5.0 Areas of Controversy

There are areas relevant to alternatives considered in this EIS, where viewpoints may differ among members of the public, technical experts, the State of Idaho, or DOE. These controversies, described below, ***were*** not resolved in the course of preparing this EIS and ***may not be resolved before*** issuing a Record of Decision.

5.1 *Mixed Low-level/* Low-level Waste Disposal Locations

At the time of publication of the Draft EIS, DOE had not yet specified disposal sites for mixed low-level waste and low-level waste in a Record of Decision that was being developed for the Waste Management Programmatic Environmental Impact Statement (DOE/EIS-0200). On February 25, 2000 (65 FR 10061), DOE issued its Record of Decision to establish regional mixed low-level waste and low-level waste disposal at Hanford and the Nevada Test Site. In addition, DOE decided to continue, to the extent practicable, to dispose of low-level waste onsite and acknowledges the potential use of commercial mixed low-level and low-level waste disposal facilities.

Onsite disposal of mixed low-level waste or low-level waste generated from treatment of mixed transuranic waste/SBW and/or calcine at the INEEL is an area of controversy, as discussed in the Foreword to this EIS prepared by the State of Idaho.

5.2 Repository Capacity - Metric Tons of Heavy Metal

Space in the proposed spent nuclear fuel/HLW repository is allocated by MTHM, and DOE has allocated 4,667 MTHM for its HLW. Under DOE's current method of calculating the amount of MTHM in a canister of HLW, however, half of the DOE HLW inventory would not be accepted for disposal in the proposed repository and would have to remain in storage. DOE has not identified the order in which sites that currently manage DOE-owned HLW would send canisters to the repository.

As described in Section 6.3.2.4 of the EIS, there are other methods for calculating MTHM equivalency that would result in a calculated quantity of MTHM that would be within the current allocation. The State of Idaho has urged DOE not to use the current method for calculating MTHM because, in the State's view, the current method overestimates the MTHM in DOE HLW. Instead, the State advocates that DOE use one of two other approaches to calculating MTHM, either one of which, in the State's view, better reflects the relative risk and actual concentrations of radionuclides in DOE HLW. Under either of the two approaches advocated by the State, ***DOE's HLW*** would be within the current allocation for the proposed repository.

DOE discusses the various methods for calculating MTHM equivalency in the ***Final*** *Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250).

5.3 Differences in Flood Studies

DOE and RCRA facility siting requirements usually restrict construction of waste management facilities within a floodplain. Two studies were completed to evaluate potential flood hazards at INTEC: one by the U.S. Geologic Survey and the other by the U.S. Bureau of Reclamation. These analyses showed differing results, ***both of which were included in the Draft EIS for public review and comment. Since publication of the Draft EIS, DOE has submitted a floodplain determination to the State of Idaho for RCRA permitting purposes based on the flood study by Koslow and Van Haaften. DOE will complete further studies in coordination with the U.S. Geological Survey and the U.S. Bureau of Reclamation to refine the projected 100-year and 500-year flood elevations and to make a final floodplain determination. DOE will consider the results of these studies in compliance***

with its floodplain environmental review requirements (10 CFR Part 1022), and in compliance with the State of Idaho RCRA regulations, as appropriate.

6.0 Conclusions of Analysis

6.1 Overview

Implementing the alternatives considered in this EIS could result in impacts to public health and the environment from processing HLW and disposition of associated facilities at INTEC. The purpose of analyzing these potential impacts is to give decision-makers and the public information they can use to understand and compare the environmental consequences of alternative courses of action.

For this EIS, DOE assessed the environmental impacts for 14 areas of interest for the waste processing alternatives and the facility disposition alternatives. ***A comparison of impacts for the five key areas of interest discussed in this section is provided in Table S-2 following Section 6.5 of this Summary***. In 9 of the 14 areas, the results indicate little or no impacts as follows:

Land Use – Estimated land use would be consistent with the *INEEL Comprehensive Facility and Land Use Plan*. The maximum additional amount of land that would be converted to industrial use at the INEEL ***under the alternatives analyzed in this EIS*** would be 22 acres. At Hanford, ***approximately 50*** additional acres could be converted to industrial use in the 200 East Area. At both sites, this additional disturbance would be less than 1 percent of the area currently used for industrial purposes.

Socioeconomics – DOE anticipates that total INEEL employment will continue to decline. Future changes in employment as a result of activities described in this EIS would be within the normal range of INEEL workforce changes, and would represent a continuation of current site employment that might otherwise be lower. Other activities at INTEC not related to alternatives discussed in this EIS would take place intermittently and would also be within normal workforce fluctuations.

Cultural Resources – The majority of INEEL activities resulting from the Proposed Action would occur in previously disturbed areas. ***Standard*** measures are in place to help prevent impacts to cultural resources that may be discovered during site development.

Aesthetic and Scenic Resources – DOE would undertake construction activities associated with any waste processing alternative or treatment option in a manner compatible with the general INEEL setting and with the Bureau of Land Management Visual Resource Management class designation for the area. Operational impacts for any of the alternatives and options are estimated to be small.

Geology and Soils – Geologic materials (soils and gravel) required for any of the waste processing or facility disposition alternatives would be obtained from existing onsite sources. DOE estimates that impacts to geologic resources would be small.

Water Resources (Usage) – Total INEEL water consumption ***from activities resulting from the bounding alternative (Hot Isostatic Pressed Waste Option) could increase by as much as 93 million gallons per year during operations.*** This usage represents an increase of ***20*** percent of water withdrawn by the INEEL from the Snake River Plain Aquifer relative to ***1996*** usage. ***INEEL water use would be well below the consumptive use water rights of 11.4 billion gallons per year.***

Ecological Resources – DOE estimates that impacts to ecological resources for the waste processing and facility disposition alternatives would be small and there would be no impact to threatened or endangered species or critical habitats. Most activities would take place in heavily developed industrial areas that have marginal value as wildlife habitat.

Environmental Justice – Impacts from proposed waste processing alternatives and treatment options, under all alternatives, would not result in high and adverse impacts on the population as a whole. Further, DOE did not identify means

Populations

Minority: individuals who are American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. For this EIS, a minority population is one in which the minority population exceeds 50 percent, or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

Low income: individuals with an income below the poverty level defined by the U.S. Bureau of the Census. A low-income population is one in which 25 percent or more of the persons in the population live in poverty.

for minority or low-income populations to be disproportionately affected. Accordingly, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

Utilities and Energy - ***Annual use of fossil fuel could increase by as much as 6.3 million gallons and electricity use could increase by as much as 52,000 megawatt-hours.*** Annual usage of electricity in ***megawatt-hours*** per year could increase by ***59*** percent relative to the 1996 INEEL baseline. This increase and the baseline together are less than one-third of the INEEL electric system capacity.

6.2 Impacts of the Waste Processing Alternatives

Most of the actions to implement the waste processing alternatives would occur before 2035, as would many of their associated impacts. After 2035, environmental impacts would result mainly from storing waste. In 5 of the 14 areas analyzed, the results indicate some impacts, although they are generally small. These areas include air, traffic and transportation, health and safety, waste and materials, and facility accidents.

6.2.1 AIR RESOURCES

Impacts to air resources could result from construction activities and normal operations for the waste processing alternatives.

Construction

The primary impact of construction activities would involve the generation of fugitive dust, which would include respirable particulate matter. While dust generation would be mitigated by the application of water and soil additives, relatively high levels of particulates could still occur in localized areas. ***The annual average concentrations are estimated to be as high as 1 and 5 percent of the applicable standard for respirable particulate matter at the INEEL boundary nearest to the construction site and at public road locations, respectively.*** Levels of all other criteria pollutants are predicted to be small fractions of applicable standards.

Construction activities at the Hanford Site would produce nitrogen dioxide levels that are estimated to be 8 percent of the Federal and State of Washington ambient air standard. All other pollutants are estimated to be less than 1 percent of applicable standards. Respirable particulate matter is not expected to exceed 16 percent of Federal or state standards.

Normal Operations

Waste processing and related activities would result in emissions through filtered exhaust systems at INTEC. ***Table S-2*** compares total radiological air impacts to the maximally exposed offsite individual, ***noninvolved worker, and to the general population.*** The annual collective dose to the surrounding population (persons residing within a 50-mile radius of INTEC) is estimated ***to*** be ***0.11*** person-rem per year ***or less*** under all alternatives. Offsite doses would be mainly attributable to the intake of iodine-129 through the food-chain pathway.

Nonradiological air emissions would be highest for the Full Separations, Planning Basis, Hot Isostatic Pressed Waste, ***and Vitrification with Calcine Separations*** Options. These emissions would result from fossil fuel consumption to meet the energy requirements (steam) of the waste processing facilities. All levels would be well below applicable standards. Prevention of Significant Deterioration regulations require that agencies evaluate new projects to see if they increase air pollution levels. These regulations apply to radioactive and nonradioactive ***pollutants***. The Planning Basis Option poses the highest impact due to emissions of sulfur dioxide, which would use up ***40*** percent of the release increment allowed for this pollutant in a 24-hour period ***at Class I areas*** under the regulations. This includes baseline sources and planned future projects. Concentrations would be well within allowable limits for all waste processing alternatives.

Emissions of fine particulate matter and nitrogen dioxide can also affect visual resources. Conservative screening-level analyses were applied to estimate potential impacts related to visibility degradation at the Craters of the Moon Wilderness Area, about ***27*** miles ***west***-southwest of the ***INTEC***. The results indicate that there would be no perceptible changes in contrast for all alternatives, but potential changes related to color shift could result. These would be well within the acceptable visibility criteria for a Class I area. ***For the Final EIS, a different method was used to model visibility impacts at Craters of the Moon Wilderness Area and Yellowstone and Grand Teton National Parks. With these new methods, the Planning Basis Option (a bounding option for air quality impacts) could result in a small exceedance of the 5 percent acceptance criterion for the light extinction change for 8 days in a 5-year period. Based on recommendations from the National Park Service, DOE used the CALPUFF model to assess long-range impacts (for 50 kilometers and beyond of the release).***

What is a rem?

A unit of radiation dose.

Waste processing ***and facility disposition*** activities analyzed in this EIS could result in radiation exposures to workers and the public during operations. Additional radiation exposures could result from facility accidents. Any radiation exposures from waste processing ***and facility disposition activities*** would be in addition to exposures that normally occur from natural sources such as cosmic radiation (involuntary exposure) and artificial sources such as chest x-rays (voluntary exposure).

The effects of radiation exposure on humans depend on the kind of radiation received, the total amount absorbed by the body, and the tissues involved. A rem is calculated by a formula that takes these three factors into account. The average individual in the United States receives a dose of about 0.36 rem or 360 millirem per year from natural and medical sources combined.

What is a person-rem?

A unit of collective radiation dose.

The collective dose to an exposed population (or population dose) is calculated by summing the estimated doses received by each member of the exposed population. The total dose received by the exposed population over a given period of time is measured in person-rem. For example, if 1,000 people each received a dose of 1 millirem (0.001 rem), the collective dose would be 1,000 persons × 0.001 rem = 1.0 person-rem. Alternatively, the same collective dose (1.0 person-rem) would result from 500 people each of whom received a dose of 2 millirem.

6.2.2 TRAFFIC AND TRANSPORTATION

Transportation is a factor in alternatives that involve construction and operation of facilities and the shipment of waste both on and offsite. Transportation impacts could result from radiation exposure during normal, incident-free transportation or from accidents, as well as from nonradiological vehicle-related accidents.

During incident-free transportation of radioactive waste, the population living and traveling along the transport route and the transportation workers would be exposed to radiation from the shipments. The total latent cancer fatalities for the shipments would be the sum of the estimated number of radiation-related latent cancer fatalities for transportation workers and the general population. ***Table S-2*** compares the estimated latent cancer fatalities to transportation workers and the public for truck transportation of radioactive materials over the life of the alternatives. Rail shipment impacts for transportation of radioactive materials are about 10 times lower than truck transportation-related impacts.

Table S-2 compares the estimated total fatalities due to vehicle accidents assumed to occur during shipment of radioactive wastes. ***New information indicates that vitrification of INEEL mixed HLW at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the Draft EIS. Table S-2 presents the revised transportation impacts for the Minimum INEEL Processing Alternative associated with this larger vitrified waste volume.***

6.2.3 HEALTH AND SAFETY

Waste processing activities can result in health and safety impacts to the public and workers. This EIS evaluates the following types of health impacts:

- Radiological health impacts
- Nonradiological health impacts from carcinogenic and toxic air pollutants
- Occupational health and safety impacts for workers, based on historical injury and illness rates.

Construction Impacts

All alternatives would result in some amount of radiation exposure to construction workers. Most of the waste processing alternatives and treatment options would result in similar levels of total collective worker dose ranging from an estimated ***37*** to ***200*** person-rem. The highest collective dose would occur under the ***Planning Basis and Direct Cement Waste Options***. DOE estimates that this would result in ***0.078*** latent cancer fatality for these ***options***.

Nonradiological emissions associated with construction activities would result primarily from fugitive dust caused by the disturbance of land and from the combustion of fossil fuels in construction equipment. DOE has evaluated the potential impacts from these sources and has concluded that construction-related impacts to workers from criteria pollutant emissions are expected to fall within applicable standards, as discussed in the air quality section of this EIS.

The highest total number of total recordable cases ***(includes work-related death, illness, or injury)*** during construction is estimated at ***230 for the Minimum INEEL Processing Alternative (at Hanford), 200*** for the Planning Basis Option, ***and 190*** for the Full Separations Option, because of the large number of total worker hours associated with these options.

Normal Operations

During normal operations, waste processing and related activities at INTEC would result in releases of radionuclides to the atmosphere, but there would be no discharge of radioactive liquid effluents under any of the waste processing alternatives or treatment options that would result in offsite radiation doses. Therefore, DOE only

What is a latent cancer fatality (LCF)?

Normal operations and accidents that could result in a release in radioactivity pose a hazard to the population exposed to such a release. LCFs measure the expected number of additional cancer deaths in a population as a result of a given exposure to ***cancer causing agents such as*** radiation. Death from cancer as a result of exposure to radiation may occur at any time after the exposure takes place. Other health effects that could result from exposure to radiation include non-fatal cancers and genetic defects in the future population. This EIS focuses on LCFs as the primary health risk from radiation exposure and estimates LCFs as the basis for comparing radiation-induced impacts among alternatives.

How is an LCF calculated?

Radiation Dose: Radioactivity from all sources combined, including natural background radiation and medical sources, produces about a 0.36 rem dose to the average individual per year.

Probability: The probability of receiving the above dose is essentially 100 percent.

Average lifetime: The average lifetime is considered to be 72 years .

Lifetime dose: Over 72 years, an individual would receive 72 years x 0.36 rem per year or approximately 26 rem.

Population dose: If 1,000 individuals each receive 26 rem, then the so-called collective dose or dose to the population is 1,000 persons x 26 rem or 26,000 person-rem.

Risk factor: The International Commission on Radiological Protection has determined that for every person-rem of collective dose, approximately 0.0005 individuals from the general public could ultimately develop a radiologically induced fatal cancer.

Estimation of LCFs: For a population exposed to a release of radioactive material (such as from a facility accident), LCFs are estimated by multiplying the resulting dose to the population (in person-rem) by a factor of 0.0005 LCF per person-rem. For the example resident population of 1,000 individuals receiving a population dose of 26,000 person-rem from all anticipated sources, the number of resulting LCFs would be estimated as 26,000 person-rem X 0.0005 LCF per person-rem, or 13 LCFs. For a hypothetical facility accident that results in a population exposure of 5,000 person-rem, the number of resulting LCFs would be estimated as 5,000 person-rem X 0.0005 LCF per person-rem, or 2.5 LCFs. The total estimated health effects in a population as a result of a given exposure to radiation can be estimated by multiplying the estimated LCFs by 1.46 based on data also provided by the International Commission on Radiological Protection.

Per Capita Population Risk: Dividing the anticipated LCFs from a radioactive release by the affected population provides a perspective on the relative per capita increase in cancer risk to that population. For the example resident population of 1,000 individuals, the hypothetical facility accident that results in 1 LCF, poses an additional per capita risk to the resident population of 0.001, or one in a thousand.

Individual Risk: Although the radiation risk data presented above, strictly apply only to large populations of individuals, mathematically one can calculate the increase in risk of cancer to an individual by multiplying the dose to that individual as a result of an exposure to radiation by 0.0005.

Sometimes, calculations of the number of LCFs associated with radiation exposure do not yield whole numbers, and especially in environmental applications, may yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total dose of 0.001 rem, the collective dose would be 100 person-rem and the corresponding estimated number of LCFs would be 0.05 (100,000 persons x 0.001 rem x 0.0005 LCF per person-rem). How should one interpret a number of LCFs **less than 1**, such as 0.05? The answer is to interpret the result as a statistical estimate. That is, 0.05 is the average number of deaths that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur an LCF from the 0.001 rem dose each member would have received. In a small fraction of the groups, 1 LCF would result; in exceptionally few groups 2 or more LCFs would occur. The average number of deaths over all of the groups would be 0.05 LCF (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome for any single group is 0 LCFs.

calculated potential health effects from airborne releases of radioactivity. ***Based on the annual air impacts data, the health effects over the life of each alternative, in terms of latent cancer fatalities, were estimated. These calculated results are provided in Table S-2.***

DOE also evaluated the potential carcinogenic and noncarcinogenic ***toxic*** effects of nonradiological emissions during waste processing operations. For the individual ***toxic air pollutants***, the maximum concentrations for each of the pollutants occur most frequently from the Planning Basis Option. However, all hazard quotients are estimated to be much less than 1.0, indicating no expected adverse health effects.

The highest carcinogenic air pollutant impacts are projected for those options that involve the greatest amount of fossil fuel combustion, most notably the Planning Basis Option. For this option, nickel concentrations are estimated to be as high as ***10*** percent of the State of Idaho standard at the INEEL boundary. All other carcinogens are expected to be at very low levels and would have correspondingly low health impacts.

The highest total number of total recordable cases (includes work-related death, illness, or injury) during operations is estimated at 480 for the Planning Basis Option and 400 for the Full Separations Option, because of the large number of total worker hours associated with these options.

6.2.4 WASTE AND MATERIALS

This EIS examines impacts associated with the generation of both radioactive and nonradioactive wastes resulting from construction and waste processing operations. ***Process waste streams may include industrial waste, hazardous waste, mixed low-level waste, and low-level waste.*** Industrial wastes are neither radioactive nor hazardous and are disposed of onsite.

Construction activities produce relatively little radioactive and hazardous waste. The greatest construction impacts for a waste processing alternative would ***depend on the process waste type considered. For industrial waste and hazardous waste, the Planning Basis Option produces the most waste at*** $\boldsymbol{6.0 \times 10^4}$ ***and 880 cubic meters, respectively. For low-level waste, the Vitrification with Calcine Separations Option generates the most at 1,700 cubic meters. For mixed low-level waste, nearly all alternatives and options produce the same amount at 1,100 cubic meters. Table S-2*** presents the total process waste volumes that would result for the operations period for all waste processing alternatives.

The No Action Alternative would leave approximately ***4,400*** cubic meters of mixed HLW calcine in the bin sets and ***1.0*** million gallons of mixed transuranic waste/SBW in the Tank Farm. The Continued Current Operations Alternative would calcine the mixed transuranic waste/SBW and empty the Tank Farm tanks down to the heels. This alternative would leave approximately 6,000 cubic meters of calcine in the bin sets.

Product wastes are the manufactured product resulting from treating and preparing the INTEC wastes for disposal. Product wastes may include grouted low-level waste, transuranic waste, canned calcine, or treated HLW. Table S-2 presents and compares the total product waste volumes that would result from each of the waste processing alternatives. DOE obtained updated information indicating that vitrification of INEEL mixed HLW at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the Draft EIS. Under the Minimum INEEL Processing Alternative, DOE had estimated that 730 cubic meters of vitrified mixed HLW would be produced and transported back to the INEEL. After the Draft EIS was issued, DOE Richland identified that their process for treating the INTEC HLW calcine would change. This change included dissolution of the calcine and raising the pH to 12 to be compatible with their process. This change resulted in an increase of the vitrified product. Based on this information, DOE now estimates that 3,500 cubic meters of vitrified mixed HLW would be produced under that alternative. Table S-2 presents revised product waste volumes for the Minimum INEEL Processing Alternative.

Accident

An unplanned, unexpected, and undesired event ***that can*** occur during ***or as a result of implementing an EIS alternative and*** that has the potential to ***impact human health*** and the environment.

Accident Scenario

A set of ***causal*** events starting with an ***accident*** "initiating event" that ***can*** lead to ***a*** release of radioactive or hazardous materials with the potential to cause injury or death.

Reasonably Foreseeable Accident

An accident scenario that does not require extraordinary initiating events or unrealistic assumptions about the progression of events or the resulting releases.

Bounding Accident

The reasonably foreseeable accident ***with*** the ***largest*** impact ***on*** human health ***in each frequency category*** for ***each*** alternative.

Bounding Accident Risk Estimation

Risks due to accidents are estimated very conservatively in this EIS. In estimating the frequency and severity of bounding accidents, no credit was taken for engineered safety systems and design features that would be incorporated in an actual facility, ***nor for other mitigating measures such as emergency response or personnel evacuations.***

Likewise, human health impacts from releases of radioactivity were ***conservatively*** estimated ***by locating hypothetical receptors close to sources and by*** using very ***conservative*** meteorological assumptions. Although this approach overstates the risk of accidents, it provides a level of certainty that the estimated risks reported in this EIS are not likely to be exceeded and it provides a viable basis for comparing one alternative to another.

6.2.5 FACILITY ACCIDENTS (OFF-NORMAL OPERATIONS)

A potential exists for accidents at facilities associated with the treatment, storage, and disposal of radioactive and hazardous materials. Accidents can be categorized into events that occur (a) more frequently than once in a thousand years (abnormal event), (b) less frequently than once in a thousand years but more frequently than once in a million years (design basis event), or (c) less frequently than once in a million years (beyond design basis events).

Two events involving the long-term degradation and eventual failure of the underground tanks and a calcine bin set ***could occur under*** the No Action and Continued Current Operations Alternatives. Under these alternatives, mixed transuranic waste/SBW and/or mixed HLW calcine are stored indefinitely and it can be assumed that over time the radioactive and hazardous materials would be released into the environment. However, there are also bounding accident scenarios ***(see definition in text box)*** associated with these alternatives, including the seismic rupture of an underground tank or bin set and the failure of a bin set due to flooding, which are discussed below with other selected waste processing alternative accidents.

In discussing anticipated risks posed by potential accidents, it should be noted that the longer an operation continues, the longer the window of vulnerability and the larger the probability that the accident will eventually occur. Therefore, No Action and Continued Current Operations Alternatives that do not result in road-ready waste and involve the storage of this waste at INTEC for an indefinite period of time, exhibit the longest window of vulnerability and therefore the highest anticipated risk. In fact, the probability of the bounding ***abnormal*** accident for the No Action and Continued Current Operations Alternatives ***is*** a factor of ***nine*** more likely than the comparable ***abnormal*** accidents for other alternatives that place waste in a road-ready form over ***a 35-year period.***

Bounding accidents for the No Action and Continued Current Operations Alternatives also produce large releases due to long-term degradation impacts on facility safety features.

For all waste processing alternatives, accidents have been analyzed according to the frequency range of the event. Bounding accidents, in terms of radiological dose to workers or the public or in terms of release of hazardous materials, are discussed below along with other accidents that were selected based on their potential impacts to workers, the public, or the environment. Additional information on postulated accidents is provided in Table S-2.

- ***An external event results in a release from the Vitrification Facility (Beyond Design Basis Event).***

  The overall bounding accident involves ***an external event resulting in a release from*** the Vitrification Facility that would be built and operated as part of the Full Separations and Planning Basis Options. For this event, the analysis predicted a dose of ***150,000*** person-rem to the offsite population within 50 miles of INTEC. This could result in up to ***76*** latent cancer fatalities due to air impacts for the exposed population. ***Should this accident occur under the Direct Vitrification Alternative (Vitrification with Calcine Separations), the results would be equivalent.***

  This accident would release molten glass fines associated with the vitrification process and, while the accident ***would*** result in an offsite impact, long-term environmental impacts would be limited by rapid solidification of the molten material. Most of the molten glass released during this type of accident would be deposited on the ground near the vitrification facility. Leaching of contaminants into the soil would be minimal, allowing for expedited mitigation and cleanup. The molten waste is in a very concentrated form, however, and, if released, would present a significant impact to both workers and to offsite populations if not remediated.

  Another design basis accident, an external event associated with a calcine bin set, could result in a bin set failure. The analysis predicts that this accident would result in less severe consequences than the above event.

- ***An earthquake breaches an underground waste storage tank full of mixed transuranic waste/SBW, releasing contents to the soil and contaminating the groundwater (Design Basis Event).***

  The No Action Alternative would continue to store mixed transuranic waste/SBW in the underground storage tanks at INTEC. For purposes of analysis, this EIS conservatively assumes that an earthquake occurs in the year ***2001***, rupturing a full storage tank. (In actuality, the likelihood of this design basis accident is less than once in 10,000 years.) The analysis for a single tank failure predicts a release of iodine-129 to the groundwater that is estimated ***to reach 13 percent of*** the EPA maximum contaminant level (i.e., as allowed for drinking water resources) assuming no mitigation takes place.

- ***A flood induced failure of a bin set causes a release of stored calcine (Design Basis Event).***

  This accident is assumed to cause failure of a bin set and release stored calcine to the environment. For this postulated event, the estimated dose to the population within 50 miles of INTEC is ***57,000*** person-rem. This could result in ***29*** latent cancer fatalities.

- ***A degraded bin set fails in a seismic event after 500 years (Abnormal Event).***

  This accident is assumed to cause failure of a bin set and release stored calcine directly to the environment. For this postulated event, the estimated dose to the population within 50 miles of INTEC is 530,000 person-rem. This could result in 270 latent cancer fatalities. The accident is more likely than either of the design basis events or the beyond design basis event described above. Further, the impacts are larger than the above events due to the amount of material assumed to enter the environment during the accident.

Either long-term degradation of the calcine bin sets, a seismic event, an ***external event***, or a flood could disperse mixed HLW calcine into the environment by air or water. Although the primary, short-term impact to the maximally exposed individual and the public would be from airborne contamination, the released calcine could be deposited onto soils surrounding the bins or move with the surface water runoff to low-lying areas, and some fraction of the calcine fines could resuspend in the air directly or as a result of water evaporation. Direct ground contamination from mixed HLW calcine could be expected within a few miles of the INEEL. Calcine could also slowly dissolve and release some contaminants to the groundwater. However, most of the available contaminants would be bound up in the first few feet of the soil column. Iodine-129 and plutonium could migrate to the groundwater over a very long period of time. Any groundwater impacts would be much lower than those analyzed for other accidents such as the seismic induced failure of a storage tank full of mixed transuranic waste/SBW.

- ***A criticality occurs due to mishandling of transuranic waste (Design Basis Event).***

  Both the Transuranic Separations Option and the Minimum INEEL Processing Alternative have the potential for a nuclear criticality accident. In both cases there is a low probability that the mishandling of transuranic waste in storage containers could result in a criticality. This accident could result in a large dose to a nearby, unshielded worker that is estimated to be 218 rem, representing an increased risk ***for the worker*** of developing a latent fatal cancer of 1 in 5. For this accident, the dose to the maximally exposed individual at the site boundary is estimated to be 3 millirem.

- ***A 15,000 gallon inventory of stored kerosene located at INTEC to support operations of the New Waste Calcining Facility is spilled (Abnormal Event).***

  This event is estimated to cause peak benzene groundwater concentrations of 24 times the EPA maximum contaminant level, or 120 micrograms per liter. Such a release would also be the maximum reasonably foreseeable hazardous material accident, but no fatalities would be expected. The benzene component of the kerosene could reach the groundwater under normal precipitation conditions in about 200 years. A less probable occurrence would be an ***external event affecting*** both kerosene storage tanks ***creating a 30,000-gallon spill.*** This beyond design basis event is estimated to cause a peak benzene groundwater contamination of 180 micrograms per liter.

  In both of these cases the ***15,000-gallon tank of*** kerosene was assumed to spill and form a pool about 3 inches deep. After pooling, the kerosene could seep into the available soil pore space to a depth of about 16 inches and could cover an area about 100 to 150 feet in diameter. It is estimated that the soil concentration could approach 100 milligrams of kerosene per kilogram of soil. If the kerosene spill were not remediated, it could move through the soil toward the aquifer. However, since INTEC would be operational during a kerosene spill, emergency crews would take immediate action to stop the spill, halt the spread of kerosene, and dispose of contaminated soil.

- ***Failure of ammonia tank connections (Beyond Design Basis Event).***

  This event is the bounding release scenario for hazardous chemicals with the greatest potential consequences to workers. The event assumes that ammonia tank connections fail resulting in a spill of the entire contents of the 3,000-gallon ammonia tank at a rate of 15,000 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool and would not enter the groundwater. For this event, the peak atmospheric concentration is estimated to be much greater than Emergency

Response Planning Guideline-2 (ERPG-2) at 3,600 meters. Exposure to airborne concentrations greater than ERPG-2 values for a period of 1 hour would result in a likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impact a person's ability to take protective action. This accident would require evacuation of workers at INTEC and nearby facilities.

6.3 Impacts of the Facility Disposition Alternatives

This EIS also evaluates the impacts of the facility disposition alternatives. Disposition of new and existing facilities could have both short-term and long-term impacts. The following subsections highlight the major impacts identified in air, traffic and transportation, health and safety, waste and materials, and accidents.

6.3.1 AIR RESOURCES

Air emissions could result from disposition of either new facilities constructed to implement the waste processing alternatives or existing HLW treatment and management facilities at INTEC. These emissions would be temporary in nature, and, in general, much lower than those that would result from operations. Impacts associated with disposition of existing facilities would be well below applicable INEEL and EPA standards. No final closure activities would be associated with the No Action Alternative.

6.3.2 TRAFFIC AND TRANSPORTATION

Based on estimated levels of INEEL employment for facility disposition activities, DOE would expect that traffic flows for Highway 20 would be virtually unaffected during disposition activities of new facilities for any of the waste processing alternatives or ***existing facilities associated with HLW management.*** The level of service would remain essentially unchanged.

6.3.3 HEALTH AND SAFETY

Health and safety ***impacts to workers and the public*** could ***potentially*** result from disposition of either new facilities constructed to implement the waste processing alternatives or existing HLW management facilities at INTEC.

Disposition of New Facilities Associated with Waste Processing Alternatives

No disposition activities would be associated with the No Action Alternative; ***however, for all other waste processing alternatives, the new facilities would be designed for clean closure.*** The highest total collective dose to involved workers for the entire disposition period for new facilities would occur ***under*** the ***Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options, corresponding to 0.12 latent cancer fatality (See Table S-2). Offsite radiation impacts are estimated to be very small for all alternatives.***

DOE also evaluated the potential for occupational injuries. The highest impacts for the entire disposition period for new facilities would be associated with ***the Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options: 79 total recordable injury cases. The impacts for these options are similar to the impacts predicted for*** the Full Separations, Planning Basis, ***Early Vitrification and Vitrification without Calcine Separations*** Options, which are estimated to result in ***68 to 74*** total recordable injury cases.

Disposition of Existing Facilities Associated with HLW Management

The collective involved worker dose would be highest for the Clean Closure Alternative due to the extensive decontamination efforts required for removing contaminated materials in order to reduce radioactivity to minimum detectable levels. DOE estimates that the maximum total collective worker dose would be ***2,300*** person-rem with a corresponding estimated health impact of ***0.91*** latent cancer fatalities for the period of disposition (approximately for the years 2035 to 2095).

Annual radiation doses associated with airborne radionuclide emissions from the Tank Farm and bin sets under the facility disposition alternatives were evaluated in this EIS. The highest ***annual*** radiation dose would be associated with the Closure to Landfill Standards Alternative; however, this dose would still be much less than the applicable standard for annual exposure. The maximum collective population dose for all closure alternatives would result in nearly zero latent cancer fatalities.

DOE also estimated the occupational safety impacts and has ***estimated*** values for lost workdays and total recordable cases. DOE expects the highest number of lost workdays and total recordable cases to occur ***under*** the Clean Closure Alternative due to the larger number of workers and duration of disposition activities associated with that alternative. For that alternative, the total lost workdays and recordable injuries are estimated to be ***2,500*** and ***340***, respectively. Worker occupational health and safety impacts for all other facility disposition alternatives would be much lower.

Long-term Impacts from Facility Disposition

The largest source of contamination that could reach the public through a groundwater pathway would result from the No Action Alternative, where mixed transuranic waste/SBW is left in the underground storage tanks ***and calcine is left in the bin sets. DOE's analysis assumes that after 500 years the Tank Farm and bin sets would begin releasing their contents to the soil beneath them.*** The primary means by which contamination could reach the public would be by leaching through the soil into the aquifer near the facilities. DOE assumes that the maximum individual dose ***under*** the No Action Alternative would be incurred by a hypothetical future INTEC ***maximally exposed*** resident who is assumed to obtain ***drinking*** water from a well drilled into the contaminated aquifer. The level of groundwater contamination could be as high as ***2,600*** picocuries per liter of ***technetium-99, resulting in a total lifetime dose from all pathways and all radionuclides of 490 millirem, with a probability of*** 2.5×10^{-4} ***latent cancer fatality.***

6.3.4 WASTE AND MATERIALS

Waste would be generated from disposition of ***both the*** new facilities built to support the waste processing alternatives ***and the existing facilities used in the HLW program. For new facilities,*** decontamination operations would generate as much ***as 95,000 cubic meters of industrial waste for the Direct Cement Waste Option and 2,600 cubic meters of hazardous waste under the Steam Reforming Option, and as much as 80,000 cubic meters of low-level waste under the Direct Vitrification Alternative, and 900 cubic meters of mixed low-level waste under the Full Separations and Vitrification with Calcine Separations Options.*** For disposition of existing HLW facilities, the Clean Closure Alternative would generate the largest estimated volumes ***for 3 of 4 waste types***: industrial waste (***180,000*** cubic meters); low-level waste (***5,700*** cubic meters); ***and*** mixed low-level waste (***11,000*** cubic meters). The Performance-Based Closure Alternative would generate the largest volume of hazardous waste (500 cubic meters).

6.3.5 FACILITY DISPOSITION ACCIDENTS

A potential exists for accidents as a result of facility disposition. Health and safety impacts from accidents during facility disposition can result from trauma, fire, and exposure to releases of radioactive and hazardous materials. For the various facilities disposition alternatives, the potential for health impacts as a result of radiation or hazardous material accidents was found to be quite limited, because inventories of radioactive and hazardous materials during facilities disposition are expected to be several orders of magnitude less than during facility operations.

The maximum reasonably foreseeable impact from facility disposition would consist of an estimated two fatalities as a result of industrial accidents such as trauma, fire, spills, or falls during clean closure of the Tank Farm. These accidents were evaluated on the basis of the type and degree of facility cleanup required.

6.4 Cumulative Impacts

Adding the impact of an action to the impacts of other past, present, and reasonably foreseeable future actions can result in cumulative impacts to the environment. These individual actions, which may be undertaken by government agencies, private businesses, or individuals, can be minor, but the combined or "cumulative" effect could be significant. Cumulative impacts are summarized below.

6.4.1 AIR RESOURCES

The cumulative dose to the maximally exposed offsite individual would be about 0.16 millirem per year under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option. The cumulative dose includes the dose from waste processing activities and is virtually the same as the maximum baseline dose of 0.16 millirem per year. The total dose would also be less than 2 percent of the 10 millirem per year airborne dose limit specified in the National Emissions Standards for Hazardous Air Pollutants. This total dose would be in addition to the estimated annual 360-millirem dose from natural background radiation.

Quantitative evaluation of air pollutant impacts determined that all applicable air quality standards would be met at the INEEL site boundary for all reasonably foreseeable site operations and at all other offsite locations within a 50-mile radius.

6.4.2 WATER RESOURCES

Past activities have contaminated soils and groundwater under INTEC. The CERCLA process is currently underway to ***investigate and remediate*** the risks posed by these contaminants. ***Although the waste processing alternatives do not significantly contaminate groundwater, some facility disposition alternatives leave contamination that could eventually migrate to groundwater.*** Therefore, any facility disposition alternative presented in this EIS that leaves contaminants in place must be evaluated in the context of the cumulative risk of contaminant loading to the groundwater. The important consideration in such an evaluation is the time it will take contaminants to reach the groundwater and whether or not concentrations will exceed drinking water standards.

The No Action and Continued Current Operations Alternatives and any alternative that disposes of Class A or Class C-type grout near INTEC have the potential to add contamination to that already existing. Cumulative impacts that could occur under those alternatives are described below.

No Action Alternative - This alternative would leave mixed transuranic waste/SBW in the tanks indefinitely. If the tanks ***were to*** leak, contaminants could migrate to the groundwater and add cumulatively to any concentrations present from historical contributions. The degree of cumulative impact would depend on when the leak occurs and how much ***waste*** is released. ***For example, if all the contents of a single tank were to leak to the soil column in 2001, the cumulative peak concentration of iodine-129 from the tank and from historical contributions to the aquifer would be approximately 0.13 picocuries per liter in the year 2075. Another radionuclide of concern, technetium-99, would provide a cumulative peak concentration of 100 picocuries per liter, or 11 percent of the drinking water standard. This peak would occur in 2095. Total plutonium for the tank release would peak at 1.1 picocuries per liter in the year 6000. There would be no cumulative effect since the plutonium from historic sources would have dispersed by that time.*** Although such a leak can be postulated during the period of assumed institutional control, DOE has mechanisms in place to detect and mitigate such an event. Furthermore, the design life of the storage tanks is estimated to be well in excess of 500 years.

Under the No Action Alternative, all five tanks could eventually degrade and release the entire inventory of mixed transuranic waste/SBW to the ground. For analysis purposes, this event is assumed to begin to occur in 500 years. At that time, the strontium-90 in the tanks would have decayed sufficiently so that it would not pose a significant radioactive risk. Iodine-129 ***would also be released to the groundwater but the iodine-129*** in the groundwater from ***past INTEC***

operations would have peaked, become diluted, and moved down-gradient in the aquifer. Therefore, the ***peak*** iodine-129 ***groundwater concentration would be 47 percent of the maximum contaminant level. Technetium-99 would also be released in this event, and the peak groundwater concentration would be about 42 percent of the current maximum contaminant level.*** For plutonium, the total contribution from the five tanks that could eventually reach the groundwater would ***be very small and*** would lag behind the contribution ***from past INTEC operations*** by ***greater than*** 500 years. ***Total plutonium would peak about 4,000 years after the five-tank failure and would be about one half the current regulatory maximum contaminant level.***

Continued Current Operations Alternative - This alternative would calcine all remaining mixed transuranic waste/SBW and store the calcine in the bin sets indefinitely. As a result, the bin set source terms would be somewhat increased from those evaluated for the No Action Alternative. The volume of calcine stored in the bin sets would be increased by about 20 percent from that evaluated for the No Action Alternative. The amount of radioactivity (total curies) remaining in the bin sets would be increased by about 5 percent.

If a bin set full of mixed HLW calcine degrades and fails during a seismic event after 500 years, the radionuclides released from this accident would be a fraction of the radionuclides released from the assumed failure of five full mixed transuranic waste/SBW tanks at 500 years described above. For the bin set failure at 500 years, the percent of the radionuclide inventory released the first year compared to the inventory released from the 5-tank failure is: iodine-129 (1 percent); technetium-99 (11 percent); neptunium-237 (7 percent), and total plutonium (less than 1 percent). The additional risk for developing cancer for a potential groundwater user after bin set failure at 500 years was not analyzed since groundwater impacts would be easily bounded by the 5-tank failure at 500 years.

The nonradiological impacts of this accident would also be bounded by the 5-tank failure accident. The most impacting contaminants are beryllium (8 percent of the 5-tank failure inventory) and molybdenum (4 percent of the 5-tank failure inventory). All other nonradionuclides would be less than 1 percent of the inventory released from the 5-tank failure. Therefore, the impacts from nonradionuclide contaminants released from the failure of a bin set would be bounded by the 5-tank failure at 500 years and the concentrations would be much less than drinking water standards.

Low-Level Class A and Class C-Type Grout Alternatives - Facility disposition alternatives that include filling the ***Tank Farm and bin sets*** with low-level waste, Class A or Class C-type grout would eventually release contaminants to groundwater. Under these alternatives, DOE assumed that the contaminants would not be available for transport to groundwater for 500 years ***when the tanks, bin sets, and disposal units are assumed to degrade. Further, even after degradation, the release of contaminants would be relatively slow*** because grout chemistry can be formulated to specifically control release of contaminants and the rate at which these contaminants migrate to groundwater. The contaminant of concern at this time would be iodine-129, because strontium-90 would have decayed sufficiently and plutonium would be removed as part of the separations process. After 500 years, the iodine-129 from historical practices should have ***dispersed***, so that any contribution from the grout would not result in a ***significant*** cumulative impact.

6.4.3 TRAFFIC AND TRANSPORTATION

Cumulative transportation impacts would result from implementation of the alternatives for this EIS in the context of continuing historical radioactive shipments and reasonably foreseeable shipments. DOE conservatively estimated the total cumulative number of cancer fatalities resulting from domestic U.S. shipments of all kinds of radioactive materials from 1953 through 2037 (DOE and non-DOE activities). These estimates indicate that these shipments collectively may cause 140 latent cancer fatalities to the public. Of this total, 1.4 latent cancer fatalities could result from the radioactive waste shipments for the INEEL waste processing alternative with the highest impact (Direct Cement Waste Option), and ***25*** latent cancer fatalities from other future INEEL programs.