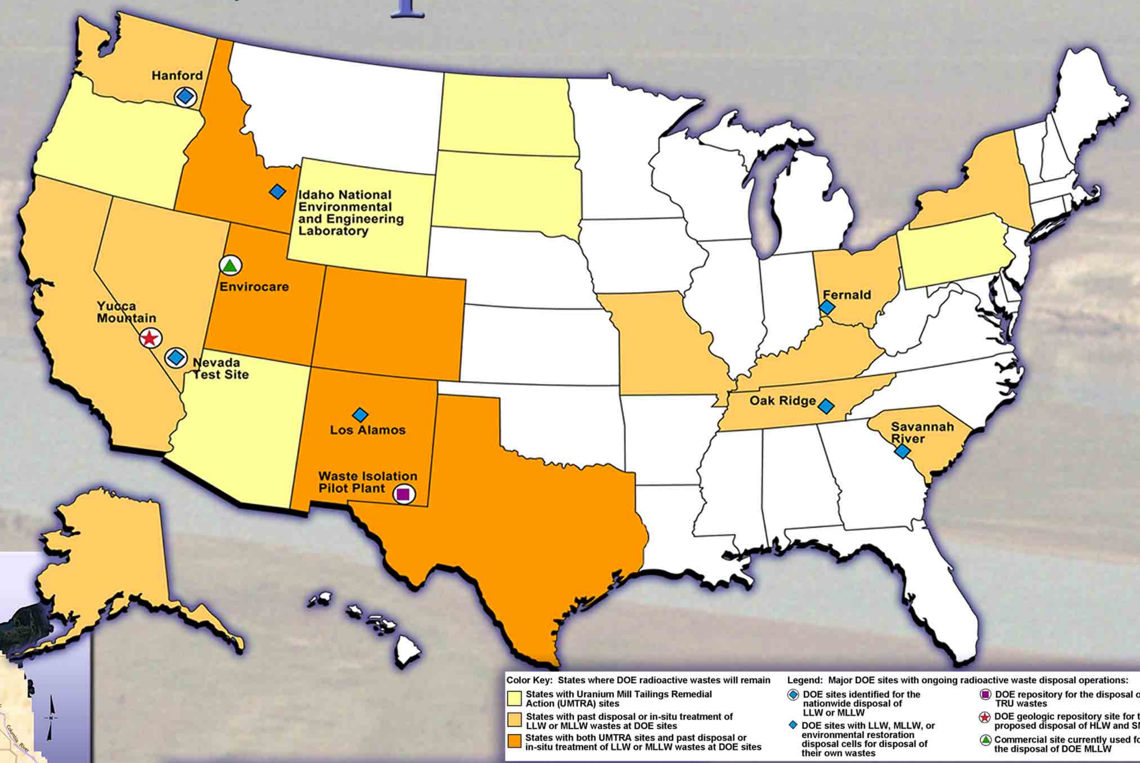
Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Hanford Site Solid Waste Program Environmental Impact Statement

Scope

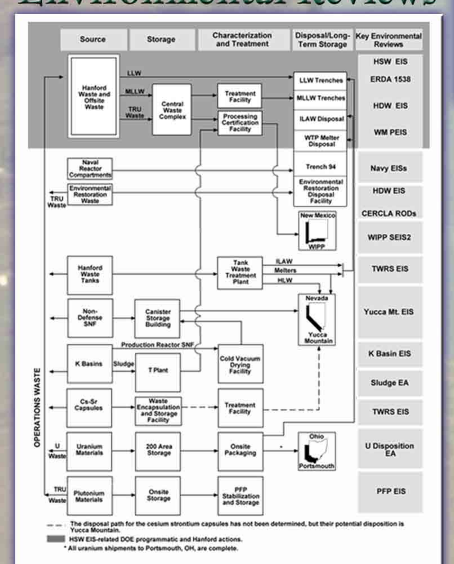
The Hanford Site Solid Waste EIS was a "Site-Specific" EIS required by DOE's Waste Management Programmatic EIS

- Regional disposal of LLW and MLLW at Hanford and the Nevada Test Site was an important component of the WM PEIS
- While a number of DOE sites have disposal cells for disposal of their wastes, many of DOE's closure sites do not have these capabilities



The HSW EIS is focused on the treatment, storage, and disposal of radioactive solid wastes at Hanford

Environmental Reviews



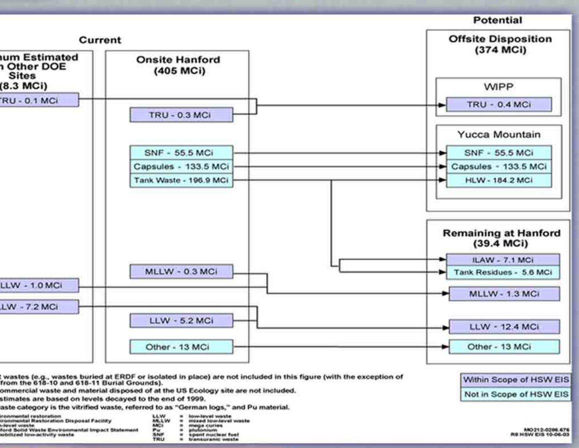
Abstract

The Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement (HSW EIS) provides environmental and technical information concerning U.S. Department of Energy (DOE) proposed waste management practices at the Hanford Site in Richland, Washington. The HSW EIS updates analyses of environmental consequences from previous documents and provides evaluations for activities that may be implemented consistent with the Waste Management Programmatic Environmental Impact Statement (WM PEIS) Records of Decision (RODs). Waste types considered in the HSW EIS include operational low-level radioactive waste (LLW), mixed low-level waste (MLLW), immobilized low-activity waste (ILAW), and transuranic (TRU) waste (including TRU mixed waste). MLLW contains chemically hazardous components in addition to radionuclides. Alternatives for management of these wastes at the Hanford Site, including the alternative of No Action, are analyzed in detail. The LLW, MLLW, and TRU waste alternatives are evaluated for a range of waste volumes, representing quantities of waste that could be managed at the Hanford Site. A single maximum forecast volume is evaluated for ILAW. The No Action Alternative considers continuation of ongoing waste management practices at the Hanford Site and ceasing some operations when the limits of existing capabilities are reached. The No Action Alternative provides for continued storage of some waste types. The other alternatives evaluate expanded waste management practices including treatment and disposal of most wastes. The potential environmental consequences of the alternatives are generally similar. The major differences occur with respect to the consequences of disposal versus continued storage and with respect to the range of waste volumes managed under the alternatives. DOE's preferred alternative is to dispose of LLW, MLLW, and ILAW in a single, modular, lined facility near PUREX on Hanford's Central Plateau; to treat MLLW using a combination of onsite and offsite facilities; and to certify TRU waste onsite using a combination of existing, upgraded, and mobile facilities. DOE issued the Notice of Intent to prepare the HSW EIS on October 27, 1997, and held public meetings during the scoping period that extended through January 30, 1998. In April 2002, DOE issued the initial draft of the HSW EIS. During the public comment period that extended from May through August 2002, DOE received numerous comments from regulators, tribal nations, and other stakeholders. In March 2003, DOE issued a revised draft of the HSW EIS to address those comments, and to incorporate disposal of ILAW and other alternatives that had been under consideration since the first draft was published. The public comment period on the revised draft was from April 11 through June 11, 2003. The final HSW EIS, approved in January 2004, responded to comments received on the revised draft and included updated analyses to incorporate information developed since the revised draft was published. The U.S. Environmental Protection Agency's Notice of Availability of the final HSW EIS was published in the February 13, 2004, Federal Register. RODs resulting from the final HSW EIS are expected to be issued in 2004.

In order to assess environmental impacts, it was necessary to have a clear definition of the existing and projected waste streams included in the scope of the HSW EIS

- Waste streams covered under existing NEPA documents were excluded
- A range of potential waste volumes from offsite generators was used to bound the analysis

Waste and Materials Coming to and Leaving Hanford



What wastes are included in the HSW EIS and how are they defined?

Low-level waste (LLW) is radioactive waste that is not high-level waste, spent nuclear fuel, transuranic waste, or byproduct material (as defined under the Atomic Energy Act of 1954 (42 USC 2011)) or naturally occurring radioactive material. LLW is technically defined not by what it is, but by what it is not. LLW has a wide range of forms, radionuclide concentrations, and hazards. LLW can range from very low to very high radionuclide concentrations, but is generally the kind of waste acceptable for shallow-land disposal.

Mixed low-level waste (MLLW) is LLW that contains both radionuclides subject to the Atomic Energy Act of 1954, and a hazardous chemical component subject to the Resource Conservation and Recovery Act (RCRA) (42 USC 6901) or applicable Washington State Dangerous Waste Regulations.

Immobilized low-activity waste (ILAW) is the solidified low-activity waste from the treatment and immobilization of Hanford tank wastes. Low-activity waste is the waste that remains after separating from high-level waste (HLW) as much of the radioactivity as practicable, and that when solidified may be disposed of as low-level waste in a near-surface facility.

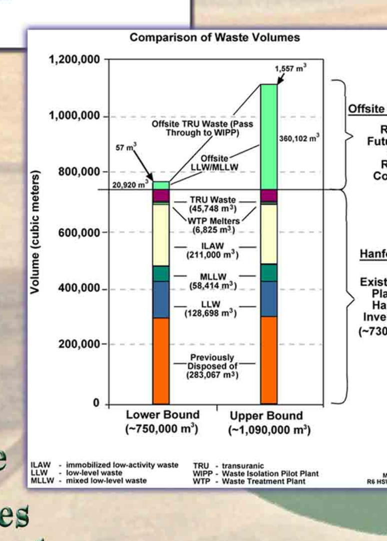
Transuranic (TRU) waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for the following:

- high-level radioactive waste
- waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR 191 disposal regulations
- waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

What waste types are not included in the analysis of HSW EIS alternatives?*

- High-level radioactive waste
- Most liquid wastes
- Spent nuclear fuel
- Naval reactor compartments
- Non-radioactive hazardous wastes
- Most environmental restoration wastes generated as part of the CERCLA process
- Commercial LLW destined for US Ecology

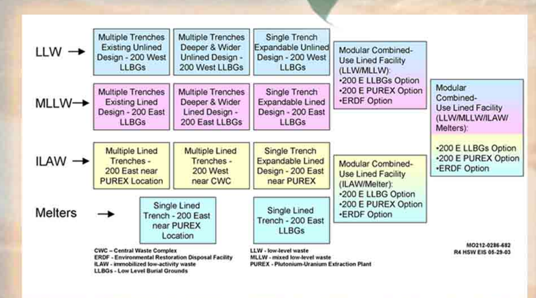
*Although these wastes are not considered in the detailed alternative analyses, they are considered in the cumulative impacts analyses.



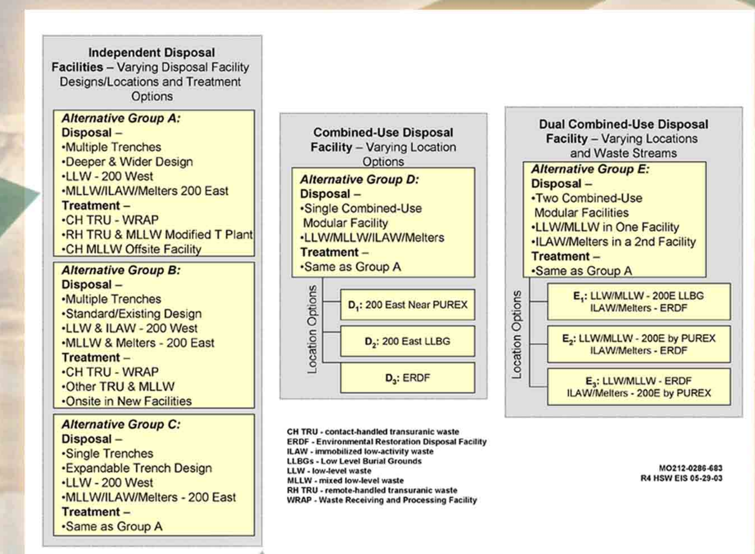
Waste Volumes Analyzed

Alternatives

Disposal Alternatives



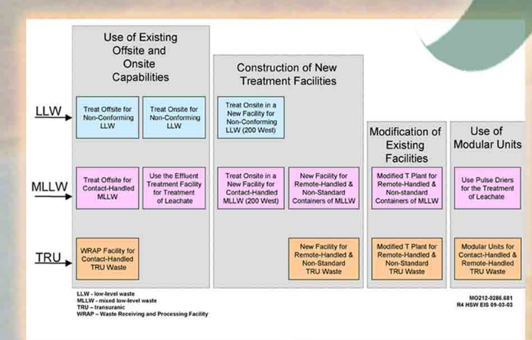
Alternative Groups



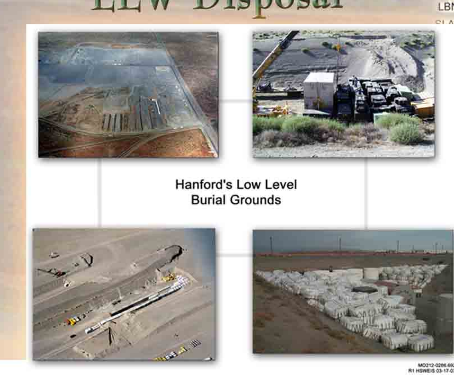
In order to effectively assess and compare environmental impacts, five primary action groups were assembled

- For the dual use and multi-use disposal configuration, subgroups were identified based on the disposal facility location
- A traditional NEPA "No Action" alternative was also evaluated
- For each alternative group impacts were assessed for the Hanford-Only, the Lower Bound, and the Upper Bound waste volumes

Treatment Alternatives

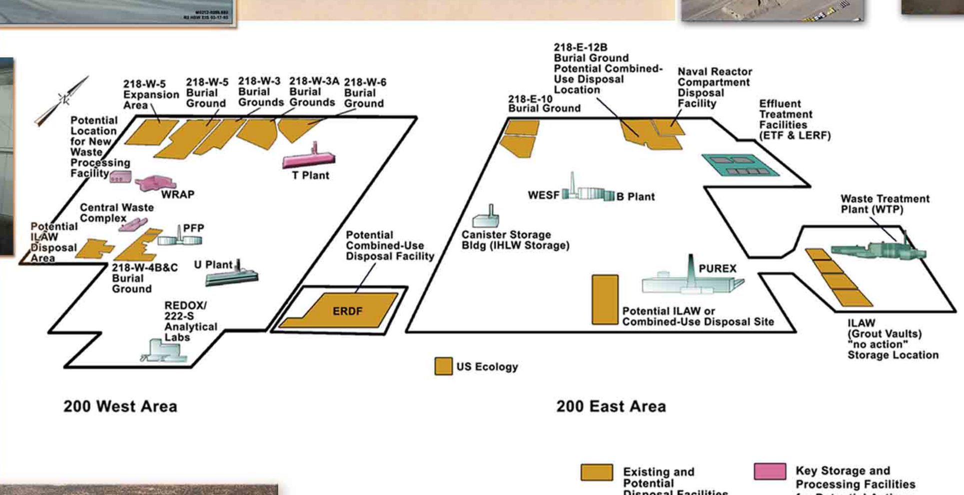


LLW Disposal



MLLW Disposal

Packaging of TRU Waste at WRAP



Central Waste Complex

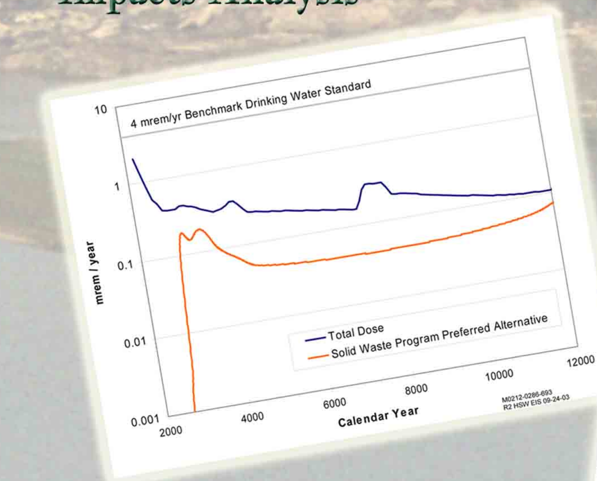
Dozens of alternatives were considered for the treatment/processing, storage, and disposal of radioactive solid wastes

Environmental Consequences

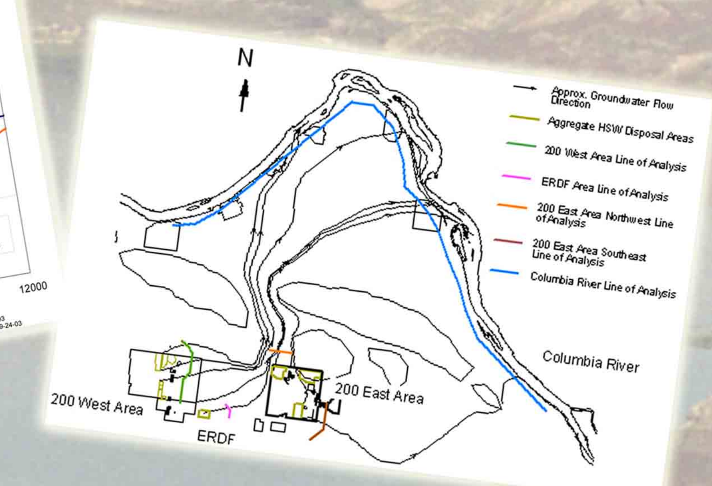
The Environmental Consequences were determined for a wide range of impact areas. Both near-term or operational impacts were determined, along with impacts over the long-term (10,000 years)

- Land Use
- Water Quality
- Geologic Resources
- Ecological Resources
- Socioeconomics
- Cultural Resources Impacts
- Traffic and Transportation
- Noise
- Resource Commitments
- Human Health and Safety
- Aesthetic and Scenic Resources
- Environmental Justice

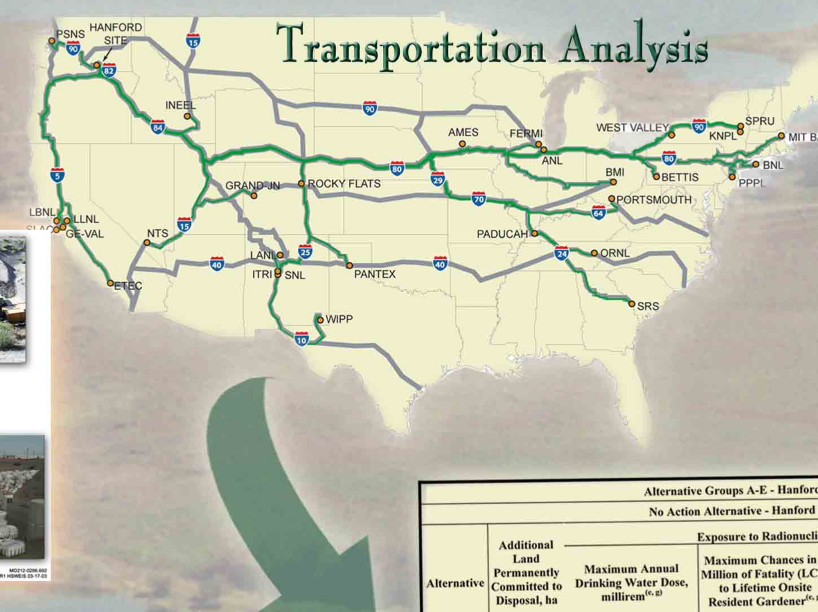
Cumulative Impacts Analysis



Groundwater Modeling and Impact Analysis



Transportation Analysis



Long-Term Impacts

Alternative Groups A-E - Hanford Only to Upper Bound Waste Volume[a]
No Action Alternative - Hanford Only to Lower Bound Waste Volume[b]

Alternative	Additional Land Permanently Committed to Disposal, ha	Maximum Annual Drinking Water Dose, millirem[e, g]: 200 Areas[f]	Near River	Maximum Chances in a Million of Fatality (LCF) to Lifetime Onsite Resident Gardener[e, g]: 200 Areas[f]	Near River	Maximum Chances in a Million of Fatality (LCF) for Lifetime Onsite Resident Gardener with Sauna/Sweat Lodge[e, g]: 200 Areas[f]	Near River	Fatalities (LCFs) in Populations over 10,000 years[d]: Tri-Cities	Portland	Waste Site Intruder Maximum Risk of Fatality at 100 Years After Closure[e]: Drilling	Excavation[h]
Group A	38-47	0.4	0.05	60	6	3000	200	0	0	4 in 100	Not Applicable
Group B	56-80	0.4	0.04	50-60	6-7	7000-8000	200-300	0	0	4 in 100	Not Applicable
Group C	20-29	0.4	0.04-0.05	60	6-7	3000	200	0	0	4 in 100	Not Applicable
Group D1	19-25	0.2	0.05	20-30	7-8	2000	200	0	0	4 in 100	Not Applicable
Group D2	19-25	0.2	0.06	30	8-9	4000	200	0	0	4 in 100	Not Applicable
Group D3	19-25	0.3-0.4	0.05	50	6-7	3000-4000	200	0	0	4 in 100	Not Applicable
Group E1	19-25	0.2	0.06	30	8-9	3000	200	0	0	4 in 100	Not Applicable
Group E2	19-25	0.2	0.04	30	5	3000	200	0	0	4 in 100	Not Applicable
Group E3	19-25	0.3-0.4	0.04	50	6	2000	200	0	0	4 in 100	Not Applicable
No Action	86-95[c]	0.4-0.5	0.04	50-140	5	10,000-20,000	600	0	0	4 in 100	Likely Fatality

(a) Where a single value is given it is essentially the same for the Hanford Only and Upper Bound waste volumes.
(b) Where a single value is given it is essentially the same for the Hanford Only and Lower Bound waste volumes.
(c) Includes additional land for long-term storage of waste that cannot be treated or processed for disposal.
(d) Zero inferred latent cancer fatalities. Assumed populations; Tri-Cities – 125,407; Portland – 538,180.
(e) Risk value given assumes that the event takes place; i.e., active institutional controls are not maintained after 100 years.
(f) Results presented are for a location within the 200 Areas having the highest radionuclide concentrations along a line of analysis 1-km downgradient from HSW disposal facilities. Sensitivity cases were also evaluated to determine the relationship of concentrations at the 1-km location to those at the waste management area or facility boundaries. The results of those analyses are presented in Volume I, Section 5.3.
(g) Differences in impacts compared with those presented in the revised draft EIS reflect additional mitigation to reduce the release and transport of contaminants resulting from assumed disposal of some forecast MLLW using higher integrity containment, such as HICs, macroencapsulation, and in-trench grouting.
(h) Excavation is not considered to be a reasonably foreseeable scenario for the action alternative groups because the depth of the barrier placed over disposal facilities at closure is greater than the depth of a typical basement excavation for a residence. The dose estimated for this scenario in the No Action Alternative likely would lead to fatality.

Operational Impacts

Alternative Groups A-E - Hanford Only to Upper Bound Waste Volume[a]
No Action Alternative - Hanford Only to Lower Bound Waste Volume[b]

Alternative	Normal Operations – Chances of Latent Cancer Fatality: Lifetime Exposure of Maximally Exposed Individual: Public	Non-Involved Workers	Latent Cancer Fatalities (LCFs) Among Population within 80 km Lifetime Exposure	Latent Cancer Fatalities (LCFs) from Collective Radiation Exposure of Workers	Fatalities from Operational Accident Having Largest Consequences: Beyond-Design-Basis Earthquake at CWC[c]: Public	Non-Involved Workers[e]	Transportation – Incident-Free Onsite, from Offsite, for Offsite Treatment, & TRU Waste to WIPP: Includes Transport Crew, Public, and Non-Involved Workers, Fatalities[d]	# Accidents/# Fatalities from Accidents: Onsite, from Offsite, for Offsite Treatment, and TRU Waste to WIPP[d]	LLW, MLLW & TRU Waste Within Oregon State Only[f]	LLW, MLLW & TRU Waste Within Wash. State Only[f]	TRU Waste to WIPP	Shrub-Steppe Habitat Disturbed, ha	Geologic Resources Committed (sand, gravel, silt/loam, and basalt), millions of m³[g]	Diesel Fuel Committed Thousands of m³	Cost in Billions of 2002 Dollars
Group A	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	32	4.0-4.2	133 - 134	3.7-4.0
Group B	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-10	22/1-74/2	1/0-5/0	0/0-2/0	17/1	0	4.4-4.9	137 - 141	3.8-4.2
Group C	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	14	3.7-4.0	66 - 67	3.5-3.9
Group D1	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	19 - 25	3.7-3.9	66 - 67	3.2-3.5
Group D2	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	0	3.9-4.0	66 - 67	3.2-3.5
Group D3	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	0	3.7-3.9	66 - 67	3.2-3.5
Group E1	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	0	3.7-3.8	66 - 67	3.4-3.8
Group E2	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	5 - 11	3.7-3.8	66 - 67	3.4-3.8
Group E3	<1/million	<1/million	0 (<0.001)	0 (<0.5)	30	1	6-9	23/1-75/3	1/0-5/0	0/0-2/0	17/1	14	3.7-3.8	66 - 67	3.4-3.8
No Action	<1/million	<1/million	0 (<0.001)	1 (0.5)	30	1	2-2	10/0-13/0	1/0-1/0	0/0-0/0	8/9	10	2.7	189	3.5-3.5

(a) For the action alternative groups, values represent the range for the Hanford Only to Upper Bound waste volume. Where a single value is given, the value applies to both Hanford Only and Upper Bound waste volumes. Values for health effects are rounded to the nearest whole number; values less than 0.5 are presented as zero.
(b) For the No Action Alternative, values represent the range for the Hanford Only to Lower Bound waste volume. Where a single value is given, the value applies to both Hanford Only and Lower Bound waste volumes. Values for health effects are rounded to the nearest whole number; values less than 0.5 are presented as zero.
(c) Unlike the action alternative groups where the risk of this accident would be over about 43 years, risk for the No Action Alternative would continue as long as waste is stored in CWC.
(d) Values are for Lower to Upper Bound waste volumes. The first value applies to the accidents and fatalities for the Lower Bound waste volume; the second value applies to the Upper Bound waste volume.
(e) The value shown is the probability of an LCF based on the estimated dose from the accident – the number of such non-involved workers is unknown, but likely would range from none to no more than 5. For the "involved" worker(s) that might be in a CWC building during such an event the consequences could range from none to several fatalities from collapse of the building.
(f) Consists of inferred fatalities from radiation exposure and vehicular emissions. In the final HSW EIS all offsite transport is addressed, including transport of TRU waste to WIPP and the entire transportation route for offsite waste sent to Hanford.
(g) As a result of refined calculations of resource needs based on the Technical Information Document (FH 2004), the need for gravel and sand, silt/loam, and basalt for action alternative groups increased by factors of approximately 1.8, 2.6, and 1.2, respectively, over those reported in the DEIS.

Recommendations

Recommendations and Conclusions

- Our analysis demonstrates that implementing any of the action alternatives (to operate existing and new facilities for the safe treatment, storage, and disposal of solid radioactive wastes and then to close those facilities) would not have adverse physical effects on populations using the Columbia River downstream of the Hanford Site.
- In general, the proposed action would potentially result in small, short-term public health and worker safety impacts due primarily to the transportation of waste, industrial accidents, and occupational exposure to radiation, regardless of the alternative group chosen for implementation.

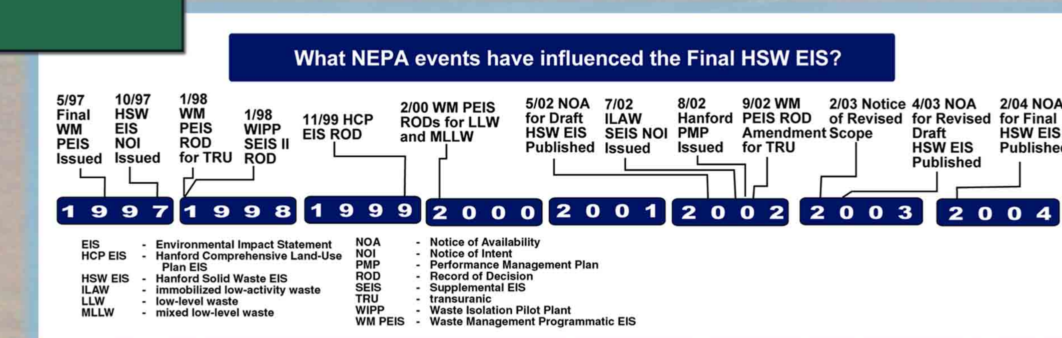
First Draft April 2002

Revised Draft March 2003

Final EIS January 2004

HSW EIS (1997–2004)—Vital Statistics

The final EIS (January 2004) was over 4,000 pages long, encompassed in five volumes. Adding the first two public-comment drafts to the mix (published in April 2002 and March 2003, respectively) brings the total page count to nearly 10,000. In all, twelve public meetings were held throughout the Northwest to obtain public input on the HSW EIS. For the final HSW EIS, over 1,200 copies were distributed to interested parties.



Preferred Alternative

The preferred alternative is Alternative Group D1:

Storage: The Central Waste Complex would continue as the primary storage facility for LLW, MLLW, and TRU waste. The storage of retrievably stored TRU waste in the Low Level Burial Grounds would continue until retrieval operations are complete.

Treatment: LLW and MLLW would be treated using a combination of existing capabilities and processes, offsite commercial capabilities, and a modified T Plant. TRU waste would be processed and certified using a combination of the Waste Receiving and Processing Facility, a modified T Plant, and the modular facilities.

Disposal: LLW, MLLW, ILAW, and melters would be disposed of in a new modular facility. This new disposal facility would include a regulatory compliant liner and a leachate collection system. When this facility is closed it would be capped with a regulatory acceptable cover. Existing LLBGs would continue to be used until the new disposal facility is available and then would be similarly capped.

Development of the Final HSW EIS has been a difficult and challenging endeavor, requiring close interaction with various federal agencies, regulators, stakeholders, area tribal nations, and the public

Public & Stakeholder Concerns/Areas of Controversy

Comments were received on both drafts, 12 public meetings were held, and all comments were considered and dispositioned in the updates of the HSW EIS

- Disagreement over the *importation of offsite waste* to Hanford, including the risk of transporting this waste
- Concerns about potential *impacts to the groundwater* and compliance with groundwater protection standards
- Concerns over the *scope and alternatives of the HSW EIS*, particularly related to uncertainty of chemical inventories in existing buried waste, continued use of unlined trenches, alternative ILAW waste forms, tank residuals, and cumulative impacts
- Health safety and regulatory concerns regarding *long-term impact calculations*, modeling approaches, and compliance with NEPA requirements
- Public involvement concerns, including the length of time for public comment and DOE's commitment to openness and *public involvement* during the decision-making process.

DOE is actively developing the associated Records of Decision resulting from the final HSW EIS and expects to issue them in 2004.