Conditions

Response
WM PEIS Volume I, Section 4.4.8, and the WM PEIS Affected Environment Technical Report describe the air quality at Nevada Test Site (NTS). The State of Nevada is divided into Air Quality Control Regions (AQCRs). NTS is located in Nevada AQCR No. 147. This region is designated as an attainment or unclassified area with respect to the National Ambient Air Quality Standards. An attainment area is an area with air quality better than those standards. The nearest nonattainment area is in Las Vegas Intrastate AQCR No. 13, which includes Clark County. This AQCR is classified as nonattainment for carbon monoxide and particulate matter less than 10 microns in diameter.

Major sources of nonradiological air emissions from NTS are test drilling, mining, and sampling operations for underground nuclear tests and, possibly, evaporation of containment pond water. Other air pollutant emissions are from construction activities, fugitive dust from unpaved roads, fuel burning equipment, open burning, fuel storage facilities, and asbestos removal activities. These activities contribute to the existing air quality within AQCR No. 147.

Comment (1718)
In Volume I, Tables 4-10 and 4-11, provide information that separates radioactive materials totals from radioactive waste totals for incoming and outgoing shipments.

Response
Tables 4.3-6 and 4.3-7 (formerly Tables 4-10 and 4-11) show the incoming truck and rail shipments, respectively, of hazardous materials to each of the major waste generating and storage sites during Fiscal Year 1993. The data provided in Tables 4.3-6 and 4.3-7 are for the purposes of establishing a transportation baseline for the current rail and truck shipments to and from DOE sites. Source data are derived from the 1993 Shipment Mobility/Accountability Collection and the Waste Manifest System FY 1993. Data are presented for each site without reference to source or destination of shipments. This database includes all radioactive materials shipments, not just waste shipments. The database does not specifically characterize the components that make up the site shipments beyond a division into radioactive and other hazardous materials categories. Because the table is intended as a summary of transportation-related activity in general, it is not useful as a source for waste volume, or other materials volume information.

Comment (1726)
In Volume I, Section 4.4.9, include information on the variety of Federal and State protected plant life that can be found on the Oak Ridge Reservation (ORR).

Response
Section 4.4.9 in Volume I of the WM PEIS is a summary of the affected environment information for ORR. Additional information on ecological resources at ORR, including sensitive plant species, is contained in Section 2.8.4 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (1729)
The WM PEIS refers to radioactive and nonradioactive parameters that exceeded water quality comparison criteria at ORR in 1992. Please include information about the parameters that exceeded comparison criteria in 1993 and 1994.

4.1 Environmental Resources and Conditions

Response
In general, DOE elected not to update or supplement the data in the WM PEIS with more recently published data because conditions rarely change drastically from year to year. Exceptions were made in instances where DOE determined that the updated data might affect the comparisons of alternatives. DOE believes that the water quality information provided gives an adequate characterization of the conditions at the sites, especially for a programmatic EIS that will not select locations for waste management facilities on the sites. More up-to-date site-specific information would be included in sitewide or project-level NEPA analyses.

Data on water quality parameters for 1993 and 1994 are available in the ORR environmental reports for those years.

Comment (1829)
The WM PEIS does not sufficiently reflect reasonable present and future conditions to allow one to draw conclusions about the impacts of the proposed actions at the ANL-E.

Response
To conduct any analysis using data that is continually being updated, the data must be "locked" at some point in time. If the data were not locked, and the analysis were updated each time new data are available, the analysis would be a "moving target" that would never be completed. As described in Section 4.4.1 in Volume I of the Draft WM PEIS and in the Draft WM PEIS Affected Environment Technical Report, the information on current conditions at ANL-E was obtained largely from reports prepared from 1990 through 1994. The low-level mixed waste volumes used in the Draft WM PEIS were obtained from the 1994 Mixed Waste Inventory Report.

More recent data at ANL-E shows a 60-fold decrease in waste generation. As a consequence, all low-level mixed waste impacts were included with the updated, lower, estimates of low-level mixed waste for ANL-E. The Final WM PEIS was revised to reflect resulting impacts from this reevaluation.

Comment (2078)
The ecological resources discussion in Volume I, Section 4.4 2, is grossly inadequate. Brookhaven National Laboratory (BNL) is located in the Central Pine Barrens State Forest Preserve, which is protected under New York State law. The site is also located within the environmentally sensitive Peconic National Estuary, which has been designated as part of the Pine Barrens Maritime Bioreserve and the National Estuary Program. Effluent from the BNL wastewater treatment plant discharges into the Peconic River, and groundwater at BNL recharges into the Peconic, Greater South, or Moriches Bays. These bays are among the most productive estuaries in the Country. They are primarily known for the production of filter feeding foods, such as clams, oysters, and scallops. Filter feeders are especially prone to bioaccumulation of toxic substances, primarily due to the amount of water filtered by each organism. A possible release of radioactive and/or hazardous materials into an estuary where commercial harvests of filter feeders occurs is not environmentally sound.

Response
BNL is in an area designated by the Pine Barrens Protection Act as "Compatible Growth Area" and "Core Preservation Area." A Compatible Growth Area is that portion of the pine barrens that has been designated to be compatible for limited development. The Core Preservation Area is the area designated to receive greater protection from development.

4.1 Environmental Resources and Conditions

The headwaters of the Peconic River Estuary are also located on BNL. While this estuary is groundwater-fed, discharge from BNL's sewage treatment plant makes up much of the surface flow in the upper reaches of the Peconic River. This surface flow typically dries up prior to leaving BNL property. Groundwater beneath BNL would recharge downstream sections of the Peconic River and, to a lesser extent, the Carmans River. These rivers discharge into the Peconic Bay and Bellport Bay portion of the Great South Bay, respectively. Theoretically, a portion of groundwater beneath BNL will eventually recharge the Moriches Bay; however, given the slow rate of groundwater movement, this has not yet occurred.

DOE considers impacts to the pine barrens and Peconic and Carmans River estuaries in all BNL project-level NEPA reviews. In addition, DOE consults the Central Pine Barrens Planning Commission about many activities at BNL and provides the Commission the opportunity to comment on environmental assessments prepared under NEPA. Also, the New York State Department of Environmental Control considers the estuaries and pine barrens during relevant permit actions. This open communication between DOE, the State of New York, and the Central Pine Barrens Planning Commission will continue.

The WM PEIS does not specifically address the potential impacts to aquatic organisms from the treatment, storage, and disposal of waste management waste, although groundwater contamination from disposal of low-level mixed waste and low-level waste is expected to be limited by design and siting considerations, as described in Sections 6.6.2.1 and 7.6.2 in Volume I of the WM PEIS.

Section 5.4.3 in Volume I states that seepage of contaminated groundwater from disposal facilities could contaminate surface water and that this would be expected to occur at sites with shallow groundwater and surface water bodies that are fed by groundwater discharge (springs). Where contaminated groundwater discharges to the surface, dilution in "clean" surface waters would cause concentrations of contaminants in surface water to be lower than concentrations in groundwater. Section 5.4.3 also states that DOE will evaluate the performance of disposal facilities at each site, and if significant groundwater contamination were predicted, changes in the waste acceptance criteria would be made to limit disposal of the waste with the potential to cause significant groundwater contamination. In no case would DOE knowingly dispose of waste in violation of legal requirements.

In addition, the Final WM PEIS was revised to include a qualitative analysis of the vulnerability of the DOE sites to surface-water impacts. This new text is located in Section 5.4.3 in Volume I and Section C.4.3.4.10 in Volume III. This text states that although BNL is somewhat vulnerable to surface-water contamination, impacts from the incremental addition of waste management activities are not expected to be major.

Comment (2130)
The Ohio Department of Health has detected radiation in Piketon, in our houses, on our yards, in our gutters, on our sidewalks, and in our water. DOE needs to be concerned about damage being done to people, pets, and personal and public property from the fallout from the Portsmouth Plant.

Response
A brief description of the existing environmental conditions at Portsmouth is provided in Section 4.4.12 in Volume I of the WM PEIS. Additional information is provided in the WM PEIS Affected

4.1 Environmental Resources and Conditions

Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9, Volume I, of the Final WM PEIS.

DOE prepares annual site environmental monitoring reports that provide information about environmental monitoring activities and releases. These reports are available to the public. In 1992, DOE reported a radiation dose of 0.26 mrem to the maximally exposed individual from airborne radionuclides. This is well below the National Emission Standards for Hazardous Air Pollutants standard of 10 mrem per year. It is DOE policy to maintain releases at a level that is as low as reasonably achievable. DOE is committed to operating its facilities and managing its wastes safely and in compliance with all applicable laws and regulations.

DOE encourages the public to immediately report any unusual activities and concerns related to its sites, to the site management.

Comment (2138)
The public is concerned about the water supply around Paducah Gaseous Diffusion Plant (PGDP) and the Portsmouth Plant. DOE needs to consider that the Portsmouth Plant is located above an aquifer, and that leaks of hazardous materials at PGDP could contaminate the water. The WM PEIS does not mention that Cairo, Illinois, which is downstream of PGDP, gets its drinking water from the Ohio River.

Response
DOE understands that PGDP and the Portsmouth Plant have the potential to impact the surface water and groundwater near the sites. These impacts are evaluated at a programmatic level in the WM PEIS. DOE would consider site-specific control measures when planning new facilities or activities for specific sites. These control measures could include: modifying the design of generic disposal facilities (used in the PEIS analysis) to fit site-specific conditions; modifying waste form requirements; optimizing the location of a facility at a site; and imposing waste acceptance criteria.

Any eventual waste storage or disposal facilities would be structured with sufficient containment and would be carefully monitored. Furthermore, sites would be equipped with sufficient safety and emergency response measures to minimize the potential for leaks to contaminate surface water or groundwater. The WM PEIS Affected Environment Technical Report contains more detailed descriptions of the sites. Section 2.9.2.1 of the WM PEIS affected Environment Technical Report accounts for the fact that Cairo, Illinois, is downstream of PGDP and obtains its drinking water from the Ohio River. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (2216)
DOE needs to explain why there is no wildlife in the neighboring creeks around PGDP. DOE claims there is no contamination of a dangerous level. This does not seem likely.

Response
There is wildlife in the neighboring creeks around PGDP. As described in the WM PEIS Affected Environment Technical Report, PGDP is surrounded by the West Kentucky Wildlife Management Area. Beaver, mink, muskrat, frogs, turtles, and several fish species reside in neighboring creeks around PGDP. Fish and wildlife in and around the creeks are monitored and sampled on a regular

basis by the Commonwealth of Kentucky. Low levels of polychlorinated biphenyls and radionuclides have been discovered in one of the creeks close to PGDP. Controls designed to limit access to these areas were presented to the public for comment, sanctioned by the Commonwealth, and instituted. A second creek had even lower levels of contamination and the Commonwealth concluded that no controls were necessary. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (2387)
Place the listed endangered species into context by discussing and comparing the relationships within the local and regional ecosystem. Simply listing the endangered species does not communicate the potential impacts of waste management activities.

Response
DOE did not attempt to evaluate impacts to endangered or threatened species, either directly from waste management activities or through effects on their local or regional ecosystems, in the PEIS. Such analyses would be too complex for a programmatic evaluation of effects at 17 different sites and would require identifying specific waste management facility locations at each site; siting location decisions are not being made in the PEIS. When selecting locations for waste management facilities on sites, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA reviews, which would include analyses of potential impacts to ecosystems, particularly any effects on threatened and endangered species or critical habitats. The WM PEIS identifies listed endangered and threatened and other sensitive species at the candidate sites simply to highlight for DOE decisionmakers the need to identify and address potential ecological impacts once DOE makes initial waste management facility siting proposals.

Comment (2482)
Attainment status should be clarified for Idaho National Engineering Laboratory (INEL), since there are INEL facilities within less than 50 miles of a nonattainment area for PM_{10} (portions of Bannock and Power Counties).

Response
Attainment and nonattainment areas are areas with specific boundaries designated by EPA pursuant to its air quality regulations. The WM PEIS considers a site to be in a nonattainment area only if a part of the site is actually located within a nonattainment area or borders a nonattainment area. Therefore, INEL is considered to be in an attainment area for all criteria air pollutants.

Comment (2487)
The WM PEIS states that most DOE sites are in geologically stable areas, that the greatest seismic risks are believed to be at Lawrence Livermore National Laboratory (LLNL) and PGDP, and that no DOE site is in an area of known substantial volcanic hazard. A commentor argues that INEL, based on its inclusion within the Intermountain Seismic Zone and close proximity to two historical magnitude 7+ earthquakes, is in a region of significant seismic potential and that this is supported by the region being included in seismic hazard zone 3. Additionally, due to the recent (approximately 1,200 years before present) volcanic activity within about 20 miles of the site, INEL is at least in a region of uncertain volcanic hazard.

4.1 Environmental Resources and Conditions

Response
The WM PEIS Affected Environment Technical Report contains more information on historic environmental conditions at INEL. Section 2.3 of that report states that INEL lies outside the Centennial Tectonic Belt, an area of seismic activity within the Intermountain Seismic Belt. Seismographs installed in 1970 show that the eastern Snake River Plain has experienced only microearthquakes (earthquakes with a magnitude less than 1.5) and that the numbers of microearthquakes are very small compared to the numbers of earthquakes outside the Snake River Plain. In fact, since 1972, only 19 microearthquakes have been recorded within the eastern Snake River Plain. The closest large earthquakes to INEL were the 1959 Hebgen Lake earthquake (magnitude 7.5) and the 1983 Borah Peak earthquake (magnitude 7.3). Both were felt at INEL, but neither caused damage to INEL facilities. Based on known earthquake sources and a hypothetical unknown random earthquake in the eastern Snake River Plain, it is estimated that an earthquake with a maximum horizontal acceleration of about 0.15g has a probability of occurrence of 1 in 5,000 per year at a centralized INEL location (Idaho Chemical Processing Plant). Note that a seismic hazards study is currently being performed at INEL. This study is expected to be completed in fiscal year 1997.

Section 2.3 of the WM PEIS Affected Environment Technical Report further states that no historical eruptions have occurred on the eastern Snake River Plain and volcanic hazards to INEL are primarily related to future basaltic and rhyolithic eruptions along the volcanic rift zones in the eastern Snake River Plain. The likelihood of basalt lava inundation or related ground disturbance is estimated to be less than 1 chance in 40,000 per year for the southern INEL. Risks from these phenomena in the northern INEL are even lower. The probability of significant impacts from all other volcanic phenomena, such as growth of new rhyolite domes on the eastern Snake River Plain or thicker than 8 centimeters (3.3 inches) ashfall from distant volcanoes, is estimated to be less than 1 chance in 100,000 per year due to the combined effects of great distance, infrequency, low volume, and topographic or atmospheric barriers to the dispersal of ash on INEL. Therefore, INEL was not considered to be in an area of substantial volcanic hazard.

The WM PEIS Affected Environment Technical Report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (2490)
In Volume I, Table 4-9, how can the peak load (550 megawatts) be greater than the total capacity (351.74 mega voltampere) at Hanford?

Response
The commentor is correct; the peak load should not be greater than the total capacity. According to the WM PEIS affected environment technical report (DOE, 1995), the peak load for Hanford should be 59.36 megawatts. DOE corrected the table (now Table 4.3-5).

Comment (2491)
Volume I, Section 4.4.5: The first bullet under *Air Quality* omits Clark and Bannock Counties. Should this bullet include all of the counties in the socioeconomic region of influence?

Response
INEL is located in Air Quality Control Region (AQCR) 3, which includes Butte, Jefferson, Bonneville, and Bingham Counties, but not Clark and Bannock Counties. AQCRs are designated by EPA and were

created by EPA for regulatory purposes that are not related to the creation of the socioeconomic regions of influence for the WM PEIS.

Comment (2492)
Volume I, Section 4.4.5, and Volume III, Section C.4.2.1.3.1 and Table C.4-3, state that Butte, Jefferson, Bonneville, and Bingham are classified as attainment areas for the six National Ambient Air Quality Standards. To designate an area as in attainment, ambient air monitoring must be performed to verify the attainment status. If an area has not had ambient air monitoring performed, like most of the area described, it is determined to be unclassified. In Volume III, the area around INEL is considered in attainment.

Response
The commentor is correct that an area that has not had ambient air monitoring performed should be designated unclassified. However, as of 1996, INEL is located in an attainment area for ambient air quality. The State of Idaho and EPA classify the counties surrounding INEL as attainment areas for the six National Ambient Air Quality Standards criteria air pollutants.

Comment (2493)
Volume I, Section 4.4.5, states that no known Federally or State-listed threatened, endangered, or candidate plant species are found at INEL and that eight Federal candidate species are found at the site. This seems contradictory.

Response
DOE revised Volume I, Section 4.4.5, of the WM PEIS to clarify that no known Federally or State-listed threatened or endangered plant species are found on INEL. However, one plant is listed by the State of Idaho as imperiled, and eight Federal candidate species (two are State species of special concern) and five State species of special concern are found on INEL.

Comment (2495)
Volume I, Section 4.4.5, gives the names of the major surface water features on and around INEL and then states that none of the rivers flow off the site. This is misleading, because the rivers all flow toward INEL, with only the Big Lost River actually flowing onto INEL in years of high precipitation.

Response
DOE has revised Section 4.4.5 in Volume I of the WM PEIS to clarify that the rivers flow toward INEL and that stream flows are often depleted before reaching INEL.

Comment (2496)
Volume I, Section 4.4.5, states that the Idaho Chemical Processing Plant the Naval Reactors Facility, and Test Area North would be flooded in the event that the Mackay Dam fails. This contradicts the conclusion of Koslow and Van Haaften (*Flood Routing Analysis for a Failure of Mackay Dam*, EEG-EP-7184, 1986). Please verify that the statement is correct. If it is found that the statement is not correct, please clarify that the existing INEL flood diversion system should prevent flooding of INEL facilities in the event that a catastrophic failure of the Mackay Dam occurs.

4.1 Environmental Resources and Conditions

Response
The WM PEIS Affected Environment Technical Report states that flooding scenarios that involve the failure of MacKay Dam have been evaluated. The results indicate that in the event of a dam failure, there would be flooding at the Idaho Chemical Processing Plant, the Naval Reactors Facility, and Test Area North. The low velocity and shallow depth of the water would not, however, pose a structural damage threat to these facilities. Section 4.8.1.3 in Volume 2 of the SNF/INEL EIS, which referenced the Koslow and Van Haaften report cited in the comment, is consistent with these statements.

***Comment* (2497)**
Volume I, Section 4.4.5, states that no onsite sampling of surface water is performed at INEL because no surface water flows off the site. This is misleading and inaccurate; surface water is sampled on the site when flows occur by both the State of Idaho INEL Oversight Program and by the U.S. Geological Survey INEL Project Office.

Response
The WM PEIS Affected Environment Technical Report states that, because the creeks and rivers at INEL are ephemeral, surface water sampling on INEL can only be performed infrequently, after heavy precipitation events. DOE modified the sentence in Volume I, Section 4.4.5, to reflect the information in the technical report.

Comment (2499)
The WM PEIS ignores all land uses but grazing. The Spent Nuclear Fuel EIS lists grazing, wildlife management, rangeland, mineral and energy extraction, recreation, and crops.

Response
Section 4.1 in Volume I of the WM PEIS indicates that the data and analyses included in the WM PEIS are commensurate with the importance of the potential impact, and that information less crucial to the analysis is summarized or referenced. The discussion in Section 4.4.5 presents the dominant land uses for INEL. A more detailed description of land uses in the INEL region of influence can be found in Section 2.3.5.5 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (2599)
Volume I, Table 4-12, lists one INEL site on the National Register of Historic Places, but Section 4.4.5 states there are two.

Response
DOE revised Table 4.3-8 in Volume I of the WM PEIS to provide more detailed information on the National Register of Historic Places status of known archaeological sites. For INEL, this table indicates that one property has been listed on the Register and one property has been designated as eligible. DOE also revised the related text description of cultural resources at INEL (Section 4.4.5 in Volume I of the WM PEIS).

Comment (2625)
Volume I, Section 11.5: There are *two* phosphate plants in Pocatello, Idaho, that release radionuclides to the atmosphere.

Response
DOE revised the discussion of INEL cumulative impacts in Volume I, Chapter 11, of the Final WM PEIS to indicate two phosphate plants are present in Pocatello. Information on these facilities was not included in the cumulative impacts analysis. However, it is unlikely that the omission would cause the relative impact of alternatives to change. DOE considers the current cumulative impacts analysis sufficient to make programmatic decisions.

Comment (2865)
Volume I, Section 4.4.5, lists Interstate 90 in the infrastructure description for INEL. Interstate 90 is not even close to the INEL. This section should list Interstates 15, 86, and possibly 84, as well as U.S. Highway 20.

Response
DOE deleted the reference to Interstate 90 from Section 4.4.5 in Volume I of the WM PEIS and added the correct roads in the vicinity of INEL.

Comment (2871)
Volume I, Section 4.3.4, should note and discuss the presence of highly permeable soils that do not naturally attenuate many contaminants. This is the case at BNL and it should be noted.

Response
Section 4.4.2 in Volume I states that soils on the BNL site consist of deep, well-drained to excessively drained, coarse-textured soils, although detailed site-specific information on geology and soil and water resources conditions is not included in Chapter 4.

Section 2.15.2.1 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS, contains more detailed information on soil and groundwater conditions at BNL. Section 2.15.2.2 of the WM PEIS Affected Environment Technical Report states that the major groundwater units in the BNL region of influence include the deeper lower aquifer system (Magothy and Raritan Formations) and the shallower Pleistocene Upper Glacial Aquifer. The Upper Pleistocene deposits are generally highly permeable--water penetrates these deposits readily-and little direct runoff into surface streams occurs. On average, about 50% of the annual precipitation percolates through the soil to recharge groundwater, and less than 2% becomes surface-water runoff.

BNL has been identified as being over a deep recharge zone for the lower aquifer system. About two-fifths of the recharge from rainfall moves into the deeper aquifers. About 350 billion gallons of recharge per year occurs from precipitation in Suffolk County.

Comment (2874)
There is no clear definition of the region of influence (ROI) related to the INEL. It seems that the ROI should include all counties that might potentially be impacted by the waste management activities. Regarding groundwater and possibly air quality, this would include the region to the southwest (Magic Valley), since any contamination would move toward that area. At a minimum, the ROI should include the entire Snake River Plain. The ROI for socioeconomics leaves out Madison County. A significant number of site workers live in Rexburg, and that community is probably an economic hub for much of Clark and Jefferson Counties.

4.1 Environmental Resources and Conditions

Response
Because the geographic area affected by any anticipated impacts will differ depending on the environmental parameter under consideration, the ROIs for groundwater, air quality, socioeconomics, etc., will differ. Table 4.2-1 in Volume I of the WM PEIS presents the ROI definition for each WM PEIS environmental parameter. Environmental conditions in the actual ROIs for INEL are presented in the discussion of INEL in Section 4.4.5 in Volume I of the WM PEIS and in much greater detail in Section 2.3 of the WM PEIS Affected Environment Technical Report.

The analytical basis for the socioeconomic ROI is explained in Section 5.4.5 in Volume I of the WM PEIS. This ROI was based on the residence patterns of the current site workforce plus the host county. For INEL, this six county area included 95% of the total site workforce. As described in the Impacts Methods and Results Technical Report the six-county ROI for INEL includes Bannock, Bingham, Bonneville, Butte, Clark, and Jefferson Counties.

Comment (2876)
Volume I, Section 4.3.5, should note that the Peconic River watershed, to which BNL is adjacent, is known to contain the highest concentration of rare and endangered plant and animal species in New York State.

Response
Section 4.3.5 in Volume I of the WM PEIS presents an overview of types of ecological resources considered in the PEIS. Section 2.15.4 of the WM PEIS Affected Environment Technical Report contains a detailed description of the ecological resources at BNL. That section describes the terrestrial communities at BNL: common fauna (mammals and birds), ecosystems that promote biodiversity, unique habitats, and nonactive species.

The technical report also states that as of September 1992, the State of New York included the banded sunfish (*Enneacanthus obesus*) as a species of special concern. The Peconic River is one of only two locations in the State known to support a population of banded sunfish. State-protected wildlife found in the Peconic basin include the tiger salamander, swamp darter (candidate for threatened species status), and the spotted turtle (species of special concern).

Comment (2878)
The list of ecological resources in Volume I, Section 4.3.5, which is oriented toward officially endangered and threatened species, should also note species that are rare or in significant decline but not officially listed. These include neotropical migratory songbirds such as warblers.

Response
The WM PEIS Affected Environment Technical Report contains detailed descriptions of ecological resources at the major sites considered in this PEIS. Federal threatened, endangered, and candidate species, and State threatened and endangered species and species of concern are considered. This level of information is adequate to support programmatic decisions. Sitewide and project-level NEPA reviews would more fully analyze potential impacts to threatened, endangered, and rare species.

Comment (2880)
Volume I, Table 4-6, and Chapters 6 and 7, note only one State-listed endangered species in the BNL Region of Influence. BNL is known to either contain or potentially contain many more endangered and

rare species than is noted. Furthermore, according to Table 4-3, the Region of Influence is to include the site and adjacent resource areas where sensitive habitats or sensitive species could be affected by the proposed action. Based on this definition and footnote "a" to Table 4-6, the WM PEIS grossly underrepresents the endangered, threatened, and rare species on and adjacent to BNL. The fact that the Peconic River and its associated wetlands and tributaries, an area known to contain the highest concentration of rare and endangered plant and animal species in New York State, are located on BNL should have generated a much more extensive list. (The commentor provided a list of species that "should be included in the site data for BNL.") BNL's own Draft Site-wide Biological Inventory Report notes some of these species as being present on the site. Furthermore, the Peconic River, found on the BNL site, flows into the Peconic Bay system, in which a number of Federally listed endangered sea turtles, particularly the rarest, Kemp's Ridley, are often found.

Response
DOE agrees and has revised Volume I, Table 4.3-2, to list one Federally and State-listed endangered, one State-listed endangered, four State-listed threatened species and 13 species of special concern for BNL. Table 4.3-2 provides a summary of the Federal and State-listed threatened and endangered species information by site. The ecological resources text section on BNL in Chapter 4 has also been updated to reflect the more recent BNL data obtained from the site's 1995 biological inventory. Section 2.15.4 of the WM PEIS Affected Environment Technical Report provides a more detailed description of the ecological resources at BNL.

When selecting locations for facilities on sites, DOE will consider the results of relevant existing or required new sitewide or project-level NEPA analyses, which would include analyses of potential impacts to threatened and endangered species and critical habitats based on site-specific conditions.

Comment (2892)
In Figure I-2b the location of the Poospatuck Indian Reservation is not correct. The Poospatuck Tribal lands are located on the Mastic peninsula, approximately 5.5 miles due south of BNL. The arrow on Figure I-2b actually locates the Shinnecock Native American Nation. The WM PEIS should be corrected to note that the Poospatuck and Shinnecock Native American Tribal Lands are located within 50 miles of BNL.

Response
Maps in Section C.4.7 in Volume III of the Final WM PEIS have been revised to reflect the presence of any Federally recognized Native American Tribes at each site. Although there also could be Tribal groups in the BNL region that are not Federally recognized, the WM PEIS does not consider these groups as cultural units (though it does consider their members in the evaluation of environmental justice impacts). The Poospatuck and the Shinnecock Tribes are included in the evaluation of environmental justice impacts even though they are not designated as Federally recognized Tribal groups.

"Recognized Native American groups" refers to those Native American groups recognized by the Federal Government as having cultural identity with an ancestral claim to lands on or in proximity to a DOE site. DOE has added a definition of Federally recognized Native American groups to Section 4.3.7 in Volume I of the WM PEIS. Table 4.3-3 has been retitled to indicate that the groups listed are Federally recognized.

4.1 Environmental Resources and Conditions

Comment (2897)
Volume I, Section 4.4.16, states that since there is no radioactive material at the Waste Isolation Pilot Plant, no radiological measurements have been performed. This statement is incorrect; preoperational radiation surveillance has been conducted by the New Mexico Environmental Evaluation Group."

Response
DOE corrected Section 4.4.16 in response to this comment.

Comment (2898)
The 3,608 available acres shown in Volume I, Table 4-8, for BNL is incorrect. According to the Future Land Use Plan for BNL (1995), the total developed area of the site is approximately 1,655 acres, leaving 3,608 acres of undeveloped land. However, this undeveloped land includes extensive wetlands areas, surface waters, areas where the water table is less than 10 feet beneath the surface, significant ecological habitats and buffer areas that have obviously not been subtracted from the site's total 5,263 acres. Therefore, DOE should not claim in Volume I, Section 5.4.4, that the figure for land available was obtained by subtracting both existing developed and land unavailable including wetlands and buffers, from the total site acreage. Furthermore, Volume I, Chapters 4 and 7, should note that all of the BNL site is located in the State-designated Central Pine Barrens and much of the site is located in the Core Preservation Area, which is designated for preservation. The Central Pine Barrens is an area recognized by New York State in Article 57 of the State Environmental Conservation Law for the significance of its ecological and groundwater resources. Therefore, the figure of 3,608 acres is wrong and must be corrected, taking into account all of the environmentally sensitive areas discussed above.

Response
DOE revised Volume I, Section 4.4.2, of the WM PEIS to show that, after subtracting developed areas, wetlands, and areas where the water table is close to the surface, approximately 2,900 acres would be available for waste management facility development at BNL.

DOE revised Section 4.4.2 to indicate that BNL is located in the Central Pine Barrens and the Peconic Estuary Systems.

Comment (2901)
Volume I, Sections 4.3.11 and 6.10.2.4.3, state that cultural resources inquiries were also sent to the State Historic Preservation Offices. It should be noted that the New York State Office of Parks, Recreation and Historic Preservation does not have complete records of archaeological and prehistoric resources. Accordingly, the New York State Museum Anthropological Survey section, the Suffolk County Archaeological Association, the Nassau County Museum, and the Department of Anthropology at the State University at Stony Brook should also be contacted. It should also be noted that much of BNL is considered to have high likelihood for the presence of aboriginal cultural resources, particularly in areas near the Peconic River. Accordingly, a complete cultural resources survey of the site, including standard subsurface testing, should be conducted.

Response
Because DOE has not proposed specific locations for waste management facilities on sites, it could not perform thorough analyses of potential cultural resources impacts. DOE recognizes that existing

cultural resources documentation might be insufficient for final facility location decisions to be made, especially where a site has not been the subject of a comprehensive cultural resource investigation.

Section 4.4.2 in Volume I of the Final WM PEIS notes that BNL has not been subjected to a comprehensive cultural resource investigation, but that three areas of BNL have been designated as eligible for inclusion on the National Register of Historic Places. A more detailed discussion of the cultural and historic background of BNL is presented in Section 2.15.7.1 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

As noted in Volume I, Section 5.4.10, implementing regulations of the National Historic Preservation Act of 1966 require Federal agencies to determine the effect of proposed actions on significant historic properties within the defined area of potential effects. Therefore, a complete cultural resources survey of the site would be required before any final facility location decision. DOE would seek input from local and State societies, museums, libraries, and academic institutions to augment information from the State Historic Preservation Office. DOE appreciates the commentor's assistance in providing names of potential additional sources of information.

Comment (2906)
Volume I, Section 4.4.2, discounts and underplays the significance of the water resources found on and near BNL. Significant surface waters, including the Peconic River headwaters, are found adjacent to BNL on the west side of William Floyd Parkway and northwest of the site. In addition, groundwater flows south from BNL toward the Forge River, a major river on the south shore of Brookhaven Town. Also, BNL is located in the Federally designated Peconic Estuary and development and activities at BNL are of great significance for this system, including the presence of brown tide in the estuary. The WM PEIS water resources subsection fails to note that BNL lies over a deep-flow aquifer and that BNL contains a groundwater divide from which groundwater flows eastward and southward, thereby creating greater potential for groundwater contamination. BNL also contains both discharge and recharge zones. These factors must be accounted for in Section 4.4.2.

Response
Section 4.4.2 in Volume I of the WM PEIS is a summary of information contained in Section 2.15 of the WM PEIS Affected Environment Technical Report. This technical report provides more detailed information on water resources at BNL. The report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

If BNL were selected for disposal, the facility would be designed and located in accordance with all applicable regulations. Best management practices for stormwater management would be implemented to ensure that no significant quantities of potentially contaminated runoff would reach the river. In addition, a detailed performance assessment would be prepared that would evaluate the performance of the disposal facilities over time. The performance assessment would be considered in the decisions about where and how to build the disposal facility.

Comment (2907)
DOE should use more recent data in the discussion of water resources in Volume I, Section 4.4.2.

4.1 Environmental Resources and Conditions

Response
In general, DOE elected not to update or supplement the data in the WM PEIS with more recently published data because conditions rarely change drastically from year to year. Exceptions were made in instances where DOE determined that the updated data might affect the comparisons of alternatives. DOE believes that the water quality information provided gives an adequate characterization of the conditions at the sites, especially for a programmatic EIS that will not select locations for waste management facilities on the sites. More up-to-date site-specific information would be included in sitewide or project-level NEPA analyses.

Comment (2908)
Volume I, Section 4.4.2, should include a discussion of the possibility of perched groundwater feeding the Peconic River.

Response
Section 4.4.2 in Volume I of the WM PEIS is intended to provide a broad overview of the affected environment at BNL. Additional information is presented in the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I.

Section E.2.15.2.1 of the technical report states that BNL is on the western rim of the Peconic River drainage basin. The onsite tributary of the Peconic River both recharges and receives water from the groundwater aquifer, depending on the elevation of the water table. In times of drought, the tributary typically recharges to groundwater, while in times of normal to above average precipitation, the tributary receives water from the aquifer. Liquid effluent from the BNL Sewage Treatment Plant constitutes the principal source of water in the tributary's river bed during drought periods. During times of low precipitation, water in the tributary does not flow offsite.

DOE has confirmed the presence of perched groundwater while conducting monitoring of groundwater quality and elevation around the Peconic River and surrounding wetlands. Since specific locations for waste management facilities on the sites are not being selected at this time, site-specific issues such as the potential impacts from perched groundwater on the Peconic River would be considered during sitewide or project-level NEPA analyses.

Comment (2909)
Volume I, Section 4.4.2, briefly mentions the significance of the underlying aquifer as being a sole-source aquifer. First of all, it should be noted that the aquifer underlying Long Island was designated a sole-source aquifer by the EPA pursuant to 42 USC 300h-3(e) (published in the *Federal Register* on June 21, 1988). BNL is in the midst of a deep recharge zone for Long Island's sole source aquifer system. Two and a half million people draw their water from this system. Soils of this aquifer are very permeable and would easily transmit contaminants to great depths. Residence times in the deeper aquifers is measured in centuries. The WM PEIS discussion of the aquifer system is extremely inadequate and more detail must be provided.

Response
Section 4.4.2 in Volume I of the WM PEIS summarizes the information contained in Section 2.15 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading

rooms listed in Section 1.9 in Volume I of the Final WM PEIS. The discussion requested in the comment is in the technical report.

Comment (2915)
Volume I, Section 4.4.2, geology and soils: Gardiner's clay is not a glacial deposit--it is a Cretaceous-age deposit. Its presence at BNL has not been confirmed and is, in fact, widely doubted. There are intervals of a clay layer between the Magothy-Matawan Deposit and the glacial deposits. However, it is believed that there is a strong hydrologic connection between the upper and lower aquifers under most of the BNL site; thus its designation as a deep recharge zone.

Response
The source document used by DOE, the *Brookhaven National Laboratory 1993 Technical Site Information Document*, describes Gardiner's clay as a glacial deposit. Figure 2.15-3 in the WM PEIS Affected Environment Technical Report shows the clay being thin or absent near BNL. This figure also shows BNL in the deep recharge zone for the lower aquifer system. Section 2.15.2.2 of the affected environment technical report states that about two-fifths of the recharge from rainfall moves into the deeper aquifers. The affected environment technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. The BNL information document is cited in the affected environment technical report.

Comment (2916)
Volume I, Section 4.4.2: Unconsolidated sediments above the "basement rock" are usually not called "rock."

Response
The commentor is correct. DOE replaced the term "rock units" with "geologic units" in Section 4.4.2 in Volume I of the WM PEIS.

Comment (2928)
Volume I, Section 4.4.2, oversimplifies the complexity of land use surrounding the BNL site. It should note significant existing or planned residential, commercial and industrial developments, parklands and recreation areas, and cultural and ecological resources.

Response
Section 4.4.2 in Volume I of the WM PEIS was intended to provide a broad overview of the affected environment at BNL. Additional information, including surrounding land use, is contained in Section 2.15 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS.

The proximity of residential, commercial, recreational, and ecological resources to sites selected for new waste management operations would also be considered as a part of sitewide or project-level NEPA analyses.

Comment (2948)
At BNL, the wastewater flow is greater than 90% of the receiving water's baseline flow rate. This should be noted as a site-specific exception in Volume I, Section 5.4.3.

4.1 Environmental Resources and Conditions

Response
Although it is true that effluent from BNL's sanitary wastewater treatment plant forms a large percentage of the flow in the upper reaches of the Peconic River, this is considered to be a baseline condition. The analysis performed in the WM PEIS examines the percent change in current conditions due to effluent discharges associated with the waste management alternatives. As described in Sections 6.6.1 and 7.6.1 in Volume I, the change in current effluent discharges would be less than 1%.

Comment (2958)
The ecological resources discussion in Volume I, Section 4.4.2, is grossly inadequate. The following concerns should be addressed. Open space in a highly developed region of the Country such as BNL plays a more significant role than in more rural areas. DOE figures show that the region of influence for BNL is the greatest of all the sites under consideration, and yet BNL is among the smallest of the candidate sites, and has one of the smallest acreage's available for waste management facilities among the candidate sites. The impact of developing this open space should be discussed.

Response
The WM PEIS ecological resources impacts analysis included evaluation of the potential loss or degradation of terrestrial habitats and the potential toxicity resulting from exposure to radioactive and hazardous contaminants released from waste treatment facilities. As shown in the Volume II data tables for BNL, low-level mixed waste facilities would require no more than 1.6 acres at BNL. In addition, the construction of low-level waste facilities would require no more than 2.8 acres at BNL. Even given the revisions to the BNL available land estimates presented in Volume I, Table 4.3-4, sufficient land appears to be available at BNL to implement any proposed waste management actions. The small amount of land required for the low-level mixed waste and low-level waste facilities should give DOE a great degree of flexibility in making facility location decisions. Mitigative measures can also be used to ensure that site clearing would not affect nearby sensitive habitats.

Comment (3003)
Volume I, Section 4.4, presents information regarding the affected environment at major waste sites. This information is not consistently presented across sites even though some of the information, like meteorological records or depth to groundwater, might be the site-specific information pulled in to certain portions of the analysis.

Response
Chapter 4 of the WM PEIS is not intended to provide comprehensive information on all site parameters. Rather, the most pertinent facts are presented. A list of appendices and technical reports is provided in Volume I. These reports provide more comprehensive information than could be presented in the body of the WM PEIS. Affected environments at individual WM PEIS sites are detailed in a two-volume affected environment technical report.

Source data for the analysis are derived from multiple sources such as site development plans and environmental reports, DOE and national laboratory technical reports, and national databases such as from the U. S. Bureau of the Census. Whenever possible, DOE used existing data in conducting the analysis; however, when addressing so many sites and corresponding regions of influence, some limitations on data availability and uniformity can be anticipated.

4.1 Environmental Resources and Conditions

To assure a consistent and uniform analysis across all 17 sites, standard, generic models (or modules in the case of the cost analysis) were used to describe potential activities for each of the waste management sites. Use of these models greatly assists the comparability of the analysis. Because individual variations among the sites cannot be incorporated into these generic descriptions, the correlation between the generic description and the conditions at any one site are imperfect. These variations are assumed as part of the overall comparison of alternatives and addressed as a recognized limitation on the analysis.

Comment (3008)
Single-year weather summaries are of no use for decisionmaking that is expected to have implications over centuries. Average summary data, covering decades at a minimum, should be included for all sites.

Response
Section 4.4 in Volume I was intended to provide summaries of the most important features of the affected environment for each of the major sites. The characterization of the affected environment (including meteorological conditions) was used to establish baseline conditions against which to measure the potential impacts of the waste management alternatives. This information enabled DOE to compare the waste management programmatic alternatives, and to make decisions at the programmatic level.

The WM PEIS impacts methods and results technical report provides more detailed information on environmental modeling/analysis criteria. Criteria used were functions of the models and generally not based on data specific to a single year. For meteorological data, 5-year wind rose data from the National Weather Service were used. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

The precision of the modeling was sufficient to enable comparisons across sites. More detailed/precise analyses will be conducted as part of a project-level NEPA reviews.

Comment (3038)
Using 1992 as a baseline year to describe the affected environment at each site suggests that much of the data are out of date. Where possible in Section 4.4, summary information should be updated.

Response
To allow completion of the Draft WM PEIS impacts analyses, the base year for the analysis data was set at 1992. Continuing revisions with more recent data would have prevented publication of the Draft PEIS within a reasonable time frame. Some sections of the WM PEIS have been revised in response to public comments to include updated information. However, DOE did not make changes to the PEIS solely to present more recent information. Changes were generally limited to those that might reasonably be expected to affect the decisions to be made based on the WM PEIS. All changes made from Draft to Final WM PEIS are indicated with a sidebar next to the changed text, or shading in tables.

Comment (3040)
Section 4.3.5 does not discuss the land area that constitutes habitat for threatened or endangered species, although the land area involved may be quite extensive.

4.1 Environmental Resources and Conditions

Response
Volume I, Section 4.3.5, provides an overview of the ecological resources identified in defining the baseline conditions at each of the sites. DOE has modified Section 4.3.5 to refer the reader to additional information contained in the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS.

Section 5.4.4.1 of the WM PEIS describes the evaluation of habitat impacts and Section 5.4.4.3 describes how effects on sensitive species were addressed. The WM PEIS analysis is a screening level assessment conducted to identify potential impacts. The land area designated by the sites for waste management activities or calculated in the PEIS as available for waste management facility construction generally excludes habitats supporting endangered or threatened species. This waste management designated or available acreage was used to evaluate waste management facility construction requirements in the PEIS. Results indicate DOE has more than sufficient lands available to support new waste management facilities so as not to require use of any lands supporting threatened and endangered species. Site-specific analyses would further evaluate the extent and severity of any ecological resource impacts resulting from the potential implementation of waste management actions.

Comment (3041)
The number of threatened and endangered species at each site is an inadequate basis for decisionmakers to compare siting options because there are more facets to ecological resources. For example, Table 4-6 fails to mention the discovery by the Nature Conservancy of three plant and seven insect species new to science at the Hanford Site and also fails to mention how much of the Hanford Site contains State priority habitat.

Response
Volume I, Table 4.3-2, presents summary information for each site. Detailed information about the ecological resources at the Hanford Site is presented in Section 2.2.4 of the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final PEIS.

A detailed analysis of impacts to sensitive species and habitats was not conducted in the PEIS because specific waste management facility locations have not been proposed. Impacts to sensitive species, including species listed as threatened or endangered by the U.S. Fish and Wildlife Service or by the State of Washington as sensitive or of concern, would be addressed in sitewide or project-level analyses. Based on the small fraction of land required for waste management facilities at any site, DOE would have sufficient flexibility in locating facilities on sites to avoid or mitigate impacts to sensitive species and habitats.

Comment (3043)
It is not clear where the figure of 14,496 acres in Table 4-8 for waste management facilities originated. The reference appears to be U.S. DOE 1995, but is not clearly cited. This figure is 140% above the 6,000 acres recommended by the Hanford Future Site Uses Working Group. If the additional acreage is located on the Central Plateau, then waste management activities will have significant effects on State Priority Habitat (shrub steppe) and Priority Species, which could lead to listing for several shrub-steppe-dependent species.

Response
The total acreage data for each site shown in Volume I, Table 4.3-4 (formerly Table 4-8), were compiled from *DOE Real Property: A Yearly Statistical Handbook, FY 1993*. The available acres for waste management facilities were obtained from available site development reports. These sources of information are listed in Volume I, Section 4.3.8, of the Final WM PEIS.

DOE has updated Table 4.3-4 to indicate that there are 6,000 acres available at Hanford for waste management facilities. The 6,000-acre figure excludes acreage that was originally considered available for waste management facilities. DOE revised other sections of the WM PEIS to reflect this new acreage figure.

According to Section 11.6 in Volume I of the PEIS, the proposed waste management alternatives for all of the waste types considered at Hanford would require a maximum of about 178 acres (Table 11.6-1). Therefore, given that the available acreage is 6,000 instead of 14,500, any of the waste management alternatives would still require only a small percentage of available land area.

DOE revised Section 11.6 to indicate that the Draft Hanford Remedial Action EIS analyzed remediation to a level suitable for unrestricted land use for portions of the Columbia River area, as well as the area on the river where reactors are located. All other areas at Hanford were analyzed under alternatives which call for restricted use, except for the Central Plateau, which would be used for waste management activities (an exclusive use).

Section 4.4.4 identifies the wildlife and plant species that could potentially be affected by waste management activities at Hanford.

Comment (3046)
Table 4-12 does not note that archaeological surveys have been completed for only a fraction of the Hanford Site.

Response
To provide a basis for the comparison of the acreage surveyed for archaeological resources with the total site acreage, DOE has updated Table 4.3-8 in Volume I to indicate both the number of acres at each site and the percentage of the total site that have been inventoried. The revised table shows that 21,358 acres, or 6%, of the Hanford Site have been surveyed sufficiently to identify all readily apparent archaeological properties.

Comment (3047)
Section 4.4.4 is not sufficient to understand the affected environment at Hanford, because it completely ignores the nature and extent of contamination and wastes currently on the site. The description of the environment and its significance is overly brief (e.g., there is no mention of the regional importance of the Columbia River).

Response
To keep the WM PEIS to a manageable size, DOE elected to provide summary descriptions of the sites' affected environments in Chapter 4, Volume I, of the WM PEIS. The WM PEIS Affected Environment Technical Report provides detailed descriptions of the WM PEIS sites including site contamination. The technical report is available in the DOE public reading rooms listed in Volume I,

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Section 1.9, of the Final WM PEIS. Some of the information that the commentor is interested in is located in the introductory text of Chapter 4 in Volume I of the WM PEIS. Hanford's wastes are listed in Volume I, Chapter 1 and Chapters 6 through 10. Section 4.3.3 in Volume I briefly describes surface water, groundwater, and sediment contamination at the sites, and Section 4.3.4 describes soil contamination at the sites.

Comment (3048)
The water resources section should include the amount of annual precipitation for the Hanford Site, which is approximately 16.5 centimeters on Central Hanford.

Response
The WM PEIS Affected Environment Technical Report contains more detailed information on environmental conditions at the sites. Precipitation is a meteorological event and is described in the air quality section of the technical report. Section 2.2.3 of the WM PEIS Affected Environment Technical Report states that average annual precipitation at the Hanford Meteorological Station Tower is 16 centimeters (6.3 inches). The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3052)
In Volume I, Section 4.4.4, the statement that, at Hanford, soils vary from sand to silty sand and sandy loam, but are predominantly sandy loams, is true only for surficial soils. For example, the Hanford Formation, a deposit of coarse-grained soils ranging in size from fine gravels to boulders, comprises most of the soil column above the basalt.

Response
As used in the WM PEIS, the term "soil" is defined as the upper layer of earth in which plants can grow, that generally exhibits some soil horizon development. Therefore, unconsolidated sediments within the Hanford Formation are not considered soils in the WM PEIS. Nonetheless, to clarify this point, DOE revised Section 4.4.4 in Volume I to read, "Surficial soils vary from sand to silty sand and sandy loam, but are predominantly deep, well-drained sandy loams."

Additional information on the affected environments at the sites is provided in the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public readings rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3053)
In Volume I, Section 4.4.4, Hanford affected environment description, the first bullet under ecological resources, should read "The Hanford Site contains the largest tract of undisturbed native shrub steppe remaining in the State of Washington, and is 6 linear miles from the second largest tract in the State, the Yakima Training Center. The National Biological Service [sic] has listed native shrub and grassland steppe in Washington and Oregon as an endangered ecosystem."

The third bullet should read "Of ecological importance, the Hanford Reach is the only significant mainstream spawning habitat remaining for Fall Chinook salmon. The Hanford Reach comprises the only significant remaining section of the inland Columbia River where White Sturgeon are able to spawn. Three plant and seven insect species new to science have been discovered on the Hanford Site since 1994, indicating a unique ecosystem exists at the Hanford Site."

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Response
DOE made the requested changes to Section 4.4.4 in Volume I of the WM PEIS.

Comment (3072)
The WM PEIS does not contain enough site-specific geological and hydrological information to adequately analyze the impacts of waste management at Hanford, or at any of the other sites.

Response
Chapter 4 in Volume I contains summary information on the affected environments at the sites. Although additional information on geology and soils and hydrologic systems would help to round out the affected environment descriptions presented in the WM PEIS, additional details for the 17 major sites evaluated would have added significantly to the size of the document. DOE determined that it would be adequate to include this information the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. For additional detailed information on the Hanford Site, consult the Tank Waste Remediation System, Hanford Site Final EIS, 1996, and the Hanford Remedial Action EIS.

Comment (3077)
WM PEIS discussions of land-use impacts (Sections 6.11, 7.11, 8.11, 9.11, and 10.11) should include tables that list the suitable acreage for each site, especially since the data tables do not contain this information.

Response
Table 4.3-4 in Volume I identifies the land available for waste management facilities at the DOE sites. To keep the PEIS to a manageable length, these data are not reproduced in each impact chapter.

Comment (3115)
The numbers in Table C.4-19 are misleading because (1) it is not clear whether the wastewater capacity shown is for sanitary or process wastewater; (2) it is not clear how these numbers were obtained; and (3) for most of the Hanford Site, the capacity for sanitary wastewater is much less than the current demand.

Response
All data contained in Volume III, Section C.4.9.3, represent baseline onsite infrastructure capacities and current use only. For wastewater capacity and current use, the data presented include sanitary wastewater only. No process wastewaters are included. DOE added a note to Volume III, Table C.4-20, to clarify that the data pertains to sanitary wastewater only.

The data in Table C.4-20 are generally contained in the WM PEIS affected environment report (DOE, 1995). The data in the technical report were obtained from numerous sources, which are identified in the technical report. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

The data obtained for Hanford indicate that current use is less than the available sanitary wastewater treatment capacity (see Table C.4-20).

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Comment (3116)
The description of Native American Resources in Section C.4.10.1.2 seems applicable to all of the Hanford Site, based on reserved rights with local tribes under the Treaty of 1855.

Response
DOE agrees that the language in Section C.4.10.1.2 would appear to indicate that all of the Hanford Site can be considered "Native American Resources," if literally interpreted. This was not the intent and DOE has modified the language to more accurately reflect the law and DOE policy.

DOE recognizes that American Tribal Governments have a special government-to-government relationship with the U.S. Government as defined by history, treaties, statutes, court decisions, and the U.S. Constitution. Although the U.S. Department of the Interior, through the Bureau of Indian Affairs, has the principal responsibility for upholding obligations of the Federal Government to Native Americans, the responsibility extends to all Federal agencies. As stated in the revised Section 1.4.5 in Volume I, and consistent with DOE American Indian Policy, at each DOE site with areas of cultural or religious concern to them, Native Americans will be consulted about the potential impacts of proposed DOE actions on these resources.

Comment (3117)
In Section C.4.10.2, it is not clear whether a "historic property" would include the Hanford B-Reactor and whether its preservation would be balanced against use of other Hanford lands more culturally important to Native American tribes.

Response
The identification of the Hanford B Reactor as a cultural resource is a function of its status as having been designated for listing on the National Register of Historic Places. As a result, it comes under the protection of Section 106 of the National Historic Preservation Act of 1966 and must be considered in the WM PEIS analysis for any potential adverse impact by the proposed actions. The determination that a given site meets eligibility criteria for listing on the National Register of Historic Places is an action independent of the PEIS and, therefore, outside the scope of this analysis.

For purposes of the PEIS description of cultural resources, a National Register of Historic Places property is presented without placing any other value on the quality of the property. Therefore, no effort is made to determine if one site is more or less valuable or deserving of protection. DOE is required to consider all such properties as equally subject to protection under the law.

Comment (3120)
Chapter 4 contains sparse information, which leads to the "unknowns" mentioned in Section C.4.10.3.

Response
The "unknowns" mentioned in Volume III, C.4.10.3, refer to two aspects of cultural resources assessment. First, the locations of waste management activities at individual sites have not been identified. Second, the survey status at different sites varies; few sites have undergone sitewide systematic surveys and, as a result, all cultural resources have not been identified. The level of detail provided in Chapter 4 does not lead to these unknowns, these unknowns lead to the level of information provided in Chapter 4.

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To keep the WM PEIS to a manageable size, DOE elected to provide summary descriptions of the sites' affected environments in Chapter 4 in Volume I, and present the detailed descriptions of the affected environments in a technical report. References to the technical report are included in Chapter 4 in Volume I and Appendix C in Volume III, and a reference to the report was added to the text in Section C.4.10.3 in Appendix C. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3153)
The WM PEIS uses obsolete or inaccurate data for various DOE sites, including Pantex. For example, the document contains no analysis of the emissions from the Burning Grounds and more than 100 other emissions points that are identified in the Pantex Resource Conservation and Recovery Act (RCRA) permit but do not have ongoing air monitoring. Therefore, statements about specific air emissions cannot be supported.

Response
As described in Section 5.4.2 in Volume I, the WM PEIS examines impacts to air quality from the incremental addition of waste management emissions. These waste management emissions are evaluated to determine if they would have major adverse impacts to existing air quality in the air quality control region. The impacts of non-waste management activities are outside the scope of the WM PEIS.

Existing facility emissions are considered as impacts of existing operations in the cumulative impacts section (Chapter 11 in Volume I). Additional details of the impacts of these site-specific activities are included in sitewide EISs that have been prepared for many DOE sites, including Pantex.

Section 4.4.11 in Volume I and Section 2.10 in Volume II of the WM PEIS Affected Environment Technical Report contain an overview of the more pertinent facts characterizing the affected environment for Pantex. The WM PEIS Affected Environment Technical Report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Sitewide and project-level NEPA analyses can more fully consider site-specific air quality conditions and impacts.

Comment (3196)
Seismic risks at Hanford are mischaracterized. Contrary to Section 4.4.4, all of Eastern Washington is regulated as a Seismic Zone 2B, not 1. Also in Section 4.3.4, Hanford is in a Seismic Zone 2B, not Zone 1. This section states that the accident scenarios were based in part on the seismic rating of the sites. These need to be recalculated for Hanford. Additionally, there are many surface features that align from the west-northwest to the east-southeast across the site. These surface features coincide with a broad band of small earthquake activity stretching from Puget Sound to the INEL site. These features and earthquake activity suggest possible unidentified faults throughout the region. It is therefore difficult to be sure that a fault does not exist within 200 feet of any proposed facility. These features and earthquake activity should be assessed and incorporated into the accident and risk assessments. Also, the Uniform Building Code requires the use of a 1.5 importance factor for construction of facilities such as those considered in the WM PEIS.

Response
The reference to Seismic Zone 1 for Hanford was removed from the Final WM PEIS, since this information is not consistent with the detail presented for the other sites. Section 4.4.4 in Volume I of the WM PEIS was changed to indicate that the seismicity of the Columbia Plateau is relatively low,

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although shallow, low-intensity earthquakes occur throughout the Hanford Site area. Nevertheless, the seismic zone designation of any of the DOE sites did not factor into the accident analysis. An assumption of the analysis was that the probability of failure due to earthquakes was the same across all DOE sites, and that facility engineering would ensure that this was the case because more robust construction would be required at the more earthquake prone sites.

The information in Section 4.4.4 summarizes the detailed information presented in the WM PEIS Affected Environment Technical Report. The report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. With respect to unidentified faults, Section 2.2.1.1 of the technical report describes existing known faults within the Hanford area and seismic history of the Columbia Plateau. DOE knows of no capable faults within 200 feet of the Hanford Site 200 Areas where waste management facilities would most likely be sited.

If DOE selected Hanford for a new waste management treatment, storage, or disposal facility as a result of the WM PEIS analysis, the specific design basis and exact locations of the waste management facilities would be identified; reviews would consider potential earthquake impacts. DOE would design, construct, operate, and maintain waste management facilities in accordance with appropriate local seismic standards. The Uniform Building Code importance factor would be considered in design of waste management facilities at all DOE sites, including Hanford.

Comment (3199)
The WM PEIS does not adequately consider site-specific environmental factors. Since it will be used in the decisionmaking process to identify preferred strategies and sites for waste management, the WM PEIS should include all applicable site-specific environmental factors in the analysis.

Response
Due to its programmatic nature, the WM PEIS does not include project-level analyses. Rather, the WM PEIS analysis is generic in character to allow for meaningful comparison of potential programmatic alternatives. However, before DOE selects locations for waste management facilities on sites, it will consider the results of project-level NEPA reviews.

Comment (3200)
Volume I, Section 4.3.5. In addition to species listed or under consideration for listing as rare, threatened, or endangered by the State and Federal governments, The Nature Conservancy recently completed one phase of an ecologic assessment of the Hanford Site. They identified several species of plants and animals that were previously unknown. Their analysis focused along the river. DOE canceled planned surveys of the rest of the site. These should be reinstated, with priority given to the shrub steppe habitat on the Central Plateau. This is needed before site selections are considered.

Response
Section 2.2.4 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS, contains a detailed description of the ecological resources of the Hanford Site. Summary information for the Hanford Site is presented in Section 4.4.4 in Volume I of the WM PEIS.

While DOE intends to use the WM PEIS as a tool to help select sites for waste management activities, DOE will not select specific locations for waste management facilities at sites based on this PEIS.

Specific locations will be selected based on sitewide or project-level NEPA reviews, which would consider impacts to sensitive species or habitats at particular locations on sites.

The commentor's request to reinstate the survey has been forwarded to the DOE Richland Operations Office.

Comment (3204)
Volume I, Section 4.3.11: Cultural resources also include all of the lands obligated under Tribal Treaty restrictions. The American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act might also apply.

Response
Section 1.4.1 in Volume I identifies several applicable laws and regulations, including the American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act. A more detailed definition of the elements included in the term "cultural resources" is provided in Section 5.4.10. DOE revised Section 4.3.11 to include a cross-reference to the more detailed discussion in Section 5.4.10.

Comment (3265)
Section 4.4.13 gives Rocky Flats Environmental Technology Site (RFETS) wind speed and direction information from Stapleton International Airport in Denver, rather than from the Rocky Flats site. The prevailing winds at Stapleton International Airport are in a pattern opposite to that which exists at RFETS. Please describe the impact of this mistake on the analysis of alternatives related to RFETS.

Response
National Weather Service wind rose data, including data collected at Stapleton International Airport, was utilized only to obtain descriptive data in a consistent format for all sites. The wind rose data are presented in the WM PEIS Affected Environment Technical Report and summarized in Chapter 4 in Volume I of the WM PEIS. However, these data were not used in the impacts analysis. The impacts analysis used wind direction data obtained from meteorological towers at the sites.

Comment (3269)
The NTS region of influence should be expanded to include all of Clark County, Nevada, where significant impacts could occur. All potential impacts addressed in the WM PEIS are confined to a 50-mile radius around the potential waste management facilities at NTS, which eliminates major population, resort, commercial, and transportation centers that could be affected by implementation of the waste management alternatives.

Response
As presented in Table 4.2-1 in Volume I of the WM PEIS, general regions of influence for 13 environmental resources considered in this document often vary by resource. Not all regions of influence are confined to a 50-mile radius around the potential waste management facilities. For example, the socioeconomic region of influence includes the site, the counties that contain the site or a part of the site, and counties in the area where 90% of the site employees reside. Thus, all of Clark County is in the NTS socioeconomic region of influence. The air quality analysis also considers impacts to Clark County.

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Comment (3374)
The region of influence (ROI) for PGDP is not accurate. It actually includes these additional counties: Lyon, Livingston, Crittendon, Caldwell, Trigg, Calloway, Fulton, Hickman, and parts of other counties to the northeast in Kentucky; Pope, Hardin, Gallatin, Saline, Williamson, Union, Johnson, Alexander, and Pulaski in Illinois. There are also counties in Tennessee and southeastern Missouri within the ROI. "It appears DOE is deliberately trying to fool the public into thinking the affected environment is less than it really is...The failure of DOE to accurately describe the ROI indicates a foundational failure to properly analyze the impacts of the proposal."

Response
As described in Volume I, Section 4.2.2, of the WM PEIS, the area encompassed by an ROI varies by site according to the potentially affected environmental resource area. For example, the ROI for air quality extends a considerable distance from the site boundary, while the ROI for cultural resources consists primarily of the onsite area that might be disturbed by implementation of the proposed action. The ROI cited in the comment as inaccurate appears to be the ROI for socioeconomic conditions, which is defined to include the site, counties that contain the site or part of the site, and counties in which 90% of site employees reside. In contrast, the ROI for human health risk at PGDP includes the site and nearby offsite area (within 50 miles from the center of the site) where worker and general public exposure is likely. According to the definition of ROI for socioeconomic conditions, the counties included in the WM PEIS for the PGDP ROI are accurate.

Comment (3375)
Within the PGDP region of influence, there is wide variety of agricultural activities. There are vegetable farms, cattle, swine, chickens, orchards, and row crops all very near to PGDP. There are processing facilities for just about all of these agricultural products, and significant amounts are locally marketed at various times of the year. This is not mentioned or analyzed at all.

Response
A more detailed description of PGDP regional and site land uses is provided in Section 2.11.5.5 of the WM PEIS Affected Environment Technical Report. This report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

As described in Section D.2.4.1 in Volume III of the PEIS, health risk analysis does include evaluation of an agricultural exposure pathway for offsite population receptors. This pathway results from releases of radionuclide and chemical contaminants to the atmosphere from waste management treatment and storage facilities. Airborne contaminants are assumed to be deposited onto surface soils, where they are taken up by plants. The plants are consumed by the local population, and are fed to livestock, which is also consumed by the local population. Offsite population receptors, therefore, are assumed to be exposed to contaminants released from treatment and storage facilities through inhalation of airborne contaminants, as well as by ingestion of contaminated locally produced plants and livestock.

Comment (3379)
DOE should look carefully at the PGDP region of influence in Missouri. There may very well be wild and scenic rivers within that area. Also, there are five candidate wild and scenic rivers, at least four of which are within the region of influence in Illinois.

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Response
Section 4.2.2 in Volume I states that the region of influence for water resources includes surface water bodies within the site's boundaries and adjacent surface water bodies that could be affected by site activities. DOE considers surface water bodies in Missouri and Illinois (except for the Ohio River) to be outside the PGDP region of influence.

Comment (3398)
Southern Illinois, western Kentucky, and southeastern Missouri all contain some of the most ecologically significant areas in the Midwest. This needs to be acknowledged and considered in the WM PEIS. An internationally significant wetland area, the Cache River area in southern Illinois, is not only within the PGDP region of influence (ROI), but very near the site. This is certainly an area of ecological concern. There are at least five Congressionally designated wilderness areas in southern Illinois within the ROI in the Shawnee National Forest, and more than likely wilderness areas in the ROI in Missouri. These areas, as well as other designated natural areas, are locations of numerous State-listed threatened and endangered species in Illinois and Missouri. What about The Land Between the Lakes? This area is certainly ecologically important, and is the location of the gray bat, a Federally listed species not mentioned in the affected environment description. The Land Between the Lakes is within the ROI and not that far from PGDP. It provides habitat for many species that have no other such habitat in western Kentucky. For example, Price's Groundnut, a Federally listed endangered plant species occurs in The Land Between the Lakes. There are sites for Mead's milkweed within the ROI in southern Illinois. Mead's milkweed is a Federally listed endangered plant species. There is habitat for the peregrine falcon, another Federally listed species, in the ROI. The information in the WM PEIS concerning this issue is incomplete.

Response
As stated in Section 4.2.2 in Volume I, the area encompassed by the ROI varies by site according to the potentially affected environmental resource area. For example, the ROI for air quality extends a considerable distance from the site boundary, while the ROI for cultural resources consists primarily of the onsite area that might be disturbed by facility development of the proposed action. The ROI for ecological resources includes the site and adjacent areas where sensitive habitats or sensitive species could be affected by the proposed action and, in particular, could be exposed to contaminants from waste management activities through one or more pathways. DOE considers most areas in Missouri and Illinois to be outside the PGDP ecological resources ROI and, therefore, has not included them in the site descriptions.

The Cache River in southern Illinois flows west and then south to its confluence with the Ohio River near Cairo, Illinois. At its closest point to PGDP, it is about 10 miles away, and at its confluence, about 15 miles away. The confluence of the Cache and the Ohio Rivers is downstream from PGDP; however, it is sufficiently distant via the surface water pathway that significant dilution of any pollutants would occur in the Ohio River. Where the Cache River is closest to PGDP, it is not in the direction of prevailing winds.

The Shawnee National Forest is quite large. Its closest part is approximately 10 miles from PGDP and its farthest part is about 100 miles. Most of the Shawnee National Forest is more than 25 miles from PGDP, with no water pathway between it and PGDP. Because of the absence of a water pathway and the Shawnee being distant from PGDP via the air pathway, it is not in the PGDP ecological resources ROI.

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The Land Between the Lakes is 30 miles from PGDP, is upwind when the prevailing winds blow, and is upstream from any surface-water connection. In the PGDP Annual Environmental Reports, exposure of deer in The Land Between the Lakes is considered to be a background standard. DOE does not consider The Land Between the Lakes part of the PGDP ROI for ecological resources. As stated in Table 4.2-1 in Volume I, Section 4.2.2, of the Final WM PEIS, the ROI for ecological resources includes the site, adjacent resource areas, and the transportation corridors between the sites.

Comment (3399)
NEPA requires that the public be fully informed of the proposed actions and that the agency fully disclose the impacts. This cannot be done if the affected environment is not sufficiently or accurately described.

Response
DOE believes that the affected environments at the sites are adequately described in the WM PEIS and has fully disclosed the potential impacts of the waste management alternatives. The affected environment descriptions in Chapter 4 in Volume I provide a brief summary of environmental conditions at the sites. The WM PEIS affected environmental technical report contains more detailed descriptions of the sites. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3400)
As to the figures in Table 4.3-6 and Table 4.3-7, it is obvious from adding and subtracting the various figures from the three facilities shipping by rail that PGDP is shipping to Portsmouth, and that ORR and Portsmouth are shipping back to PGDP. In Volume I, Table 4.3-7, "Rail Shipments During Fiscal Year 1993," Portsmouth and PGDP received 117 and 106 incoming rail shipments of radioactive materials, respectively. Other listed major sites received none. From the same chart, Portsmouth and PGDP had 98 and 117 rail shipments, respectively. Where were these shipments sent? No other sites report incoming rail shipments. Were these shipments sent back and forth between PGDP and Portsmouth exclusively? What is the material that is being shipped to PGDP from ORR and Portsmouth? If this is waste, it might represent further evidence that DOE is implementing a decision regarding waste movement prior to completion of the WM PEIS. What materials are being shipped out of PGDP, either by truck or rail? The amount going in is much greater than the amount going out.

Response
Shipments coming into PGDP are uranium hexafluoride; those going out are enriched uranium hexafluoride. Neither of these materials is considered waste. The data provided in Table 4.3-6 and Table 4.3-7 are for the purposes of establishing a transportation baseline for the current rail and truck shipments to and from DOE sites. Source data are derived from the 1993 Shipment Mobility/Accountability Collection and the Waste Manifest System FY 1993. Data are presented for each site without reference to source or destination of shipments. This database includes all radioactive materials shipments, not just waste shipments. The database does not specifically characterize the components that make up the site shipments beyond a division into radioactive and other hazardous materials categories. Because the table is intended as a summary of transportation-related activity in general, it is not useful as a source for waste volume, or other materials volume information.

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Comment (3404)
The New Madrid fault is perhaps the most dangerous earthquake fault in the Nation. Scientists predict a 90% chance of a major earthquake in the New Madrid fault within 10 to 20 years. PGDP is on the edge of the highest intensity zone for a New Madrid event, and is possibly located in liquefaction soils. This is the worst possible place for a long-term nuclear storage and treatment facility. An earthquake could cause a release of radiation. The consequences from pollution by stored nuclear waste will be catastrophic.

Response
As described in Section 2.9.2 of the WM PEIS Affected Environment Technical Report, PGDP is near the northeastern end of the New Madrid fault zone. Within a 322-kilometer (200-mile) radius, six additional fault zones have been recognized, including the Rough Creek, Saint Genevieve, Cottage Grove, Shawnetown, Wabash Valley, and Illinois-Kentucky Mineral District. There is no evidence to support faulting of post-Paleocene surface strata in the PGDP region of influence; however, faults found in the Paleocene strata have been proposed to be capable. A capable fault (active fault) is one that has had movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the last 500,000 years.

Section 2.9.2 also states that the site is near two active seismic zones--the New Madrid fault zone is located immediately to the south-southwest and the Wabash Valley fault zone is located immediately northeast. The largest earthquake in the region occurred in 1812 and was centered in the New Madrid fault zone. The earthquake had a magnitude of 7.3 on the Richter scale, with an epicenter 96 kilometers (60 miles) southwest of the site. The intensity of the earthquake in the region near PGDP was estimated to be Modified Mercalli Intensity X. An earthquake of this magnitude destroys most masonry and frame structures; destroys some well-built wooden structures and bridges; causes serious damage to dams, dikes, and embankments; and causes slope failures. An earthquake with a maximum horizontal acceleration of 0.45g has an annual probability of occurrence of 1 in 1,000 at PGDP.

Accidents initiated by earthquakes at treatment facilities were included in the WM PEIS, assuming generic facility characteristics, and were shown to produce minimal risks at PGDP. See Sections 6.4.3 and 7.4.3 in Volume I for analysis results. Additional information on accident scenarios and health risks from accidents initiated by earthquakes is provided in Appendix F (Volume IV) and Appendix D (Volume III), respectively.

Any waste management facility constructed at PGDP would be built to conform to Federal criteria that take into account the higher seismic risk at PGDP relative to some of DOE's other sites.

Comment (3544)
The Hanford ecological resources description should state that there are 24 (as opposed to 10) major plant communities on the site.

Response
DOE revised Volume I, Section 4.4.4, to indicate that there are 24 major plant communities on the Hanford Site.

4.1 Environmental Resources and Conditions

Comment (3727)
The public is concerned about the apparent disproportionate number of cancer deaths and the high incidence of pediatric cancer in DuPage County, Illinois.

Response
The WM PEIS health risk analysis estimates that there would be no significant health impacts in the offsite population surrounding ANL-E resulting from the proposed waste management actions. The analysis addresses only the potential future incremental risk of new waste management actions. This risk would be additive to the baseline cancer risk in the region, some of which might be related to past and current ANL-E actions. The WM PEIS does not attempt to characterize the existing baseline health risk through the use of regional epidemiological or health statistics information.

At the public hearing held at ANL-E on January 24, 1996, Dr. Holly Howe, Chief of the Epidemiology Department of the Illinois Department of Public Health was asked by DOE to speak about the results of a recent local cancer study. The residents of Lemont, Illinois, requested that the Illinois Department of Public Health initiate a study of the pediatric cancer incidence. The Division of Epidemiologic Studies performed a study based on hospital reports found in the Illinois State Cancer Registry for the years 1986 through 1993. Seventeen cases of childhood cancer were observed in the study area, while 13 cases were expected; this difference was determined in the study to be not statistically significant. The most frequently reported childhood cancer type was leukemia, with six cases observed and three cases expected; this difference also is not statistically significant (Illinois Department of Public Health, 1995).

Comment (3754)
In one place the WM PEIS indicates that the size of ANL-E is 266 square miles. In another, it says 1,700 acres.

Response
The most recent survey of the ANL-E site shows an area of approximately 1,500 acres, which is the size identified in Section 4.4.1 in Volume I of the WM PEIS. Table 4.3-4 in Volume I of the PEIS has been revised to show the correct size of ANL-E.

Comment (3763)
DOE needs to include the groundwater flow direction for ANL-E in the PEIS.

Response
Section 4.4.1 in Volume I is a summary of information contained in a technical report. More detailed information is contained in Section 2.14.2.2 of the WM PEIS Affected Environment Technical Report, which states that at ANL-E, water flows through the upper aquifer (Niagara and the Alexandria dolomite aquifer) in a southern direction. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3949)
DOE assumes that sites where cultural resource studies have not been done have no cultural resources. DOE cannot assume that no cultural resources exist until cultural resources studies have been conducted, with appropriate input from the public and directly affected populations.

Response
Although the WM PEIS could not evaluate cultural resources impacts in detail, it does identify the sites with known cultural resources based on the extent to which each site has already been surveyed for those resources. This analysis does not, however, contain any assumption with respect to the presence or absence of resources from the areas that have not been surveyed. Information on the status of cultural resources surveys and registered cultural resources at the sites was compiled from environmental reports provided by the sites. Details of status, listings, and sources are provided in the WM PEIS Affected Environment Technical Report (available in the DOE reading rooms listed in Volume I, Section 1.9, of the Final PEIS).

Volume I, Table 4.3-8, lists the 17 major sites considered in the PEIS and the extent to which these sites have been surveyed for cultural resources. DOE revised the table and its related text to emphasize the percentage of each site's total area that has not been inventoried for resources.

Based on the WM PEIS land-use analysis, which indicates that only a small fraction of available land would be required for waste management facilities, DOE believes it will have sufficient flexibility in locating waste management facilities to be able to avoid or mitigate cultural resources impacts. Sitewide or project-level analyses would include a more detailed examination of existing and newly identified cultural resources at the sites. Before beginning construction of any new facilities, sites are required to conduct specific cultural resources surveys of any potentially affected land.

Comment (3950)
Great Serpent Mound in Adams County of Ohio is a sacred site to many Native American peoples. It is not identified in DOE's WM PEIS as a cultural resource, even though it qualifies by agency standards as a site eligible for inclusion as a national landmark.

Response
The affected environment for the assessment of cultural resources includes the total area within the site boundary and the areas near the site that might experience some physical effect associated with site actions. (See Volume I, Table 4.2-1.) The Great Serpent Mound and the entire area of Adams County are outside this defined region for the FEMP and the Portsmouth Plant. Therefore, although the Great Serpent Mound is a major cultural resource, it is not included in the cultural resources analysis for the WM PEIS.

Comment (3960)
Cultural resources inside or outside the property boundaries must first be identified by a credible cultural resource study. No such study exists for Portsmouth, although a study is presently being funded by Meade Paper, Lockheed-Martin, Dow Chemical, and Ashland Oil for the Ohio River Corridor.

Response
Cultural resources impacts are not directly evaluated in the WM PEIS because the specific locations for proposed waste management facilities are not identified. However, the analysis performed indicates that sufficient land is available at sites to locate waste management facilities to avoid adverse impacts to cultural resources. A site cultural resources survey would be required prior to any final siting decision and the start of any new construction.

4.1 Environmental Resources and Conditions

The PEIS recognizes the importance of a credible cultural resources survey in determining the nature and extent of potential impacts at individual sites. The status of cultural resources surveys at each of the 17 major sites considered in the PEIS is presented in Table 4.3-8 in Volume I of the WM PEIS. As noted in the table, no cultural resources survey has been conducted for the Portsmouth Plant.

Comment (3961)
Volume I, Section 4.3.2: What criteria were used to determine which "large sites" receive air quality monitoring of a radius of only 6.2 miles and which receive air quality monitoring of a radius of 50 miles?

Response
Section 4.3.2 of the Draft WM PEIS describes how monitoring data for the WM PEIS were collected. How and where air quality monitoring stations are established is outside the scope of the WM PEIS.

In accordance with EPA-recommended modeling techniques, the region of influence includes a circular area with a radius of at least 6.2 miles. For some large sites, a radius of as much as 50 miles was considered, to include information on the existing air quality environment from monitoring stations located on the site, or as close to the site as possible. Section 4.3.2 in Volume I of the Final WM PEIS was revised to clarify the air quality region of influence concept.

Comment (3972)
Table 4-8 identifies 4,003 acres of Federal land at the Portsmouth Plant, with 3,203 available for waste management facilities. Do these figures include lands now in use and/or under United States Enrichment Corporation management? Does privatization transfer ownership of the Portsmouth Plant lands to USEC and, thereby, impact lands available for DOE waste management uses? Do the 3,203 acres identified as available for waste management activities include the two solid waste management units currently under U.S. EPA and Ohio EPA remediation activities?

Response
The data presented for the Portsmouth Plant in Table 4.3-4 (formerly Table 4-8) (Volume I) include the total site acreage and the acreage available for waste management facilities. The total acreage includes land under USEC management.

A "privatized" facility is considered (only for the purposes of the WM PEIS analysis) to be a former DOE facility (typically located on a DOE site) that is operated, maintained, and eventually decontaminated and decommissioned by a private entity. Under this definition, the transfer of ownership from DOE to USEC would constitute privatization. However, should USEC operate as a private entity, it would operate for the exclusive use of DOE. This would include the construction and subsequent operation of any new waste management facilities. Therefore, lands available for DOE wastes management uses at the Portsmouth Plant would not be affected by privatization. Currently, the facilities at the Portsmouth Plant are leased to USEC to conduct ongoing enrichment operations as provided in the Energy Policy Act of 1992. The USEC Privatization Act provides that this lease be transferred to the privatized corporation and that it have an exclusive option to extend this lease. DOE remains the owner of the Portsmouth Plant. This lease agreement between DOE and USEC does not limit any of DOE's options for waste management or environmental restoration. Further explanation of privatization and how it relates to the WM PEIS can be found in Section 1.7.4 in Volume I of the PEIS.

The 3,203 acres excludes the land leased to the United States Enrichment Corporation in the developed core area, but includes all lands outside the core area, including a number of areas being investigated for suspected contamination.

Comment (3977)
In Volume I, Section 4.3.9, please clarify whether the Breeder Reactor at the Portsmouth Plant is used for onsite operational needs or whether it is a backup source of power. What does DOE list as the major provider of electrical service to the Portsmouth Plant? Could the Tennessee Valley Authority be the major provider? I feel this is a significant question for DOE response given the considerable use of electricity by the Portsmouth Plant (roughly the equivalent of the City of Los Angeles) and the probable transfer of the Tennessee Valley Authority's vast resources and power-generating facilities to the private sector. The Ohio Valley Electric Corporation is listed as supplying electrical power, current site load of 1,537 megawatts requiring 4,500 tons of coal per month. Could DOE please clarify and explain where power for this site is generated and how? Table 4-9 lists total capacity power at the Portsmouth Plant as 1,929 megawatts. Is this from onsite generation of electric power?

Response
Issues surrounding the future source of the power for the Portsmouth Plant are outside the scope of the WM PEIS, but can be addressed by local DOE officials as part of site planning. As indicated in Section 2.11.6 of the WM PEIS Affected Environment Technical Report (available in the DOE reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS), electric power to the Portsmouth Plant is currently provided by the Ohio Valley Electric Corporation using a coal-fired system. As the commentor has noted, the current site load of 1,537 megawatts is well within the current site capacity of 1,929 megawatts.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

Comment (395)
At Hanford, the Columbia Reach and the native shrub-type habitat must be protected from degradation as a result of waste management actions. Existing groundwater contamination plumes under the Hanford Site are already reaching the Columbia river. We cannot afford further sacrifices at Hanford or to the surrounding natural environment.

Response
About 6 percent of the Hanford Site has been used for defense production and waste management purposes. Because much of the Hanford Site has been undisturbed for nearly 50 years, the Site contains one of the largest remaining relatively undisturbed shrub-steppe habitat areas in Washington State. Shrub-steppe habitat is vegetation that flourishes on arid lands in areas with extreme temperature ranges. Shrub-steppe is considered a priority habitat by Washington State because of its importance to sensitive wildlife. About one-half of the land located on the Hanford Site has been designated as an ecological study area or wildlife refuge. These areas include the Fitzner Eberhardt Arid Lands Ecology Reserve located south and west of the 200 Areas and areas north of the Columbia River.

Much of the defense production activity occurred in the 200 Areas and, therefore, much of the land in the 200 Areas is disturbed. The 200 Areas also are the location of large low-level waste burial grounds. The 200 Areas and the surrounding Central Plateau have been identified as potential exclusive-use waste management areas to support the Hanford Site's waste management and environmental restoration programs. Because of past disturbances in the 200 Areas, the shrub-steppe habitat, wildlife typically found in the shrub-steppe habitat, and archaeological sites are limited.

Based on projected land requirements, DOE analyzed the potential for proposed waste management activities to affect sensitive habitats and species. The analysis indicated that the land required for the construction of waste management facilities would be a small fraction of available nonsensitive lands, which would enable DOE to avoid direct impacts to sensitive lands. Further, DOE would have enough flexibility in locating facilities on sites to avoid indirect impacts, such as those that could result from building access roads.

DOE has not included environmental restoration in the scope of this PEIS. The Hanford Remedial Action EIS and Comprehensive Land Use Plan are addressing issues of environmental restoration.

Comment (451)
DOE is allowing BNL to destroy the Carmans River by dumping gallons of contaminated wastewater.

Response
DOE is unaware of any such dumping of contaminated wastewater into the Carmans River. BNL has five National Pollutant Discharge Elimination System (NPDES) permitted outfalls to recharge basins, and one NPDES permitted outfall to the Peconic River. Wastewater is discharged at an average rate of 3.8 million liters (1.0 million gallons) per day *(Brookhaven National Laboratory 1993 Technical Site Information Document)*. Permit compliance for all NPDES outfalls was 99.9% percent in 1991. Discharges to the Peconic River met all radioactive discharge limits. Only iron, pH, and 1,1,1-trichloroethane exceeded permit limits on limited occasions (Brookhaven National Laboratory, *Site Environmental Report for Calendar Year 1991* [BNL-52347]).

4.2 Existing Contamination/Historic Releases/Past DOE Practices

In addition to NPDES outfall monitoring, the Peconic River is monitored for radioactive and nonradioactive parameters at three onsite and four offsite locations. In addition, the Carmans River is sampled as a background location. In 1991, all radionuclide concentrations were within applicable limits and did not exceed 10 percent of the State and Federal Drinking Water Standards. All nonradioactive analyses were consistent with the offsite control location and with historical data except for toluene, 1,1,1-trichloroethane, and xylene. In 5 out of 100 samples, 1,1,1-trichloroethane was present at concentrations ranging from 3 to 6 micrograms per liter. The exceedances for toluene and xylene concentrations just above the analytical detection limit of 3 micrograms per liter occurred once at a sampling point 25 kilometers (16 miles) downstream from the sewage treatment plant discharge. This occurrence is probably associated with a non-BNL source. Table 2.15-3 in Volume I of the WM PEIS summarizes results of surface water quality monitoring for 1991 (Brookhaven National Laboratory, *Site Environmental Report for Calendar Year 1991* [BNL-52347]). The maximum concentration of trichloroethylene was above its comparison criteria at least once in 1991. Any information relating to the allegation that the Carmans River is being contaminated by BNL should be forwarded to DOE. The commentor is also welcome to attend any of the DOE-sponsored public forums at BNL to express concerns. BNL is in the process of helping the community establish a community forum. This group will be open to the public and will provide an opportunity for people to voice their concerns and issues regarding BNL.

Comment (483)
What, if any, studies have been conducted to assure those of us who live near LLNL that we are safe from radioactive contamination? The WM PEIS must include a complete report on the full impacts to the Livermore community.

Response
The WM PEIS is a national and programmatic study to assist DOE in formulating and implementing a strategy to manage its radioactive and hazardous wastes. The PEIS includes estimates of health risks for the proposed waste management alternatives. DOE considered LLNL for management of low-level mixed waste, low-level waste, and transuranic waste, and describes the potential health risks associated with managing these wastes in Volume I, in Sections 6.4, 7.4, and 8.4, respectively. The PEIS also estimates the cumulative health risk from adding proposed waste management actions to other past, present, and reasonably foreseeable future actions and presents the cumulative impacts for LLNL in Section 11.8. If DOE selects LLNL for a new waste management operation, additional studies might be required.

The LLNL and SNL-CA Sitewide EIS prepared by DOE in 1992 contains additional detail on the health risks from radionuclides released from the sites. In addition, DOE prepares annual Site Environmental Reports that describe the results of site monitoring and summarize each site's compliance with applicable regulations. These reports also provide estimates of doses received by the public from releases of radionuclides. The EIS and annual reports are available to the public for review in the LLNL and SNL-CA public reading rooms.

Comment (1558)
The WM PEIS should include a detailed map of plutonium-239 concentrations left on the ground by the explosions at NTS.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

Response
Contamination from weapons testing at NTS and the cleanup of any existing contamination are outside the scope of the WM PEIS. This information is presented in the NTS Sitewide EIS, which is discussed in Volume I, Section 1.8.1, of the WM PEIS. A copy of that EIS is available at the DOE Nevada Operations Office public reading room located at 2621 Losee Road, Building B-3, Las Vegas, Nevada.

Comment (1574)
Commentors are concerned that the recently discovered deep aquifer system at Los Alamos National Laboratory (LANL) has been contaminated by site activities. Some state that the hydrogeology of the site is not well understood and site-specific water quality impacts should be addressed in the WM PEIS.

Response
While the WM PEIS considers the potential impacts of waste storage and disposal at the programmatic level, DOE will consider site-specific control measures when it develops project-level plans for specific sites. These control measures could include modifying the design of generic disposal facilities (used in the PEIS analysis) to fit site-specific conditions; modifying waste form requirements; optimizing the location of a facility on a site; and imposing waste acceptance criteria.

Any eventual waste storage or disposal facility located at LANL would be built with sufficient containment and would be carefully monitored. Furthermore, the site would be equipped with sufficient safety and emergency response measures to minimize the potential for leaks to contaminate surface water or groundwater.

The WM PEIS Affected Environment Technical Report contains additional information on hydrogeologic conditions at LANL. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. The LANL Sitewide EIS currently in preparation will contain a more detailed description of the water contamination referred to in this comment.

Comment (1604)
A commentor stated that he is a landowner adjacent to Site 300, has experienced major health problems, and does not know if they can be attributed to Site 300 activities.

Response
The WM PEIS evaluates the potential health impacts from postulated future activities to determine the degree to which human health and the environment could be impacted and the best course of action to follow to minimize these impacts. Although the WM PEIS contains information on existing public health risk near LLNL, the Site Environmental Reports and the 1992 LLNL Sitewide EIS are the primary sources that should be consulted to obtain information relevant to determining potential health effects that might result from operations at Site 300. These reports are available in the LLNL public reading room. Local health agencies could also be consulted for possible epidemiological information on health effects.

Comment (1626)
NTS already has extensive contamination and it should be cleaned up, especially the groundwater.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

Response
Environmental restoration activities are not within the scope of the WM PEIS. NTS has entered into a Federal Facility Agreement/Consent Order with the State of Nevada to characterize the groundwater and surface contamination to determine the required amount of remediation, if any.

Comment (1707)
More research needs to be done on the long-term effects of plutonium exposure on people living in communities near RFETS. For example, a study should be done on the long-term effects of the 1969 fire.

Response
The WM PEIS examines potential radiation exposure, including exposure to plutonium isotopes, to the offsite population from the implementation of the WM PEIS alternatives. In addition, the evaluation of cumulative impacts considers estimates of annual radiation doses from existing activities and other ongoing actions at the sites (see Volume I, Chapter II). A dose reconstruction study investigating historical exposure data is underway at RFETS. DOE funded this project, the final phase of which should be complete by Spring 1997.

Comment (1710)
Uranium should be listed in Volume I, Section 4.3.3, sediment section, as a sediment contaminant at ORR. Technetium should be listed in Section 4.3.3, groundwater section, as a groundwater contaminant at ORR.

Response
DOE made the requested changes in 4.3.3.

Comment (1724)
The WM PEIS should identify the 17 contaminants that exceeded comparison criteria for 1992 at ORR.

Response
Table 2.8-7 in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS, lists the following 17 groundwater contaminants that exceeded comparison criteria at ORR in 1992: 1,2 dichloroethane, 1,1-dichloroethylene, benzene, cadmium, carbon tetrachloride, chromium, cobalt-60, fluoride, gross alpha, gross beta, manganese, nitrate, pH, tetrachloroethylene, trichloroethylene, tritium, and vinyl chloride.

Comment (1780)
DOE should address containment activities at RFETS immediately, rather than waiting for a detailed study.

Response
The WM PEIS addresses the treatment and disposal of low-level mixed and low-level wastes and the treatment and storage of transuranic waste at RFETS. It does not address the containment or remediation of existing contamination at the site, which DOE will handle under its Environmental Restoration Program. Site-specific environmental analyses will address remediation of existing contamination at sites.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

Comment (2101)
A commentor stated that DOE needs to take responsibility for offsite contamination in areas around the Portsmouth Plant where children play and swim. Health is being compromised by lack of communication with the public.

Response
The affected environment section in Volume I (Chapter 4), and the WM PEIS Affected Environment Technical Report (which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS) describe existing conditions at the Portsmouth Plant. These descriptions include the results of environmental monitoring of media affected by past practices.

DOE has a policy of full disclosure of information regarding releases to the environment. Each DOE site prepares annual environmental monitoring reports that provide information about releases and environmental monitoring activities. These reports are readily available to the public. The 1992 Portsmouth Plant Environmental Report states that discharges from the site appear to have no noticeable effect on radioactivity levels in the Scioto River.

Although of great concern to DOE and the Nation, cleanup of contamination caused by past practices is outside the scope of the WM PEIS.

Comment (2145)
The holding ponds overflow at the Portsmouth Plant during a rain event. DOE needs to consider that contamination is flowing into the Scioto River.

Response
Section 4.4.12 in Volume I of the WM PEIS describes existing conditions at the Portsmouth Plant. Additional information is presented in Section 2.11.2.1 of the WM PEIS Affected Environment Technical Report, which states that the Portsmouth Plant National Pollutant Discharge Elimination System (NPDES) outfalls are monitored for radioactive and nonradioactive parameters. In 1992, permit compliance for all NPDES outfalls was 99.1%.

In 1992, discharges from the Portsmouth Plant affected the receiving streams minimally and were comparable to past discharges. Little Beaver Creek was the only surface-water body that appeared to show slightly elevated radionuclide levels downstream versus upstream levels. Portsmouth Plant discharges appear to have no noticeable effect on radioactivity levels in Big Run Creek or in the Scioto River. No sediment contamination was found in the Scioto River.

The WM PEIS Affected Environment Technical Report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (2192)
DOE should not use the old cooling tower at PGDP for stream stripping contaminated groundwater. It is unsafe and NEPA documentation is poor.

Response
The WM PEIS does not analyze specific waste management technologies because it will not be used to select such technologies. Moreover, the activity described in the comment would be considered an

environmental restoration activity. Environmental restoration activities are not analyzed in the WM PEIS, other than to examine the extent to which some environmental restoration waste volumes could affect the comparison among waste management alternatives (see Appendix B in Volume III). The impacts of specific environmental restoration activities will be analyzed through the RCRA or CERCLA process, or other site-specific environmental analyses.

Comment (2212)
A commentor expressed concern that Little Bayou Creek is contaminated by waste from activities carried out at PGDP.

Response
Section 4.4.10 in Volume I of the WM PEIS, and the WM PEIS Affected Environment Technical Report, which can be found in the DOE reading rooms listed in Volume I, Section 1.9, of the PEIS, describe existing conditions at PGDP. These descriptions include results of environmental monitoring of media affected by past practices.

As described in Section 2.9.2.1 of the WM PEIS Affected Environment Technical Report, in 1992, downstream sediments on Big Bayou Creek contained uranium levels 3.5 times higher than sediments from the upstream monitoring location (4.6 versus 1.3 micrograms per gram). Downstream sediments on Little Bayou Creek contained uranium levels 36 times higher than upstream sediments (107 versus 2.8 micrograms per gram). None of the locations contained levels of neptunium-237, plutonium-239, technetium-99, or thorium-230 above the detection limit. In addition, polychlorinated biphenyls were detected in Little Bayou Creek at a maximum concentration of 0.7 microgram per gram.

As described in Section 2.9.9.1 of the WM PEIS Affected Environment Technical Report, in 1992, DOE estimated a maximum multimedia radiation dose of 2.8-millirem per year from ingestion of contaminated sediment and exposure to radiation from spending one-half hour per day, every day, fishing in the most contaminated area of Little Bayou Creek. This exposure is well below the DOE 100-millirem per year standard for multimedia exposure.

Comment (2450)
The WM PEIS should state whether groundwater quality at INEL has improved or deteriorated since 1992. In 1992, elevated levels of 14 contaminants were found in site wells.

Response
DOE revised Section 4.4.5 in Volume I to state that groundwater monitoring at INEL in 1992 showed levels above comparison criteria for four contaminants at onsite wells and for only one contaminant at onsite wells in 1994.

Comment (2485)
Detailed information on the known groundwater and soil contaminants at INEL would be useful in determining the magnitude of existing problems. For example, is the plutonium soil contamination a concern for future groundwater contamination?

Also, Volume I, Section 4.3.3, lists groundwater contaminants that have been detected at INEL. This list is inconsistent with the Spent Nuclear Fuel EIS in that it fails to mention iodine-129, cobalt-60,

4.2 Existing Contamination/Historic Releases/Past DOE Practices

cesium-137, plutonium-238, -239, and -240, americium-241, chromium, lead, mercury, chloride, sulfate, and nitrate.

Response
Section 4.3.3 in Volume I of the WM PEIS is a summary of the known water resource contamination. The list provided is not meant to be all inclusive. The detailed information requested in the comment is provided in Section 2.3.2.2 of the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Even more detailed information on this subject is available in the technical reference documents cited in Section 2.3.2.2 of the Affected Environmental Technical Report.

Comment (2494)
Volume I, Section 4.4.5 identifies uranium recovery from highly enriched spent fuels as a major source of air pollution at INEL. This process has not been performed at INEL since sometime before the decision in April 1992 to cease fuel reprocessing in the DOE complex.

Response
The commentor is correct and DOE has deleted the incorrect statement from the WM PEIS.

Comment (2873)
Sediment contamination is also present at BNL and should be included in Volume I, Section 4.3.4. This is particularly significant due to BNL's presence over a sole-source aquifer and the presence of highly permeable soils throughout the site.

Response
DOE assumes that the commentor is referring to soils contamination described in Section 4.3.4 in Volume I of the WM PEIS and not sediment contamination described in Section 4.3.3. The list of soils contaminated provided in Section 4.3.4 in Volume I was not meant to be comprehensive. Additional information on the affected environments at the sites is provided in the WM Affected Environment Technical Report, which is available in the DOE reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Section 2.15.1.2 of the WM PEIS Affected Environment Technical Report states that offsite soil samples are routinely analyzed for radionuclides. In 1991, no radionuclides attributable to BNL operations were detected in any of the soil samples.

Existing contamination, and the cleanup of any contaminated areas at the sites, are part of environmental restoration activities at the site, which are outside the scope of the WM PEIS. Furthermore, because waste management activities are not expected to add to existing levels of soil contamination, they are not addressed in the cumulative impacts analysis.

Comment (2911)
Volume I, Section 4.3.3, of the Draft WM PEIS stated that contamination is usually limited to onsite areas at DOE facilities. This is not the case at BNL, which has pervasively contaminated the surrounding region with a variety of compounds. Tritium is known to have contaminated surface water and groundwater at BNL. BNL is also the cause of dissolved metals occurring above State drinking water standards, both on and off the site. These omissions should be corrected.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

In addition, the statement in Volume I, Section 4.4.2, that BNL offsite concentrations do not exceed drinking water standards is incorrect. Offsite concentrations for several organic compounds and metals in plumes from contaminated areas within the site exceed drinking water standards. Some of these plumes have become the focal point of significant public concern. The nature and extent of these plumes and all exceedances should be listed.

Response
Section 4.3.3 in Volume I of the WM PEIS was revised to indicate that tritium is a groundwater contaminant at BNL. This section is a partial summary of the known water resource contamination and was not meant to be all inclusive. The WM PEIS Affected Environment Technical Report contains more detailed information on current contamination at BNL. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

In addition, DOE revised Section 4.4.2 in Volume I of the WM PEIS to state that offsite concentrations of certain contaminants at BNL *do* exceed drinking water standards. Section 4.4.2 is also a summary of information contained in the WM PEIS Affected Environment Technical Report.

Section 2.15.2.2 of the technical report states that in 1991, groundwater at BNL was monitored at 81 wells, including 17 offsite private wells, for radioactive parameters and at 71 wells for nonradioactive parameters. Some groundwater contamination has migrated off the site at concentrations exceeding New York State Drinking Water Standards. The full extent of offsite contamination is currently being evaluated under an Interagency Agreement between the New York State Department of Environmental Conservation, EPA, and DOE.

Comment (3005)
Tables 6.7-2 and 7.7-2 indicate the numbers of Federal and State endangered and threatened species at low-level mixed waste and low-level waste sites under each of the alternatives. The numbers in these tables do not coincide with the information on threatened and endangered species contained in Section 4.4 for FEMP or Portsmouth.

Response
DOE revised Section 4.4.12 in Volume I to state that one candidate species (listed as State threatened), four State endangered species, five State threatened species, four State potentially threatened species, and seven State special-interest species occur near the Portsmouth Plant. Section 4.4.3 in Volume I was also revised to reflect the correct number of threatened and endangered species at FEMP. No Federally listed threatened or endangered plant or animal species are known at FEMP. However, potential habitat exists for the Indiana bat (Federal and State endangered). Running buffalo clover, a Federally listed endangered plant species, occurs near FEMP. Seven state-listed endangered species (including the Indiana bat) and three state-listed threatened species occur or potentially occur at FEMP.

Comment (3007)
Section 4.4 (for all sites) should contain information on what contaminants exceed comparison criteria.

Response
Section 4.4 in Volume I of the WM PEIS is intended to provide a broad overview of the affected environment for the DOE sites and, therefore, does not include information on specific contaminants.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

The WM PEIS Affected Environment Technical Report listed in Volume I of the Final PEIS provides more detailed site-specific information.

As stated in Section 4.4, more precise information on site environmental parameters would be provided in site environmental monitoring reports and sitewide or project-level NEPA documents.

Comment (3039)
Table 4-5 does not include important contaminants, such as chromium and nitrates, that are major contaminants in sediments and groundwater, respectively, at Hanford.

Response
Table 4-5 in Volume I of the Draft WM PEIS lists the criteria pollutant attainment status at the 17 major sites. DOE assumes that the commentor is instead referring to the text of Section 4.3.3 on the pages adjacent to Table 4-5.

Section 4.3.3 in Volume I of the Draft WM PEIS is a partial summary of the known water resource contamination and is not meant to be comprehensive. The WM PEIS Affected Environment Technical Report contains more information on current sediment and groundwater contamination at Hanford. Section 2.2.2.2 of the technical report states that maximum concentrations of chromium nitrate and tritium in the groundwater were above their comparison criteria at least once in 1992. This document further states that tritium and nitrate groundwater contaminant plumes occur over 316 square kilometers (122 square miles) of Hanford. Other contaminants, for example, chromium cyanide, have been detected in groundwater in areas surrounding disposal sites. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3050)
The statement in Volume I, Section 4.4.4, that four major plumes enter the Columbia River in at least three locations is an extreme simplification. The carbon tetrachloride plume, which is one of the most extensive at the Hanford Site, could enter the river in high concentrations in approximately 100 years. Thus, referencing only plumes currently entering the Columbia River minimizes potential problems stemming from waste management activities.

Response
The description of existing contamination in Section 4.4.4 in Volume I of the WM PEIS and Section 2.2.2.2 of the WM PEIS Affected Environment Technical Report (which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the WM PEIS) is provided only to give the reader background information about conditions at the site. The technical report does list carbon tetrachloride among the Hanford Site's groundwater contaminants and Section 4.3.3 in Volume I notes that solvents are known groundwater contaminants at Hanford. No attempt was made in the WM PEIS to predict future plume movement, since future remediation activities could change the extent of groundwater contamination. For more detailed information on the Hanford Site, please consult the Tank Waste Remediation System, Hanford Site Final EIS, 1996, and the Hanford Remedial Action EIS.

To the extent information is available, impacts from other programs and actions are considered in the cumulative impacts analysis in Volume I, Chapter 11, of the Final WM PEIS.

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Comment (3193)
Volume I, Chapter 4, does not identify the two major groundwater plumes that extend beyond the facility boundaries at PGDP.

Response
DOE revised Section 4.4.10 in Volume I to note that two plumes of groundwater contamination extend into an offsite area. Section 4.4.10 is a summary of information contained in Section 2.9.2.2 of the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3194)
See Volume I, Section 4.3.3. Known groundwater contaminants at Hanford also include uranium, iodine-129, carbon tetrachloride, chromium, cobalt-60 and nitrate.

Response
The commentor is correct about the contaminants at Hanford. Section 4.3.3 in Volume I of the WM PEIS is not intended to provide a comprehensive list of contaminants. However, the WM PEIS Affected Environment Technical Report notes that groundwater contamination at Hanford includes uranium, iodine-129, carbon tetrachloride, chromium, cobalt-60, and nitrate as known groundwater contaminants. The technical report is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS.

Comment (3197)
Volume I, 4.3.4: High-level, low-level, uranic, transuranic, and mixed waste were disposed of directly to the ground at Hanford. Many of the high-level waste tanks have leaked large quantities of high-level mixed and transuranic waste to the soil. Every fission product and actinide with a sufficiently long half-life to remain is present at various locations around the site.

Response
Since environmental remediation was removed from the scope of the PEIS, DOE does not focus on contamination at the sites. Environmental remediation activities are undertaken pursuant to CERCLA and the Hanford Site Tri-Party Agreement.

Volume I, Sections 4.3.3 and 4.3.4, of the WM PEIS provide a summary of known water, soil, and sediment contamination at the sites. These sections were not intended to be comprehensive listings of the contaminants. Additional information on contaminants at the Hanford Site is provided in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3225)
See Section 4.4.4. Many of the wetlands at Hanford are contaminated with radioactive materials from the operations of the reactors along the Columbia River.

Response
Cleanup actions at the DOE sites are not within the scope of the WM PEIS. However, Chapter 11 does address potential impacts from environmental restoration operations that could contribute to the overall environmental impacts resulting from DOE waste management and other activities. DOE recognizes

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and is addressing cleanup of contaminated sites, including situations such as contaminated shoreline seeps at Hanford. Section 2.2.2.1 of the WM PEIS Affected Environment Technical Report contains a detailed description of the surface water and sediment quality data for the Hanford Site, including descriptions of existing radionuclide contamination. The Affected Environment Technical Report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3403)
The WM PEIS discloses that there is a serious risk from neptunium-237 contamination at PGDP. Where did the neptunium come from? How long has it been there, and how is it being stored? Neptunium-237 is a very long-lived, toxic isotope. Has DOE been testing for neptunium-237 in the groundwater up until now?

Response
Neptunium-237 is an alpha-emitting radionuclide with a half-life of 2.2 million years. It was introduced into the enrichment cascades at PGDP in the early 1970's when reprocessed fuel was blended with other feedstocks. Some low-level waste at PGDP contains neptunium-237.

Neptunium-237 was identified in the 1992 version of the waste management information system database that provided the low-level waste site-specific waste information used in the WM PEIS. This information is presented in the WM PEIS Low-Level Waste Technical Report referenced at the end of Chapter 7 in Volume I.

As described in Section 2.9.2 of the WM PEIS Affected Environment Technical Report, analyses for neptunium-237 are routinely performed for environmental media at PGDP. However, it is not routinely detected because it is present in such low concentrations.

Comment (3531)
In the affected environment description of NTS, DOE should explain the statement, "Groundwater monitoring in 1991 indicated that eight contaminant comparison criteria were exceeded at onsite wells" and use more recent groundwater monitoring data than 1991.

Response
In general, DOE elected not to update or supplement the data in the WM PEIS with more recently published data because conditions rarely change drastically from year to year. Exceptions were made in instances where DOE determined that the updated data might affect the comparisons of alternatives. DOE believes that the water quality information provided gives an adequate characterization of the conditions at the sites, especially for a programmatic EIS that will not select locations for waste management facilities on the sites. More up-to-date site-specific information would be included in sitewide or project-level NEPA analyses.

The WM PEIS Affected Environment Technical Report contains more detailed information on environmental conditions at the sites. Section 2.7.2.2 of the report states that water supply wells at NTS are routinely monitored for radioactive and nonradioactive parameters, as required by the Safe Drinking Water Act, State of Nevada regulations, and DOE Orders. Table 2.7-4 of the report summarizes the monitoring results for 1991. Maximum concentrations of bismuth-214, gross alpha, lead-212, lead-214, nitrate, pH, plutonium-239 and -240, and total dissolved solids were above their comparison criteria at least once in 1991. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3757)
Past waste storage and handling activities were unsafe and dangerous to the environment. In the year 2020, let us hope that we will not hear how stupid we were in the 1990s.

Response
The WM PEIS will help DOE develop a comprehensive national strategy to manage its radioactive and hazardous wastes in a safe and efficient manner. By careful study and planning of waste management at the national and site levels, DOE hopes to correct past waste management practices to ensure protection of the public, workers, and the environment in the future.

Comment (3781)
For 50 years, airborne contamination has occurred at ANL-E, and gardening and construction recirculated the contamination in the air. Air quality is currently affected by treatment of waste onsite. Inhalation of isotopes is even more risky than isotopes found in drinking water.

Response
As described in Section 4.4.1 in Volume I of the WM PEIS, in 1992 the radiation dose from airborne radionuclides to a maximally exposed individual at ANL-E was 0.0085 mrem. This is well below the 10 mrem per year National Emission Standards for Hazardous Air Pollutants limit. The collective radiological dose from airborne radionuclide emissions to the ANL-E region of influence health risk population was 16.8 person-rem.

As detailed in Section 5.4.1 in Volume I, the WM PEIS human health risk analysis assesses the atmospheric pathway (including inhalation) as a major exposure pathway for a variety of potentially exposed populations and individuals. Section 5.4.2 addresses the methodology for air quality impacts, which were assessed for the construction of new treatment, storage, and disposal facilities, for the operation and maintenance of the facilities, and for shipment of wastes between sites. For the waste management alternatives relating to ANL-E, the analysis found that human health risks and air quality impacts would be low. Sections 6.4, 6.5, 7.4, 7.5, 8.4, and 8.5 contain more detail related to these issues.

Comment (3787)
DOE needs to better inform the public about the potential for existing contamination in the area around ANL-E. Radionuclides in the Illinois River water is a problem.

Response
Additional information on surface water resources at ANL-E is presented in Section 2.14.2.1 of the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Approximately 0.5 miles from ANL-E, Sawmill Creek, which is joined by two ANL-E onsite streams, enters the Des Plaines River. According to 1993 monitoring data, concentrations of radionuclides in Sawmill Creek were low and only a small fraction of the DOE-derived concentration guides for water. Dilution in the Des Plaines River reduced the concentration of the measured radionuclides below their

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respective detection limits. The Illinois River is approximately 30 miles southwest of ANL E where it is formed by the Des Plaines River and the Kankakee River. DOE is not aware of any radioactive contamination in the Illinois River.

Comment (3859)
Handling of past contamination does not instill public confidence.

Response
DOE is committed to operating its facilities in a safe and efficient manner. This includes selecting facility locations and waste management technologies that result in a minimum of health risk and environmental impact. The WM PEIS is part of the process to ensure that the potential impacts to the public and environment are accounted for when DOE makes programmatic decisions on waste management activities.

Most health risk concerns at DOE sites are from former operations that occurred when accepted waste management practices were less rigorous than those in force today. Health risks from current DOE waste management operations are generally low. DOE is committed to reducing radiation exposure to levels as low as reasonably achievable.

Comment (3876)
The people around ANL-E are familiar with waste dumping. Remember the Red Gate Woods area? Most of the radioactively contaminated wells had to be capped or disabled.

Response
Wells in the Red Gate Woods area were contaminated with tritium from dumping of radioactive waste during the late 1940s and early 1950s. These wells are now being monitored by environmental surveillance personnel at ANL-E. DOE is committed to disposing of radioactive waste in a way that is safe to humans and the environment. DOE's Order 5820.2A requires that such waste be disposed of in disposal facilities. The combination of disposal waste form and facility design must ensure that the standards of the Safe Drinking Water Act and other standards to protect human health and the environment are met.

Comment (3913)
DOE needs to explain what waste is presently onsite at ANL-E and what the plans are for this temporary storage. DOE needs to explain who is going to watch over the currently stored low-level waste.

Response
Storage, which plays a role in all waste management activities, consists of the collection and containment of waste to await treatment or disposal. DOE is responsible for its Department-wide waste, including the low-level waste at ANL-E.

The Final WM PEIS reports the following quantities of waste material at ANL-E as the current inventory: 34 cubic meters of low-level mixed waste (Table 6.1-1), 880 cubic meters of low-level waste (Table 7.1-1), and 15 cubic meters of transuranic waste (Table 8.1-1). ANL-E does not store high-level waste, and DOE did not consider the site for future high-level waste management. The PEIS does not present an inventory of hazardous waste because this waste type is stored on the site for a limited time only to accumulate sufficient quantities for treatment.

Chapters 6, 7, 8, 9, and 10 of the PEIS describe the waste management activities and siting options for each waste type. Appendix I contains newly available data on low-level waste inventories at ANL-E and DOE has incorporated these data into the analysis of alternatives in the Final PEIS.

Comment (3962)
Does uranium contamination exist in sediment offsite or onsite at PGDP and the Portsmouth Plant? The Little Beaver, Big Beaver, Big Run, and Scioto Rivers have been documented by Ohio EPA and the U.S. EPA as having contaminated sediment offsite at Portsmouth.

Response
Chapter 4 in Volume I of the WM PEIS summarizes environmental conditions at the sites. The WM PEIS Affected Environment Technical Report contains more detailed descriptions of the sites. For PGDP, Section 2.9.2.1 of the technical report states that stream sediments are routinely monitored at site locations for radioactive and nonradioactive parameters. In 1992, downstream sediments on Big Bayou Creek indicated uranium levels of 4.6 micrograms per gram. Downstream sediments on Little Bayou Creek indicated uranium levels of 107 micrograms per gram. For the Portsmouth Plant, Section 2.11.2.1 of the technical report states that stream sediments are routinely monitored for radioactive parameters at 4 onsite and 13 offsite locations. In 1992, minor sediment contamination was found in the east drainage ditch, Little Beaver Creek, and Big Beaver Creek. In addition, some contamination was found in two onsite locations in Big Run Creek. No sediment contamination was found in the Scioto River. The technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (3963)
Section 4.4.12 in Volume I states that groundwater monitoring at the Portsmouth Plant in 1992 showed eight parameters above comparison data. Does this mean that groundwater contamination has been documented on the site, off the site, or both?

Response
Chapter 4 in Volume I of the WM PEIS summarizes detailed descriptions of the affected environments found in the WM PEIS Affected Environment Technical Report. Section 2.11.2.2 of the WM PEIS Affected Environment Technical Report states that onsite groundwater at Portsmouth is monitored for radioactive and nonradioactive parameters and water levels at more than 245 wells. Maximum concentrations of 1,1,1-trichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, chloroform, chromium, gross alpha, gross beta, and trichloroethylene were above their comparison criteria at least once in 1992. Offsite groundwater is monitored for radioactive parameters at 11 locations. None of the results were above their comparison criteria. The WM PEIS Affected Environment Technical Report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

DOE has revised Section 4.4.12 in Volume I of the WM PEIS to state that for the Portsmouth Plant, no contaminants exceeded comparison criteria in measurements of offsite groundwater.

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Comment (4017)
DOE should add the following sites with known groundwater contaminants to Volume I, Section 4.3.8: (1) BNL, because of tritium (see Baseline Environmental Management Report, Volume II, DOE-EM-232); and (2) WVDP, because of strontium contamination (see Doc ID WVDP-220).

Response
DOE assumes that the commentor is referring to Section 4.3.3 and not 4.3.8 in Volume I of the WM PEIS.

As stated in the PEIS, the list provided in Section 4.3.3 in Volume I was not meant to be all-inclusive. Additional information on the affected environments at the sites is provided in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Section 2.15.2.2 of the technical report states that, at BNL, the only average radionuclide concentrations that exceeded concentration limits were gross beta and strontium-90. The high radionuclide concentrations occurred onsite near the landfill areas and the hazardous waste management facility. The maximum offsite tritium concentration in drinking water wells in 1991 was 3,780 picocuries per liter compared to the 20,000 picocuries per liter drinking water standard. The information in the WM PEIS Affected Environment Technical Report was obtained from individual site data reports. Volume II of the 1995 Baseline Environmental Management Report does identify tritium in groundwater at BNL. However, this contaminant is found in specific locations in groundwater onsite at BNL, and the extent of contamination is not yet known. Moreover, some of the contamination is the result of environmental restoration activities.

In Section 4.3.3, WVDP is identified as a site that has surface water contaminated with strontium.

Comment (4019)
In Volume I, Section 4.3.4, DOE should add BNL and WVDP to the list of sites with known soil contaminants because of cesium contamination at those sites (see the Baseline Environmental Management Report, Volume II, DOE-EM-232). Known contaminants at BNL also include petroleum products, metals, solvents, and other radionuclides.

Response
The affected environment descriptions in Chapter 4 in Volume I of the WM PEIS summarize the information in technical reports. As stated in Section 4.3.4, the list provided contains examples and, therefore, was not meant to be comprehensive. Additional information on the affected environments at the sites is provided in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Section 2.15.1.2 of the report, which pertains to BNL, states, "Offsite soil samples are routinely analyzed for radionuclides. In 1991, no radionuclides attributable to site operations were detected in any of the soil samples." Table 2.19-3 of the report lists the maximum concentrations of radionuclides in soils at WVDP, including cesium.

The WM PEIS Affected Environment Technical Report also indicates that the maximum concentration of cesium-137 in drinking water wells at BNL is significantly less than the comparison criteria of 120 picocuries per liter established by EPA in its Primary Drinking Water Regulation. WVDP does not use groundwater as a source of drinking water, and Section 2.19.2.2 of the technical report indicates that groundwater monitored at 10 offsite residential wells shows no evidence of contamination by WVDP activities.

The information in the WM PEIS Affected Environment Technical Report was obtained from individual site data reports. Volume II of the 1996 Baseline Environmental Management Report does identify cesium-137 and other contaminants in soils at BNL. However, these soils are in specific locations onsite at BNL, and the extent of contamination is not yet known. The 1996 Baseline Environmental Management Report does not indicate the presence of soil contaminated by cesium-137, nor other specific substances at WVDP.

Comment (4433)
Much radionuclide exposure data in the Draft WM PEIS was taken from the *Summary of Radionuclide Air Emissions from Department of Energy Facilities for CY 1992*, which apparently fails to cover major sources of radionuclide exposure at the sites covered in the WM PEIS. Taxpayer dollars were wasted using this source of information, especially if the summary report fails to cover radionuclide exposures as comprehensively as Site Environmental Reports. No detailed justification for basing the characterization of site impacts on the air emissions report rather than on Site Environmental Reports was given, nor was the significance of the missing information revealed.

Response
The WM PEIS Affected Environment Technical Report contains radionuclide exposure information from site Annual Environmental Reports. The report indicates that some sites have exposure data estimates for different years (1991 through 1993), for different pathways (airborne exposure and/or multimedia exposure), and different treatments of background radiation exposure, including radon. To provide some consistency among the sites, DOE used the report, *Summary of Radionuclide Air Emissions from Department of Energy Facilities for CY 1992*, which provided estimates of offsite maximally exposed individual exposures to radionuclides in 1992 for all major sites considered in the PEIS. These values are presented in Chapters 4 and 11 in Volume I and in the WM PEIS Affected Environment Technical Report. This technical report is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. Because the air pathway was considered to be the only important pathway for exposures to the public, other pathways were not evaluated in the PEIS. Existing contamination that might contribute to exposures through other pathways were not included in the analysis.

Comment (4490)
Section 4.3.1 of the Draft WM PEIS should include summarized data on radon exposure from waste at DOE sites and on exposure from other pathways. As shown below, the result is a misleading characterization in the Draft PEIS of radiation and radionuclide exposure to the general public and associated human health impacts at DOE sites.

1992 RADIATION EXPOSURE TO THE MOST EXPOSED INDIVIDUAL (mrem)

Site	WM PEIS	1992 Site Environmental Report		Ratio
ANL-E	0.0085	0.34	air including radon	40
		0.41	air, ingestion, radiation	48
BNL	0.11	0.92	including fish	8.4
ETEC	-	0.0001		-
FEMP	0.0021	51	from Radon	24,000
Hanford	0.0037	0.02	from Columbia River	5.4
		0.07	per kg duck	19
INEL	0.0015	4	from max. duck	2,700
LBL	0.060	2.1	accelerator	35
LLNL	0.069 or 0.69	0.28	air, food, water	0.29 to 2.9
LANL	7.9	4.4	Accelerator only	-

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1992 RADIATION EXPOSURE TO THE MOST EXPOSED INDIVIDUAL (mrem)
(Cont'd)

Site	WM PEIS	1992 Site Environmental Report		Ratio
Middlesex	0.009	0.3	gamma radiation	33
NTS	0.012	0.007	air, milk, veg., beef liver	3.5
ORR	1.4	4 to 17	air, water, fish, rad.	2.9 to 12
Pantex	<0.0001	0.000027		-
PGDP	0.0045	3.8	food, water, sediment, rad.	840
Portsmouth	0.26	0.03		0.12 typo?
RFETS	0.0002 or 0.000028	0.46	Plutonium monitoring	2,300 to 16,000
Sandia-NM	0.0034	0.0034		1.0
SRS	0.140	49	for hunter	350
		3.1	from fish	22
WVDP	0.0003	0.046	Fish	150

Failing to include data on exposure from other exposure pathways (including surface-water contamination, exposure to direct radiation, the ingestion of contaminated fish and game, etc.) results in a very misleading characterization of radiation and radionuclide exposure to the general public and associated human health impacts at DOE sites.

The summary table in Chapter 4 and Chapter 11 of the Draft PEIS shows different values for the exposure to the maximally exposed individual for LLNL and for RFETS. DOE needs to check the values in the WM PEIS.

The data in Site Environmental Reports clearly showed radiation and radionuclide exposures that were usually much higher (and, for many sites, more than 100 times higher) than the exposures reported in the Draft WM PEIS.

Risks to the most exposed individual above one in ten thousand are generally considered to be unacceptable under EPA CERCLA guidelines (which usually assume a maximum 30-year exposure) and EPA RCRA permit writer's guidelines (which usually assumes a 70-year exposure), unless they are due to pollutants complying with specific regulatory limits for the route of exposure causing the risk. Most of the actual exposures above 1 mrem are not covered by such route-of-exposure or source-specific EPA regulations.

Risks above one in one million indicate a need to evaluate better pollution control under CERCLA guidelines and the Clear Air Act of 1990 (which assumes a 70-year exposure), when applicable, along with some State regulations.

As described in 1992 Site Environmental Reports, the combined direct and indirect exposures associated with airborne radionuclides from DOE installations (excluding radon) to the hypothetical or actual most exposed members of the general public were well below the 10-mrem EPA standard (that also excludes radon). However, radon exposure was 24,000 times higher than the non-radon radionuclide exposure at FEMP and 40 times higher than non-radon exposure at ANL-E reported in the Draft WM PEIS. Radon was either not detected above background levels, not monitored at the site boundary, not modeled, or not discussed in the Site Environmental Reports for many of the other installations.

Based on available data on radionuclide levels measured in onsite animals (and background animal monitoring), potential exposure to the hypothetical maximally exposed individual from the ingestion of contaminated game could be much higher than the modeled direct and indirect exposure to airborne and liquid radionuclide releases because such game could conceivably be caught on or off the site.

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The general public has access to locations at the boundary of and within several DOE sites. At some of these locations, exposures exceeding 100 mrem from direct external exposure to radiation would have been possible in less than a year in the highly unlikely event that a person were to remain at such a location continuously. However, under plausible exposure assumptions (considering the land use) that were identified in Site Environmental Reports, exposure exceeding the 100 mrem limit did not occur.

Response
DOE has revised Table 4.2-2 to include radon doses related to site actions at FEMP and ANL-E. These estimates are also included in the cumulative impacts analysis presented in Chapter 11 in Volume I of the WM PEIS in the description of existing site conditions for those sites.

The commentor is correct in noting that many of the exposures listed in the Site Environmental Reports are higher than the exposures used in the PEIS analysis. All of the exposure information described in the comment is presented in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS. However, this information was not listed in Chapter 4 (Affected Environment) or used in Chapter 11 (Cumulative Impacts) because the routes of exposure for these higher exposure estimates are not as relevant for most members of the offsite public as airborne exposure.

Consumption of contaminated wildlife and other multimedia exposure scenarios are best addressed as parts of site-specific analyses. These pathways would require additional information or assumptions about the dietary habits of these individuals who consume fish and wildlife. The WM PEIS attempted to estimate risks to the offsite population through pathways that are relevant for the general population (i.e., airborne releases from facilities, leading to inhalation exposure, and deposition of contaminants to soil, followed by uptake in crops and livestock and ingestion by receptors). The maximally exposed individual exposure and risk estimates for these pathways are more likely to be potentially applicable to most members of the general public. Consideration of hot-spot or contaminated wildlife exposures involves the use of site-specific characteristics that are better addressed in sitewide and project-level NEPA reviews.

The WM PEIS evaluates potential health risk impacts to offsite populations from waste treatment operations that are assumed to occur over a 10-year period. Exceptions to this assumption would include a full 20-year operations phase (i.e., construction phase not applicable) for the No Action Alternative, and the site-specific operational periods for high-level waste storage facilities, which are discussed in Chapter 9 in Volume I of the WM PEIS. Impacts to offsite populations during the operations period are assumed to result mainly from airborne releases of radionuclides and hazardous chemicals from waste treatment facilities. During this 10-year operations period, institutional control of the sites is assumed to be maintained by DOE. Consequently, the offsite population should not come into contact with hot spots of contamination located inside the site boundary. The WM PEIS does not attempt to estimate future land-use scenarios at the sites. These decisions are better made on the basis of a sitewide analysis. Therefore, the airborne pathway is the only exposure route analyzed in the cumulative impacts section of the WM PEIS.

DOE has revised the Chapter 11 tables to list the correct maximally exposed individual doses for LLNL (6.9×10^{-1} mrem) and RFETS (2×10^{-4} mrem) for an offsite individual.

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Comment (4492)
The statement in Section 4.3.1 of the Draft WM PEIS that airborne radionuclide exposure is readily measured and that its potential impact can be immediately determined is highly misleading. Airborne radionuclide exposure is extremely difficult to measure directly and separate from background at the levels reported in the Draft WM PEIS, and the exposures included in the Draft WM PEIS were not, in fact, measured. Air pollution exposures (and associated exposure from ingestion of biota contaminated by the air pollution) in the Draft WM PEIS were determined by modeling, mostly using the CAP-88 model (which used the results of emission monitoring and modeling as data input). This is not measurement of exposure, but modeling of exposure.

The only potential airborne exposures that were directly measured in Site Environmental Reports were for radon, for radiation and for fugitive plutonium dust at RFETS, none of which was covered in the Draft WM PEIS.

The results of monitoring were used in Site Environmental Reports to determine potential radon exposure to the maximally exposed individual at FEMP, potential radiation exposure at the boundary of several sites, the amount of potential exposure to a hunter at SRS (from game that he caught), potential exposure from the ingestion of contaminated ducks at INEL, and potential exposure to plutonium at RFETS. The WM PEIS should include this information.

Response
DOE has revised the discussion in Section 4.3.1 of the WM PEIS to indicate that exposures of individuals in offsite populations would occur primarily through inhalation of airborne contaminants released from new waste treatment facilities. Except for the airborne exposures based on direct measurements at RFETS the commentor notes, estimates of these releases, as well as estimates of airborne releases from existing site activities, were developed using air dispersion models rather than measurements.

Comment (4494)
The statement in Section 4.3.1 of the Draft WM PEIS that, at DOE sites, the maximally exposed individual received a dose considerably less than 1 mrem per year does not agree with the following impacts reported in 1992 DOE Site Environmental Reports:

- The potential exposure in the game caught by a hunter at SRS was 49 mrem;
- The potential exposure from eating the most contaminated duck at INEL was 4 mrem;
- The exposure to a residence near the target of an accelerator at LBL was 2.1 mrem;
- The exposure to a residence near the target of an accelerator was estimated to be 4.4 mrem at LANL;
- Radon exposure at FEMP was estimated to be 51 mrem for the maximally exposed individual;
- PGDP had a potential multimedia exposure of 3.8 to 4 mrem to the maximally exposed individual;
- ORR had a potential multimedia exposure of 1.4 mrem from airborne radionuclides and 4 to 17 mrem from multimedia exposure.

Response
DOE has revised Section 4.3.1 of the WM PEIS to indicate that the estimated airborne maximally exposed individual dose at most sites is considerably less than 10 mrem per year, since the estimates for LANL and ORR exceed 1 mrem per year. Note that these are estimates of maximally exposed

individual exposure via the airborne pathway only. The source of these estimates is not the annual Site Environmental Reports, but rather the DOE report, *Summary of Radionuclide Air Emissions from Department of Energy Facilities for CY 1992.*

The WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Volume I, Section 1.9, of the Final WM PEIS, contains all the exposure information described in the comment. However, DOE did not carry this information into Chapters 4 (Affected Environment) and 11 (Cumulative Impacts) because those routes of exposure are not as relevant for most members of the offsite public as airborne exposures.

The consumption of contaminated wildlife and other multimedia exposure scenarios are best addressed in site-specific analyses. These pathways would require additional information or assumptions about the dietary habits of those populations who consume fish and wildlife. In addition, wildlife contamination data vary widely from year to year in site monitoring reports. The WM PEIS estimated risks to the offsite population through pathways that are relevant for the general population (i.e., airborne releases from facilities, leading to inhalation exposure, and deposition of contaminants to soil, followed by uptake in crops and livestock and ingestion by receptors). The maximally exposed individual exposure and risk estimates for these pathways are more likely to be applicable to most members of the general public. The consideration of hot-spot or contaminated wildlife exposures involves the use of site-specific characteristics that are better addressed in sitewide or project-level NEPA analyses.

The PEIS evaluates potential health risk impacts to offsite populations from waste treatment operations that would occur over an assumed 10-year period. Exceptions to this assumption would include a full 20-year operations phase (i.e., construction phase not applicable) for the No Action Alternative, and the site-specific operational periods for high-level waste storage facilities, which are discussed in Chapter 9 in Volume I of the WM PEIS. Impacts to offsite populations during the operations period would result primarily from airborne releases of radionuclides and hazardous chemicals from waste treatment facilities. DOE would maintain institutional control of the sites during this period. As a consequence, the offsite population should not come in contact with hot spots of contamination inside the site boundary.

The PEIS does not attempt to estimate future land-use scenarios at the sites. DOE will make these decisions based on sitewide or project-level analyses. Therefore, the airborne pathway is the only exposure route analyzed in the cumulative impacts section of the WM PEIS.

Comment (4495)
The Draft WM PEIS misrepresents impacts of existing DOE sites during the baseline year and makes impacts of planned and alternative actions look much smaller than Site Environmental Reports and previous modeling.

Potential or actual radionuclide and radiation exposure to maximally exposed individuals in the general public from DOE sites in 1992 includes exposures that are at least 100 times higher than reported in the Draft WM PEIS because of contaminated wildlife at SRS, INEL, and WVDP, plausible multimedia exposure at PGDP, radioactivity at hot spots at the boundaries of ANL-E, LBL, ORR, and PGDP, and at the shoreline of the Columbia River at Hanford, plutonium impacts are RFETS, and radon from materials onsite at FEMP.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

The Draft PEIS did not include exposures to populations that were much higher than the exposures reported in the Draft WM PEIS at many sites due to routes of exposure whose impacts were quantified in DOE Site Environmental Reports and other internal documents.

Section 4.4.1 and Table 11-3 in the Draft WM PEIS reported that the radiation dose from airborne radionuclides from ANL-E to a maximally exposed individual was 0.0085 mrem. However, the 1992 ANL-E Site Environmental Report said that the exposure to airborne radionuclides excluding radon was 0.0091 mrem, and that, including radon, it was 0.34 mrem at an actual receptor 800 meters north of the site (40 times higher than the 0.0085 mrem reported in the Draft WM PEIS). Furthermore, the maximum reported potential multimedia exposure was 0.41 mrem from ingestion, inhalation, and radiation (48 times higher than the value in the WM PEIS). In addition, the Site Environmental Report provided data on a location at the ANL-E fenceline, near some transuranic waste where the maximum potential exposure from penetrating radiation was 82 mrem (and 0.01 mrem under more realistic exposure assumptions).

Section 4.4.2 of the Draft WM PEIS reports that the dose to the maximally exposed individual at BNL is 0.11 mrem from air emissions. However, the Site Environmental Report indicates that the dose to the maximally exposed individual from contaminated fish in the Peconic River is 0.64 mrem; the dose from contaminated water is 0.11 mrem; and the dose from airborne radionuclides is 0.17 mrem. This would make the maximum dose 0.92 mrem. The Draft WM PEIS reports that the collective radiological dose from airborne radionuclide emissions is 2.7 rem per year. However, the Site Environmental Report indicated that the dose is 3.6 rem per year, including 0.40 rem per year from fish, 0.07 rem per year from water, and 3.1 rem per year from airborne radionuclides.

The reported radiation dose in Section 4.4.3 and Table 11-7 of the Draft WM PEIS from airborne radionuclides to a maximally exposed individual of 0.0021 mrem impacted by FEMP is grossly misleading. It fails to include the 51 mrem potential exposure to airborne radon in the 1992 FEMP Site Environmental Report. This exposure is 24,285 times (24,000 to two significant figures) higher than that reported in the Draft WM PEIS, and represents a significant risk to public health. No analysis of the significance of deleting the radon data when characterizing human health impacts was provided in the WM PEIS. The fact that NESHAPS standards exclude radon is stated in the PEIS, but this is irrelevant to human health impact assessment, as such, in an EIS, under NEPA regulations. To try to use NESHAPS standards to justify excluding the radon data from the PEIS is to inappropriately mix regulatory compliance issues with human health impact issues.

Radon exposures from FEMP to the maximally exposed individual were reduced from 93 mrem per year (in 1991) to 51 mrem per year due to better containment of the radon from the uranium in a silo and waste pits on the site. DOE should be proud of this achievement, and it should be recognized in the Draft WM PEIS. However, more needs to be done, and plans existed in 1994 to do more at FEMP. Any plans for further mitigation of the impacts of the radon from this uranium and waste at FEMP and other sites (such as ANL-E) should be mentioned, and the most recent available information on radon exposure should be covered in the affected environment section of this WM PEIS. The impact of future reductions in radon impacts should be covered in the cumulative impacts section. Because radon exposure contributes to human health impacts from DOE sites and dominates those impacts at sites such as ANL-E and FEMP during the baseline year, it cannot be ignored just because there is no specific exposure limit for those impacts.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

The Draft WM PEIS provides a misleading characterization of radionuclide exposure to the general public from existing sites by basing the characterization on air emissions from stacks with exposure limits under NESHAPS, which do not include radon. This misses the most important routes of exposure at many sites (water pollution, bioaccumulation in fish and game, radiation, fugitive plutonium dust, etc.), as well as radon exposure. Exposure from the onsite waste at FEMP was reported in the Site Environmental Report to be substantial (51 mrem per year based on radon monitored at the fenceline in 1992). Mitigating measures for such radon exposure should also be covered, along with the latest information at FEMP (where dramatic reductions in radon impacts were reported).

The 1992 Site Environmental Report for Hanford reported an exposure of 0.0004 mrem at the Ringold Site near Hanford (consistent with the 0.0037 mrem reported in the Draft WM PEIS). However, this was based on the GENII model, and modeling using CAP-88 (the model specified in applicable regulations) showed the exposure to be 0.005 mrem. Monitoring at the Ringold Site showed a somewhat questionable value of 0.09 mrem.

Radionuclide exposure associated with contamination at the Columbia River (at Riverview) was reported to cause an estimated exposure of 0.02 mrem for the maximally exposed individual, according to the 1992 Site Environmental Report.

A location at the Columbia River near the 100N area has a potential exposure of 175 mrem in the unlikely event a member of the general public were to remain there for a year. Exposure was estimated to be 0.07 mrem per kilogram of contaminated duck on the site, 0.002 mrem per kilogram of contaminated pheasant, and 0.001 mrem per kilogram of contaminated deer, according to the 1992 Site Environmental Report.

The reported doses to the maximally exposed individual in the general public from airborne radionuclides at INEL are 0.0015 mrem for 1992 in Section 4.4.5, and 0.0029 mrem for 1994 in Table 11-11. DOE should explain how the dose changed so drastically.

Based on the 1992 INEL Site Environmental Report, the dose to the maximally exposed individual is 0.0018 mrem, based on modeling using CAP-88; and it was 0.0042 mrem at Atomic City, based on the MESODIF model.

However, a much more severe potential exposure from radionuclides is possible. The 1992 INEL Site Environmental Report showed that the most contaminated duck tested in 1992 could cause a dose of 4 mrem if eaten, and the most contaminated measured antelope, 0.2 mrem. The INEL Site Environmental Report estimated that two contaminated ducks from INEL are eaten annually (based on a rather detailed analysis of hunting and duck migration). The potential impact of ingestion of contaminated animals should be covered in the WM PEIS because contaminated ducks can travel far from the site, be shot and then eaten, and the INEL Site Environmental Report confirms that this is likely.

The reported airborne dose to the maximally exposed individual of 0.690 mrem and the collective dose of 1.7 mrem per year at LLNL in Section 4.4.6 of the Draft WM PEIS were higher than the doses reported in the 1992 Site Environmental Report (0.28 mrem to the maximally exposed individual and 0.28 rem per year to the population). However, the dose to the maximally exposed individual is

4.2 Existing Contamination/Historic Releases/Past DOE Practices

reported to be 0.069 mrem in Table 11-13 of the Draft PEIS, a value that is less than the 0.28 mrem summarized from the Site Environmental Report. The discrepancy indicates an error somewhere in the Draft WM PEIS.

The dose to the maximally exposed individual from radionuclides from the accelerator at LANL should be specifically delineated. It is unclear from the affected environment section of the Draft WM PEIS where the reported 7.9 mrem exposure comes from (it was reported to be 4.4 mrem in the 1992 Site Environmental Report). Mitigating measures for accelerator impacts should be covered in the WM PEIS.

Section 4.4.8 and Table 11-17 of the Draft WM PEIS reported airborne dose to the maximally exposed individual of 0.012 mrem for NTS is less than the 0.07 mrem exposure reported in the Site Environmental Report (which included exposure from air, milk, vegetables and beef liver). The most contaminated deer monitored onsite in 1992 would have caused a dose of 0.027 mrem (assuming 100 pounds of meat and 3 pounds of liver were eaten). The collective dose of 0.029 mrem per year for NTS was less than the 0.042 mrem exposure reported in the Site Environmental Report.

In addition to the 1.4 mrem exposure from airborne radionuclides at ORR, the 1992 Site Environmental Report showed a plausible multimedia exposure of 4 to 17 mrem from airborne radionuclides, drinking water from Gallagher Creek, eating contaminated fish from the Clinch River, and spending 250 hours at the radioactive areas of either the Clinch River (2 mrem) or Poplar Creek (15 mrem). In the unlikely event that someone were to spend all year in the contaminated area of Poplar Creek, potential exposure was reported to be 526 mrem in the Site Environmental Report. DOE should have included this information in the WM PEIS.

In addition to the 0.0045 mrem exposure from airborne radionuclides, the 1992 Site Environmental Report for PGDP showed a maximum multimedia exposure to the maximally exposed individual of 3.8 mrem from sediment, radiation from 30 minutes per day at the Little Bayou Creek, contaminated well water, and contaminated crops.

A hot spot was reported at the confluence of the K011 ditch and Little Bayou Creek, where the potential exposure was 187 mrem. This information should have been included in the Draft WM PEIS.

Table 11-23 in the Draft WM PEIS gives specific values for exposure for Pantex; these values should have been included in Section 4.4.11. A slight discrepancy exists between the exposure to the maximally exposed individual on Table 11-23 of 0.000036 mrem, and the 0.000027 mrem in the Site Environmental Report.

Exposure from airborne radionuclides reported in the 1992 Portsmouth Site Environmental Report (0.03) is an order of magnitude less than that in the Draft WM PEIS (0.26 mrem). The correct values for exposure should be verified and included in the WM PEIS.

Section 4.4.13 of the Draft WM PEIS shows a dose to the maximally exposed individual of 0.0002 mrem for RFETS in Chapter 4, and of 0.000028 mrem in Table 11-27, suggesting a typographical error somewhere. The Site Environmental Report also indicated a dose to the maximally exposed individual of 0.46 mrem based on plutonium monitoring between the source and the nearest actual housing and CAP-88 modeling. This plutonium exposure should be covered in the WM PEIS.

4.2 Existing Contamination/Historic Releases/Past DOE Practices

The doses in Section 4.4.14 of the Draft WM PEIS match those in the Site Environmental Report for SNL.

Section 4.4.15 and Table 11-31 of the Draft WM PEIS state the use of doses from airborne radionuclides to characterize exposure to the maximally exposed individual at SRS as 0.14 mrem; this is grossly misleading because it did not include exposure to hunters or fishermen. The maximally exposed individual at SRS is a hunter who eats contaminated game that he caught on the site (49 mrem). Potential exposure from the ingestion of contaminated fish was reported to be 3.1 mrem in 1992. The figures for the hunter were based on radiation monitoring for the game the hunter actually caught, and the only hypothetical issue was whether he would eat it himself, if others would eat it, or if he would discard it. In addition, fish were contaminated from the site. Ingestion of 42 pounds of bass were reported to result in a potential exposure of 3.1 mrem in the 1992 Site Environmental Report.

The 1992 SRS Site Environmental Report shows exposure data higher than the 6.40 person-rem for airborne exposure reported in Section 4.4.15 and Table 11-31 of the Draft WM PEIS. The collective radiological dose from all routes of exposure combined, based on the 1992 SRS Site Environmental Report was 17.5 person-rem per year, based on the CAP-88 (an EPA-approved airborne radionuclide model) and LAPTAPII. The 1992 Site Environmental Report also showed the collective radiological dose from all routes of exposure combined to be 8.9 person-rem per year, based on the POPGASP and LAPTAPII models (POPGASP was not approved by EPA at last report).

The Draft WM PEIS reports that the exposure to the maximally exposed individual from airborne radionuclides for WVDP was 0.0003 mrem in Section 4.4.17 and 0.00029 mrem in Table 11-35. However, the Site Environmental Report shows an exposure of 0.046 mrem from liquid effluents, assuming that the maximally exposed individual consumes 46 pounds of fish. This dose is 160 times higher than the dose in the Draft WM PEIS.

Response

With respect to the discrepancies noted by the commentor between the WM PEIS airborne doses and doses reported in Site Environmental Reports, the airborne radiation doses presented in Sections 4.4.1 through 4.4.17 in Volume I were taken from a DOE report entitled, *Summary of Radionuclide Air Emissions from Department of Energy Facilities for CY 1992*. DOE used this report rather than Site Environmental Reports to provide consistent information for the 17 major sites. The report includes the same information for the same year for all major sites considered in the PEIS. Site environmental reports differ considerably in the information they include and the year on which they are based. However, radionuclide information from site reports is included in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

With respect to use of estimates of the dose from combined routes rather than airborne exposures at any of the sites, because they include more exposure pathways, multimedia maximally exposed individual e stimates will generally exceed airborne maximally exposed individual estimates. However, the WM PEIS health risk analysis considers airborne exposure to contaminants released from waste treatment facilities the most important exposure pathway for most members of the public living offsite in the vicinity of potential waste management sites. This assumption was also used in characterizing existing site conditions. The basis for this assumption is the 10-year treatment period analyzed, during which institutional controls would be maintained to limit access of the offsite population to many of the areas

4.2 Existing Contamination/Historic Releases/Past DOE Practices

considered in the multimedia pathway maximally exposed individual estimates. Therefore, only airborne maximally exposed individual estimates were used in Chapter 4 to characterize existing site conditions and in Chapter 11 to estimate cumulative impacts.

The maximally exposed individual multimedia dose estimates presented in the annual Site Environmental Reports are estimates that do not appear to be relevant to the potential exposure of most members of the offsite population living in the region of influence of the sites. These pathways would be relevant only for certain specialized populations (e.g., hunters and fishermen), and would require additional information or assumptions about the dietary habits of those populations. To be comprehensive, multimedia exposure is included in the WM PEIS Affected Environment Technical Report.

With respect to radon exposures at ANL-E and FEMP, Chapter 4 in Volume I of the WM PEIS summarizes the affected environments of the proposed waste management sites with information presented on potential exposure from existing site activities to offsite maximally exposed individuals from the airborne pathway, as well as from multimedia pathways, where available. The airborne pathway exposure estimates do not include background radiation. Radon accounts for about 200 mrem of the estimated 300 mrem average annual background radiation dose received in the U.S. These exposures are not associated with site activities. At certain DOE sites, storage of wastes containing uranium, thorium, and radium could serve as additional, diffuse sources of radon exposure, since radon is formed when these radionuclides decay. Estimates of this type of radionuclide exposure, which, for example, totaled 51 mrem at the fenceline at FEMP in 1992 and 0.3 mrem at ANL-E in 1993, are provided in the WM PEIS Affected Environment Technical Report supporting the WM PEIS. Airborne maximally exposed individual exposure estimates that include radon exposure, including that at ANL-E in 1993, are also presented in this technical report. The main radon emission at FEMP came from radium-bearing materials stored in the K-65 silos. Radon released from Building 200 at ANL-E was chiefly due to radioactive contamination from the "proof-of-breeding" program. These contaminated areas are undergoing remedial actions. Reduction or elimination of radon release is expected. DOE revised Table 4.2-2 to include radon doses related to site actions at FEMP and ANL-E. These estimates are also included in the cumulative impacts analysis presented in Chapter 11 under the description of existing conditions at these sites.

With respect to risks from exposures at site hot spots, the PEIS does not attempt to estimate future land-use scenarios and the potential for exposure at hot spots at the sites. DOE will make these decisions on the basis of site-level analyses. Therefore, the airborne pathway is the only exposure route analyzed in the cumulative impacts section of the PEIS. However, the WM PEIS Affected Environment Technical Report describes existing hot-spot contamination at the sites.

With respect to the accelerator at LANL, the WM PEIS includes the estimated effects of all existing activities, including the accelerator in the cumulative impacts analysis. LANL is currently preparing a sitewide EIS, which will evaluate the accelerator effects in greater detail and would address mitigation of those operations.

With respect to the maximally exposed individual dose at RFETS, DOE has revised Section 11.15.2 of the WM PEIS to incorporate the correct estimate of airborne maximally exposed individual exposure (0.0002 mrem), as presented in Section 4.4.13 in Volume I. Multimedia maximally exposed individual and hot-spot exposures are not applicable to most members of the offsite populations living in the vicinity of the sites. However, this information is included in the WM PEIS Affected Environment Technical Report.

Comment (4506)
Exposure from airborne radionuclides reported in the 1992 Portsmouth Site Environmental Report (0.03) is an order of magnitude less than that in the Draft WM PEIS (0.26 mrem). The correct values for exposure should be verified and included in the WM PEIS.

Response
Sections 4.4.12 and 11.12 in Volume I present airborne maximally exposed individual dose estimates obtained from the DOE report, *Summary of Radionuclide Air Emissions from Department of Energy Facilities for CY 1992*, rather than the Portsmouth Site Environmental Report. DOE used this report rather than Site Environmental Reports to provide consistent information among the sites. The report includes the same information for the same year for all major sites considered in the PEIS. Site Environmental Reports differ considerably in the information they include and the year on which they are based. However, radionuclide information from site reports is included in the WM PEIS Affected Environment Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (4512)
According to the 1992 Site Environmental Report for LBL, the exposure at a residence was 2.1 mrem from an accelerator. The 1992 Site Environmental Report also showed that a cobalt irradiator is estimated to cause a potential exposure of 17 mrem at the fencepost. The collective dose was reported to be less than 5 rem per year, including both the accelerator and conventional airborne radionuclide releases. Why was this information not included in the Draft WM PEIS?

Response
DOE summarized site doses only for the 17 major sites in Volume I, Chapter 4, of the Final WM PEIS and used the doses to estimate cumulative impacts at the 17 major sites in Volume I, Chapter 11. LBL is not one of the 17 sites, therefore, LBL data are not provided in Volume I of the PEIS. However, this information for LBL is included in the WM PEIS Affected Environmental Technical Report, which is available in the DOE public reading rooms listed in Section 1.9 in Volume I of the Final WM PEIS.

Comment (4513)
The gamma ray exposure reported in Section 4.5 of the Draft WM PEIS of 0.3 mrem to the nearest resident from pitchblende-contaminated soil should be mentioned for Middlesex Sampling Plant, along with the fact that the radon impact from the pitchblende has not been quantified.

Response
DOE summarized site doses only for the 17 major sites in Volume I, Chapter 4, of the Final WM PEIS and used the doses to estimate cumulative impacts at the 17 major sites in Volume I, Chapter 11. Middlesex is not one of the 17 sites, therefore, data on Middlesex were not provided in Volume I of the PEIS.

4.3 Existing or Planned Facilities and Activities

Comment (28)
Plan to use staff at LLNL to develop management and cleanup methods and plans.

Response
The mission of LLNL currently includes waste management and environmental restoration activities appropriate to the wastes and issues at the site. The WM PEIS analysis is based on information provided by the site, and is being closely coordinated with the site, including reviews by LLNL personnel before the Draft WM PEIS was released and before the Final WM PEIS was released. As the national decisions on waste management are made, they will be implemented at the individual sites based on additional environmental impact reviews. Implementation will include studies to identify the location, design and operating parameters of any necessary waste management facilities. DOE has programs in place to help retrain employees that had previously focused on the production of nuclear weapons to support the waste management mission.

Comment (40)
INEL is not considered as a Regionalized Alternative site for high-level waste storage because it has no existing or approved storage facilities. Aren't naval and commercial fuel rods high-level waste?

Response
No, they are spent nuclear fuel. The definition of spent nuclear fuel is nuclear reactor fuel elements (e.g., Naval and commercial fuel rods) and targets that have been irradiated in a nuclear reactor. A target is material that is placed in a nuclear reactor to be bombarded with neutrons to produce new, man-made materials, such as plutonium and tritium.

High-level waste is the highly reactive waste material that results from the chemical processing of spent nuclear fuel and irradiated targets, and includes liquid waste produced directly from reprocessing and any solid material derived from the liquid that contains fission products in concentrations sufficient to require permanent isolation. High-level waste might also contain toxic metals, organic materials, and corrosive characteristics that are considered hazardous under the Resource Conservation and Recovery Act. Therefore, high-level waste is sometimes considered mixed waste.

Although INEL has facilities for wet storage of spent nuclear fuel, it has no facilities capable of or approved for storing the immobilized high-level waste glass logs. The current and final physical form (calcine and glass-ceramic, respectively) of INEL's high-level waste is also different from the other three high-level waste storage sites (liquid high-level waste and vitrified borosilicate glass). Therefore, DOE does not consider INEL a reasonable regional site for high-level waste management.

Volume I, Section 9.3.6, describes the rationale for selecting high-level waste storage sites. The SNF/INEL EIS addresses programmatic decisions for the management of spent-nuclear fuel.

Comment (1177)
ANL-E currently stores its low-level nuclear waste until it can be transferred to long-term storage locations. Even this short-term storage concerns area residents.

Response
ANL-E currently stores low-level nuclear waste safely onsite. One of the reasons DOE prepared the WM PEIS was its concern about storage of waste in the DOE complex. Although storage is generally