5. ENVIRONMENTAL IMPACTS

5.1 Introduction

Chapter 5 describes the environmental impacts to the Idaho National Engineering and Environmental Laboratory (INEEL) and surrounding region that may result from implementing each of the Advanced Mixed Waste Treatment Project (AMWTP) alternatives.

In accordance with Council on Environmental Quality (CEQ) regulations, the environmental impacts discussions provide the analytical detail for comparisons of environmental impacts associated with the various AMWTP alternatives. Discussions are provided for each environmental resource and relevant issues that could be affected.

To determine the potential environmental impacts resulting from the alternatives analyzed, the period of analysis used was a maximum of 30 years of facility operation starting in 2003. Construction was assumed to begin in 1999 and be completed by 2002. As stated in Section 1.3 of this document, retrieval of waste at the INEEL and transportation of waste to and from the INEEL are related actions that are analyzed in other NEPA documents and therefore are not analyzed in this document.

For comparison purposes, environmental concentrations of emissions and other potential environmental effects are presented with appropriate regulatory standards or guidelines. However, compliance with regulatory standards is not necessarily an indication of the significance or severity of the environmental impact for purposes of the *National Environmental Policy Act* (NEPA) of 1969.

The purpose of the analysis of environmental impacts is to identify the potential for environmental impacts. The environmental assessment methods used and the factors considered in assessing environmental impacts are discussed in each resource section and in the appropriate appendices. The potential for impacts to a given resource or relevant issue is described in each section that follows.

5.2 Land Use

This section discusses the potential effects of the construction and operation of the proposed AMWTP and alternatives on land use at the INEEL and surrounding area.

5.2.1 Methodology

Potential effects were qualitatively assessed by comparing potential land use changes and/or conflicts of the Proposed Action and alternatives to the existing land use plans and policies.

5.2.2 Land Use Impacts from the No Action Alternative

This alternative would not result in any new major upgrades or new projects to support current INEEL waste management activities for transuranic (TRU) waste, alpha-contaminated low-level mixed waste (alpha LLMW), and low-level mixed waste (LLMW). No land disturbance would occur at the Radioactive Waste Management Complex (RWMC). Existing and planned land uses within the RWMC and other INEEL facility areas would not change as a result of No Action Alternative activities. Ongoing operations at INEEL are consistent with planning documents, including the INEL Site Treatment Plan (DOE-ID 1995b), the *Integration of Environmental Management Activities at the INEL* (LITCO 1995), and the *INEL Comprehensive Facility and Land Use Plan* (LMITCO 1997a). No Action Alternative activities would be conducted in existing developed industrial-type areas where other historic similar and supporting land uses occur. No Action Alternative ongoing activities conducted outside of the INEEL boundaries would not change, and no effects on surrounding land use plans and policies are expected.

5.2.3 Land Use Impacts from the Proposed Action

The AMWTP facility would occupy 7 acres within and adjacent to the RWMC for project construction activities. All of the project area has been previously disturbed as a result of past and ongoing waste management and environmental restoration activities within the RWMC. The AMWTP facility operations would be consistent with existing ongoing industrial-type activities at the RWMC. Under this alternative, most construction and operation activities would occur within the RWMC (see Figure 1.4-1). The possible expansion of the RWMC sewage lagoon system by constructing a 0.5-acre lagoon would occur within a 1-acre disturbed portion of land used as a subcontractor office and construction laydown area adjacent to the existing sewage lagoons. The routing of a new 3,000 ft 138-kV electrical power line needed to serve the AMWTP facility would parallel the existing north/south RWMC emergency gravel road on the east side. The tie-in would be at the existing 138-kV line supporting the Pit 9 substation on the north side of Adams Blvd. This alternative would be consistent with the current and planned future uses of the RWMC identified in the *INEL Comprehensive Facility and Land Use Plan* (LMITCO 1997). No effects on surrounding land uses or local land use plans or policies are expected from constructing and operating the AMWTP at the RWMC.

Sand, gravel, aggregate, and clay to support construction and operation of the AMWTP would be extracted from the existing INEEL borrow areas. The impacts of expanding the INEEL borrow pits to support waste management activities at the INEEL, including the AMWTP, were addressed in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE INEL EIS [DOE 1995]), Volume 2, Part B, Section C-4.9.2 and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental*

Laboratory (DOE-ID 1997f). The extraction of these materials to support the Proposed Action activities is consistent with the existing and planned INEEL land uses and management plans for the continued operation and waste management activities at the site.

5.2.4 Land Use Impacts from the Non-Thermal Treatment Alternative

The Non-Thermal Treatment Alternative would be the same as the Proposed Action except that incineration would not be used as a treatment option in the new plant, and it would require the increased use of existing storage facilities to accommodate repackaged waste awaiting appropriate treatment in the future.

The increased use of the existing storage facilities under the Non-Thermal Treatment Alternative would not require any additional land outside of the current boundaries of the RWMC. The storage of alpha low-level and mixed waste is consistent with ongoing and planned uses and activities of the RWMC; no effects on existing INEEL land uses would be expected. Potential land use impacts under this alternative due to possible expansion of the existing RWMC sewage lagoons or construction of a new power line would be the same as described for the Proposed Action.

5.2.5 Land Use Impacts from the Treatment and Storage Alternative

The potential land use impacts of the Treatment and Storage Alternative would be the same as those described for the Proposed Action with regard to treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.3 Socioeconomics

Socioeconomic factors, such as employment, income, population, housing, and community services, are interrelated in their response to implementation of an action. This section describes the potential effects of the AMWTP alternatives on the socioeconomic factors of the Region of Influence (ROI). Proposed changes in the Department of Energy (DOE) related expenditures and workforce levels have the potential to generate economic impacts that may affect local employment, population, and community resources.

5.3.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are changes in INEEL employment and expenditures expected to take place under each alternative and include both construction-phase and operations-phase impacts. Indirect impacts include (a) the impacts to ROI businesses and employment resulting from changes in DOE ROI purchase or nonpayroll expenditures and (b) the impacts to ROI businesses and employment that result from changes in payroll spending by affected INEEL employees. The total economic impact to the ROI is the sum of direct and indirect impacts. Both the direct and indirect impacts were estimated for the ROI described in Section 4.3, Socioeconomics.

The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by DOE in cooperation with INEEL contractors and their representatives. Direct employment impacts represent actual increases or decreases in INEEL staffing; they do not include changes in staffing due to reassignment of the existing workforce within the INEEL. Total employment and earnings impacts were estimated using RIMS II multipliers developed specifically for the INEEL ROI by the U.S. Bureau of Economic Analysis. A comprehensive discussion of the methodology can be found in Appendix E-1, Socioeconomics.

The importance of the actions and their impacts is determined relative to the context of the affected environment. Projected baseline conditions in the ROI, as presented in Section 4.3, Socioeconomics, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of any of the alternatives. Baseline employment and population represent socioeconomic conditions expected to exist in the ROI through 2025. Each alternative other than the No Action Alternative is expected to generate short-term increases in employment and income as a result of construction, as well as longer-term increases as a result of operations.

5.3.2 Socioeconomic Impacts from the No Action Alternative

Under the No Action Alternative, the proposed AMWTP would not be built. No new employment or workers would be expected as a result of this project. The employment and population of the ROI would remain the same as the baseline described in Section 4.3, Socioeconomics.

5.3.3 Socioeconomic Impacts from the Proposed Action

5.3.3.1 Regional Economy Characteristics. Implementation of the proposed action would generate a total of 254 jobs (125 direct and 129 indirect) in the ROI during the peak year of construction, an increase of less than 1 percent in ROI employment. This would increase total ROI income by approximately $5,836,500 (less than 1 percent). These changes would be temporary, lasting only the duration of construction.

Operation of the facility would require 146 workers and would generate a total of 406 jobs (146 direct and 260 indirect) in the ROI. Total ROI income would increase by $10,268,900 annually (less than 1 percent).

5.3.3.2 Population and Housing. The existing ROI labor force could fill all of the jobs generated by the increased employment and expenditures at the INEEL. Therefore, there would be no impacts to the ROI's population or housing sector.

5.3.3.3 Community Services. Because there would be no significant change in the population of the area, there would likely be no change to the level of community services provided in the ROI.

5.3.4 Socioeconomic Impacts from the Non-Thermal Treatment Alternative

The impacts from the implementation of the Non-Thermal Treatment Alternative on the ROI population, housing, and community services would be the same as from the implementation of the Proposed Action. The impacts on the ROI economy from construction would also be the same. Operation would result in a slightly lower impact, as discussed below.

5.3.4.1 Regional Economy Characteristics. Operation of the facility would require approximately 133 workers. This would generate a total of 369 jobs (133 direct and 236 indirect) in the ROI and increase total ROI income by $9,354,500 annually (less than 1 percent).

5.3.5 Socioeconomic Impacts from the Treatment and Storage Alternative

The impacts from the implementation of the Treatment and Storage Alternative on the ROI economy, population, housing, and community services would be the same as the Proposed Action.

5.4 Cultural Resources

This section discusses the potential impacts of the alternatives on cultural resources; that is, archaeological and historic sites, areas of cultural or religious importance to local Native Americans, and paleontological localities on the INEEL.

5.4.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to cultural, historical and Native American resources has been established through Federal laws and regulations as discussed in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE INEL EIS). In general, direct impacts to existing historic structures may result from demolition, modification, or deterioration of the structures; isolation from or alteration of the property's setting; or the introduction of visual, auditory, or atmospheric elements that are out of character or that alter the property's setting. Direct impacts to traditional Native American resources may occur through land disturbance, vandalism, changes in accessibility to sacred sites or traditional use areas by Native Americans, or by changing the environmental setting of traditional use and sacred areas. Indirect impacts may also result from pollution, noise, and contamination that may affect traditional use areas or the visual or auditory setting of sacred areas. While not all of the archaeological sites, structures, or traditional cultural properties at the RWMC have been formally evaluated, they are considered to be potentially eligible for nomination to the National Register of Historic Places (NRHP).

Both direct and indirect impacts due to the proposed alternatives were evaluated. At the RWMC, direct impacts to archaeological resources are usually those associated with ground disturbance from construction activities. Indirect impacts to cultural resources may also occur due to an overall increase in activity at the RWMC brought about by the proposed AMWTP facility construction workforce.

5.4.2 Cultural Resource Impacts from the No Action Alternative

Impacts to cultural resources at the RWMC are not expected to occur as a result of the No Action Alternative as the proposed AMWTP facility would not be constructed. The Idaho State Historic Preservation Officer (SHPO) has determined that operations within the perimeter fence should not impact cultural resources because of the high degree of prior ground disturbance at this facility (Yohe 1993).

5.4.3 Cultural Resource Impacts from the Proposed Action

The Proposed Action would involve the construction and operation of the AMWTP facility, a project that would affect about 7 acres within the Transuranic Storage Area (TSA) located inside of the RWMC. Impacts to cultural resources appear negligible, although a potential for subsurface discoveries of cultural material always exists. Construction of the proposed AMWTP facility would result in ground disturbance and a change in the visual setting at the RWMC. This facility will contain permanent generators and night lights, creating a visual and audible intrusion. Soil erosion could occur during the construction of the proposed facility, as well as the release of fugitive dust particles that might temporarily affect visibility in localized areas. Such activities would be of limited duration, however, and the INEEL would follow standard construction practices to minimize both erosion and dust. There would be no intentional discharge of radioactive or chemical liquid effluents to the subsurface or natural water resources above allowable levels, as required under applicable Federal and State regulations. Because the proposed construction would occur in a disturbed area of the RWMC the impacts to cultural resources are expected to be minor.

Expansion of the existing RWMC sewage lagoons located south of the outside of the RWMC boundary may be required to support AMWTP operations. If needed the existing sewage lagoons would be augmented with a new 0.5-acre lagoon. Construction of the lagoon would occur within an existing 1-acre disturbed portion of land used as a construction laydown area next to the existing sewage lagoons. The 0.5-acre lagoon expansion would potentially impact a known archaeological site; however, archaeological testing has indicated that the site is likely not eligible for nomination to the NRHP (Natoni 1998). A formal determination of eligibility of this site has not yet been made. In the absence of such determination, the site should be monitored by archaeologists during any ground-disturbing activities.

The RWMC has contributed to the overall operation of the INEEL since the 1950s and is considered to be a critical element of the area's historic landscape. The architecture of the proposed treatment facility would be consistent with the industrial style of the existing facilities at the RWMC. Modifications of the three NRHP-eligible Waste Management Facility (WMF) buildings (WMF-601, WMF-610, WMF-612) at the RWMC would be done in consultation with the SHPO prior to activities that might alter those properties (Ringe-Pace 1998).

As discussed in Section 4.4, Cultural Resources, limited paleontological and prehistoric resources have been found inside of the RWMC. Archaeological clearance has been recommended by the SHPO for ongoing and future ground disturbances, such as the construction of the proposed AMWTP facility inside of the RWMC (Yohe 1993). The INEEL has implemented strong "stop work" stipulations in the event that cultural resources or human remains are discovered during any project implementation. These stipulations include provisions for notification of, and consultation with, the SHPO and Native American Tribes in accordance with the *National Historic Preservation Act* (NHPA) and the *Native American Grave Protection and Repatriation Act* (NAGPRA). (Ringe-Pace 1998, Yohe 1995)

Construction of a new 138-kV power line approximately 100 feet east of the RWMC perimeter fence to support the proposed AMWTP facility would not impact any known archaeological sites (Natoni 1998). Other future construction activities associated with AMWTP uses (other power lines, access roads, underground cables, monitoring wells, flood control devices, etc.) outside of the RWMC fence must be carefully monitored to prevent inadvertent impacts to recorded and unrecorded archaeological sites and traditional Native American use areas.

The Shoshone-Bannock Tribes consider noise, air and water quality, plants and wildlife, and visual settings to be important Native American resources. The area surrounding the RWMC contains sensitive habitat, possessing plant and animal diversity that is sensitive to disturbance and subject to exposure to radionuclides, although the level of exposure would be so low that no effect would be expected (see Sections 5.7, Air Resources, and 5.9, Ecological Resources). Impacts to traditionally used plant and animal species that currently occupy or use the area near the RWMC, as discussed in Section 5.9.3, are expected to be minimal.

The visual setting, particularly in the Middle Butte, Big Lost River, Little Lost and Birch Creeks, and Big Southern Butte areas located in the southern portion of the INEEL is perceived by the Shoshone-Bannock Tribes to be an important Native American resource. The Big Southern Butte area is located approximately 5 miles south of the RWMC, Middle Butte is about 15 miles southeast, the Big Lost River is 5 miles north, and the Little Lost and Birch Creeks are located approximately 12 and 25 miles, respectively, to the north and northeast of the RWMC (see Sections 4.2, 5.2, 4.5, 5.5, 4.8, and 5.8).

Construction of the AMWTP facility would not impact these areas or change current Tribal access, as reflected by the Memorandum of Agreement for the Middle Butte area (DOE-ID 1994). DOE will continue its practice to consult with the Shoshone-Bannock Tribes during project development with consideration for potential impacts to resources of importance to the Tribes.

5.4.4 Cultural Resource Impacts from the Non-Thermal Treatment Alternative

Impacts to cultural resources from the Non-Thermal Treatment Alternative would be the same as those of the Proposed Action as both involve the construction of the AMWTP facility at the RWMC.

5.4.5 Cultural Resource Impacts from the Treatment and Storage Alternative

Impacts to cultural resources from the Treatment and Storage Alternative would be the same as those of the Proposed Action.

5.5 Aesthetic and Scenic Resources

This section discusses the potential effects of the construction and operation of the AMWTP and alternatives on aesthetic and scenic resources at the INEEL and the surrounding area.

5.5.1 Methodology

Potential impacts to aesthetics and scenic resources include the construction of new structures and/or modifications to existing structures and the additional project contribution of air pollutants that may alter the view or quality of these resources. The impact analyses for the Proposed Action and alternatives considered the effects of construction and operation of the AMWTP at the RWMC on the INEEL. The significance of visual resource degradation due to the construction and operation of the AMWTP is based on the extent of the modification to the RWMC and facility operations. The degree of impact is based on the existing visual setting (i.e., the nature, density, and extent of sensitive visual resources that contribute to the visual character of the INEEL site and surrounding area).

Construction and operation of facilities have the potential to result in visual resource degradation by contributing air emissions that reduce contrast and cause discoloration of the air. The greatest contributor to these types of impacts are emissions of oxides of nitrogen and particulate matter. Atmospheric visibility has been specifically designated as an air-quality-related value under the 1977 Prevention of Significant Deterioration (PSD) Amendments to the *Clean Air Act*. The VISCREEN computer code (EPA 1992b) was used to estimate the potential worst-case visibility impacts of the “action” alternatives at Craters of the Moon Wilderness Area and the Fort Hall Indian Reservation. The VISCREEN method yields impact results that are greater than those that would be obtained using more realistic input and modeling assumptions. The model calculates contrast and color shift for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. Results were then compared to acceptable criteria for these parameters. Additional information on the visibility assessment methodology is presented in Section E-3.3.3.5 Appendix E-3, Air Resources.

5.5.2 Aesthetic and Scenic Resource Impacts from the No Action Alternative

Under the No Action Alternative, no new additional construction or major facility upgrades would be implemented at the RWMC. Any new activities would be limited to environmental, safety, and health actions to maintain safe worker and facility operations. Neither the existing INEEL visual setting nor area scenic resources would be affected by No Action Alternative activities. The Bureau of Land Management (BLM) Visual Resource Management classification for INEEL acreage of Class III (mixed use) and Class IV (industrial use) would not change.

The air quality analysis (see Section 5.7.4) indicates that No Action Alternative emissions would not adversely impact contrast reduction or color shift values as seen from the Craters of the Moon Wilderness Area. Cumulative criteria pollutant emissions are all well below applicable standards (Table 5.7-8), therefore no visual degradation would be expected in the INEEL area. There would be no change to the visual setting of the Middle Butte area located in the southern portion of the INEEL. The Middle Butte area is considered by the Shoshone-Bannock tribes to be an important Native American resource.

5.5.3 Aesthetic and Scenic Resource Impacts from the Proposed Action

Under the Proposed Action, the construction of the AMWTP facility would be confined to the TSA located within the RWMC, the construction laydown area next to the existing sewage lagoon system adjacent to the TSA, and along the existing north/south RWMC emergency gravel road located east and adjacent to the TSA. The proposed new facility would be 60 feet tall and similar in size and shape to the existing waste management structures at the RWMC. The plant's air emissions control system would have a 90-foot offgas stack (see the facility description in Chapter 3). The poles for the new power line would be wood "H" frame poles set about every 400 feet. Approximately seven or eight poles would be needed to span the 3,000-foot extension. The new power line extension would be visually consistent with the existing infrastructure and site form and context. Because of the developed industrial character of the RWMC, the AMWTP would not change the visual setting of the area (Visual Resource Management Class IV [industrial use]); therefore, no adverse visual impacts are expected.

Construction of the AMWTP facilities would produce fugitive dust that may affect visibility temporarily in the local construction area (see Section 5.7.6). Dust control measures, such as watering, would be implemented to minimize impacts. Operational emissions under the Proposed Action were modeled (see Appendix E-3.3.3.5) and indicated that potential visual impacts resulting from contrast reduction or color shift would be negligible. The absolute value of the sky contrast parameter is about 0.001 compared to the recommended screening criterion of 0.5. The highest color shift value is 0.18 compared to the screening criterion of 2.0. These results indicate that views within the Craters of the Moon Wilderness Area and National Monument would not be impacted. Values at Fort Hall Indian Reservation are about one-third of the Craters of the Moon values for each of these parameters and are not expected to impact the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes.

5.5.4 Aesthetic and Scenic Resource Impacts from the Non-Thermal Treatment Alternative

The impacts of the Non-Thermal Treatment Alternative would be somewhat less than those for the Proposed Action. The air quality analysis (see Section 5.7.4.1) indicates that for criteria pollutant emissions (e.g., nitrogen dioxide, sulfur dioxide, and particulates), ambient air concentrations would be roughly half as high as those for the Proposed Action due to the elimination of incinerator emissions as well as lower boiler and diesel generator emission rates. However, when the cumulative effect of the baseline and projected increases is considered (i.e., with inclusion of potential impacts of other foreseeable projects), there is little difference between the alternatives (see Table 5.7-5). There would be no change to the visual setting of the RWMC area (Class IV) or visual degradation of nearby Craters of the Moon Wilderness Area and National Monument and the Middle Butte area.

5.5.5 Aesthetic and Scenic Resource Impacts from the Treatment and Storage Alternative

The impacts of the Treatment and Storage Alternative would be the same as those for the Proposed Action. There would be no changes to the visual setting of the RWMC area or visual degradation of nearby Craters of the Moon Wilderness Area and National Monument, and the Middle Butte area due to treatment and storage of waste after treatment.

5.6 Geology

This section discusses the potential effects of the construction and operation of the AMWTP facility and alternatives on geology at the INEEL and surrounding area. Potential impacts from seismic events and lava flows are discussed in Section 5.14. The potential for these types of events and probability of occurrence are discussed in detail in Appendix E–2.1. Based on previous studies described in detail in Appendix E–2.1, the probability for a lava flow inundation of the RWMC by the Axial Volcanic Zone, the Arco Volcanic Rift Zone, and the Lava Ridge-Hell's Half Acre Volcanic Rift Zone is $2.9x10^{-6}$ per year, $9.3x10^{-6}$ per year, and $2.4x10^{-6}$ per year, respectively. The impacts from lava flow are analyzed in Section 5.14 and not in this section.

5.6.1 Methodology

Potential impacts to geologic resources would be associated with excavation during construction of the AMWTP and/or modification to existing facilities and infrastructure, and the mining of aggregate, clay, and sand resources to support the construction and operation of new and/or modified facilities.

5.6.2 Geologic Impacts from the No Action Alternative

Activities associated with the No Action Alternative would have minor adverse impacts on the geology and geologic resources of the INEEL. Direct impacts to geologic resources would result from excavating into the soil and rock at the site; soil mounding and banking; and extracting aggregate, clay, and sand from gravel and borrow pits on the INEEL to support existing and ongoing waste management, road maintenance, environmental restoration, and other site construction activities necessary for the continued operation of the site.

The estimated extraction volume of mineral resources from INEEL gravel and borrow pits for the preferred alternative in the DOE INEL EIS is approximately 513,000 cubic yards. The geology and soil impacts were addressed in Volume 2, Part A, Section 5.6.2 of the DOE INEL EIS. The environmental impacts of expanding the existing INEEL gravel/borrow areas were addressed in Volume 2, Part B, Section C-4.9.2 of the DOE INEL EIS, and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE 1997b).

5.6.3 Geologic Impacts from the Proposed Action

Activities associated with the Proposed Action would have minor adverse impacts on the geology and geologic resources of the INEEL. Disturbance would occur at building, parking, and construction laydown areas, destroying the soil profile and causing potential short-term soil erosion. Approximately 16,000 cubic yards of soil would be excavated for the AMWTP facility building foundation and electric substation foundations down to the bedrock to provide a stable construction base. If needed in the future, the new 0.5-acre sewage lagoon expansion would require excavation of an additional 1033 cubic yards of soil. Soil not used for construction backfill and other project purposes would be dispositioned based on the *INEEL Soil Plan for the RWMC* (Taylor 1997). The major steps in the RWMC soil management plan process involve documentation of historical information, screening and/or conducting detailed sampling and analyses, and completion, including approval from RWMC Operations and WAG-7 Manager, of an Outage Request Form. The strategy is intended to address foreseeable requirements for the excavation and movement of soil associated with RWMC construction and operations. Excavation and movement of clean soil and rock is not constrained by the *Resource Conservation and Recovery Act* (RCRA), *Toxic*

Substance Control Act (TSCA), *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), or radiation control regulations. Soil can be excavated and related within the RWMC controlled area, without posting or special management if:

- Management has approved the intended location of the stockpile,
- The screening survey indicates that levels of volatile organic compounds are not above background, and
- The concentration of radionuclides does not exceed maximum background levels identified in Technical Procedure (TPR)-713 Radioactive Contamination Added Determination Rev 0, Table 1: Activities in Soil Local to the INEEL.

If sampling and analysis indicates that radioactive and/or chemical contaminants exceed background or regulatory levels, soil excavated or moved may require subsequent management as radioactive or mixed waste, or alternative management. Such alternative management will be determined by DOE and the State of Idaho as part of a RCRA Closure Plan or remedial action under CERCLA.

Soil management associated with environmental restoration activities at RWMC will be addressed in CERCLA decision documents. Unique soil movement circumstances and needs that are not adequately encompassed by the plan will be addressed on a case-by-case basis, and may require negotiation involving DOE Idaho Operations Office (DOE-ID), the State of Idaho, and Region X of the Environmental Protection Agency (EPA). Standard construction control measures would be used to minimize soil erosion due to storm water runoff and wind.

Construction of the AMWTP would require the extraction of approximately 20,000 cubic yards of aggregate, clay, and sand from INEEL borrow areas. Mineral resource construction materials needed for the AMWTP were included in the estimated extraction volumes analyzed in Volume 2, Part A, Section 5.6.2 of the DOE INEL EIS and the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE 1997b). The 20,000 cubic yards of materials extracted from the gravel/borrow pit areas would not have a significant adverse impact on the geologic resources of the INEEL.

5.6.4 Geologic Impacts from the Non-Thermal Treatment Alternative

Activities associated with the Non-Thermal Treatment Alternative would have similar potential impacts on geology and geologic resources as described for the Proposed Action.

5.6.5 Geologic Impacts from the Treatment and Storage Alternative

Activities associated with the Treatment and Storage Alternative would have similar potential impacts on geology and geologic resources as described for the Proposed Action regarding the treatment of waste. However, the potential storage impact identified in Section 5.21 would be in addition to impacts for treatment.

5.7 Air Resources

The air resource existing in the region of the INEEL could be affected by air pollutant emissions associated with construction and operation of the proposed AMWTP. Air resource assessments have been performed to determine the maximum consequences at onsite and offsite locations resulting from proposed AMWTP emissions under the four alternatives. The assessments include evaluation of impacts of emissions from stationary sources at the proposed AMWTP (main stack, boiler, and diesel generator stacks); fugitive sources from construction; and mobile sources (motor vehicles) that will operate in support of the facility under each alternative. The types of emissions assessed are the same radiological and nonradiological emissions as those in the baseline assessment (see Section 4.7, Air Resources), namely, radionuclides; criteria pollutants (carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter, and lead); and toxic air pollutants.

This section describes the assessment methodology and potential effects of construction and operation of the proposed AMWTP on local and regional air quality. Results of air quality assessments are presented in terms of expected radiation dose and nonradiological pollutant concentration levels which are compared to applicable standards. Public health impacts from expected radiation dose and nonradiological pollutant concentrations are analyzed in Section 5.12, Occupational and Public Health and Safety. Volatile organic compounds, which can lead to the formation of ozone, are characterized. Related impacts such as potential for visibility degradation and air quality impacts due to project-induced secondary growth are discussed. Additional details on assessment methods, assumptions, and related information are contained in Appendix E-3, Air Resources, and in the DOE INEL EIS, Section 5.7 and Appendix F-3.

5.7.1 Methodology

The consequences of air pollutant emissions were assessed using methods and data considered acceptable for regulatory compliance determination by Federal and State agencies and designed to allow for a reasonable prediction of the impacts of proposed facilities. Public comments raised during the scoping were also considered in defining the methodology. For the most part, the methodology used paralleled that used in the DOE INEL EIS. In a few cases, however, it was necessary to employ more current methods. The principal components of the air resource assessment methodology are source term estimation and characterization of release parameters, together with local meteorological data and computerized dispersion modeling codes which are used to simulate transport and dispersion of air contaminants. A summary of each of these aspects of the assessment methodology follows.

5.7.1.1 Methodology for Radiological Consequences. Radiological source terms for the proposed AMWTP have been estimated on the basis of knowledge of the proposed equipment and processes, operating schedule, and characteristics of the waste to be treated. These source terms, which represent reasonable estimates of emissions under the proposed AMWTP alternatives, are presented in Section 5.7.2, Sources and Emissions.

The dispersion modeling used features of two computer codes: GENII (Napier et al. 1988) and the Industrial Source Complex (ISC-3) code (EPA 1995b). The GENII model has been extensively tested and conforms to applicable software quality assurance criteria. Meteorological and population data specific to the INEEL are used by the model together with project emission rates. The GENII model calculates doses from all important pathways of exposure, including external and inhalation dose from immersion in contaminated air, external dose from deposition of radionuclides on ground surfaces, and ingestion of contaminated food products. The ingestion pathway, however, is not a realistic exposure pathway for onsite workers and was therefore not used for worker exposure assessments. In some cases, dispersion factors were computed using ISC-3, which incorporates features for better prediction of impacts influenced by building (eg., wake effects, terrain features). In particular, ISC-3-generated dispersion factors were used to determine the location of the highest predicted radionuclide concentrations within the RWMC area and at site boundary locations. The dispersion factors computed for these locations were then manually entered into GENII for calculation of radiation dose from the applicable exposure pathways.

5.7.1.2 Methodology for Nonradiological Consequences. Dispersion modeling to assess nonradiological air contaminants was conducted using the ISC-3 atmospheric dispersion computer code (EPA 1995b). This is a regulatory update of the ISC-2 version (EPA 1992a) used in the DOE INEL EIS. The ISC-3 version incorporates certain improvements in the model, including the incorporation of improved algorithms to better address impacts due to area (fugitive) emission sources. However, for most applications, values estimated by ISC-3 will not differ significantly from those of the earlier version of the model (EPA 1995b). This has been verified by comparative evaluations of sources at the INEEL; the results produced by ISC-3 are virtually identical to the results produced by ISC-2.

The ISC-3 analyses used hourly meteorological data collected during 1991 and 1992 at the Grid III monitoring station, which is the same monitoring location and years used in the DOE INEL EIS analyses. Wind-flow patterns at the Grid III location, which is located about 13 kilometers northeast of the proposed AMWTP site, are representative of those at the proposed site. Data are collected at both the 10- and 61-meter levels. The meteorological data collected at the 61-meter level are used to model elevated releases (such as from the proposed AMWTP main stack), while the 10-meter data are used for ground-level releases.

As in the DOE INEL EIS, the nonradiological assessment did not include methods for quantifying impacts related to ozone formation. Emissions of volatile organic compounds (which are precursors of ozone formation) from the proposed AMWTP are well below the significance level designated by the State of Idaho. In addition, no simple, well-defined method exists to assess ozone formation potential (Wilson 1993); and, while the Idaho Division of Environmental Quality has no ozone monitoring data from the vicinity, it is not aware of problematic ozone levels in the area (Andrus 1994). This is further discussed in section 5.7.4.3.1.

5.7.1.3 Methodology for Mobile Source Impacts. The DOE INEL EIS contained an extensive analysis of the ambient air quality impacts at offsite receptor locations due to mobile sources associated with INEEL operations. Sources included the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEEL facilities. These impacts were quantitatively assessed in the DOE INEL EIS using emission factors and the computerized CALINE-3 methodology (Benson 1979). The model, which implements the recommended EPA methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic. The model was used to predict maximum 1-hour ambient air concentrations of carbon monoxide and respirable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters from the edge of the roadway, in accordance with EPA guidance. Modeling was conducted for 1993 to quantify the impact due to INEEL buses and traffic serving projects and activities on the INEEL at that time, the projected impact of projects planned for construction before 1995, and the projected impacts of environmental restoration and waste management alternatives given in the DOE INEL EIS.

The impacts of mobile sources at the proposed AMWTP are qualitatively assessed in Section 5.7.5. These impacts are assumed to be bounded by the mobile source impacts assessed in the DOE INEL EIS.

5.7.2 Sources and Emissions

The principal source of radionuclide emissions at the proposed AMWTP would be the main stack, which is actually an assemblage of several individual smaller stacks (or flues) shrouded by a wind screen. The offgas streams from the incinerator, vitrification process, gloveboxes, and various waste pre-treatment and handling areas pass through separate air pollution control systems and are then exhausted through separate flues. These flues vary in diameter, but each extends to the top of the 27.5-meter main stack. (An illustration and additional information on main stack parameters are provided in Section E-3.3.3.2 of Appendix E-3, Air Resources.) In addition to the main stack, nonradiological pollutants would be emitted from six propane-fueled water boilers (up to four of which could operate at any one time), one hot water heater, and two diesel-fueled emergency generators. The boiler and heater stacks will be located at a utility building situated about 21 meters south of the proposed AMWTP main building. The generators will be located near the southeast and southwest corners of the main building.

Radionuclide emission rates have been estimated for the incinerator, vitrifier, and non-thermal handling and treatment areas. Emission rates for plutonium and other radionuclides have been estimated on the basis of process design, proposed operations, and radionuclide concentrations in the waste to be treated (BNFL 1998a). These emission rates are presented in Table 5.7-1. The incinerator and virtifier emissions listed in Table 5.7-1 would occur under either the Proposed Action or the Treatment and Storage Alternative; the non-thermal emissions estimates apply to those two alternatives and are also considered an upper bound for the Non-Thermal Treatment Alternative.

There would be no radiological emissions from the AMWTP under the No Action Alternative. The methods and assumptions used in deriving these estimates are described in Section E-3.3.1 of Appendix E-3, Air Resources.

Criteria and toxic air pollutant emissions have been estimated for the incinerator, non-thermal treatment and handling areas, boilers, heater, and diesel generators. The methods and assumptions used to estimate emissions are based primarily on information contained in permit applications prepared for the proposed AMWTP (BNFL 1998b, 1998c). These methods are described in Appendix E-3.3.1 of Appendix E-3, Air Resources, and are summarized in this section.

Table 5.7-1. Radionuclide emission rates (curies per year) for operation of the AMWTP under the Proposed Action and Non-Thermal Treatment Alternative.[a]

	Source				Totals by alternative	
Radionuclide	Incinerator	Vitrifier	Non-thermal glovebox	Non-thermal Zone 3	Proposed Action[b]	Non-Thermal Treatment Alt.[c]
Am-241	5.4×10^{-4}	5.4×10^{-4}	7.3×10^{-8}	1.6×10^{-5}	1.1×10^{-3}	1.6×10^{-5}
Pu-238	5.1×10^{-4}	5.1×10^{-4}	6.9×10^{-8}	1.5×10^{-5}	1.0×10^{-3}	1.5×10^{-5}
Pu-239	3.0×10^{-4}	3.0×10^{-4}	4.1×10^{-8}	9.0×10^{-6}	6.2×10^{-4}	9.0×10^{-6}
Pu-240	7.0×10^{-5}	7.0×10^{-5}	9.5×10^{-9}	2.1×10^{-6}	1.4×10^{-4}	2.1×10^{-6}
Pu-242	4.6×10^{-9}	4.6×10^{-9}	6.2×10^{-13}	1.4×10^{-10}	9.3×10^{-9}	1.4×10^{-10}
Pu-241	7.1×10^{-4}	7.1×10^{-4}	9.6×10^{-8}	2.1×10^{-5}	1.5×10^{-3}	2.1×10^{-5}
Ba-137m	1.0×10^{-5}	1.0×10^{-4}	1.3×10^{-9}	2.9×10^{-7}	1.1×10^{-4}	3.0×10^{-7}
Cs-137	1.0×10^{-5}	1.0×10^{-4}	1.4×10^{-9}	3.0×10^{-7}	1.1×10^{-4}	3.0×10^{-7}
Sr-90	8.9×10^{-6}	8.9×10^{-6}	1.2×10^{-9}	2.6×10^{-7}	1.8×10^{-5}	2.7×10^{-7}
Y-90	8.9×10^{-6}	8.9×10^{-6}	1.2×10^{-9}	2.6×10^{-7}	1.8×10^{-5}	2.7×10^{-7}
U-233	4.5×10^{-6}	4.5×10^{-6}	6.1×10^{-10}	1.3×10^{-7}	9.2×10^{-6}	1.3×10^{-7}
Cm-244	2.4×10^{-6}	2.4×10^{-6}	3.2×10^{-10}	7.0×10^{-8}	4.9×10^{-6}	7.1×10^{-8}
H-3	$1.2 \times 10^{+1}$	$1.2 \times 10^{+0}$	1.6×10^{-4}	3.5×10^{-2}	$1.3 \times 10^{+1}$	3.5×10^{-2}
Cs-134	4.9×10^{-7}	4.9×10^{-6}	6.6×10^{-11}	1.5×10^{-8}	5.4×10^{-6}	1.5×10^{-8}
Co-60	4.4×10^{-7}	4.4×10^{-7}	6.0×10^{-11}	1.3×10^{-8}	9.0×10^{-7}	1.3×10^{-8}

Source: BNFL (1998a).

a. Emissions estimates are based on the radionuclide inventory of waste to be processed and facility operations of 24 hours per day, 330 days per year. See Table E-3-2 of Appendix E-3 for additional details regarding radionuclide emissions estimates.

b. Emissions under the Treatment and Storage Alternative would be same as those for the Proposed Action. Proposed Action totals are the sum of all four columns under Source.

c. Non-Thermal Treatment Alternative totals are the sum of non-thermal glovebox and non-thermal Zone 3 columns.

Nonradiological emissions may arise through two primary mechanisms: (1) release of contaminants which are present in the waste and which are released during treatment or (2) formation and release of products of combustion. The first category involves primarily toxic air contaminants and is associated with both thermal and non-thermal treatment. Emissions estimates for this category take into account:

- The maximum amount of contaminant in the waste;
- The waste processing rate;
- Release of waste contaminants from the treatment or handling area into the offgas system; and
- Removal of contaminants from the offgas by air pollution control systems.

The second category includes both criteria and toxic air pollutants and is associated with thermal treatment and fuel combustion in the boilers, heater, and generators. For thermal treatment, emissions estimates are based on material and energy balance calculations, which have been performed for a variety of waste types and operating conditions (BNFL 1998b). Boiler, heater, and diesel generator emissions are based on projected fuel consumption rates and emission factors recommended by the EPA for fuel-burning equipment (EPA 1997).

A summary of projected nonradiological emission rates for the Proposed Action and Non-Thermal Treatment Alternative is provided in Table 5.7-2. Emissions under the Treatment and Storage Alternative would be the same as the Proposed Action. Additional details regarding these emissions estimates are provided in Table E-3-3 of Appendix E-3, Air Resources.

5.7.3 Radiological Impacts

Radiation doses associated with radionuclide emissions from the proposed AMWTP have been calculated for (1) a worker at the location of highest predicted radioactivity level, (2) the maximally exposed individual (MEI) at an offsite location, and (3) the entire population (adjusted for future growth) within an 80-kilometer radius of the RWMC (see Table 5.7-3). Doses are assessed for emissions under each alternative and are added to current (baseline) doses and projected increases as a result of other future INEEL facilities to determine cumulative radiological doses. Public and worker health impacts from projected doses are analyzed in Section 5.12, Occupational and Public Health and Safety. Projected increases are assumed to be represented by dose estimates for the Preferred Alternative from the DOE INEL EIS, modified as described in Section 4.7.3.2.

Under the No Action Alternative, the AMWTP would not be constructed, but other new sources of radiological emissions would come into operation between the present and 2005. The doses for the No Action Alternative are based solely on site-wide emissions from existing facilities and projected increases as defined by the Preferred Alternative assessed in the DOE INEL EIS.

Under the Proposed Action, doses would result from radionuclide emissions from thermal treatment (incineration and vitrification) and non-thermal waste processing. The highest dose from AMWTP emissions to an offsite individual is 0.11 millirem per year and occurs at the site boundary about 6 kilometers south-southwest of the facility. The most important radionuclide and exposure pathway are inhalation of americium-241. When added to the baseline dose and projected increases, the cumulative dose to the offsite individual would be 0.25 millirem per year. As in the case of each AMWTP alternative, the cumulative dose from AMWTP emissions and other sources is a very small fraction of that received from natural background sources and is well below the National Emissions Standard for Hazardous Air Pollutants (NESHAP) dose limit of 10 millirem per year.

The highest estimated dose at a potentially occupied onsite location under the Proposed Action is 0.73 millirem per year and would occur within the RWMC area about 300 meters south-southwest of the facility. This dose, when added to the baseline dose and projected increases, remains a very small fraction of the occupational dose limit of 5,000 millirem per year.

Table 5.7-2. Projected nonradiological emission rates for the proposed AMWTP and support equipment.[a]

Substance	Proposed Action Maximum hourly g/hr	Proposed Action Annual average kg/yr	Non-Thermal Treatment Alternative Maximum Hourly g/hr	Non-Thermal Treatment Alternative Annual average kg/yr
Criteria pollutants				
Carbon monoxide	8.4E+03	2.3E+03	4.1E+03	4.9E+02
Oxides of nitrogen	4.0E+04	2.2E+04	1.9E+04	2.6E+03
Sulfur dioxide	5.4E+03	2.0E+04	1.3E+03	2.0E+02
Particulate matter (PM-10)	2.7E+03	3.3E+02	1.3E+03	1.2E+02
Volatile organic compounds	3.0E+03	4.8E+02	1.5E+03	1.7E+02
Lead	4.9E-06	3.9E-05	2.4E-08	1.9E-07
Carcinogens				
Arsenic	2.6E-05	2.1E-04	1.5E-09	1.2E-08
Asbestos	5.0E-09	4.0E-08	5.0E-09	4.0E-08
Benzene	1.2E+02	9.0E+00	6.0E+01	3.5E+00
Beryllium	1.0E-05	8.2E-05	1.0E-09	7.9E-09
Cadmium	2.6E-05	2.1E-04	1.5E-09	1.2E-08
Carbon tetrachloride	3.1E+00	2.5E+01	1.7E-01	1.3E+00
Chloroform	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Chromium (hexavalent forms)	1.0E-05	8.2E-05	7.5E-11	5.9E-10
1,2-Dichloroethane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
1,1-Dichloroethylene	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Dioxin/furans (2,3,7,8 TCDD equivalent)	7.3E-07	5.8E-06	(b)	(b)
Formaldehyde	2.3E+02	1.2E+01	1.2E+02	6.0E+00
Methylene chloride	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Nickel	1.0E-05	8.2E-05	4.5E-10	3.6E-09
Polychorinated biphenyls (PCBs)	8.9E-02	7.0E-01	2.9E-09	2.3E-08
Tetrachloroethylene	8.4E-01	6.7E+00	5.4E-01	4.3E+00
1,1,2-Trichloroethane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Trichloroethylene[c]	8.4E-01	6.7E+00	5.4E-01	4.3E+00
Noncarcinogens				
Acetone	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Barium	1.0E-05	8.2E-05	1.5E-09	1.2E-08
Butyl alcohol	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Chlorine	1.8E+01	1.5E+02	(b)	(b)
Chlorobenzene	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Chromium (trivalent forms)	1.0E-05	8.2E-05	1.4E-09	1.1E-08
Cyanide	3.0E-01	2.3E+00	3.6E-10	2.9E-09
Cyclohexane	3.5E-01	2.7E+00	5.0E-02	4.0E-01
2-Ethoxyethanol	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Ethyl benzene	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Hydrogen chloride	2.5E+01	1.9E+02	(b)	(b)
Hydrogen fluoride	1.4E+02	1.1E+03	(b)	(b)
Mercury	9.2E+00	7.3E+01	1.6E-09	1.3E-08
Methanol	3.6E-01	2.8E+00	6.4E-02	5.0E-01
Methyl ethyl ketone	3.5E-01	2.7E+00	5.0E-02	4.0E-01
Nitrobenzene	3.1E-01	2.5E+00	1.5E-02	1.2E-01
Selenium	7.3E+01	5.8E+02	1.5E-09	1.2E-08
Silver	1.0E-05	8.2E-05	1.5E-09	1.2E-08
Toluene	8.4E-01	6.7E+00	4.0E-01	3.2E+00
1,1,1-Trichloroethane	9.3E+00	7.3E+01	5.4E-01	4.3E+00
Trichloroethylene[c]	8.4E-01	6.7E+00	1.7E-01	1.3E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	3.1E+00	2.5E+01	5.4E-01	4.3E+00
Xylene	8.4E-01	6.7E+00	5.4E-01	4.3E+00

a. See Appendix E-3, Table E-3-3, for additional details, assumptions, and notes related to emissions estimates.
b. Substance would not be emitted by non-thermal treatment.
c. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

The maximum collective dose (i.e., the sum of all individual doses) to the entire population residing within 80 kilometers that would result under the Proposed Action is 0.05 person-rem per year. When added to the baseline population dose and projected increases, the collective dose is 0.55 person-rem per year. The differences in cumulative population dose between the alternatives are not significant since the baseline dose and projected increases are dominant. It should be noted that the baseline population dose and projected increases were calculated in the DOE INEL EIS and apply to the entire population residing within 80 kilometers of each major area at INEEL, with growth projected to the year 2010. The population dose resulting from projected AMWTP emissions is determined only for the population residing within 80 kilometers of the RWMC area (within which the AMWTP would be located). Assuming an annual growth rate of 6 percent, this population within 80 Km of RWMC would grow to about 82,000 people by 2010. If it is conservatively assumed that the cumulative population dose is distributed among 82,000 people, the average individual dose would be less than 0.007 millirem per year. Since this cumulative dose is dominated by baseline conditions and projected increases, it applies to the other alternatives as well. No applicable standards exist for collective population dose; however, DOE policy requires that doses resulting from radioactivity in effluents be reduced to the levels which are as low as reasonably achievable (ALARA). The radiological health effects associated with these doses are presented in Section 5.12, Occupational and Public Health and Safety.

Table 5.7-3. Summary of radiation dose associated with airborne radionuclide emissions from the proposed AMWTP alternatives.

Case	Baseline	Projected increases [a]	Dose from AMWTP operation	Cumulative dose
Highest onsite (worker) location	(millirem per year)			
No Action Alternative	0.21 [b]	0.023	0	0.23
Proposed Action [c]	0.21	0.023	0.73	0.96
Non-Thermal Treatment Alternative	0.21	0.023	0.003	0.24
Maximally exposed offsite individual	(millirem per year)			
No Action Alternative	0.031 [d]	0.11	0	0.14
Proposed Action [c]	0.031	0.11	0.11	0.25
Non-Thermal Treatment Alternative	0.031	0.11	0.0017	0.14
Collective population dose	(person-rem per year)			
No Action Alternative	0.085 [b,e]	0.41	0	0.50
Proposed Action [c]	0.085	0.41	0.056	0.55
Non-Thermal Treatment Alternative	0.085	0.41	0.00037	0.50

a. Modified as described in Section 4.7.3.2.
b. From Table 5.7-4 of DOE INEL EIS, modified as described in Section 4.7.3.2.
c. Dose from the Treatment and Storage Alternative would be the same as that from the Proposed Action regarding the treatment of wastes, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.
d. From 1996 NESHAP Report (DOE-ID 1997b).
e. Baseline population dose applies to total population within 80 kilometers of each major INEEL area.

Doses incurred under the Non-Thermal Treatment Alternative result from emissions associated with radioactive waste handling and non-thermal treatment such as supercompacting or macroencapsulation, but do not include incineration or vitrification. These emissions and the associated doses (Table 5.7-3) are noticeably lower than those that would result from thermal treatment emissions. Doses projected for the Treatment and Storage Alternative would be identical to the Proposed Action. The relative magnitude of the cumulative doses for the four alternatives is illustrated by the comparisons presented in Figure 5.7-1. The cumulative doses depicted in this figure represent the sum of contributions from baseline emissions, projected increases to the baseline, and projected emissions from the proposed AMWTP.

The radiological doses described above are specified in terms of annual radiation dose, which facilitates comparison to applicable standards. In general, the total radiological doses over the life of the facility would be approximately equal to the annual dose multiplied by the number of years of operation. These results are presented in Table 5.7-4.

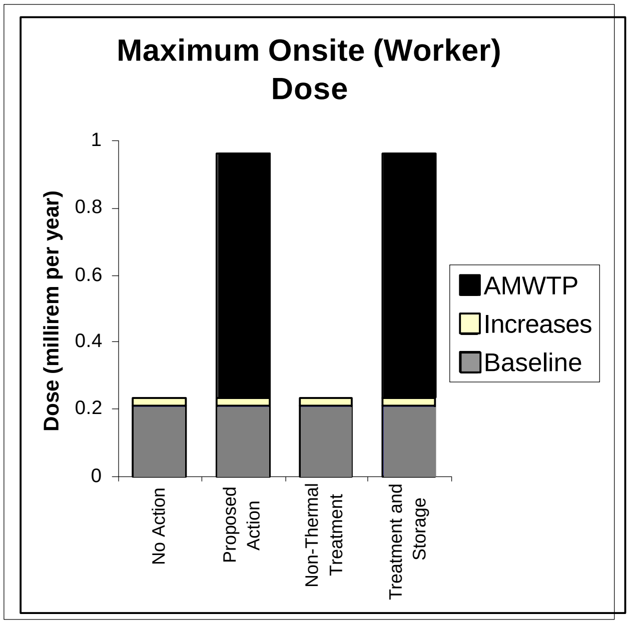
Table 5.7-4. Radiation doses and fatal cancer risk over the projected operating lifetime of the AMWTP.[a]

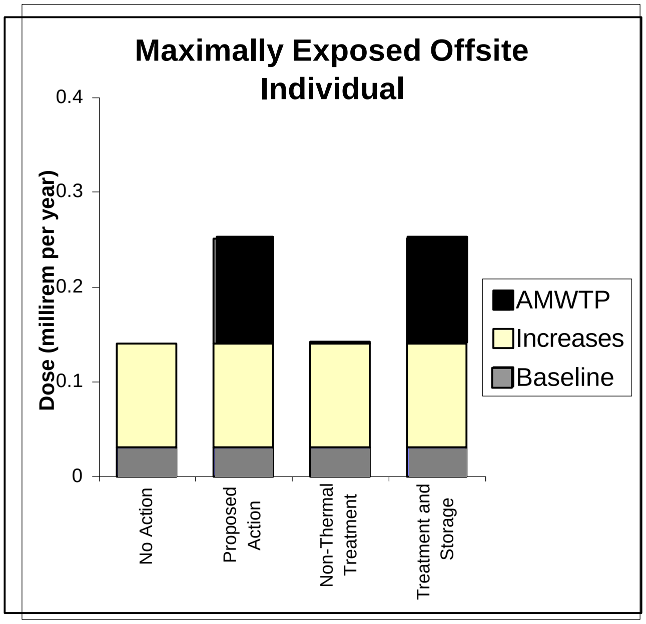
Dose category	Effective dose equivalent		
	13-year facility lifetime	30-year facility lifetime	Fatal Cancer
	Proposed Action		
Offsite MEI	1.5 millirem	3.4 millirem	1.7E-06
Offsite population	0.65 person-rem[b]	1.6 person-rem[c]	8.00E-04
Onsite worker	9.5 millirem	22 millirem	8.80E-06
	Non-Thermal Treatment Alternative		
Offsite MEI	0.023 millirem	-[d]	1.15E-08
Offsite population	0.0043 person-rem[b]	-[d]	2.15E-08
Onsite worker	0.039 millirem	-[d]	1.56E-08
	Treatment and Storage Alternative[e]		
Offsite MEI	1.5 millirem	3.4 millirem	1.7E-06
Offsite population	0.65 person-rem[b]	1.6 person-rem	8.00E-04
Onsite worker	9.5 millirem	22 millirem	8.80E-06

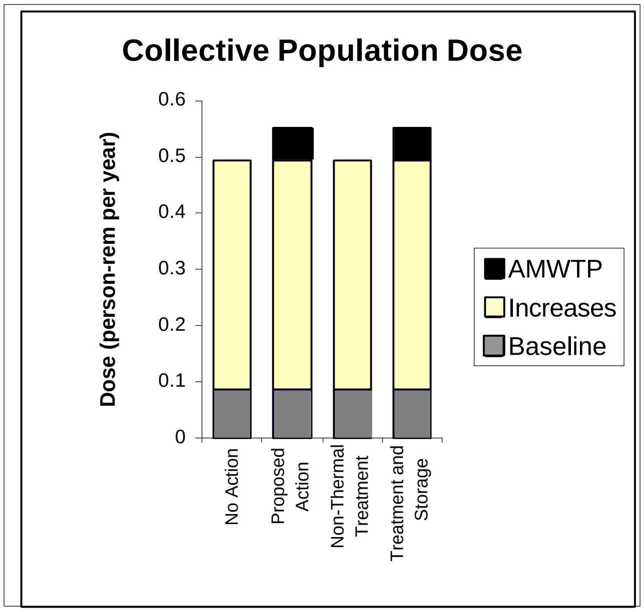
a. See Chapter 3 for information on projected AMWTP operating lifetime under the proposed alternatives.
b. Assumes average population of 82,000.
c. Assumes average population of 89,000.
d. AMWTP would not operate beyond 13 years under this alternative.
e. The Treatment and Storage Alternative impacts are the same as the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.7.4 Nonradiological Impacts

This section presents results of the air quality assessments for sources of nonradiological air pollutants. The primary goal of this presentation is to facilitate comparisons of impacts between alternatives. The importance of the results as they apply to regulatory compliance aspects of predicted alternative consequences is also discussed. The impacts described below are expressed in time frames (hourly, annual, etc.) that correspond to the averaging times specified by regulatory criteria. The human health risks associated with these impacts, including total risk over the projected operating life of the facility, are discussed in Section 5.12, Occupational and Public Health and Safety.







Note: The applicable radiological limits for an individual member of the public are 10 mrem per year resulting from operations for the air pathways. The radiological limit for an individual worker is 5,000 mrem per year (10 CFR 835).

Note: The Treatment and Storage Alternative impacts are the same as the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

Figure 5.7-1. Dose to onsite worker, maximally exposed offsite individual, and collective population due to projected airborne radionuclide emissions under each of the four AMWTP alternatives.

5.7.4.1 Concentrations of Pollutants in Ambient Air a Offsite Locations. Maximum concentrations of criteria pollutants in ambient air (i.e., at locations of public access) have been determined for INEEL site boundary locations, along public roads, and at Craters of the Moon Wilderness Area. Results of these assessments are presented and compared to applicable standards in Table 5.7-5. Projected pollutant levels associated with each of the alternatives are low and well within the limits defined by applicable standards (IDHW 1997). As in the case of radiological impacts, these consequences include contributions from existing (baseline) sources and projected increases.

On a comparative basis, impacts for the Proposed Action and Treatment and Storage Alternative are greater than the Non-Thermal Treatment Alternative, since the former include incinerator emissions as well as higher boiler and diesel generator emission rates. However, when the cumulative effect of the baseline and projected increases is considered, there is little difference between the alternatives. Figure 5.7-2 illustrates the cumulative impacts with respect to applicable standards for the Proposed Action and Non-Thermal Treatment Alternative at the INEEL boundary and public road locations. It should be noted that the scale of these graphs does not extend to 100 percent to facilitate comparison. The incremental impact from proposed AMWTP operations is greatest at INEEL boundary locations; however, when the effect of baseline levels is added, cumulative pollutant levels are projected to be highest along public roads. The dominance of the baseline and projected increases is clearly evident in these charts.

Increases in criteria pollutant concentrations at Craters of the Moon Wilderness Area would be very minor under either the Proposed Action, Non-Thermal Treatment, or Treatment and Storage Alternative. Potential impacts related to PSD and visibility at Craters of the Moon are discussed in Section 5.7.4.3.2.

The cumulative emissions from the proposed AMWTP include consideration of maximum baseline conditions and the effects of projected increases to the baseline. Background concentrations have not been added because reliable data on background levels in the INEEL environs are not available for most pollutants. Background levels are assumed to be low and are represented in the maximum baseline by incorporation of conservative assumptions. Some pollutants have been monitored onsite, but those results reflect INEEL site facility contributions and are not indicative of actual background. (INEEL facility contributions are accounted for in this EIS assessment by application of dispersion modeling.)

Table 5.7-5. Cumulative criteria pollutant emissions at public access locations for proposed AMWTP alternatives.

Pollutant	Averaging time	Baseline plus increases (ug/m^3) [a] Site boundary	Baseline plus increases Public roads	Baseline plus increases Craters of the Moon	Impact of alternative (ug/m^3) Site Boundary	Impact of alternative Public roads	Impact of alternative Craters of the Moon	Cumulative emissions (ug/m^3) [b] Site boundary	Cumulative emissions Public roads	Cumulative emissions Craters of the Moon	Applicable standard [c] (ug/m3)	Percent of standard Site boundary	Percent of standard Public roads	Percent of standard Craters of the Moon
No Action Alternative														
Carbon monoxide	1-hour	418	1219	137	0	0	0	418	1219	137	40,000	1	3	<1
	8-hour	122	285	29	0	0	0	122	285	29	10,000	1	3	<1
Nitrogen dioxide	Annual	7.1	11	0.58	0	0	0	7.1	11	0.58	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	0	0	0	180	580	61	1,300	14	45	5
	24-hour	45	135	11	0	0	0	45	135	11	365	12	37	3
	Annual	2.3	6.1	0.3	0	0	0	2.3	6.1	0.33	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	0	0	0	14	33	3.1	150	9	22	2
	Annual	0.77	3.5	0.12	0	0	0	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	0	0	0	0.0024	0.005	0.00012	1.5	<1	<1	<1
Proposed Action [e]														
Carbon monoxide	1-hour	418	1219	137	111	93	1.5	529	1312	139	40,000	1	3	<1
	8-hour	122	285	29	50	22	0.61	172	307	30	10,000	2	3	<1
Nitrogen dioxide	Annual	7.1	11	0.58	0.22	0.1	0.007	7	11	0.6	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	40	24	0.8	220	604	62	1,300	17	46	5
	24-hour	45	135	11	8.3	3.4	0.16	53	138	11	365	15	38	3
	Annual	2.3	6.1	0.3	0.23	0.1	0.008	2.5	6.2	0.3	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	6.0	2.5	0.09	20	35	3.2	150	13	24	2
	Annual	0.77	3.5	0.12	0.004	0.002	0.0001	0.8	3.5	0.1	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.8E-09	4.6E-10	5.3E-11	0.002	0.005	0.0001	1.5	<1	<1	<1
Non-Thermal Treatment Alternative														
Carbon monoxide	1-hour	418	1219	137	55	44	0.75	473	1263	138	40,000	1	3	<1
	8-hour	122	285	29	24	11	0.3	146	296	29	10,000	2	3	<1
Nitrogen dioxide	Annual	7.1	11	0.58	0.03	0.02	0.0006	7.1	11	0.6	100	7	11	<1
Sulfur dioxide	3-hour	180	580	61	12.8	8	0.21	193	588	61	1,300	15	45	5
	24-hour	45	135	11	2.8	1.2	0.04	48	136	11	365	13	37	3
	Annual	2.3	6.1	0.3	0.002	0.001	4.5E-05	2.3	6.1	0.3	80	3	8	<1
Particulate matter [d]	24-hour	14	33	3.1	2.9	1.2	0.05	17	34	3.1	150	11	23	2
	Annual	0.77	3.5	0.12	0.001	0.0009	3.0E-05	0.77	3.5	0.12	50	2	7	<1
Lead	Quarterly	0.002	0.005	0.0001	1.2E-12	3.6E-13	5.1E-14	0.002	0.005	0.0001	1.5	<1	<1	<1

a. Baseline plus increases are assumed to be as assessed for maximum baseline case plus the Preferred Alternative in the DOE INEL EIS.

b. Cumulative emissions are assessed as the sum of the baseline plus increases and the impact of alternative for a given receptor category. This is conservative since in most cases the highest concentration for each would occur at different locations or times.

c. All standards are Idaho Primary Ambient Air Quality Standards (AAQS) except for 3-hour sulfur dioxide, which is a secondary AAQS. Primary AAQS are designed to protect public health, whereas secondary standards are intended to protect public welfare.

d. Respirable particulate matter; does not include contributions of fugitive dust.

e. Emissions due to Treatment and Storage Alternative would be identical to those of Proposed Action.

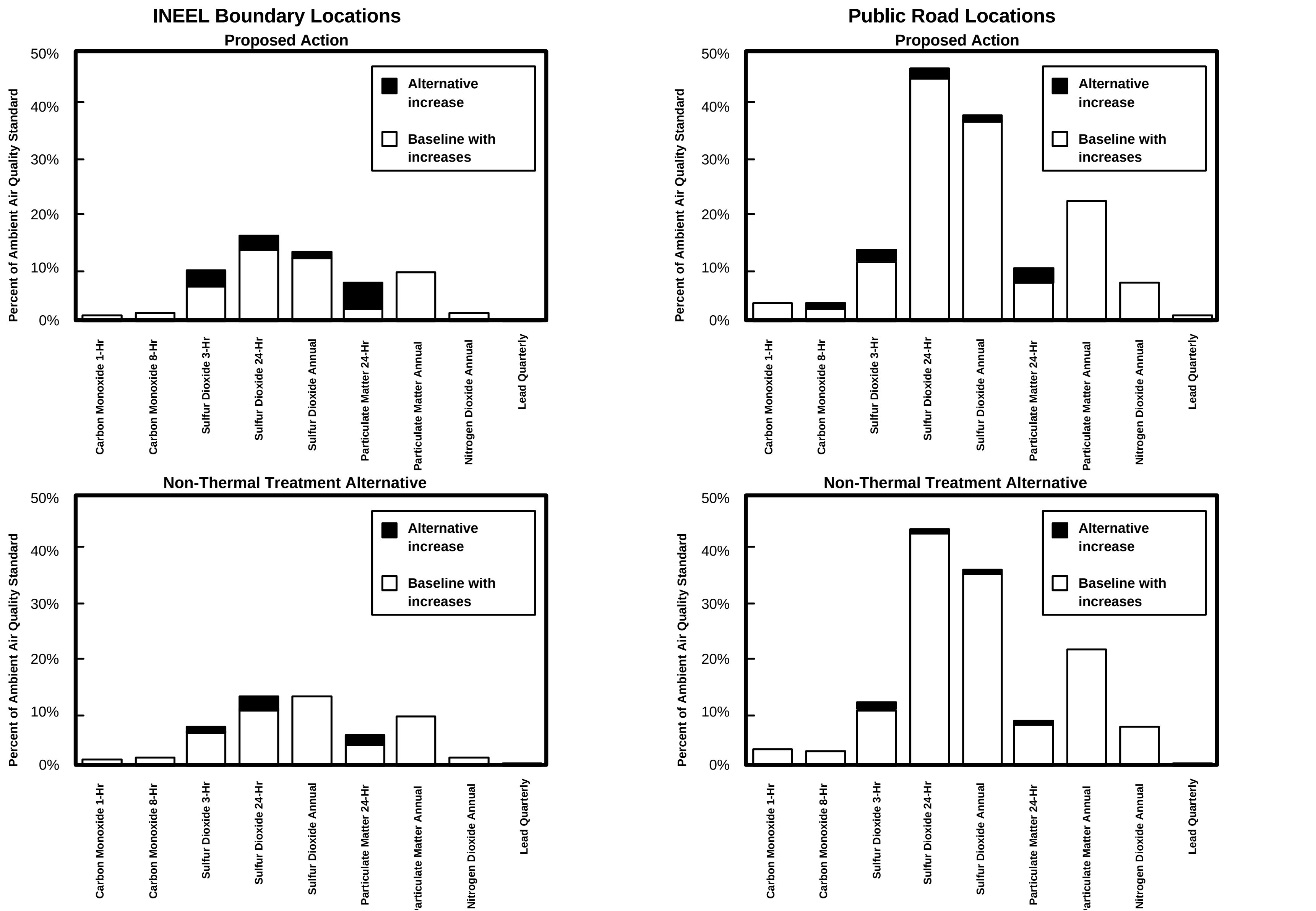


Figure 5.7-2. Cumulative criteria pollutant impacts at INEEL boundary (left) and public road locations (right), as percentages of the applicable Ambient Air Quality Standards. Impacts for the Treatment and Storage Alternative would be identical to the Proposed Action.

Results of assessments for carcinogenic (that is, capable of inducing cancer) and noncarcinogenic toxic air pollutants at offsite locations are presented in Table 5.7-6. As described in Section 4.7.4.2.2, Offsite Conditions, toxic air pollutant increments have been promulgated by the State of Idaho for the control of toxic pollutants in ambient air. These increments, however, apply only to new or modified sources and would only require the evaluation of cumulative impacts for those sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pollutant impacts to these increments. In all cases, the maximum incremental impacts of carcinogenic and noncarcinogenic air pollutants are projected to occur at INEEL boundary locations, and levels of all substances would be well below the applicable standards.

Under the Proposed Action or Treatment and Storage Alternative, incremental levels of all carcinogenic substances would be less than 1 percent of the applicable standard. All noncarcinogenic levels would be less than 1 percent of applicable standards except for selenium, for which maximum projected levels would be about 1 percent of the standard. Carcinogenic impacts under the Non-Thermal Treatment Alternative would not exceed 0.1 percent of any standard, while noncarcinogenic levels would be less than 0.001 percent of the standard for each substance.

5.7.4.2 Concentrations of Pollutants at Onsite Locations. Onsite concentrations of toxic air pollutants are presented in Table 5.7-7. These results represent the maximum predicted levels at any point within the RWMC, averaged over an 8-hour period, to which workers might be exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration (OSHA), whichever standard is lower. The highest onsite concentrations (as a percentage of applicable limits) are projected for formaldehyde, which is produced by diesel fuel combustion and would only be present during periods when the emergency generators are running. Under the Proposed Action and Treatment and Storage Alternative (which include two diesel generators), formaldehyde levels could reach about 7 percent of the applicable standard. This level would be about 5 percent under the Non-Thermal Treatment Alternative (which includes only one diesel generator). Onsite levels of all other substances under any of the alternatives would be about 1 percent or less of applicable occupational limits. When the cumulative effect of baseline levels at the RWMC (including foreseeable increases) are considered, concentrations of toxic air pollutants would remain well below applicable occupational limits.

Table 5.7-6. Ambient air concentrations of toxic air pollutants for proposed AMWTP alternatives.

		Proposed Action[a]				Non-Thermal Treatment Alternative			
	Applicable	INEEL boundary[c]		Craters of the Moon		INEEL boundary[c]		Craters of the Moon	
Pollutant	standard[b] (ug/m^3)	Impact (ug/m^3)	% of standard	Impact (ug/m^3)	% of standard	Impact (ug/m^3)	% of Standard	Impact (ug/m^3)	% of standard
Carcinogens									
Arsenic	2.3E-04	2.2E-09	<0.001	7.5E-11	<0.001	9.1E-14	<0.001	4.5E-15	<0.001
Asbestos	1.2E-04	3.1E-13	<0.001	1.6E-14	<0.001	3.1E-13	<0.001	1.6E-14	<0.001
Benzene	1.2E-01	1.0E-04	0.09	2.4E-06	0.002	4.3E-05	0.04	9.4E-07	<0.001
Beryllium	4.2E-03	8.7E-10	<0.001	2.9E-11	<0.001	6.0E-14	<0.001	3.0E-15	<0.001
Cadmium	5.6E-04	2.2E-09	<0.001	7.5E-11	<0.001	9.1E-14	<0.001	4.5E-15	<0.001
Carbon tetrachloride	6.7E-02	2.5E-04	0.4	9.1E-06	0.01	1.0E-05	0.02	5.0E-07	<0.001
Chlorororm	4.3E-02	2.7E-05	0.06	1.1E-06	0.002	3.8E-06	0.009	1.9E-07	<0.001
Chromium (hexavalent)	8.3E-05	8.7E-10	0.001	2.9E-11	<0.001	4.6E-15	<0.001	2.3E-16	<0.001
1,2-Dichloroethane	3.8E-02	2.7E-05	0.07	1.0E-06	0.003	3.1E-06	0.008	1.6E-07	<0.001
1,1-Dichloroethylene	2.0E-02	2.7E-05	0.1	1.1E-06	0.005	3.8E-06	0.02	1.9E-07	<0.001
Dioxins and furans	2.2E-08	5.8E-11	0.3	2.1E-12	0.01	(d)	(d)	(d)	(d)
Formaldehyde	7.7E-02	1.5E-04	0.2	3.2E-06	0.004	7.6E-05	0.1	1.6E-06	0.002
Methylene chloride	2.4E-01	2.7E-05	0.01	1.1E-06	<0.001	3.8E-06	0.002	1.9E-07	<0.001
Nickel	4.2E-03	8.7E-10	<0.001	2.9E-11	<0.001	2.6E-14	<0.001	1.3E-15	<0.001
Polychlorinated biphenyls	1.0E-02	7.1E-06	0.07	2.6E-07	0.003	1.7E-13	<0.001	8.6E-15	<0.001
Tetrachloroethylene	2.1E+00	5.7E-05	0.003	2.5E-06	<0.001	3.4E-05	0.002	1.7E-06	<0.001
1,1,2-Trichloroethane	6.2E-02	2.7E-05	0.04	1.0E-06	0.002	3.1E-06	0.005	1.6E-07	<0.001
Trichloroethylene[e]	7.7E-02	5.7E-05	0.07	2.5E-06	0.003	3.4E-05	0.04	1.7E-06	0.002
Noncarcinogens									
Acetone	8.9E+04	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Barium	2.5E+01	1.7E-08	<0.001	3.4E-10	<0.001	1.3E-12	<0.001	5.1E-14	<0.001
Butyl alcohol	7.5E+03	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Chlorine	1.5E+02	2.7E-02	0.02	6.1E-04	<0.001	(d)	(d)	(d)	(d)
Chlorobenzene	1.8E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Chromium (trivalent)	2.5E+01	1.7E-08	<0.001	3.4E-10	<0.001	1.2E-12	<0.001	4.8E-14	<0.001
Cyanide	2.5E+02	3.5E-03	0.001	7.7E-05	<0.001	3.1E-13	<0.001	1.2E-14	<0.001
Cyclohexane	5.3E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
2-Ethoxyethanol	9.5E+02	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Ethyl benzene	2.2E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Hydrogen chloride	3.8E+02	3.7E-02	0.01	8.1E-04	<0.001	(d)	(d)	(d)	(d)
Hydrogen fluoride	1.3E+02	2.1E-01	0.2	4.6E-03	0.004	(d)	(d)	(d)	(d)
Mercury	2.5E+00	1.4E-02	0.5	3.0E-04	0.01	1.4E-12	<0.001	5.3E-14	<0.001
Methanol	1.3E+04	3.5E-03	<0.001	7.9E-05	<0.001	5.6E-05	<0.001	2.2E-06	<0.001
Methyl ethyl ketone	3.0E+04	3.5E-03	<0.001	7.9E-05	<0.001	4.3E-05	<0.001	1.7E-06	<0.001
Nitrobenzene	2.5E+02	3.5E-03	0.001	7.8E-05	<0.001	1.2E-05	<0.001	4.8E-07	<0.001
Selenium	1.0E+01	1.2E-01	1.2	2.4E-03	0.02	1.3E-12	<0.001	5.1E-14	<0.001
Silver	5.0E+00	1.7E-08	<0.001	3.4E-10	<0.001	1.3E-12	<0.001	5.1E-14	<0.001
Toluene	1.9E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<0.001
1,1,1-Trichloroethane	9.6E+04	1.0E-01	<0.001	2.3E-03	<0.001	3.4E-04	<0.001	1.3E-05	<0.001
Trichloroethylene[e]	1.4E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<0.001
Xylene	2.2E+04	3.9E-03	<0.001	9.5E-05	<0.001	4.6E-04	<0.001	1.8E-05	<0.001

a. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.
b. Annual average carcinogenic impacts of new sources are compared to the State of Idaho Acceptable Ambient Concentration for Carcinogens (AACC). Twenty-four-hour maximum noncarcinogenic impacts of new sources are compared to the State of Idaho Acceptable Ambient Concentration (AAC).
c. Annual average impacts are evaluated only for offsite locations; 24-hour impacts are evaluated for both offsite and public road locations. In all cases, boundary impacts are greater than public road impacts, so only the former are listed.
d. Substance would not be emitted by non-thermal treatment.
e. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

Table 5.7-7. Onsite concentrations of toxic air pollutants for proposed AMWTP alternatives.

	Maximum concentration (ug/m³)[a]			Percent of occupational standard	
Toxic air pollutant	Proposed Action	Non-Thermal Treatment Alt.	Occupational Standard[b]	Proposed Action	Non-Thermal Treatment Alt.
Carcinogens					
Arsenic	8.6E-07	9.4E-12	1.0E+01	<0.001	<0.001
Asbestos[c]	3.1E-11	3.1E-11	3.0E+00	<0.001	<0.001
Benzene	3.4E+01	2.6E+01	3.0E+03	1	1
Beryllium	3.6E-07	6.3E-12	2.0E+00	<0.001	<0.001
Cadmium	8.6E-07	9.4E-12	2.0E+00	<0.001	<0.001
Carbon tetrachloride	4.1E-01	1.0E-03	1.3E+04	0.003	<0.001
Chloroform	4.1E-02	4.0E-04	9.8E+03	<0.001	<0.001
Chromium (hexavalent)	3.6E-07	4.7E-13	5.0E+01	<0.001	<0.001
1,2-Dichloroethane	4.1E-02	3.1E-04	4.0E+04	<0.001	<0.001
1,1-Dichloroethylene	4.1E-02	4.0E-04	2.0E+04	<0.001	<0.001
Dioxins and furans	1.0E-07	0.0E+00	(d)	(d)	(d)
Formaldehyde	6.5E+01	4.8E+01	9.0E+02	7	5
Methylene chloride	4.1E-02	4.0E-04	1.7E+05	<0.001	<0.001
Nickel	3.6E-07	2.9E-12	1.0E+02	<0.001	<0.001
Polychlorinated biphenyls	1.2E-02	1.8E-11	(d)	(d)	(d)
Tetrachloroethylene	4.3E-02	3.3E-03	1.7E+05	<0.001	<0.001
1,1,2-Trichloroethane	4.1E-02	3.1E-04	5.5E+04	<0.001	<0.001
Trichloroethylene[e]	4.3E-02	3.3E-03	2.7E+05	<0.001	<0.001
Noncarcinogens					
Acetone	4.1E-02	4.0E-04	1.8E+06	<0.001	<0.001
Barium	3.6E-07	9.4E-12	5.0E+02	<0.001	<0.001
Butyl alcohol	4.1E-02	4.0E-04	1.5E+05	<0.001	<0.001
Chlorine	3.2E-01	0.0E+00	1.5E+03	0.02	<0.001
Chlorobenzene	4.1E-02	3.1E-04	4.6E+04	<0.001	<0.001
Chromium (trivalent)	3.6E-07	8.9E-12	5.0E+02	<0.001	<0.001
Cyanide	4.1E-02	2.2E-12	5.0E+03	<0.001	<0.001
Cyclohexane	4.1E-02	3.1E-04	1.0E+06	<0.001	<0.001
2-Ethoxyethanol	4.1E-02	3.1E-04	1.8E+04	<0.001	<0.001
Ethyl benzene	4.1E-02	3.1E-04	4.3E+05	<0.001	<0.001
Hydrogen chloride	4.3E-01	0.0E+00	7.0E+03	0.01	<0.001
Hydrogen fluoride	2.4E+00	0.0E+00	2.5E+03	0.1	<0.001
Lead	8.6E-07	1.5E-10	5.0E+01	<0.001	<0.001
Mercury	1.6E-01	9.8E-12	5.0E+01	0.3	<0.001
Methanol	4.1E-02	4.0E-04	2.6E+05	<0.001	<0.001
Methyl ethyl ketone	4.1E-02	3.1E-04	5.9E+05	<0.001	<0.001
Nitrobenzene	4.1E-02	8.9E-05	5.0E+03	<0.001	<0.001
Selenium	2.0E+00	9.4E-12	2.0E+02	1	<0.001
Silver	3.6E-07	9.4E-12	1.0E+01	<0.001	<0.001
Toluene	4.3E-02	3.3E-03	1.9E+05	<0.001	<0.001
1,1,1-Trichloroethane	1.2E+00	2.5E-03	1.9E+06	<0.001	<0.001
Trichloroethylene	4.3E-02	3.3E-03	2.7E+05	<0.001	<0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	4.1E-01	1.0E-03	7.6E+06	<0.001	<0.001
Xylene	4.3E-02	3.3E-03	4.3E+05	<0.001	<0.001

a. All maximum values occur within the RWMC.
b. Occupational exposure limits are 8-hour averages established by either the American Conference of Government Industrial Hygienists (ACGIH) or the Occupational Safety and Health Administration (OSHA); the lower of the two is used.
c. Value reported for asbestos standard is mass equivalent of most restrictive National Institute of Occupational Safety and Health standard of 0.1 fibers per cubic centimeter.
d. There is no occupational exposure limit for PCBs or dioxins/furans.
e. Trichloroethylene is listed as both a carcinogen and noncarcinogen in the Idaho regulations.

Note: The Treatment and Storage Alternative impacts are the same regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.7.4.3 Regulatory Compliance Evaluation. The *Clean Air Act* (CAA) and the State of Idaho have established ambient air quality standards for designated criteria air pollutants. Proposed major projects or modifications must demonstrate that project emissions would not cause an established ambient air quality standard to be exceeded. While cumulative annual emission rates associated with many pollutants do not exceed the threshold level to be designated as major according to the State of Idaho Rules for the Control of Air Pollution in Idaho (IDHW 1997), the impact of each criteria pollutant has been assessed (IDHW 1997).

In addition to the comparison to ambient air standards presented in Section 5.7.4.1, evaluations have been performed for (1) potential for ozone formation, (2) PSD increment consumption, (3) impacts due to secondary growth (indirect or induced impacts), (4) stratospheric ozone depletion, (5) acidic deposition, and (6) global warming. These analyses are summarized in the following subsections.

5.7.4.3.1 Ozone Formation. In addition to the previously mentioned criteria pollutants, the CAA designates ozone as a criteria air pollutant and establishes a National Ambient Air Quality Standard (NAAQS) of 235 micrograms per cubic meter for a 1-hour averaging period. Recently, a more restrictive ozone standard based on an 8-hour averaging time has been promulgated. Ozone, unlike the other criteria pollutants, is not emitted directly from facility sources but is formed in the atmosphere through photochemical reactions involving nitrogen oxides and volatile organic compounds (VOCs, also referred to as non-methane hydrocarbons). Therefore, the regulation of ozone is effected by the control of emissions of ozone-producing compounds or precursors, that is, nitrogen oxides and VOCs.

The National Park Service (NPS) has recently established an ozone monitoring program at Craters of the Moon. Data for the 1992 calendar year show a peak 1-hour concentration of 0.051 ppm (about 100 micrograms per cubic meter), which is well below the standard. Levels at Craters of the Moon are also expected to remain well below the new 8-hour standard (0.085 ppm or about 160 micrograms per cubic meter). The Idaho Division of Environmental Quality is not aware of problematic ozone levels in the area (Andrus 1994) and does not require evaluation of projected increases in ambient ozone concentrations under application procedures for major stationary sources, unless a new or modified major facility will result in a net increase in VOCs of 100 tons per year or greater (Andrus 1994, IDHW 1997). Part of the reason for the lack of required analysis at lesser emittant levels is because no simple, well-defined methods exist to evaluate ozone generation potential (Wilson 1993).

Emissions of VOCs have been estimated to establish the need to perform detailed ozone generation modeling. Under the Proposed Action Alternative, the projected VOC annual emission rate is 480 kilograms, or about one-half ton per year. The maximum cumulative emission rate, which includes baseline emissions and projected increases, is about 16 tons per year. This level is well below the threshold emission level of 100 tons per year for which analyses are required by the State and the 40-ton-per-year threshold for designation as a major VOC source. Therefore, ozone precursor emissions of VOCs are expected to be minor contributors to ozone generation and no further analyses have been conducted.

5.7.4.3.2 Prevention of Significant Deterioration Increment Consumption. PSD regulations require that proposed major projects or modifications, together with minor sources that become operational after PSD baseline dates are established, be assessed for their incremental contribution to increases of ambient pollutant levels. A proposed major project, together with the sum of other major and minor net emissions increases that occur after the specified baseline date in the same impact area, may not contribute to an increase in attainment pollutants above an allowable increment. The baseline date is triggered by regulation or the submittal of a permit application. Increments have been established for specific averaging times associated with nitrogen dioxide, sulfur dioxide, and particulate matter. PSD requirements also apply for radionuclides if the projected radiation dose exceeds 0.1 millirem per year.

The INEEL is in a Class II area as designated by PSD regulations, while the nearest Class I area is Craters of the Moon Wilderness Area. Previous PSD permits for INEEL site projects have consumed a portion of the available Class I and II increments (see Section 4.7.4.2.2). Projected emissions associated with the proposed AMWTP and other future projects would contribute to further increment consumption. In the DOE INEL EIS, the maximum amount of future increment consumption associated with the Preferred Alternative was estimated at 76 percent of the allowable Class I increment for 3-hour sulfur dioxide concentrations, with lesser amounts for all other averaging times and pollutants. However, these levels include contributions of the Idaho Waste Processing Facility and other facilities, which were assessed under the DOE INEL EIS Preferred Alternative but which will not be incurred; therefore, the actual values are expected to be substantially lower.

Table 5.7-8 presents estimated increment consumption at Craters of the Moon for the combined effects of the DOE INEL EIS Preferred Alternative and the proposed AMWTP. The combined increment consumption at this Class I area would not exceed 45 percent, which is projected for 3-hour sulfur dioxide concentration, while the highest annual average increment consumption is 16 percent for nitrogen dioxide. Table 5.7-9 shows PSD evaluation results for Class II areas. For these areas (which include INEEL boundary and public road locations), the highest consumption would not exceed 58 percent for any 3-hour or 24-hour increment and 33 percent for any annualized increment.

Table 5.7-8. PSD increment consumption at Craters of the Moon Wilderness Area for the combined effects of existing sources, foreseeable increases, and the proposed AMWTP.

Pollutant	Averaging time	Allowable PSD increment (ug/m^3)	Baseline sources plus increases[a] Impact (ug/m^3)	Baseline sources plus increases[a] % of increment	Impact of AMWTP alternatives Impact (ug/m^3)	Impact of AMWTP alternatives % of increment	Cumulative PSD increment consumed Impact (ug/m^3)	Cumulative PSD increment consumed % of increment
Proposed Action[b]								
Sulfur dioxide	3-hour	25	10.5	42	0.8	3.2	11.3	45
	24-hour	5	2.0	40	0.16	3.2	2.2	43
	Annual	2	0.10	5	0.008	0.4	0.11	5.5
Particulate matter (PM-10)	24-hour	8	1.0	12	0.09	1.1	1.1	13
	Annual	4	0.03	0.6	0.00009	0.002	0.026	0.65
Nitrogen dioxide	Annual	2.5	0.38	15	0.007	0.3	0.39	16
Non-Thermal Treatment Alternative								
Sulfur dioxide	3-hour	25	10.5	42	0.21	0.8	10.7	43
	24-hour	5	2.0	40	0.043	0.9	2.0	41
	Annual	2	0.1	5	0.00005	0.002	0.1	5.1
Particulate matter (PM-10)	24-hour	8	1.0	12	0.05	0.6	1.0	13
	Annual	4	0.03	0.6	0.00003	0.001	0.026	0.65
Nitrogen dioxide	Annual	2.5	0.38	15	0.0006	0.02	0.38	15

a. Foreseeable increases are assumed to be represented by the DOE INEL EIS Preferred Alternative, modified as described in Section 4.7.3.2.
b. Impacts of Treatment and Storage Alternative would be same as those for Proposed Action.

The projected radiation dose to the maximally exposed offsite individual under the Proposed Action and Treatment and Storage Alternative slightly exceeds the significance level (0.11 compared to 0.1 millirem per year). Under these alternatives, the cumulative dose from projected AMWTP emissions plus the baseline dose from existing sources and foreseeable increases to the baseline is about 0.25 millirem per year. Although Idaho regulations do not specify an allowable increment for radiation dose, this level is well below the applicable NESHAP standard of 10 millirem per year. The projected radiation dose for the Non-Thermal Treatment Alternative is 0.0017 millirem per year, which is below the significance level.

5.7.4.3.3 Impacts Due to Secondary Growth. The construction and operation of the proposed AMWTP would be associated with a minor growth in employee population and would not result in any air quality impacts due to general commercial, residential, industrial, or other growth.

5.7.4.3.4 Stratospheric Ozone Depletion. The 1990 amendments to the CAA address the protection of stratospheric ozone through a phaseout of the production and sale of stratospheric ozone-depleting substances. Ozone-depleting substances would be produced or emitted by the proposed AMWTP in very small quantities, and there would be no effect on stratospheric ozone depletion.

Table 5.7-9. PSD increment consumption at INEEL boundary and public road locations (Class II areas) for the combined effects of existing sources, foreseeable increases, and the proposed AMWTP.

		Allowable	Baseline sources plus increases[a]			Impact of alternative			Cumulative PSD increment consumed		
Pollutant	Averaging time	PSD increment (ug/m³)	Site Boundary (ug/m³)	Public roads (ug/m³)	% of PSD Increment[b]	Site boundary (ug/m³)	Public roads (ug/m³)	% of PSD increment[b]	Site boundary (ug/m³)	Public roads (ug/m³)	% of PSD increment[b]
Proposed Action[c]											
Sulfur dioxide	3-hour	512	135	147	29	40	24	8	175	171	34
	24-hour	91	29	32	35	8.3	3.4	9	37	35	41
	Annual	20	0.99	2.4	12	0.2	0.1	1.2	1.2	2.5	12
Particulate matter (PM-10)	24-hour	30	7.4	15	50	6.0	2.5	20	13	17	58
	Annual	17	0.32	0.92	5	0.004	0.002	0.02	0.32	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	33	0.2	0.1	0.9	6.1	8.3	33
Non-Thermal Treatment Alternative											
Sulfur dioxide	3-hour	512	135	147	29	13	8.0	2	148	155	30
	24-hour	91	29	32	35	2.8	1.2	3	32	33	36
	Annual	20	0.99	2.4	12	0.002	0.001	0.01	1.0	2.4	12
Particulate matter (PM-10)	24-hour	30	7.4	15	50	2.9	1.2	10	10	16	54
	Annual	17	0.32	0.92	5	0.001	0.0009	0.01	0.32	0.92	5
Nitrogen dioxide	Annual	25	5.9	8.2	33	0.03	0.02	0.1	5.9	8.2	33

a. Foreseeable increases are assumed to be represented by the DOE INEL EIS Preferred Alternative (unmodified).
b. The higher of the site boundary and public road locations is used.
c. Impacts of the Treatment and Storage Alternative would be identical to those of the Proposed Action.

5.7.4.3.5 Acidic Deposition. Emissions of sulfur and nitrogen compounds and, to a lesser extent, other pollutants, including VOCs, contribute to a phenomenon known as acidic deposition.[1] Under the Proposed Action or Treatment and Storage Alternative, emissions of sulfur dioxide from the proposed AMWTP could reach levels of about 22 tons per year, while emissions of nitrogen dioxide could reach almost 26 tons per year. Under the Non-Thermal Treatment Alternative, nitrogen dioxide emissions would be about 3 tons, while sulfur dioxide emissions would be less than 1 ton. Emissions of these levels are not expected to contribute significantly to acidity levels in precipitation in the region, nor will they have effects over greater distances, such as may occur with very tall stacks associated with large utility power plants.

5.7.4.3.6 Global Warming. Emissions of carbon dioxide, methane, nitrous oxides, and chlorofluorocarbons (commonly known as greenhouse gases) are associated with potential for atmospheric global warming. Of these, only carbon dioxide would be emitted by the proposed AMWTP in potentially significant amounts. Under the Proposed Action or Treatment and Storage Alternative, annual emissions of carbon dioxide (a combustion byproduct of thermal treatment and fuel combustion in boilers, heaters, and emergency generators) would be about 10,800 tons. Under the Non-Thermal Treatment Alternative, roughly one-fourth this amount—about 2,530 tons—would be emitted from boilers and a generator. Total U.S. carbon dioxide emissions are over 5.5 billion tons per year (USA 1997). There are currently no requirements that limit emissions of carbon dioxide from the proposed facility (USA 1997).

5.7.5 Air Resource Impacts from Alternatives Due to Mobile Sources

The ambient air quality impacts at offsite receptor locations due to the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEEL site facilities were assessed in the DOE INEL EIS. The mobile source impacts associated with the proposed AMWTP are bounded by those associated with the Preferred Alternative described in the DOE INEL EIS. The assessment findings indicate that the Preferred Alternative would result in some minor increase in service vehicles and employee vehicles, especially during construction activities. The peak cumulative impacts (baseline plus future projects) were due almost entirely to existing traffic conditions and were found to be well below applicable standards. The proposed AMWTP is expected to have little or no impact on traffic volume at the INEEL and would produce only a small increase in vehicular-induced air quality impacts.

5.7.6 Air Resource Impacts from Alternatives Due to Construction

The primary impact related to construction activities would be the generation of fugitive dust, which includes respirable particulate matter. While dust generation would be mitigated by the application of water, relatively high levels of particulates could still occur in localized areas. Emissions of other criteria pollutants from construction-related combustion equipment may also result in localized impacts to air quality. Impacts of construction were assessed in the DOE INEL EIS for projected construction for the period 1995 through 2005 under each of the environmental restoration and waste management alternatives. For the DOE INEL EIS Preferred Alternative, annual average concentrations of respirable particulate matter would not exceed 1 percent and 3 percent of the applicable standard at the maximum INEEL boundary and public road locations, respectively. Over shorter periods (24-hour averaging time), respirable and total particulate levels would be 1 percent or less of the standards at the INEEL boundary. However, it is typical of major construction activities to intermittently produce relatively high levels of fugitive dust in the vicinity of the activity, and short-term, localized levels of particulate matter, which, if not mitigated,

[1] One form of acidic deposition is commonly referred to as acid rain.

could exceed applicable standards. Levels of other criteria pollutants are predicted to be a small fraction of applicable standards.

The impacts of construction of the proposed AMWTP would result primarily from the disturbance of up to 7 acres of land, resulting in the generation of fugitive dust, and from the emission of combustion byproducts from construction equipment. As specified by Sections 650 and 651 of Rules for the Control of Air Pollution in Idaho (IDHW 1997), all reasonable precautions will be taken to prevent the generation of fugitive dust. Dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls (such as halting construction during high-wind conditions) (IDHW 1997). Construction-related impacts for the proposed AMWTP are expected to fall within the bounds of impacts identified in the DOE INEL EIS.

5.7.7 Advanced Mixed Waste Treatment Project Design Measures to Minimize Impacts

The proposed AMWTP has been designed to minimize the potential environmental impacts associated with releases of air contaminants and to operate within the specifications of current and proposed regulations for combustion of hazardous waste. In particular, the following design and operational features will minimize the production and release of air pollutants (BNFL 1997a):

- Controlled feed streams to the incinerator, including limits on hourly feed rate, and maximum chlorine, ash, and regulated metals feed rates;

- Controlled combustion with temperature, pressure, gas velocity, residence time, waste feed rate, and other combustion parameters continuously monitored and controlled as a means to achieve the minimum required destruction and removal efficiency for organic hazardous constituents;

- Independent air pollution control systems for the incinerator, melter, non-thermal treatment, and other ancillary processes;

- Good Engineering Practice stack design to minimize concentrations of contaminants in the building cavity and provide good dispersion of airborne effluents (MK 1997);

- Various controls and parameter monitoring and recording to ensure proper system operation and compliance with standards; and

- Trial burn, startup, and testing of incinerator operations which will occur for a period of several months with simulant chemicals and materials that are not regulated as hazardous wastes.

The incinerator air pollution control system includes a combination of dry filtration and wet scrubbing systems, including quench air cooling, a high-temperature filter, saturation quencher, packed bed absorber for acid gas and mercury removal, a candle demister, three-stage high-efficiency particulate air (HEPA) filtration, associated pumps and blowers, and an exhaust stack. Detailed information on the incinerator air pollution control system, as well as systems for other pre-treatment, treatment, and sampling processes, is provided in Section E-3.2.8 of Appendix E-3, Air Resources.

5.8 Water Resources

This section discusses potential environmental consequences to water resources inside and outside the INEEL site boundaries under each of the four alternatives. Each alternative was evaluated with respect to its impacts on surface and subsurface water quality and water use. Previous groundwater computer modeling of the vadose zone and saturated contaminant transport shows that existing plumes would not greatly affect the regional groundwater quality because no contaminants would migrate offsite in concentrations above the EPA drinking water standards (DOE INEL EIS, Volume 2, Section 5.8.2.2 [DOE 1995]). Since the existing major facility area (RWMC) would be affected most by the Proposed Action, the water resources for the RWMC and area surrounding the RWMC are emphasized.

5.8.1 Methodology

The methodology used to assess the impacts to water resources from treatment and storage activities identified under the alternatives was to integrate available studies and technical information with available computer modeling studies to evaluate aquifer contaminant transport and predict future trends in water quality during the implementation period for the proposed alternatives.

The primary assumption used to evaluate consequences to water resources under any of the alternatives was that no future intentional discharge of radioactive liquid effluents to subsurface or surface waters would occur exceeding the standards established in DOE Order 5400.5 (DOE 1993) and applicable Federal and State regulations. Activities proposed under the alternatives have been reviewed to identify potential waste streams and water usage. No alternative would result in the intentional discharge of radioactive liquid effluents to the vadose zone (DOE INEL EIS, Volume 2, Section 5.8.2.2). There are no radioactive discharges directly to the Snake River Plain Aquifer from existing operations, and deep well injection of radioactive waste at the Idaho Chemical Processing Plant (ICPP) was discontinued in 1985. In addition, the existing lagoons at the facility are used exclusively for retention of sanitary sewage effluent from the support facilities at RWMC and do not accept process waste. Liquid effluent discharges from RWMC activities to the surface and subsurface waters via ponds are monitored (see Section 4.8, Water Resources) for the presence of radioactive and chemical constituents and would be in compliance with applicable Federal and State regulations.

Any process effluents generated under the alternatives at the proposed facility would be contained in tanks or sumps and, under normal operating conditions, radioactive and chemical discharges to the soil or directly to the aquifer would not occur.

5.8.2 Water Resources Impacts from the No Action Alternative

Under the No Action Alternative, existing waste management operations, facilities, and projects would continue for the management of TRU, alpha LLMW, and LLMW on the INEEL. No near-term discharges of hazardous or radioactive wastes to the vadose zone would be expected to occur. Over the long-term, however, the potential for chronic leakage and contamination of the vadose zone would increase (see Section 5.21). The evaluation of water resources consequences for the No Action Alternative involves assessing the impacts from past activities and estimating what might occur in the future.

For surface water, no direct impact would result to the Big Lost River, Little Lost River, or Birch Creek from continuation of existing activities and normal operations at the RWMC. Current operating and monitoring practices would continue for National Pollution Discharge Elimination System (NPDES) storm water and liquid effluent discharges from associated facilities within the RWMC.

DOE INEL EIS (Volume 2, Section 5.8.2) conducted an extensive review of the INEEL's environmental consequences for the No Action Alternative as well as portions of other alternatives. In lieu of duplication of that discussion in this EIS, Volume 2, Section 5.8 and Appendix F-2.2 of the DOE INEL EIS are referenced for surface and subsurface water and water use.

For subsurface waters, very small impacts would result from potential future sources of contamination compared with sources from previous practices (Becker et al. 1996). Past groundwater modeling indicates that current contaminant plumes will continue to migrate, but contaminant concentrations within the plumes would continue to decrease with time (DOE INEL EIS, Section 5.8.2.2). Currently, volatile organic compound contamination at the RWMC is being actively remediated with the vapor vacuum extraction system. As a result of these remediation activities, these contaminants would pose a negligible impact to the groundwater or vadose zone (DOE-ID 1997c).

A radiological performance assessment for the low-level waste buried at the RWMC from 1984 through 1995 and projected to be disposed of through 2020 indicated that the maximum total pathway exposure occurring by 2060 at the INEEL site boundary would be less than 0.60 millirem/year (Maheras et al. 1994).

Waste retrieved from the TSA Retrieval Enclosure (TSA RE), along with newly generated waste, would be stored onsite or offsite.

The consumption of water from the Snake River Plain Aquifer under the No Action Alternative would continue at the current level (DOE INEL EIS, Volume 2, Section 5.8.2.2).

5.8.3 Water Resources Impacts from the Proposed Action

Under the Proposed Action, water consumption would increase as a result of construction activities, operational activities, and increased workers at the facility. The total water consumption of 2.7 million gallons per year under this alternative is a small percentage increase compared to INEEL's current water usage (1.9 billion gallons per year) or the consumptive use water rights of 11.4 billion gallons per year (Yaklich 1998). Water would be required for operational activities during pretreatment, supercompaction, and macroencapsulation processes as part of the AMWTP operations (BNFL 1997a).

The existing grade of the AMWTP would be 1.2 feet above the probable maximum flood elevation of 5,016.8 feet above mean sea level (BNFL 1997a). The AMWTP would not be located within a 100-year floodplain based on probable maximum precipitation (Dames & Moore 1993).

Excess water used for dust control purposes during construction activities would be collected and routed through erosion and sedimentation control measures prior to discharging to the existing approved NPDES outfall (BNFL 1997b) and would be monitored according to the current Storm Water Pollution Prevention Plan. For surface water, no liquid effluent would be discharged. Storm water would flow from the AMWTP facility's sloped roof to an exterior catch basin as part of the storm water drainage system (BNFL 1997a). Storm drain culverts in the vicinity of the AMWTP facility are designed to discharge peak flows from a 25-year storm event. To satisfy the Design Basis Flood event, ponding, or backwater elevation of the 100-year storm does not exceed 5,017 feet (1 foot below the finished grade of the AMWTP facility) (BNFL 1997a). The storm water would be collected ultimately within one of the storm water sampling collection points and appropriately monitored according to the Storm Water Pollution Prevention Plan currently operating at the INEEL prior to leaving the RWMC. Compliance with the RWMC NPDES Permit and Idaho Administrative Procedures Act (IDAPA) 16.01.02.299 Wastewater Treatment Regulations would be maintained. Current operating and monitoring practices would continue for NPDES storm water at associated facilities within the RWMC.

No liquid effluents from waste treatment processes would be discharged to the subsurface; therefore, no impacts would be expected. All waste handling, storage, and treatment would be conducted in areas of the facility that are covered with a base that consists of a secondary spill containment system (e.g., engineered system constructed for detection and collection of spills) to prevent leaks and spills of waste until the accumulated materials are detected and removed, preventing releases to the environment that could potentially impact groundwater (BNFL 1997a). Because all waste handling, storage, and treatment occurs within a building, impacts to groundwater would not occur for the Proposed Action. Construction activities would increase the number of workers and water usage, but the amount of water usage during construction would be minimal.

The AMWTP design would include storage provisions to isolate containerized waste from the environment and prevent deterioration of container integrity. Additionally, secondary containment would be provided to prevent any inadvertent releases from entering the environment (BNFL 1997a). Waste packages having a potential for residual liquid would have an absorbent agent added to ensure immobilization of potential liquid (BNFL 1997a). In order to prevent contamination of the water supply, no restrooms or drinking water fountains would be located within the operational areas of the AMWTP (BNFL 1997a).

5.8.4 Water Resources Impacts from the Non-Thermal Treatment Alternative

Impacts to water resources would be similar for the Non-Thermal Treatment Alternative as for the Proposed Action.

5.8.5 Water Resources Impacts from the Treatment and Storage Alternative

Impacts to water resources would be the same for the Treatment and Storage Alternative as for the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.9 Ecological Resources

This section discusses the potential effects of the construction and operation of the AMWTP and alternatives on ecology on the INEEL, the RWMC, and the surrounding area.

5.9.1 Methodology

The assessment of potential effects is based on an evaluation of the location of activities for constructing and operating the AMWTP at the RWMC and the alternatives in relation to the presence of biological attributes. Impacts have been assessed based on studies of impacts of similar types of activities on the biota at INEEL and in the surrounding area. Construction activities associated with land and animal disturbance (e.g., earth-moving and equipment noise) would be the primary source of impacts.

5.9.2 Ecological Impacts from the No Action Alternative

Potential effects of existing waste management operations, facilities, and projects under the No Action Alternative include traffic noise, human presence, radiological and nonradiological emissions from waste treatment, and restoration operations. All No Action Alternative activities would be conducted within or immediately adjacent to existing operating facilities. Existing noise, human presence, night lighting, and emissions would not change. Plant and animal species currently occupying or using areas near these facilities already have some tolerance to human presence and waste management operations and activities. Therefore, adverse effects to plants and animals near the RWMC due to human presence, noise, night lighting, and emissions are expected to be minor.

Under the No Action Alternative, the potential to affect Federal-listed plant and animal species or species identified by other Federal and/or State agencies as sensitive, rare, or unique is not likely, because the existing waste management operations occur in developed industrial areas.

No Action Alternative activities would continue within the developed industrial areas designated for these functions; therefore, no activities that could potentially affect wetlands and surface waters would be expected.

Under the No Action Alternative, biota would continue to be exposed to existing levels of radionuclides in water and soil. Small mammal and vegetation studies conducted within and near existing waste management facility areas indicate that observable radiological effects have been noted (Section 4.9.5); however, no effects on populations or transport of radionuclides by vegetation or animals have been observed (Arthur 1982, Morris 1993).

5.9.3 Ecological Impacts from the Proposed Action

The Proposed Action would disturb approximately 7 acres to construct the AMWTP and support infrastructure. All of the project area within the RWMC has been previously disturbed as a result of ongoing waste management and environmental restoration activities. Since the construction site is a large area of packed gravel, there is little or no vegetation and no wildlife cover or food. The utilization of previously disturbed habitat within the boundary of the RWMC would have a negligible impact on INEEL wildlife habitat. The undisturbed native vegetation surrounding the RWMC provides much more important and higher quality habitat than that of the project site.

Construction of the AMWTP and support infrastructure modifications (i.e., electric substation and power line extension) could have a minor adverse impact on small, less mobile, mammals during project site construction activities. Birds in the project site area may be displaced to adjacent similar habitat within the RWMC or offsite. Large mammals would not be affected because the majority of activities associated with the Proposed Action would occur within the fenced boundary of the RWMC. Because of the proximity of the new power line extension to the boundary and fence of the RWMC, large mammals would not be adversely affected.

The operation of the AMWTP could slightly increase human presence, night lighting, and noise within the RWMC. However, the disturbance would not eliminate or restrict the use of habitat by animals surrounding the RWMC.

The Proposed Action would not affect Federal- or State-listed protected, sensitive, rare, or unique species because none occur inside the fenced boundary of the RWMC. Before construction, pre-activity surveys of the new facility areas, including the potential sewage lagoon site, would be conducted to identify any protected or sensitive species. The power line extension corridor would be surveyed before construction and could be re-routed if necessary to avoid damage to biological and cultural resources. Because there are no wetlands within the RWMC where the AMWTP would be constructed or along the proposed power line extension corridor, wetlands would not be affected by the Proposed Action.

Expansion of the existing RWMC sewage lagoon system located south of the TSA outside the RWMC fenced boundary may be required to support AMWTP operation. If needed, the existing sewage lagoons would be augmented with a new 0.5-acre lagoon. Construction of the lagoon would occur within an existing 1-acre disturbed portion of land used as a construction laydown area next to the existing sewage lagoons. If constructed, the new lagoon would represent an increase in surface water and would have a small beneficial effect on some wildlife species with access to the lagoons.

Due to the projected minor increases in ambient criteria pollutant concentrations, no impacts to local soils or vegetation, including the local sagebrush vegetation community, gazing habitats, or distant agricultural areas are expected. The NPS has issued interim guidelines for protection of sensitive resources relative to air quality concerns (DOI 1994). For sulfur dioxide, the NPS recommendation to maximize protection of all plant species is to maintain levels below 40 to 50 ppb for a 24-hour averaging time, and 8 to 12 ppb for annual average levels. The lower end of these irnages correspond to about 100 to 20 micrograms per cubic meter, respectively. The NPS guideline for annual average nitrogen dioxide is less than 15 ppb, which corresponds to about 28 micrograms per cubic meter.

For the proposed AMWTP operating under either the Proposed Action or Treatment and Storage Alternative, the maximum ambient air levels to sulfur dioxide would be about 8 micrograms per cubic meter. The projected annual average nitrogen dioxide level at the maximally impacted offsite or public road location would also be about 0.2 micrograms per cubic meter. When the additive impacts of baseline plus foreseeable projects are included, sulfur dioxide concentrations remain well within these guidelines for offsite locations, but modeling results indicate that 24-hour levels could exceed the guidelines for locations along public roads traversing the INEEL. This exceedance is due almost entirely to levels associated with existing sources (including foreseeable increases). The annual average guideline for nitrogen dioxide would not be exceeded at any INEEL boundary or public road locations, even when the contributions from existing sources are added.

The State of Idaho has established air quality standards intended to limit the concentration of fluoride in vegetation used for feed and forage (IDHW 1997). Monitoring of fluoride levels would be required unless analysis shows that fluoride concentrations in ambient air, averaged over 24-hour periods, would not exceed 0.25 micrograms per cubic meter. Analyses were performed to estimate the projected fluoride levels at the nearest grazing areas as a result of hydrogen fluoride emissions from the proposed AMWTP. Under the Proposed Action, the maximum 24-hour averaged level is estimated at 0.23 micrograms per cubic meter and would occur within the INEEL at a location 3 kilometers south-southwest of the proposed AMWTP location. From this, it can be reasonably concluded that fluoride levels in feed and forage outside INEEL boundaries would be within the Idaho standards. The State may or may not require monitoring to ensure compliance with these standards.

Potential radionuclide exposure of plant and animal species within the RWMC and in the adjacent surrounding area may increase slightly due to the operation of the AMWTP; however, potential radionuclide emissions from the facility are well below regulatory limits (Section 5.7.3) and are not expected to significantly affect biotic populations and communities in the area. The long-term exposure and uptake by plant and animal species within the RWMC and adjacent surrounding area are surveyed and reported annually in the INEEL Site Environmental Report in accordance with DOE Order 5400.1 (DOE 1990). Any measurable change in exposure or uptake due to the AMWTP would be identified by the environmental surveillance program and assessed to determine any measurable long-term impacts.

5.9.4 Ecological Impacts from the Non-Thermal Treatment Alternative

The ecological effects under the Non-Thermal Treatment Alternative would be similar to those described for the Proposed Action except for the potential radionuclide emissions exposure and uptake by plant and animal species, and there would be no fluoride emission. Radionuclide emissions predicted for the Non-Thermal Treatment Alternative (Section 5.7.3) are lower than for the AMWTP using the thermal treatment process under the Proposed Action, and indicate a smaller potential for exposure and uptake by plant and animal species within the RWMC and in the adjacent surrounding area. Any measurable increase in long-term exposure and uptake by plant and animal species within the RWMC and adjacent surrounding area would be reported in the INEEL Site Environmental Report in accordance with DOE Order 5400.1. Potential ecological impacts under the Non-Thermal Treatment Alternative due to construction of the power line extension and the potential expansion of the existing RWMC sewage lagoons would be the same as described for the Proposed Action.

5.9.5 Ecological Impacts from the Treatment and Storage Alternative

Activities associated with the Treatment and Storage Alternative would have the same potential impacts on ecological resources as described for the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21 would be in addition to impacts for treatment.

5.10 Noise

This section discusses the potential effects of the four proposed AMWTP alternatives on noise levels at the INEEL site and in the surrounding area.

5.10.1 Methodology

Outdoor noise source terms associated with the proposed AMWTP alternatives are provided in Table 5.10-1. The table presents AMWTP sound sources within the human hearing frequency range and their associated attenuation with distance. For comparison, a maximum permissible outdoor sound level near a hospital or church would be 55 decibels A-weighted (dBA) (i.e., referenced to the A-scale, approximating human hearing response) during the day and 45 dBA at night. The U.S. Department of Housing and Urban Development has classified sources exceeding 65 dBA for a total of less than 8 hours per 24 hours as normally acceptable (HUD 1971). Facility noises generated on the INEEL do not propagate offsite at levels that impact the general population, since all public areas are at least 4 miles away from site facility areas. Therefore, INEEL noise impacts for each alternative would derive from transportation noises generated during the movement of personnel and materials to and from the proposed AMWTP and within nearby communities.

Plant operating noises, as well as roadway, aircraft, and railroad noises have been considered. The roadway noises considered are noises caused by busing personnel to and from the proposed AMWTP and transporting construction materials and waste by truck. Blasting may be necessary during the construction phase.

Table 5.10-1. Predicted noise impact from sources related to the proposed AMWTP.

Activity	Source strength (dBA)/reference distance	Predicted noise level ranges (dBA) at various distances from sources: 500 ft.	1,000 ft.	1/2 mile	1 mile
Construction equipment	85-90 / 50 ft.	65 - 75	59 - 69	51 - 61	45 - 55
Rail engine	86-96 / 100 ft.	76 - 86	71 - 81	64 - 74	58 - 68
Rail car (40 mph)	80-86 / 100 ft.	68 - 74	62 - 68	53 - 59	48 - 54
Bus, truck	85-90 / 50 ft.	65 - 75	59 - 69	51 - 61	45 - 55

Source: adapted from VTN 1977, and EPA 1975.

5.10.2 Noise Impacts from Alternatives

Noise impacts for the No Action Alternative are addressed in Section 5.10 of the DOE INEL EIS and are found to be insignificant.

Because the proposed AMWTP workforces are expected to be a small component of the proposed INEEL workforce, the overall noise level resulting from the proposed AMWTP construction- and operations-traffic in the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative would be expected to be generally lower than the DOE INEL EIS noise baseline.

The number of trucks carrying construction materials or waste under the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative, respectively, is expected to be, at most, a few per day (see Section 5.11, Traffic and Transportation). These trucks would be indistinguishable from existing (No Action Alternative) traffic that travels to and from the INEEL each day. Construction and operation of the proposed AMWTP would have little effect on existing levels of highway use. Because current noise levels are well within acceptable values, noise impacts due to the proposed AMWTP personnel transportation would not be expected.

With regard to aircraft noises, the modest changes in the workforce for the Proposed Action, the Non-Thermal Treatment Alternative, and the Treatment and Storage Alternative, respectively, would be insufficient to change the combined number of aircraft landings in the Idaho Falls and Pocatello Airports.

Likewise, regional freight trains would not be expected to increase or decrease in number as a result of any AMWTP alternative. Construction and operation of the proposed AMWTP would have little effect on existing levels of rail use.

Previous studies of the effects of noise on wildlife indicate that the projected noise levels associated with all alternatives for the proposed AMWTP (less than 65 dBA at 3,000 feet for all activities) would have no deleterious effect on wildlife sensitive receptors (ERT 1980, Leonard 1993b).

In summary, noise impacts associated with any construction and operation of the proposed AMWTP or any of the alternatives would not be expected.

5.11 Traffic and Transportation

This section summarizes the methods of analysis and potential impacts related to traffic and transportation associated with the construction and operation of the proposed AMWTP. The impacts are presented by alternative and include doses and health effects where applicable. Transportation impacts associated with shipments to WIPP are addressed in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (SEIS-II) and are not part of the scope of this EIS (DOE 1997d). Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL were assessed both in DOE INEL EIS and in the Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE 1997c).

5.11.1 Methodology

Transportation of people and materials required due to increased construction and operational activities could impact the regional traffic system around the INEEL and could result in increases in traffic accidents, injuries, and fatalities. These impacts, such as increased vehicle mileage, accidents, and traffic congestion, are measured using the level of service for each road segment.

The Level-of-Service concept is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and passengers. A Level-of-Service is defined for each roadway or section of roadway in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety (TRB 1994).

For purposes of evaluating impacts of increased traffic and usage, the capacity of the roadway in terms of vehicles per hour for a given level of service is first established using the procedure in the Transportation Research Board's Highway Capacity Manual (TRB 1994). The level of service based on existing traffic flow is then established. A new level of service is calculated, based on the number of shipments of waste and construction materials and the number of workers associated with each alternative. These levels of service are compared to determine if the capacity of the highway is exceeded or if the level of service has changed.

The baseline level of service for the road system surrounding the INEEL is Level-of-Service A, or free-flowing, as reported in Section 5.11, Traffic and Transportation, of Volume 2 of the DOE INEL EIS (DOE 1995). This was based on data for U.S. Highway 20, which has the highest use around the INEEL. The peak number of vehicles per hour would have to increase from 122 to 291 to re-classify U.S. Highway 20 from Level-of-Service A to Level-of-Service B, where the presence of other users in the traffic system begins to be noticeable. The peak number of vehicles per hour on U.S. Highway 20 would have to increase from 122 to 2,126 to exceed the capacity of the highway.

5.11.2 Traffic and Transportation Impacts from the No Action Alternative

There would be no traffic or transportation impacts associated with the proposed AMWTP under the No Action Alternative since the facility would not be constructed. Shipment of TRU waste to WIPP would continue on a schedule that meets the milestone date of December 31, 2002. Shipments to WIPP would continue only as could be supported by existing facilities at the INEEL. Transportation impacts associated with shipments to WIPP are addressed in the SEIS-II and are not part of the scope of this EIS (DOE 1997d).

5.11.3 Traffic and Transportation Impacts from the Proposed Action

Under the Proposed Action, construction of the proposed facility would begin in 1999 and would be completed before the end of 2002. The proposed AMWTP construction would involve less than 50 offsite truck trips as assessed in Section C-4.4.1 of Volume 2 of the DOE INEL EIS. The peak workforce associated with the proposed AMWTP is 254 jobs and would occur during the construction phase of the project as noted in Section 5.3, Socioeconomics.

The increased movement of materials and workers under the Proposed Action would increase the maximum number of vehicles per hour by less than 50, which is still within the range of Level-of-Service A and would result in no change to the Level-of-Service associated with U.S. Highway 20. The number of vehicles per hour would have to increase by a factor of over 10 to exceed the capacity of the highway. Based on these results, the impacts to the regional traffic system around the INEEL would be minimal under the Proposed Action.

Shipments to WIPP of up to 29,000 cubic meters of contact-handled (CH) TRU waste and up to 1,920 cubic meters of remote-handled (RH) TRU waste from INEEL and Argonne National Laboratory-West (ANL-W) were assessed in the SEIS-II (DOE 1997d). The transportation impacts associated with the shipment of these treated TRU waste volumes from INEEL to WIPP are not part of the scope of this EIS.

Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL were assessed both in DOE INEL EIS and in the WM PEIS (DOE 1997d). A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued.

5.11.4 Traffic and Transportation Impacts from the Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, the proposed treatment facility would not use any thermal treatment technology but would use the treatment options of supercompaction and macroencapsulation. Construction of the proposed AMWTP facility would still begin in 1999 and be completed before the end of 2002. The impacts on the regional transportation system and impacts associated with the transportation of TRU waste are the same as discussed in Section 5.11.3 for the Proposed Action.

The treatment of offsite waste, such as LLMW, in the proposed facility is expected to be minimal. A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued. The assessment of the transportation impacts associated with LLMW is outside the scope of this EIS.

5.11.5 Traffic and Transportation Impacts from the Treatment and Storage Alternative

Under the Treatment and Storage Alternative, construction of the proposed AMWTP facility would still begin in 1999 and be completed before the end of 2002. The impacts on the regional transportation system during construction are the same as discussed in Section 5.11.3 for the Proposed Action. There would be no offsite transportation impacts associated with TRU waste because INEEL TRU waste would remain in storage at the RWMC after treatment.

Transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL have been assessed both in DOE INEL EIS and in the WM PEIS. A decision regarding the treatment and disposal alternatives for LLMW assessed in the WM PEIS has not been issued. The assessment of the transportation impacts associated with LLMW is outside the scope of this EIS.

5.12 Occupational and Public Health and Safety

This section presents potential health effects to both workers and the public from implementation of the four proposed waste management alternatives under consideration for treatment of LLMW currently stored at the RWMC. The potential health effects assessed in this section consider the following receptors:

- Involved workers – workers directly involved with proposed treatment alternatives;
- Highest onsite (worker) location – location with the highest health impacts within the INEEL boundary;
- Maximally exposed individual (MEI) – location with the highest health impacts outside of the INEEL boundary;
- Population – collective offsite population in the INEEL region; and
- Construction worker – labor force associated with construction activities.

Radiological and chemical health effects and industrial safety hazards are considered in the analysis. The methodology used for this assessment parallels that used in the DOE INEL EIS. Additional details on assessment methods, assumptions, and related information are contained in Appendix E-4, Occupational and Public Health and Safety, and in Section 5.12 and Appendix F-4 of the DOE INEL EIS.

5.12.1 Radiological Exposure and Health Effects

The measure of impact used for evaluation of potential health effects from radiation exposure is risk of fatal cancer. Worker and MEI effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of cancer fatality. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of latent cancer fatalities in the affected population. For the calculation of health effects from radiation exposure, radiation doses are multiplied by the appropriate International Commission on Radiological Protection (ICRP) risk factors. Tables 5.12-1, 5.12-2, and 5.12-3 summarize the annual and operating lifetime radiological health effects calculations for the No Action, Proposed Action, and Non-Thermal Treatment Alternative, respectively. The impacts from the Treatment and Storage Alternative would be similar to those for the Proposed Action regarding the treatment of waste, however, the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

The human health risk associated with radiological exposure is assessed based on risk factors contained in the ICRP Recommendations (ICRP 1991). For the calculation of health effects from exposure to airborne radionuclides, the annual doses provided in Section 5.7, Air Resources, were multiplied by the appropriate risk factors presented in Tables 4.12-1 and 4.12-2 of Section 4.12, Occupational and Public Health and Safety. Receptor doses were modeled using GENII (Napier et al. 1988) with meteorological and population data specific to the INEEL together with projected emission rates. The meteorological data, population distribution, and emission rates are presented in Section 5.7, Air Resources. The ISC-3 dispersion model (EPA 1995b) is used to estimate dispersion factors used in the radiological dose calculation for MEI and onsite worker chemical hazard evaluation. The estimated fatal cancer incidence in Tables 5.12-1, 5.12-2, and 5.12-3 is for annual and operating lifetime cumulative radiological exposure that includes (1) the baseline dose associated with the existing operations at INEEL, (2) projected increases that would occur from INEEL activities aside from the proposed AMWTP, and (3) the dose contribution that would occur from the proposed alternatives. The contribution from each of these sources and the cumulative doses and associated human health impacts are presented in Appendix E-4. The annual and operating lifetime cumulative dose and fatal cancer information in Tables 5.12-1, 5.12-2, and 5.12-3, is from INEEL sources only and does not include natural background doses presented in Table E-4.1-5 of Appendix E-4, Occupational and Public Health and Safety.

The involved worker is an individual who would work at the proposed AMWTP. The dose received by this worker results from direct exposure and is assumed to be equal to that received by workers involved in current RWMC operations. The dose to the involved worker is assumed to not exceed the current annual INEEL administrative limit of 1.5 rem. The average dose to the involved worker is calculated based on the average dose measured from 1992 to 1997 for the RWMC workers. These data are presented in Appendix E-4.

Table 5.12-1. Fatal cancer risk from radiological exposure resulting from annual radiological emissions [a].

Receptor	No Action Alternative		Proposed Action Alternative		Non-Thermal Treatment Alternative	
	Dose (millirem)	Fatal cancer	Dose (millirem)	Fatal cancer	Dose (millirem)	Fatal cancer
MEI involved worker [b]	1500	6.00E-04	1500	6.00E-04	1500	6.00E-04
Average involved worker [c]	0.081	3.24E-08	0.081	3.24E-08	0.081	3.24E-05
MEI onsite	0.023	9.20E-09	0.73	2.92E-07	0.003	1.20E-09
MEI offsite	0.11	5.50E-08	0.11	5.50E-08	0.0017	8.50E-10
Population [d]	0.41	2.05E-04	0.056	2.80E-05	0.00037	1.85E-07

a. Data including identification of radionuclides responsible for doses from Table 5.7-3 of Section 5.7, Air Resources.
b. The involved worker dose is 1500 mrem and is based on the INEEL administrative dose limit. This is a conservative assumption and the involved worker would not be expected to reach this dose limit in any year of continuous routine operation.
c. The average involved worker dose is the average dose measured from year 1992-1997 for RWMC radiation workers (see Appendix E-4 Table E-4.1-7 for detail) and is based on the assumption that the doses for activities under the proposed
alternative would be similar to the doses measured during waste management activities at the RWMC.
d. The population dose is in person-rem

Table 5.12-2. Summary of cumulative radiation dose and human health impacts associated with annual radiological airborne emissions from the AMWTP.

Receptor	Baseline		Projected		AMWTP		Cumulative	
	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)	Dose millirem	Risk [a] (fatality)
No Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.0	-	0.23	9.20E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0	-	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.0	-	0.50	2.50E-04
Proposed Action Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.73	2.92E-07	0.96	3.84E-07
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.11	5.50E-08	0.25	1.25E-04
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.056	2.80E-05	0.55	2.75E-04
Non-Thermal Treatment Alternative								
MEI Onsite	0.21	8.40E-08	0.023	9.20E-09	0.003	1.20E-09	0.24	9.60E-08
MEI Offsite	0.031	1.55E-08	0.11	5.50E-08	0.0017	8.50E-10	0.14	7.00E-08
Population [b]	0.085	4.25E-05	0.41	2.05E-04	0.00037	1.85E-07	0.50	2.50E-04

a. The risk fatality for MEI is based on annual dose and one individual, the population risk is based on annual dose and total population of 82,000 within 80 kilometer of the site.
b. The population dose is in person-rem per year.

Table 5.12-3. Summary of radiation dose and human health impacts associated with airborne emissions over the projected operating lifetime of the AMWTP [a].

	13-year facility lifetime		30-year facility lifetime	
Receptor	Dose	Risk (fatality)	Dose	Risk (fatality)
Proposed Action				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04
Non-Thermal Treatment Alternative				
MEI Onsite	0.039 millirem	1.56E-08	d	d
MEI Offsite	0.023 millirem	1.15E-08	d	d
Population	0.0043 person-rem[b]	2.15E-06	d	d
Treatment and Storage Alternative				
MEI Onsite	9.5 millirem	3.80E-06	22 millirem	8.80E-06
MEI Offsite	1.5 millirem	7.50E-07	3.4 millirem	1.70E-06
Population	0.65 person-rem [b]	3.25E-04	1.6 person-rem [c]	8.00E-04

a. Data for dose and lifetime from Table 5.7-4 of Section 5.7, Air.
b. The population dose and risk is based on total population of 82,000.
c. The population dose and risk is based on total population of 89,000.
d. AMWTP would not operate beyond 13 years under this alternative.

Because there would be no discharges to surface or groundwater under the Proposed Action and other alternatives, the human health risk from radiological contaminants in the drinking water for onsite workers and the public would be the same as described in Section 4.12, Health and Safety.

5.12.2 Nonradiological Exposure and Health Effects

The projected AMWTP emissions data listed in Table 5.7-2 of Section 5.7, Air Resources, were used to evaluate health impacts associated with potential exposure to criteria and toxic air pollutants. Maximum concentrations of criteria pollutants and toxic pollutants in ambient air for the maximum levels predicted to occur at the INEEL boundary, along public roads, and at Craters of the Moon are presented in Tables 5.7-5 and 5.7-6 of Section 5.7, Air Resources. As in the case of radiological impacts, the consequences described for nonradiological impacts include contributions from existing (baseline) sources and projected increases. For all cases, the predicted cumulative impacts for criteria pollutants would be well within the Ambient Air Quality Standard contained in Idaho regulations (IDHW 1997). This corresponds to a hazard quotient of less than one, indicating that no adverse health effects would occur as a result of criteria pollutant emissions. Hazard quotients for noncarcinogenic toxic air pollutants are much less than one in all cases, indicating that offsite levels are well below the acceptable ambient concentrations established by the State of Idaho (IDHW 1997).

Table 5.12-4 presents the lifetime cancer risks from the concentration of carcinogenic air pollutants at the INEEL boundary location and at Craters of the Moon. Table 5.12-4 provides the maximum concentration, inhalation unit risk, and calculated cancer risk from chemicals in air. The inhalation unit risk for carcinogens is assessed using EPA inhalation slope factors. The highest offsite cancer risk under the Proposed Action is for carbon tetrachloride (released from the treatment facility) at the site boundary (1 cancer incidence in 263 million). The total cancer risk under the Proposed Action for all nonradiological carcinogenic chemicals would be 1.3×10^{-8} (1 in 80 million) at the site boundary and 4.4×10^{-10} (1 in 2 billion) at Craters of the Moon. The total cancer risk under the Non-Thermal Treatment Alternative for all nonradiological carcinogenic chemicals would be 2.0×10^{-9} (1 in 500 million) at the site boundary and 4.5×10^{-10} (1 in 2 billion) at Craters of the Moon. The impacts from the Treatment and Storage Alternative would be the same as those for the Proposed Action regarding the treatment of waste, however, the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

Because there would be no discharges to surface water or groundwater under the Proposed Action and other alternatives, the human health risk from chemical contaminants in the drinking water for onsite workers and the public would be the same as described in Section 4.12, Occupational and Public Health and Safety.

5.12.3 Industrial Safety

This section describes the following impacts for workplace hazards: (1) total reportable injuries and illness and (2) fatalities in the workforce. This analysis considered injury and fatality rates for construction workers from Section 4.12, Occupational and Public Health and Safety, and applied them to the estimated number of worker hours for each proposed alternative. The estimated nonradiological impacts to workers at the proposed AMWTP by alternative for the duration of facility construction and operations are presented in Table 5.12-5. The activities that workers would perform under each of the proposed alternatives would be similar to those currently performed at the INEEL and RWMC. Therefore, the potential hazards encountered in the workplace would be similar to those that currently exist at the INEEL and RWMC. The impacts from the Treatment and Storage Alternative would be the same as those for the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

Table 5.12-4. Lifetime cancer risk for annual release of nonradiological carcinogenic air pollutants.

Pollutant	Concentration μg/m³		Inhalation unit risk [μg/m³]⁻¹	Cancer risk (cancer incidence)	
	Site Boundary	Craters of the Moon	Site Boundary and Craters of the Moon	Site Boundary	Craters of the Moon
Proposed Action					
Arsenic	2.2E-09	7.5E-11	4.3E-03	9.46E-12	3.2E-13
Asbestos	3.1E-13	1.6E-14	2.3E-01	7.1E-14	3.7E-15
Benzene	1.0E-04	2.4E-06	8.3E-06	8.3E-10	2.0E-11
Beryllium	8.7E-10	2.9E-11	2.4E-03	2.1E-12	7.0E-14
Cadmium	2.2E-09	7.5E-11	1.8E-03	4.0E-12	1.4E-13
Carbon tetrachloride	2.5E-04	9.1E-06	1.5E-05	3.8E-09	1.4E-10
Chloroform	2.7E-05	1.1E-06	2.3E-05	6.2E-10	2.5E-11
Chromium (hexavalent)	8.7E-10	2.9E-11	1.2E-02	1.1E-11	3.5E-13
1,2-Dichloroethane	2.7E-05	1.0E-06	2.6E-05	7.0E-10	2.6E-11
1,1-Dichloroethylene	2.7E-05	1.1E-06	5.0E-05	1.4E-09	5.5E-11
Dioxins and furans[a]	5.8E-11	2.1E-12	42.9	2.5E-09	9.0E-11
Formaldehyde	1.5E-04	3.2E-06	1.3E-05	2.0E-09	4.2E-11
Methylene chloride	2.7E-05	1.1E-06	4.7E-07	1.3E-11	5.2E-13
Nickel	8.7E-10	2.9E-11	2.4E-04	2.1E-13	7.0E-15
Polychlorinated biphenyls	7.1E-06	2.6E-07	1.0E-04	7.1E-10	2.6E-11
Tetrachloroethylene	5.7E-05	2.5E-06	NA[c]	NA[c]	NA[c]
1,1,2-Trichloroethane	2.7E-05	1.0E-06	1.6E-05	4.3E-10	1.6E-11
Trichloroethylene	5.7E-05	2.5E-06	NA[c]	NA[c]	NA[c]
Non-Thermal Treatment Alternative					
Arsenic	9.1E-14	4.5E-15	4.3E-03	3.9E-16	1.9E-17
Asbestos	3.1E-13	1.6E-14	2.3E-01	7.1E-14	3.7E-15
Benzene	4.3E-05	9.4E-07	8.3E-06	3.6E-10	7.8E-12
Beryllium	6.0E-14	3.0E-15	2.4E-03	1.4E-16	7.2E-18
Cadmium	9.1E-14	4.5E-15	1.8E-03	1.6E-16	8.1E-18
Carbon tetrachloride	1.0E-05	5.0E-07	1.5E-05	1.5E-10	7.5E-12
Chloroform	3.8E-06	1.9E-07	2.3E-05	8.7E-11	4.4E-12
Chromium (hexavalent)	4.6E-15	2.3E-16	1.2E-02	5.5E-17	2.8E-18
1,2-Dichloroethane	3.1E-06	1.6E-07	2.6E-05	8.1E-11	4.2E-12
1,1-Dichloroethylene	3.8E-06	1.9E-07	5.0E-05	1.9E-10	9.5E-12
Dioxins and furans[a]	(b)	(b)	42.9	(b)	(b)
Formaldehyde	7.6E-05	1.6E-06	1.3E-05	1.0E-09	2.1×10^{-11}
Methylene chloride	3.8E-06	1.9E-07	4.7E-07	1.8E-12	8.9E-14
Nickel	2.6E-14	1.3E-15	2.4E-04	6.2E-18	3.1E-19
Polychlorinated biphenyls	1.7E-13	8.6E-15	1.0E-04	1.7E-17	8.6E-19
Tetrachloroethylene	3.4E-05	1.7E-06	NA[c]	NA[c]	NA[c]
1,1,2-Trichloroethane	3.1E-06	1.6E-07	1.6E-05	5.0E-11	2.6E-12
Trichloroethylene	3.4E-05	1.7E-06	NA[c]	NA[c]	NA[c]

a. The unit risk factor for dioxins and furans was conservatively based on the most toxic congener 2,3,7,8-Tetrachloro dibenzo dioxin (TCDD).
b. Substance would not be emitted by non-thermal treatment.
c. NA refers to not available at this time.

Note: The Treatment and Storage Alternative impacts would be the same as the Proposed Action regarding the treatment of waste, however, the potential storage impacts identified in Section 5.21 would be in addition to Impacts for treatment.

Table 5.12-5. Estimated industrial safety impacts by alternative for duration of construction and operation [a].

	Proposed Action			Non-Thermal Treatment Alternative		
Category	Operation	Construction	All Workers	Operation	Construction	All Workers
Annual workers	146	2,400	2,546	133	2,400	2,533
Annual hours[a]	2.72E+05	4.80E+06	5.07E+06	2.47E+05	4.80E+06	5.05E+06
Annual injury/illness[b]	4.5	154	159	4.1	154	158
Annual fatalities[c]	<<1	0.38	0.4	<<1	0.38	0.4
Total injury/illness	135	385	520	53	385	508
Total fatalities	0.65	0.96	1.6	0.26	0.96	1.5

a. Total injury/ illness and total fatalities are calculated for treatment facility duration of 30 years for the Proposed Action and 13 years for Non-Thermal Treatment, and construction activity duration of 2.5 years.

b. Annual injury/illness rates for INEEL operation and construction are 3.3 and 6.4 per 200,000 hours, Respectively (DOE rates are 3.7 and 6.4 per 200,000 hours, respectively) (DOE 1996a).

c. Annual fatality rates for INEEL operation and construction are 0.016 fatalities per 200,000 hours (DOE rate is 0.0034).

5.13 Idaho National Engineering and Environmental Laboratory Services

5.13.1 Methodology

This section describes the impact on INEEL services for the four proposed AMWTP alternatives: No Action, Proposed Action, Non-Thermal Treatment, and Treatment and Storage. These impacts are evaluated by comparing engineering estimates of service usage for the proposed AMWTP with the INEEL and RWMC usage rates described in Section 4.13, INEEL Services, and comparing potential total usage rates with physical and regulatory limits where appropriate.

5.13.2 Idaho National Engineering and Environmental Laboratory Services Impacts from the No Action Alternative

There would be minimal service impacts from the No Action Alternative. Essentially, the service requirements would continue to be the same for managing the waste that is in the TSA. Some amount of additional storage space might be required for waste generated in the future. TRU waste would continue to be shipped to the WIPP; but, since waste would continue to be stored at the RWMC, the change in service usage would not be significant. Additional shipments to WIPP would be supported using current INEEL facilities. Retrieval of waste from the TSA RE would require storage in RCRA-compliant storage, resulting in minimal additional service usage. The Waste Experimental Reduction Facility would continue to operate (until 2003 or 2006) to treat LLMW. Some additional services would be used in the future, if this facility continued to operate longer than currently planned.

5.13.3 Idaho National Engineering and Environmental Laboratory Services Impacts from the Proposed Action

The usage rates for various services for the Proposed Action are based on engineering estimates provided in the "Advanced Mixed Waste Treatment Project's submittal of Compa's request for Utility Loads in support of the AMWTP Environmental Impact Statement (EIS)-AM-BN-L-124" (Yaklich 1998). Except for the potential requirement for a new sewage lagoon, and the requirement for a new substation and power line, no additional new facilities would be required to provide these services to the proposed AMWTP. Most of these new services represent a small increase from current INEEL services and would not cause negative impacts to RWMC services. These estimated AMWTP service requirements are compared with current INEEL and RWMC service usage and INEEL capacities in Table 5.13-1.

With the exception of propane use, the increase in usage relative to current INEEL usage is small, and, for water and electricity, would not approach INEEL site capacities. The large propane usage increase results primarily from the use of propane in the AMWTP incinerator. Propane storage tanks would be part of the proposed AMWTP.

The AMWTP would hook into the current RWMC water system. The current water system has adequate capacity to support the proposed AMWTP.

The AMWTP may require new wastewater disposal facilities. Existing sewage lagoons south of the RWMC might be used, or a new approximately 0.5-acre lagoon may be added to operate in parallel with the existing lagoons. The need for the additional 0.5-acre lagoon has not been determined. The expanded sewage system would be tied into an existing sewage line.

Table 5.13-1. AMWTP services compared to INEEL services.

Service	INEEL capacity[a]	INEEL usage[b]	AMWTP usage[b]	AMWTP % increase	RWMC usage
Water	11.4 billion gal/yr	1.3 billion gal/yr	2,700,000 gal/yr	0.7	4,190,000 gal/yr
Electricity	394,000 MWh/yr[c]	173,862 MWh/yr	35,022 MWh/yr	20	6,206 MWh/yr
Diesel	NA	617,947 gal/yr	16,000 gal/yr	2.6	(d)
Propane	NA	130,249 gal/yr	925,000 gal/yr	810	48,019 gal/yr
Wastewater	NA	149 million gal/yr	1,870,000 gal/yr	1.0	1,270,000 gal/yr

a. Based on physical, contractual, and regulatory limits as described in Section 4.13. NA means "not applicable" or "unknown."
b. Based on usage in Section 4.13 for INEEL and RWMC, not including Idaho Falls facilities.
c. MWh = megawatt-hour.
d. Very small unknown amount is used.

Only sewerage and clean waste water would be collected by the sanitary waste system and discharged to the sewage lagoons. Process water, such as that used in the incinerator and vitrification processes, and potentially radioactive contaminated water from decon showers would be processed in evaporators.

The proposed AMWTP would require a new electrical substation and a new approximately 3,000-foot aboveground power line (DOE-ID 1998). The new substation would be placed in the southeast corner of the RWMC, and an underground line would connect to the AMWTP facility. The aboveground power line would run from the new substation east and north to tap into an existing 138-kilovolt line.

The phone and data communication lines for the AMWTP would be tied into the current INEEL system. Radio communications would be integrated into the current INEEL system. No capacity issues or negative impacts would be anticipated on the current INEEL systems.

Existing security and emergency protection site services would provide adequate services for the AMWTP. No significant expansion of these site services is anticipated as a consequence of constructing and operating the proposed AMWTP. AMWTP-specific security and emergency protection programs would be developed and provided by the AMWTP staff and would meet the equivalent requirements and provide similar capabilities as described in Section 4.13.5, Security and Emergency Protection.

All onsite contractors and DOE-ID are part of a site-wide system for providing security and emergency protection. The proposed AMWTP would be integrated into this system and formal, documented interfaces would be developed between the AMWTP and the other onsite contractors and DOE-ID.

The proposed AMWTP would have a Waste Minimization Plan which would outline methods to minimize wastes generated and would have elements on pollution prevention awareness. The plan's implementation would minimize the quantity and toxicity of wastes generated and would provide for reporting waste minimization/pollution prevention progress. The project would advance DOE's waste minimization/pollution prevention goals by reducing the volume and toxicity of current wastes stored at RWMC. The waste would also be packaged to comply with final disposal requirements. There would be a short-term increase in pollution emissions and a small additional amount of waste generated during operation of the facility. But the long-term environmental risk of the currently stored waste would be greatly reduced.

It would be premature to identify energy and water conservation features that might be incorporated into this project. As the design progresses, studies would be performed and conservation features would be incorporated into the facility if there is a reasonable financial payback. Some preliminary examples are multiple glazing on windows; a heat recovery system on the heating ventilation, and air conditioning system; a process water recovery system; and maximizing the use of energy efficient lighting.

5.13.4 Idaho National Engineering and Environmental Laboratory Services Impacts from the Non-Thermal Treatment Alternative

The significant difference for the services requirements for the Non-Thermal Treatment Alternative relative to the Proposed Action is that there would be no incinerator or vitrification system. This would mean a reduction in water, electricity, and propane usage for the proposed AMWTP. There would be no significant change in other service requirements.

Water usage for the vitrifier, incinerator, and evaporators would be eliminated. This would have an insignificant effect because the RWMC currently has adequate capacity for the Proposed Action. Since most of the process water eliminated would have been evaporated and not discharged to the sewage system, this would not affect requirements for the sewage system. If less personnel were employed at the facility, the potential need for an addition to the sewage lagoons would be lessened.

Electricity requirements would increase by 23,980 megawatt hours per year compared to 35,022 megawatt hours per year increase required for the Proposed Action and Treatment and Storage Alternative. The facility would still exceed the power capacity currently available at the RWMC. The new electrical substation and power line would still be required (Hanson 1998). Part of the waste stream would not be treatable and would require storage. There may be slight increases in electricity usage for other operations because a greater part of the waste stream might be subjected to non-thermal treatment, but this increase would be small compared to the decreased electricity use without thermal treatment.

The propane usage would increase by 185,000 gallons per year compared with the 925,000 gallons per year increase required for the Proposed Action and Treatment and Storage Alternative. The use or non-use of this propane would not be expected to significantly impact the INEEL or RWMC.

5.13.5 Idaho National Engineering and Environmental Laboratory Services Impacts from the Treatment and Storage Alternative

This alternative is the same as the Proposed Action regarding the treatment of waste, however the potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment. The current storage facilities at the RWMC would be utilized, but additional onsite storage facilities would probably have to be built. The services impacts would be the same as for the Proposed Action with small increases in the use of energy for heating and lighting to support storage. This energy would probably be in the form of electricity or propane. No new facilities to provide services beyond those for the Proposed Action would be anticipated to be required, except that the eventual shipping of the stored waste to a final repository might require additional services.

5.14 Facility Accidents

This section addresses potential environmental consequences inside and outside of the INEEL site boundaries from facility accidents under each of the alternatives. Since the RWMC would primarily be affected by the alternatives, accidents at the RWMC are emphasized.

An accident is defined here as an unexpected or undesirable event that leads to a release of hazardous or radioactive material within a facility or into the environment. Events that could lead to an accidental release of hazardous or radioactive material fall into three broad categories: external events, internal events, and natural phenomena events. External events (e.g., aircraft crashes) originate outside a facility. Internal events (e.g., equipment failures or human errors) originate within a facility. Natural phenomena events include weather-related and geological occurrences (e.g., tornadoes, earthquakes, and volcanism). All of these events could lead to a release of hazardous or radioactive material from a facility.

The DOE INEL EIS conducted an extensive review and analysis of environmental consequences, which can be applied here. In particular, the potential impacts of facility accidents under various alternatives are addressed. As a result, Section 5.14 and Appendix F-5 of Volume 2 of the DOE INEL EIS are incorporated by reference in this EIS. Specifically, the bounding accident from the DOE INEL EIS, a lava flow over the RWMC, will be presented as a baseline. Then, the bounding accidents from the updated RWMC Safety Analysis Report (SAR) will be presented which provide a focused evaluation of consequences from RWMC operations. Preliminary screening results from the AMWTP Preliminary SAR (PSAR) will be used to provide an estimate of expected additional risk from the proposed facility.

5.14.1 Historical Perspective

Information on accidents that have occurred in INEEL waste activities is based on review of safety analysis reports and the INEL Historical Dose Evaluation Project (DOE-ID 1991b). The airborne pathway is the principal pathway by which radioactive materials released on the INEEL can reach an offsite member of the public.

Three fires have occurred at the RWMC. Two occurred in 1966 in exposed waste material in trenches, thought to be caused by alkali metals in disposed waste. Disposal in trenches was later discontinued at the RWMC. The third fire occurred in 1970 in a drum of stored waste from the Rocky Flats Plant, postulated to have been caused by radiant solar heating of the black drum surface. Monitoring and accident recovery activities from the fires indicated that releases and spread of radionuclides was undetectable (EG&G 1986). As a result of this waste container fire, the drums are now painted white to reduce the absorption of heat from the sun. There has not been a fire in a waste container at the RWMC since the 1970 incident (LMITCO 1997c).

One accident involving a spill and release of radioactive material occurred on January 9, 1978. In a handling accident, a drum was penetrated by a forklift tine, spilling a portion of the drum contents. The spilled waste was immediately contained, and no detectable airborne release of radionuclides occurred (EG&G 1986). A second spill occurred on April 21, 1988, when a damaged waste box was moved by forklift from the TSA RE pad into the Certified and Segregated (C&S) Building. The original damage was apparently caused by a forklift when the waste box was initially stored. The subsequent movement spread contamination into the C&S Building.

The DOE INEL EIS presented data on the rate of worker fatalities that showed the worker fatality rate was very low compared to the rates from industry groups, such as agriculture and construction, and was comparable to those for trade and services groups. The average worker fatality rate at the INEEL from 1983-1992 was 2.5×10^{-5} per worker per year.

5.14.2 Methodology

The DOE INEL EIS methodology employed a screening approach that focused detailed analysis on scenarios that posed the greatest risk to the public. Those scenarios were termed bounding, and the calculations that supported the estimates of risk were performed such that the estimates are unlikely to be exceeded in the event of an actual accident. The hypothetical accidents analyzed were selected so that they would produce effects that would be as severe or more severe than any other accidents that might reasonably be foreseen (Slaughterbeck et al. 1995).

The RWMC SAR (LMITCO 1997c) and the AMWTP PSAR (BNFL 1998d) both performed a similar screening approach in which potential accidents were grouped into four categories corresponding to different likelihood ranges. The frequency of an accident is defined based on the quantitative assessment of how many times a year a particular accident is expected to occur. Table 5.14-1 illustrates this concept for the four categories: anticipated events, unlikely events, extremely unlikely events, and beyond extremely unlikely events.

Table 5.14-1. Likelihood categories of potential accidents.

Category	Frequency (accidents per year)
Anticipated events (A)	Frequency $\geq 1 \times 10^{-2}$
Unlikely events (U)	1×10^{-2} > frequency $\geq 1 \times 10^{-4}$
Extremely unlikely events (E)	1×10^{-4} > frequency $\geq 1 \times 10^{-6}$
Beyond extremely unlikely events (B)	Frequency $< 1 \times 10^{-6}$

The AMWTP PSAR accident selection criteria are consistent with guidance in DOE-STD-3009-94, "Preparation Guide for U.S. Department of Energy NonReactor Nuclear Facility Safety Analysis Reports." The methodology begins with the accident scenarios identified by a detailed hazards evaluation. Those scenarios are then used to select candidate accidents for more detailed analysis.

The hazard evaluation identifies a set of accident scenarios that can result in the uncontrolled release of radioactive and/or hazardous material from AMWTP facilities. The objective of the accident selection process is to identify a subset of these accident scenarios which bounds the consequences and represents the various release situations for the purpose of characterizing the level of safety of the AMWTP. Candidate accidents are selected based on the following criteria: 1) accidents that bound those of lesser but similar potential consequences; 2) accidents that represent the highest risk based on qualitative estimates of likelihood and consequences; and 3) other accidents, while not necessarily bounding, that represent accidents presenting some unique but important phenomenological challenge to system safety.

Selected accidents provide an envelope of accident conditions to which AMWTP operations can be evaluated. They represent a variety of accident causes and locations, involving different materials at risk. Included are internal events, external events, and events caused by natural phenomena. These accidents were selected such that they represent others that present some unique but important challenge to AMWTP safety. This set of accidents contains accidents that represent all other accidents with high and moderate consequences and is know as the candidate design basis accidents. It should be noted that there are numerous credible accidents that do not appear in the list of design basis accidents. That is because they are essentially duplicates or accidents that were bounded by another of a similar type. Details of this accident selection process can be found in the AMWTP PSAR.

Doses to the public resulting from accidents are mechanistically calculated and presented in units of rem or millirem. Resulting health effects from the potential exposure are then calculated using risk factors taken from the 1990 ICRP Recommendations (ICRP 1991). The risk factor for a member of the public is defined as the probability of contracting a fatal cancer, which is 0.0005 per rem. These results are given (when available) for an individual at the nearest public access location, the MEI, and the offsite population within a 50-mile radius of the facility. The risk factors for contracting a nonfatal cancer or genetic effect are a factor of 5 and 4 less, respectively, than the risk factor for fatal cancers. Fatal cancers thus are the dominant risk measure.

Nonradiological exposures to the public were also considered by the DOE INEL EIS for the bounding lava flow accident. The consequences are presented in Section 5.14.3.

Details of the facility accident methodology are given in Appendix E-5, Facility Accidents, of this EIS.

5.14.3 Facility Accident Impacts from the No Action Alternative

The DOE INEL EIS indicated that there was enough radioactive material at the RWMC to potentially cause consequences to the public under accident conditions. That was the case for TRU waste, low-level waste, and LLMW. Table 5.14-2 lists the accidents that were determined to be the bounding scenarios. Bounding, in this sense, means being the largest potential contributors of dose to the public. The hypothetical MEI is that individual whose residence is assumed to be located at the nearest site boundary which is about 6 kilometers south of the RWMC. The SAR utilized for the explosion and fire accidents did not provide the population risk of fatal cancers, because DOE Orders do not specifically require this information. As demonstrated by the dose to the MEI, however, public consequences from those accidents are bounded by the lava flow accident.

Table 5.14-2. Bounding accidents for TRU wastes.

				Number of fatal cancers	
Accident	Frequency category	Dose to MEI (rem)	Likelihood of fatal cancer to MEI	Population, 50% meteorology	Population, 95% meteorology
Waste box spill	Anticipated	6.5×10^{-3}	3.3×10^{-6}	Not calculated	Not calculated
Drum explosion	Anticipated	4.0×10^{-3}	2.0×10^{-6}	Not calculated	Not calculated
Earthquake	Unlikely	5.0×10^{-2}	2.5×10^{-5}	Not calculated	Not calculated
Fire in C&S	E[a]	7.5×10^{-2}	3.8×10^{-5}	Not calculated	Not calculated
Lava flow over RWMC	E to B[b]	9.4×10^{-2}	4.7×10^{-5}	1.2×10^{-2}	4.8×10^{-2}

Source: LMITCO 1997c, pg. 3-47; Slaughterbeck 1995, pg. 5-16.
a. E: extremely unlikely.
b. B: beyond extremely unlikely.

The highest consequences are reported for the lava flow scenario that is estimated to have the lowest frequency. The frequency of this scenario reported in support of the DOE INEL EIS would place the event in the extremely unlikely category (2.5×10^{-5} per year). However, the latest SAR for the RWMC ([LMITCO 1997], pg. A-7) has refined this frequency. The conditional probability of thermal or physical disruption of the wastes at RWMC is estimated to be one or more order of magnitude lower than 2.5 x 10^{-5} per year, because not all lava flows would reach RWMC.

Using the accepted risk factor of 0.0005 deaths per rem to the general public from the 1990 ICRP Recommendations (ICRP 1991), the risk of contracting a fatal cancer for a member of the public living at the nearest site boundary can be calculated. For the lava flow scenario, that risk is less than 1 in 10,000. When the probability of occurrence of that scenario is accounted for, the risk of fatal cancer to the MEI is less than 1 in a billion per year.

Doses to the co-located worker at a downwind distance of 100 meters were also determined for the bounding accidents for the RWMC SAR (LMITCO 1997c) and are presented in Table 5.14-3. The lava flow scenario was not assessed because the co-located worker would have ample time to evacuate prior to the lava flow covering the RWMC. The risk factor for contracting a fatal cancer from radiation exposure to a worker population is 0.0004 deaths per rem from the 1990 ICRP Recommendations (ICRP 1991). The risk factor for a worker population is slightly smaller than for the general population because of the difference in age distribution between the two population groups.

Table 5.14-3. Bounding accident results for 100-meter co-located worker.

Accident	Frequency category	Dose to 100-m co-located worker (rem)	Likelihood of fatal cancer to co-located worker
Waste box spill	Anticipated	0.032	1.3 x 10^{-5}
Drum explosion	Anticipated	2.77	1.1 x 10^{-3}
Earthquake	Unlikely	5.69	2.3 x 10^{-3}
Fire in C&S	Extremely unlikely	8.50	3.4 x 10^{-3}

Source: LMITCO 1997c, pg. 3-47.

The accident with the most severe consequences from hazardous chemical release would be the lava flow over the RWMC. The chemical concentrations of greatest concern are due to mercury and nitric acid. As shown in Table 5.14-4, exposure guidelines are only exceeded for the lava flow accident which is now considered to be a beyond extremely unlikely event. No Emergency Response Planning Guideline (ERPG) values have been established for mercury and nitric acid. However, the toxicological guidelines developed for these chemicals are intended to have the same definitions as the ERPGs. Both mercury and nitric acid exceed the TOX-2 limits for the lava flow scenario. Based on the ERPG definitions, TOX-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

Table 5.14-4. Bounding accident results for toxicological releases.

		Chemical concentration at MEI (mg/m^3)	
Accident	Frequency category	Nitric acid TOX-2[a]: 6.4 TOX-1[a]: 5	Mercury TOX-2[a]: 1.0 TOX-1[a]: 0.05
Waste box spill	Anticipated	3.26 x 10^{-7}	1.27 x 10^{-8}
Drum explosion	Anticipated	2.04 x 10^{-8}	3.79 x 10^{-8}
Earthquake	Unlikely	5.51 x 10^{-4}	2.16 x 10^{-5}
Fire in C&S	Extremely unlikely	1.72 x 10^{-4}	3.20 x 10^{-3}
Lava flow over RWMC	Extremely unlikely to beyond extremely unlikely	16.0 > TOX-2	3.0 > TOX-2

Source: LMITCO 1997c, pgs. 3-37 thru 3-46; Slaughterbeck 1995, pg. 7-11.
[a] For anticipated events, the offsite consequences should be less than the PEL-TWA or the TLV-TWA, whichever is more restrictive. TOX-1 is the applicable evaluation guideline for unlikely events and TOX-2 is applied for more extreme unlikely events. (See E-5.2.3)

5.14.4 Facility Accident Impacts from the Proposed Action

Preliminary accident screening for the proposed AMWTP has identified nine scenarios as part of its design basis (BNFL 1998d). These accident scenarios are described in Table 5.14-5. The fire scenario in the box/drum line is contained within the proposed AMWTP facility so that no release occurs outside the facility. The waste box drop is the same accident identified in the No Action Alternative but would occur at a higher frequency due to the greater number of annual handling operations during operation of the proposed AMWTP facility. The waste box drop is the scenario with the highest consequences within the anticipated frequency category. For the unlikely frequency category, the waste transfer vehicle fire has the highest consequences. The Type II storage module fire has the highest consequences within the extremely unlikely frequency category. The remaining eight accident scenarios have offsite consequences and are either specific to the proposed AMWTP facility or a potential result of AMWTP operations.

Table 5.14-5. Preliminary accident screening for proposed AMWTP.

Accident description	Frequency category
Fire involving uncontained waste in the AMWTP box and drum line confinement cell	Anticipated
Loss of pressure differential between confinement zones due to loss of electrical power and backup diesel generator failure	Anticipated
Waste box dropped outdoors and breaks open during transfer between facilities within the TSA	Anticipated
Fire involving TRU waste containers within the TSA RE	Unlikely
Incinerator explosion and confinement cell breach caused by a flameout, buildup of excess volatiles and/or propane, and subsequent ignition and explosion	Unlikely
Wind-borne missile breach of building structure which causes a waste box to break open	Unlikely
Fire involving waste transfer vehicle during transfer between facilities within the TSA	Unlikely
Vitrifier explosion and confinement cell breach due to severe water incursion and subsequent steam explosion	Extremely unlikely
Fire in Type II storage module caused by either a range fire, a propane delivery truck accident, or an internal fire that is not detected or suppressed	Extremely unlikely

Preliminary quantification of the source terms for the eight significant accidents scenarios are presented in Table 5.14-6 (BNFL 1998d). The lava flow scenario for the No Action Alternative would have a potential source term of 0.231 grams of americium-241 (Am-241); 18,400,000 grams of mercury; and 9,900,000 grams of nitric acid. While the radiological consequences of the Type II storage module fire may be similar to the lava flow scenario, the toxicological exposures are expected to be a couple orders of magnitude lower. Quantitative assessments of the consequences to the co-located worker and offsite public will be calculated as part of the preliminary safety analysis report that is under preparation.

Table 5.14-6. Source terms for bounding accident scenarios for Proposed Action.

Accident	Am-241 release (g)	Mercury release (g)	Nitric acid release (g)
Fire box/drum line	3.63×10^{-6}	1.68	2.03
Loss of electrical power	8.78×10^{-6}	2.02×10^{-5}	1.22×10^{-2}
Waste box drop	1.75×10^{-3}	4.04×10^{-3}	2.44
Fire within the TSA RE	4.46×10^{-6}	2.40	2.90
Incinerator explosion	1.97×10^{-5}	2.27×10^{-3}	2.75×10^{-2}
Wind-borne missile breach	1.75×10^{-4}	4.04×10^{-4}	0.244
Waste transfer vehicle fire	9.37×10^{-4}	505	610
Vitrifier explosion	3.29×10^{-4}	—	—
Fire in Type II storage module	0.167	9.00×10^{4}	1.09×10^{5}

Additional details on the AMWTP accidents and associated source terms are provided in Appendix E-5, Facility Accidents.

5.14.5 Facility Accident Impacts from the Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, the proposed treatment facility would not use any thermal treatment technology but would use the treatment options of supercompaction and macroencapsulation. Although the waste inventories and the amount of handling of waste should be very similar between the two alternatives, the Non-Thermal Treatment Alternative would not have any incinerator or vitrifier accidents as in the Proposed Action.

5.14.6 Facility Accident Impacts from the Treatment and Storage Alternative

The impacts from facility accidents for the Treatment and Storage Alternative would be the same as the impacts from the Proposed Action regarding the treatment of waste. There would be no risk reduction from the offsite shipment of stored TRU waste. The potential storage impacts identified in Section 5.21, Long-Term Storage Impacts, would be in addition to impacts for treatment.

5.15 Cumulative Impacts

Impacts from Proposed Action are cumulative when added to impacts from other existing and planned activities at the INEEL. An assessment incorporating the impacts from these other activities is important because cumulative impacts can result from several smaller actions that by themselves do not have significant impacts.

A cumulative impact is defined as the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). This section describes potential impacts resulting from other facilities, operations, and activities (see Table 5.15-1) described and analyzed for Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal) in Section 5.15 of the DOE INEL EIS that in combination with the Proposed Action and additional area projects may contribute to cumulative impacts. The AMWTP was included in the DOE INEL EIS as a component evaluated in Alternative B and D, but because of the conceptual design and lack of a specific siting location the potential impacts of the facility were very conservative. The more refined analyses presented in this document indicate fewer and much smaller potential adverse impacts. Therefore, the approach to evaluate cumulative impacts was to tier from the DOE INEL EIS cumulative impact analysis, and identify the project-specific impact increment attributed to the Proposed Action analyzed in this document. This resulted in an overall reduction in the cumulative impacts identified in the DOE INEL EIS analyses. Reasonably foreseeable offsite actions evaluated in the DOE INEL EIS are shown in Table 5.15-2.

Because of its proximity to the INEEL and the use of the Scoville siding on INEEL near the RWMC, the proposed System Integration Corporation quartzite mining operation in Arco Hills was included as a reasonably foreseeable action that could potentially contribute to cumulative impacts in this analysis.

The following sections discuss the cumulative impacts identified for the AMWTP evaluated in this EIS. In order to show the highest potential cumulative impacts, the maximum impacts of the Proposed Action are used in the discussion. In addition to the impacts of these alternatives, impacts from other proposed projects that may contribute to a cumulative impact are also discussed. Detailed discussions of the resources are provided only when potentially notable cumulative impacts were identified. Table 5.15-3 shows a summary of the related cumulative impacts by resource area for the resources which have the potential to result in significant cumulative impacts.

Land Resources. Construction activities associated with the proposed AMWTP at INEEL would result in land resource impacts due to site preparation. The INEEL would receive additional land resource impacts from the other projects evaluated in the cumulative impact analysis presented in the DOE INEL EIS. Cumulatively, the proposed AMWTP facilities would use a small percentage of the INEEL's available land. Additionally, the Proposed Action activities would be located in the RWMC conducting the same or very similar types of activities. The Proposed Action activities and land use would be consistent with the existing land use plans and policies of the INEEL.

Table 5.15-1. Projects at the INEEL associated with Alternative B (Ten-Year Plan) and Alternative D (Maximum Treatment, Storage, and Disposal).

Project Name	Project Name
Expended Core Facility Dry Cell Project	Mixed/Low-Level Waste Treatment Facility
Increased Rack Capacity for CPP-666	Mixed/Low-Level Waste Disposal Facility[b]
Additional Increased Rack Capacity (CPP-666)	Nonincinerable Mixed Waste Treatment[b]
Dry Fuel Storage Facility; Fuel Receiving Canning/Characterization and Shipping[b]	Remote Mixed Waste Treatment Facility
Fort St. Vrain Spent Nuclear Fuel Receipt and Storage	Sodium Processing Project
Spent Fuel Processing[a]	Greater-Than-Class-C Dedicated Storage
Experimental Breeder Reactor-II Blanket Treatment	Hazardous Waste Treatment, Storage, and Disposal Facilities
Electrometallurgical Process Demonstration (formerly known as Actinide Recycle Project)	Industrial/Commercial Landfill Expansion
Central Liquid Waste Processing Facility Decontamination and Decommissioning (D&D)	Gravel Pit Expansions[b]
Engineering Test Reactor D&D	Central Facilities Area Clean Laundry and Respirator Facility
Materials Test Reactor D&D	Calcine Transfer Project (Bin Set #1)
Fuel Processing Complex (CCP-601) D&D	Plasma Health Process Project
Fuel Receipt and Storage Facility (CCP-603) D&D	Test Area North Pool Fuel Transfer
Headend Processing Plant (CCP-604) D&D	Remediation of Groundwater Contamination
Waste Calcine Facility (CPP-633) D&D	Pit 9 Retrieval
Tank Farm Heel Removal Project	Vadose Zone Remediation
Waste Immobilization Facility[c]	Auxiliary Reactor Area (ARA)-II D&D
High-Level Tank Farm New Tanks[a]	Boiling Water Reactor Experiment (BORAX)-V D&D
New Calcine Storage[a]	High-Level Tank Farm Replacement (upgrade phase)
Radioactive Scrap/Waste Facility	Transuranic Storage Area Enclosure and Storage Project
Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	Waste Characterization Facility
Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	Waste Handling Facility
Idaho Waste Processing Facility[b]	Health Physics Instrument Laboratory
Experimental Reduction Facility Incineration[b]	Radiological and Environmental Sciences Laboratory Replacement

a. Alternative D only.
b. These projects would be expanded for Alternative D (Maximum Treatment, Storage, and Disposal).
c. Sodium-bearing and calcine waste treatment technology selection would be implemented through this facility.

Aesthetic and Scenic Resources. The potential for cumulative impacts on atmospheric visibility at Craters of the Moon Wilderness Area were indicated in the DOE INEL EIS (Section 5.7.4.3, Regulatory Compliance) using worst-case modeling conditions and no abatement controls for Alternatives B and D. While contrast evaluations showed no potential for objectionable impact, the criterion for acceptable color shift (delta E 2.0) would be exceeded. When maximum abatement was included in the analysis (70 percent on the Waste Characterization Facility and the AMWTP and 90 percent on the Waste Immobilization Facility and the Pit 9 Waste Retrieval) cumulative emissions resulted in an acceptable level (less than 2.0 delta E) of visibility degradation at the Craters of the Moon under Alternatives B and D. The contribution of the AMWTP to the color shift value based on analysis present in this EIS is 0.18 delta E. Air quality analysis prepared for the quartzite mine operation indicated no visual impacts would result at the Crater of the Moon Wilderness Area. No significant cumulative visual impacts are expected.

Table 5.15-2. Offsite activities included in the assessment of cumulative impacts in the DOE INEL EIS.

Activity	Description
Housing Development, Idaho Falls	300-unit single family housing development planned on approximately 150 acres of vacant land
Business Park, Rexburg	50 acres of vacant land between two light industrial facilities are planned for an expansion into a light industrial/business park for 30-40 businesses.
Manufacturer, Pocatello	Existing manufactured home factory to expand from approximately 50 to between 140 and 150 employees. Expansion of 22 acres in Pocatello Airport Industrial Park.
Food, Machinery, and Chemical Corp., Pocatello	FMC phosphate manufacturing plant to reduce number of furnaces from 4 to 3 within the next two years; 25-30 jobs could be lost.
Target Department Store, Idaho Falls	Opening of Target discount store and associated commercial development planned on vacant land near the Teton Mall in Idaho Falls.
System Integration Corporation Arco Hills Quartzite Mine[a]	Quartzite mining operation and ore processing near Arco Hills on 56 acres. Fourteen acres would be disturbed by the quarry operation and a small waste ore dump, 22 acres, would be disturbed by the construction of a haul road, 11 acres would be disturbed by the ore crushing facilities, and 9 acres would be disturbed by the loading facilities on the INEEL. The project would employ 40 workers.

a. New project added since the DOE INEL EIS was published.

Geology and Soils. Construction activities associated with the proposed AMWTP facility at INEEL, would result in soil disturbances and a potential for temporary increases in erosion. The INEEL would receive additional impacts to geology and soils from the other projects evaluated in the cumulative impact analysis presented in the DOE INEL EIS. Cumulatively, the potential for significant impacts as a result of soil disturbances would be minor since the AMWTP site has been previously disturbed. Standard construction soil erosion and stormwater control measures would mitigate any erosion from disturbed areas.

Ecological Resources. Construction activities associated with the AMWTP facility at the INEEL, could potentially disturb biotic resources. The construction and operation of other facilities evaluated in the cumulative impact analysis presented in the DOE INEL EIS could also impact biotic resources at the INEEL. Cumulatively, the total area of the habitats potentially affected would be small in comparison to the entire area of habitat available and actually less than analyzed in the DOE INEL EIS because it considered a 200 acre undisturbed site for the AMWTP outside the RWMC. The habitat losses would not be expected to affect any threatened or endangered species.

Cultural and Paleontological Resources. No known cultural resources would be affected by any of the proposed AMWTP action alternatives. The optional expansion of the RWMC sewage lagoon would potentially impact a known archeological site; however, archeological testing has indicated that the site is likely not eligible for nomination to the NRHP. A formal determination of eligibility of this site has not yet been made. Archeologists would monitor the site during any ground-disturbing activities. The Systems Integration Corporation quartzite mining area was surveyed and identified no significant archeological sites or archeological values that need to be protected. Because the DOE INEL EIS assumed the AMWTP facility would be located on 200 acres of undisturbed land, the potential cumulative impacts to cultural resources are actually less than indicated in that document.

Waste Management. Construction and operation wastes attributed to the AMWTP facility were included in the B and D Alternatives in the DOE INEL EIS. The TRU, low-level, and LLMW generated during operation would be managed in accordance with the INEEL Site Treatment Plan. Industrial waste generated during construction and operation would be disposed of in the INEEL Landfill Complex, based on the anticipated INEEL industrial waste quantities expected to be generated from the DOE INEL EIS Modified Ten-Year Plan Alternative and the other reasonably foreseeable DOE actions shown in Table 5.15-4. The INEEL Landfill Complex would provide adequate capacity for the next 30 to 50 years.

Transportation Radiological Impacts. The following discussion of cumulative impacts of transportation of radioactive material is tiered from the DOE INEL EIS analysis. The AMWTP was included in the analyses of the B and D Alternatives for transportation radiological impacts in the DOE INEL EIS. The analysis assumed 48 offsite construction truck trips, and during operations 9 non-radiological offsite truck trips per year and 1,022 radiological offsite truck trips per year. Therefore, the transportation radiological impacts of the project-specific analysis presented in this document have not been added here and are not cumulative.

The cumulative impacts of the transportation of radiological material consist of impacts from (1) historical shipments of waste and spent nuclear fuel to the INEEL site, (2) the alternatives evaluated in the DOE INEL EIS, (3) reasonably foreseeable actions that include transportation of radioactive material, and (4) general radioactive materials transportation that is not related to a particular action. The assessment of cumulative transportation impacts concentrated on the cumulative impacts of offsite transportation, because off site transportation yields larger doses to the general population than does onsite transportation. The collective dose to the general population and workers was the measure used to quantify cumulative transportation impacts. The measure of impact was chosen because it can be directly related to estimates of cancer fatalities using a cancer risk coefficient, and because of the difficulty in identifying a maximally exposed individual for shipments that occur, and would occur, all over the U.S. over an extended period of time, 1953 through 2005 (53 years).

The historical waste shipments consisted of shipments from offsite waste generators to the INEEL RWMC from 1957 through 1993. These data were linearly extrapolated back to 1954, the year that TRU waste was first shipped to the RWMC from the Rocky Flats Plant, because data for 1954 through 1956 were not available.

The historical shipments of spent nuclear fuel to the INEEL site consisted of shipments of naval spent nuclear fuel and test specimens from 1957 through 1995. Historical spent nuclear fuel also consisted of shipments of other DOE spent nuclear fuel to the INEEL besides naval shipments, such as research reactor spent nuclear fuel, commercial spent nuclear fuel, and Three Mile Island Core debris. Data for these shipments were available for 1973 through 1993 and were linearly extrapolated back to 1953, the start of operations at the ICPP, because data for 1953 through 1972 were not available.

For workers, historical offsite shipments of waste and spent nuclear fuel to the INEEL yielded a collective dose of 110 person–rem or 0.044 cancer fatalities. For the general population, historical offsite shipments of waste and spent nuclear fuel to the INEEL site yielded a collective dose of 60 person-rem or 0.030 cancer fatalities.

Table 5.15-3. Cumulative impacts by resource area and alternative.

Discipline	DOE INEL EIS Alternative B (Ten-Year Plan)	DOE INEL EIS Alternative D (Maximum Treatment storage and Disposal)	AMWTP	Systems Integration Corporation Quartzite Mine	Comments
Land use/disturbance	823 acres	1339 acres	7 acres[a]	56 acres[b]	The B&D alternatives analyzed use of 200 acres of undisturbed land located on INEEL 2.5 miles east of the RWMC for the AMWTP
Socioeconomics/ Change in number of total jobs	Overall decrease of 2,250	Overall decrease of 1,449	Increase of 125 direct during construction and 146 direct during operation	Increase of 40 direct	The B&D alternatives analyzed 768 direct during construction and 71 direct during operation for the AMWTP
Cultural resources/minimum number of potentially historic structures/archaeological sites distrubed[a]	70 structures and 22 sites	70 structures and 22 sites	No structures and 1 site	No structures or sites	Under alternatives B&D, the overall number of cultural resources would be reduced
Air resources	Below applicable standards	Below applicable standards	Below applicable standards (<1 percent increase)	No impact	
Water resources/water usage	Negligible (79 million gal/year). Increase of 0.04 percent over current water use. Cumulative appropriately 0.4 percent of available groundwater rights.	Negligible (67 million gal/year). Increase of 0.03 percent over water use. Cumulative approximately 0.4 percent of available groundwater rights.	2.7 million gal/yr. Increase of 0.001 percent over current water use. Cumulative approximately than 0.4 percent of available groundwater rights.	2,000 gal/day –200 work days/yr. Cumulative approximately 0.4 percent of available groundwater rights.	The B&D alternative analyzed 9 million gal/yr for the AMWTP
Ecological resources/acreage loss	1,068	1,584	7 acres[b]	56 acres	The B&D alternatives analyzed disturbance of 200 acres of undisturbed land 2.5 miles east of RWMC for the AMWTP

a. 7 acres of disturbed land within the RWMC.
b. 47 acres on BLM lands and 9 acres on land withdrawn to the DOE.

Collective doses for waste shipments associated with Alternatives B and D are summarized in Section 5.11, Traffic and Transportation, of the DOE INEL EIS. For truck shipment, the collective dose to workers was 870 person-rem (Alternative B, Ten-Year Plan) and 1700 person-rem (Alternative D, Maximum Treatment Storage and Disposal), or 0.035 to 0.68 cancer fatalities. Collective dose to the general population would be 480 person-rem (Alternative B) and 940 person-rem (Alternative D), or 0.23 to 0.47 cancer fatalities.

For train shipments, the collective dose to workers was 2.0 person-rem (Alternative B) and 48 person-rem (Alternative D), or 0.0080 to 0.019 cancer fatalities. Collective dose to the general population was 2.9 person-rem (Alternative B) and 58 person-rem (Alternative D), or 0.015 to 0.029 cancer fatalities.

Collective doses for spent nuclear fuel shipments associated with Alternatives B and D are summarized in Section 5.11, Traffic and Transportation, of the DOE INEL EIS. For truck shipments, the collective dose to workers was 7.3 person-rem (Alternative B) to 1,000 person-rem (Alternative D, Centralization at Savannah River), or 0.11 and 0.4 cancer fatalities. Collective dose to the general population was 2.1 person-rem (Alternative B) and 2,400 person-rem (Alternative D, Centralization at Savannah River), or 0.30 to 1.2 cancer fatalities.

Transportation impacts may also result from reasonably foreseeable projects. Two major proposed projects that would involve transportation of radioactive material are (1) shipments of spent nuclear fuel and defense high-level waste to a geologic repository and (2) proposed shipments of TRU waste to the WIPP, located in Carlsbad, New Mexico. DOE is presently studying the Yucca Mountain, Nevada site to determine its suitability for a geologic repository for commercial spent nuclear fuel and defense high-level waste; therefore, the geologic repository was assumed to be located in Yucca Mountain, Nevada, for the transportation cumulative impacts analysis.

Based on previous transportation dose assessments for the transportation of commercial radioactive waste, the worker collective dose for truck shipments to a repository was 8,600 person-rem or 3.4 cancer fatalities. The collective dose to the general population from truck shipments to a repository was 48,000 person-rem or 24 cancer fatalities. The worker collective dose for train shipments to a repository was 750 person-rem or 0.3 cancer fatalities. The collective dose to the general population from train shipments to a repository was 740 person-rem or 0.37 cancer fatalities.

Based on the transportation dose assessments prepared for the WIPP, the worker collective dose from truck shipments to the WIPP was 1,900 person-rem or 0.76 cancer fatalities. The collective dose to the general population from truck shipments to the WIPP was 1,500 person-rem or 0.75 cancer fatalities. The worker collective dose from train shipments to the WIPP was 990 person-rem or 0.4 cancer fatalities. The collective doses include the 5-year Test Phase and the 20-year Disposal Phase.

There are also general transportation activities that take place that are unrelated to the alternatives that were evaluated in the DOE INEL EIS or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipment of commercial low-level radioactive waste to commercial disposal facilities. The U.S. Nuclear Regulatory Commission (NRC) evaluated these types of shipments based on a survey of radioactive materials transportation in 1997 (NRC 1997). Categories of radioactive material evaluated by the NRC included (1) limited quantity shipments, (2) medical, (3) industrial, (4) fuel cycle, and (5) waste. NRC estimated that the annual collective worker dose for these shipments was 5,600 person-rem or 2.2 cancer fatalities. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem or 2.1 cancer fatalities. Because comprehensive transportation doses were not available, these collective dose estimates were used to estimate transportation collective doses for 1953 through 1982 (30 years). These dose estimates included spent nuclear fuel and radioactive waste shipments.

Based on the transportation dose assessments by the NRC (1997), the cumulative transportation collective doses for 1953 through 1982 were 170,000 person-rem for workers and 130,000 person-rem for the general population. These collective doses correspond to 68 cancer fatalities for workers and 65 cancer fatalities for the general population.

Weiner et al. (1991a) evaluated eight categories of radioactive material shipments by truck: (1) industrial, (2) radiography, (3) medical, (4) fuel cycle, (5) research and development, (6) unknown, (7) waste, and (8) other. Based on a median external exposure rate, an annual collective worker dose of 1,400 person-rem, and an annual collective general population dose of 1,400 person-rem were estimated. These collective doses correspond to 0.56 and 0.7 cancer fatalities/year for workers and the general population, respectively.

Weiner et al. (1991b) also evaluated six categories of radioactive materials shipments by plane: (1) industrial, (2) radiography, (3) medical, (4) research and development, (5) unknown, and (6) waste. Based on a median external exposure rate, an annual collective worker dose of 290 person-rem and an annual collective general population dose of 450 person-rem were estimated. These collective doses correspond to 0.12 and 0.23 cancer fatalities/year for workers and the general population, respectively. Over the 23-year time period from 1983 through 2005, the collective worker dose would be 6,700 person-rem and the general population collective dose would be 10,000 person-rem or 2.7 and 5 cancer fatalities for workers and the general population, respectively.

The total worker and general population collective doses are summarized in Table 5.15-3. Total collective worker doses from all types of shipments (historical, the alternatives, reasonably foreseeable actions, and general transportation) were estimated to be 220,000 person-rem (88 cancer fatalities), for the period of time 1953 through 2005 (53 years). Total general population collective doses were also estimated to be 220,000 person-rem (110 cancer fatalities). The majority of the collective dose for workers and the general population was due to general transportation of radioactive material. The total number of cancer fatalities from 1953 through 2005 was estimated to be 200. Over this same period of time (53 years), approximately 16,000,000 people will die from cancer, based on 300,000 cancer deaths/year (NRC 1977). The transportation-related cancer deaths are 0.0013 percent of this total.

Transportation Vehicular Accidents Impacts. Facilities that involve the shipment of radioactive materials were surveyed for 1971 through 1993 using accident data from the U.S. Department of Transportation (DOT), NRC, DOE, and state radiation control offices. For 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These were fatalities that resulted from vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities due to transportation accidents have ever occurred in the U.S. During the same period of time, over 1,000,000 persons were killed in vehicular accidents in the U.S.

Transportation Regional Traffic Impacts. The baseline level of service for the road system surrounding the INEEL is Level-of-Service A or free flowing. This was based on data for U.S. Highway 20, the regional highway with the highest use around the INEEL and a likely route for materials that are transported to and from the INEEL. The peak number of vehicles per hour would have to increase from 122 to 291 to exceed the capacity of the highway.

Table 5.15-4. Cumulative transportation-related radiological collective doses and cancer fatalities (1953 to 2005).

Category[a]	Collective occupational dose (person-rem)	Collective general population dose (person-rem)
Historical		
Waste (1954-1995)	47	28
DOE spent nuclear fuel (1953-1995)	56	30
Naval spent nuclear fuel (1957-1995)	6.2	1.6
Alternatives B-D		
Waste shipments for Alternatives B-D		
Truck (100 percent)	870-1,700	460-940
Train (100 percent)	20-48	29-58
Spent nuclear fuel shipments for Alternatives B-D		
Truck (100 percent)	7.3-1,000	2.1-2,400
Train (100 percent)	7.3-1,000	2.1-190
Reasonably Foreseeable Actions		
Geologic Repository		
Truck	8,600	48,000
Train	750	740
Waste Isolation Pilot Plant		
Test Phase	110	48
Disposal Phase		
Truck	1,900	1,500
Train	180	990
General Transportation		
1953-1982	170,000	130,000
1983-2005	39,000	42,000
Summary		
Historical	110	60
Waste shipments for Alternatives B-D		
Truck (100 percent)	870-1,700	460-940
Train (100 percent)	20-48	29-58
Spent nuclear fuel shipments for Alternatives B-D		
Truck (100 percent)	7.3-1,000	2.1-2,400
Train (100 percent)	7.3-130	2.1-190
Reasonably Foreseeable Actions		
Truck	11,000	50,000
Train	750	1,730
General transportation (1953-2005)	210,000	170,000
Total collective dose	220,000	220,000
Total cancer fatalities	88	110

Source: DOE 1995.
a. LLMW, alpha LLMW, and TRU Waste
b. Information not available

The increased movements of materials and people due to Alternative D analyzed in the DOE INEL EIS would increase the maximum number of vehicles per hour to 150, which is still within the range of Level-of-Service A and would result in not change to the level of service associated with U.S. High 20. The Systems Integration Corporation quartzite mine project would add only 18 round trips per day to traffic along an 18 mile stretch of Highway 20 between the proposed mine and Scoville siding; an increase of 2 to 4 percent while ore is being transported. Based on these results, the impacts to the regional traffic system around the INEEL would be minimal for all alternatives.

For Alternatives B and D in the DOE INEL EIS, 2.7 and 4.8 vehicular accident fatalities were estimated to occur. During the ten-year time period from 1995 through 2005, approximately 400,000 people will be killed in vehicular accidents in the U.S.

Health and Safety. A number of potential exposure pathways exist by which radioactive materials from INEEL operations could affect workers onsite or could be transported to off-site environments. The airborne pathway is the principal pathway by which radioactive materials released on the INEEL site could reach an off-site member of the public.

A summary of the health effects from these individual exposure pathways is presented in Table 5.15-5. The health effects from radiation exposure are presented as the estimated number of fatal cancers in the affected population. The health effects for chemical carcinogens are presented as the estimated number of lifetime cancers in the affected population. For exposure to noncarcinogenic chemicals, the health effects are presented as estimated fatalities.

Occupational Health. The activities to be performed by workers under the B and D Alternatives analyzed in the DOE INEL EIS, which includes the AMWTP, are similar to those currently performed at the site. Therefore, the potential hazards encountered in the work place would be similar to those that currently exist. For these reasons, the average measured radiation dose and the number of reportable cases of injury and illness are anticipated to be proportional to the number of workers employed under each alternative. The airborne pathway, by which radioactive materials released on the INEEL site could affect workers, was modeled in the DOE INEL EIS, but was found to add negligible amounts to actual measured data.

Based on occupational radiation monitoring results, the average reportable radiation dose to an INEEL worker (includes both RWMC and non-RWMC workers) is about 0.027 rem (27 millirem) per year. In addition, there is a potential for small additional radiation dose due to atmospheric releases from INEEL facilities. For the maximally exposed worker, the additional dose would be 4.6 millirem for Alternative B (Ten-Year Plan) and 4.9 millirem for Alternative D (Maximum Treatment, Storage, and Disposal). The AMWTP project-specific analyses presented in this document (section 5.12) for the Proposed Action indicates the potential radiological dose to the maximally exposed worker would be 1.0 millirem. These potential radiation doses would be in addition to natural background radiation which averages about 0.35 rem per year.

The occupational radiation dose received by the entire INEEL workforce for ten years would result in about one fatal cancer. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 2,000.

For the evaluation of occupational health effects from chemical emissions, the modeled chemical concentration was compared with the applicable occupational standard. Modeled concentrations below the occupational standards were considered acceptable (see Section 5.7.4.2). As a result, no adverse health effects for onsite workers are projected as a result of normal chemical emissions.

Routine workplace safety hazards can also result in injury or fatality. Total injury and illness rates for INEEL workers are comparable to those for DOE and its contractors, which average 3.7 and 6.4 per 200,000 hours worked. About three fatalities would result in the entire INEEL workforce in a 10-year period due to workplace safety hazards. The estimated industrial safety hazard impact for the Proposed Action analyzed in this document for duration of construction (2.5 years) and operation (30 years) is 385 total injury and illness/0.96 total fatalities and 135 total injury and illness/0.65 total fatalities, respectively.

These analyses indicate that the cumulative impacts of radiological health effects, nonradiological health effects, and workplace safety hazards to the INEEL workforce would be small. The combined occupational risks are less than those encountered by the average worker in private industry.

Public Health. The airborne pathway is the principal pathway by which radioactive materials released on the INEEL can reach an offsite member of the public. The potential for radiation dose to the public in the vicinity of the INEEL site due to atmospheric releases was similar for the B and D Alternatives analyzed in the DOE INEL EIS. For the maximally exposed member of the public, the additional radiation dose would be 1.6 rem for Alternative B and 0.84 for Alternative D. The AMWTP project-specific analyses presented in this document (section 5.12) for the Proposed Action indicates the potential annual radiological dose to the maximally exposed individual offsite would be 0.011 millirem. These potential radiation doses would be in addition to natural background radiation, which averages about 0.35 rem per year. Less than one fatal cancer would result from radiation dose received by the population within 50 miles (80 km) of the INEEL over 10 years. The natural lifetime incidence of fatal cancers in the same population from all other causes would be about 24,000 out of a population of 120,000. The Treatment and Storage Alternative impacts would be the same as the Proposed Action regarding the treatment of waste, however the potential storage impacts to public health identified in Section 5.21, Long-Term Storage Impacts, would be in addition to the impacts for treatment.

Other regional sources of atmospheric radioactivity have the potential to contribute to the radiation dose of the public near the INEEL. The primary source is emissions from phosphate processing operations in Pocatello, Idaho. These emissions have been evaluated by the EPA (EPA 1989). The number of fatal cancers in the population within 50 miles (80 km) of Pocatello would be about one over a ten-year period. The population exposed to the cumulative impact of both facilities would be small.

In addition to radiation dose from atmospheric emissions, there is a potential for impacts to the public from exposure to carcinogenic chemicals released to the air. The highest risks calculated for Alternative D in the DOE INEL EIS was small compared to the risks from radioactive releases and imply less than one fatal cancer in the exposed population over a ten-year period. There is no basis currently available for evaluating risks from chemical exposure from other regional commercial, industrial, and agricultural sources, such as combustion of diesel and gasoline fuels and agricultural use of pesticides, herbicides, and fertilizers.

Table 5.15-5. Health-related cumulative impacts.

	Pathway	Type of impact	Alternative B (Ten-Year Plan)	Alternative D (Maximum Treatment Storage and Disposal)	AMWTP	Comments
			Radiological			
Public	Atmospheric	Estimated excess fatal cancers	<1	<1	<1 (2.8×10^{-5})	
Workers[a]	Atmospheric	Estimated excess fatal cancers	Negligible	Negligible	<1 (6.0×10^{-4})	Overall cancers expected to be less than baseline because of fewer employees
			Nonradiological			
Public	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1	<1	
	Atmospheric (Noncarcinogens)	Estimated adverse health effects	0	0	0	
Workers	Atmospheric (Carcinogens)	Estimated lifetime cancers	<1	<1	<1	
	Atmospheric (Noncarcinogens)	Estimated adverse health effects	0	0	0	
	Routine workplace safety hazards	Estimated fatalities	3	3	(0.96 concentration) (0.65 operation)	

a. Estimated excess fatal cancers calculated from dosimeter measurements.

5.16 Unavoidable Adverse Impacts

This section summarizes potential unavoidable adverse environmental effects associated with the activities analyzed in this EIS. Unavoidable impacts are impacts that would occur after implementation of all feasible mitigation measures. For this EIS, effects were considered for Cultural Resources, Aesthetic and Scenic Resources, Air Resources, Water Resources, and Ecology.

5.16.1 Cultural Resources

The Proposed Action involves the construction and operation of the AMWTP facility, a project that would affect about 7 acres within the TSA located inside of the RWMC. Impacts to cultural resources appear negligible, although a potential for subsurface discoveries of cultural material always exists. Ground disturbance has the potential to affect archaeological, traditional, and paleontological sites located on the surface of the ground or buried beneath recent sediments. In locations that have been intensively surveyed, many areas of concern can be identified; but in unsurveyed locations, the sensitive areas would not be known until field work is completed. Alteration in the setting of a traditional, archaeological, or historic resource through the introduction of additional noise, pollution, contamination, or lighting may adversely affect archaeological, historic, and traditional resources located outside of the fence.

5.16.2 Aesthetic and Scenic Resources

Construction of the AMWTP facility would result in ground disturbance and a change in the visual setting at the RWMC. This facility would contain permanent generators and night lights, creating a visual and audible intrusion. Soil erosion could occur during the construction of the facility, as well as the release of fugitive dust particles that might temporarily affect visibility in localized areas. However, dust control measures, such as watering, would be implemented to minimize impacts.

5.16.3 Air Resources

The highest dose from AMWTP emissions to an offsite individual would be 0.11 millirem per year and occurs at the site boundary about 6 kilometers south-southwest of the facility. The most important radionuclide and exposure pathway would be inhalation of americium-241. When added to the baseline dose and projected increases, the cumulative dose would be 0.25 millirem per year. As in the case of each AMWTP alternative, the cumulative dose from AMWTP emissions and other sources would be a very small fraction of that received from natural background sources and is well below the NESHAP dose limit of 10 millirems per year. The maximum collective dose (i.e., the sum of all individual doses) to the entire population residing within 80 kilometers that would result under the Proposed Action is 0.05 person-rems per year. When added to the baseline population dose and projected increases, the collective dose is 0.55 person-rems per year.

Under the Proposed Action, incremental levels of all carcinogenic substances would be less than 1 percent of the applicable standard. All noncarcinogenic levels would be less than 1 percent of applicable standards except for selenium, for which maximum projected levels would be about 1 percent of the standard.

5.16.4 Water Resources

Water consumption would increase as a result of construction activities, operational activities, and increased workers at the facility; however, the total water consumption of 2.7 million gallons per year under this alternative would be much less than the INEEL's current water usage or the consumptive use water rights of 11.4 billion gallons per year (Yaklich 1998). Water would be required for operational activities during pretreatment, supercompaction, and macroencapsulation processes as part of the AMWTP operations (BNFL 1997a).

5.16.5 Ecological Resources

The Proposed Action would disturb approximately 7 acres within the RWMC to construct the AMWTP and support infrastructure. All of the project area within the RWMC has been previously disturbed as a result of ongoing waste management and environmental restoration activities. Since the construction site is a large area of packed gravel, there is little or no vegetation and no wildlife cover or food. The net loss of 7 acres of previously disturbed habitat within the boundary of the RWMC would have a negligible impact on INEEL biodiversity and wildlife habitat. The undisturbed native vegetation surrounding the RWMC provides much more important and higher quality habitat than that of the project site. Construction of the AMWTP and support infrastructure modifications within the RWMC would have a minor adverse impact on small, less mobile, mammals during project site construction clearing activities. Birds in the project site area would move away from the construction activities to adjacent similar habitat within the RWMC or offsite. The operation of the AMWTP would increase slightly human presence, night lighting, and noise within the RWMC. Potential radionuclide exposure to plant and animal species within the RWMC and in the adjacent surrounding area may increase slightly due to the operation of the AMWTP.

5.17 Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term use of the environment and the associated effects on the maintenance and enhancement of long-term productivity of the environment associated with the AMWTP were addressed in Volume 2, Part A, Section 5.17 of the DOE INEL EIS. Implementation of any of the alternatives, including No Action, would cause some short-term commitments of resources (e.g., air emissions and land) and would permanently commit certain resources (e.g., construction materials, energy). Under all alternatives, the short-term use of the environment would cause some potential long-term enhancements to the environment by decreasing risk to workers, the public, and the surrounding environment from reducing exposure to hazardous and radioactive substances.

5.17.1 No Action Alternative

Under the No Action Alternative, short-term uses of resources would have some change on long-term productivity. LLMW would require space for onsite storage and waste processing and would involve the commitment of associated land, transportation, processing facilities, and other disposal resources. Continuing current waste management operations and activities at INEEL would result in a slight decrease in the risk to workers, the public, and the environment from hazardous and radioactive materials. However, these activities would be interim actions that would not meet the Federal Facility Agreement and Consent Order, and provide only a relatively small enhancement of the environment in the long-term.

5.17.2 Proposed Action

Under the Proposed Action, short-term uses of resources would be greater than for the No Action Alternative. Because of the environmental benefits associated with treatment and offsite disposal of mixed waste under the Proposed Action, any short term commitment of resources associated with the additional land disturbance, air emissions, and waste handling would be in exchange for enhanced long-term productivity compared to the other alternatives.

5.17.3 Non-Thermal Treatment Alternative

Under the Non-Thermal Treatment Alternative, short-term uses of resources—such as land, air emissions, energy, and construction materials—would be greater than for the No Action Alternative, and less than for the Proposed Action and the Treatment and Storage Alternative. The Non-Thermal Treatment Alternative would reduce environmental risk slightly less than Proposed Action and Treatment and Storage Alternative but greater than the No Action. Non-Thermal Treatment would still leave some waste types at the INEEL untreated and in temporary storage contributing a slightly higher risk to the environment.

5.17.4 Treatment and Storage Alternative

Under this alternative, short-term uses of resources would be greater than for the No Action Alternative. However, because this alternative would return treated waste to onsite storage at the INEEL, the potential enhanced long-term productivity at INEEL through reduced environmental risk would be less than for the Proposed Action but greater than the Non-Thermal Treatment Alternative.

5.18 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources for each alternative would potentially include land and mineral resources during the life of the project, and energy used in treating the waste. The irreversible and irretrievable commitment of resources for the Waste Management Program at INEEL, including resources potentially used for the AMWTP, was addressed as part of the analyses presented in Volume 2, Part A, Section 5.18, of the DOE INEL EIS.

In that analysis, the disposal of radioactive and/or hazardous wastes would cause irreversible and irretrievable commitments of land resources under Alternatives B (Ten-year Plan) and D (Maximum treatment, storage, and disposal). Under Alternative D, LLMW and low-level waste disposal would irreversibly and irretrievably commit approximately 400 acres of previously open-space land. Hazardous waste treatment, strorage, and disposal under the same alternative would be irreversibly and irretrievably affect 5 acres of open-space land. Under Alternative B, LLMW and low-level waste disposal would irreversible and irretrievably affect 200 acres of previously open-space land. Services potentially lost from the commitment of these acreage would include lost vegetation productivity, and lost multiple-use or alternative-use opportunities (for example, disposal sites would not undergo future decommissioning or decontamination and habitat reclamation).

The aggregate resources (sand, pumice, and landscaping cinders) extracted on the INEEL would be irreversibly and irretrievably committed in support of INEEL spent nuclear fuel and Environmental Restoration and Waste Management activities. Aggregate also would be utilized during construction for concrete production, foundation preparation, and road construction and maintenance. Aggregate demands would be highest under Alternative D (Maximum Treatment, Storage, and Disposal) with an estimated volume of approximately 1,772,000 cubic meters (2,317,000 cubic yards). Estimated aggregate demands commensurate with the level of construction activities proposed under Alternative B would be 408,000 cubic meters and 534,000 cubic yards.

The DOE INEL EIS also shows that the commitment of energy and other resources would be greatest under Alternative D (Maximum Treatment, Storage, and Disposal). Alternative D would require (above the baseline usage of these resources) about 127,700 megawatt-hours per year of electricity, 5.86 million liters (1.55 million gallons) per year of hearing oil, 1.2 million liters (320,000 gallons) per year of diesel fuel, and 2.73 million liters (730,000 gallons) per year of propane. Construction associated with this alternative is estimated to require about 100,000 cubic meters (130,000 cubic yards) of concrete.

Under the alternatives analyzed for the AMWTP in this document, the No Action Alternative would have the least commitment of additional land, mineral resources, and energy resources. The commitment of resources for the Proposed Action and other alternatives is shown in Table 5.18-1. The Treatment and Storage Alternative and the Proposed Action would use the largest amounts of energy resources, respectively. Required land and mineral resources during the life of the project would be the same for the Proposed Action; the Non-Thermal Treatment; and the Treatment and Storage Alternatives.

Table 5.18-1. Commitment of resources by alternative.

Resource	Proposed Action	Non-Thermal Treatment	Treatment and Storage
Land [a,b]	7 acres	7 acres	7 acres
Energy	--	--	--
Electricity	35,022 MWh/yr	23,980 MWh/yr	35,022 MWh/yr
Diesel fuel	16,000 gal/yr	16,000 gal/yr	16,000 gal/yr
Propane	925,000 gal/yr	185,000 gal/yr	925,000 gal/yr
Minerals[a]	16,000 cubic yards	16,000 cubic yards	16,000 cubic yards

a. Committed during the life of the project only.
b. Though this land would not be open to the public or multiple use, it is currently committed to waste management operations.

5.19 Mitigation

An overview of planned mitigation measures for the proposed activities outlined in this EIS is presented in the following discussion. These measures address impacts that remain after application of design features and operating practices required by permits.

5.19.1 Cultural Resources

The Idaho SHPO has determined that there is little potential for undisturbed archeological materials occurring inside of the current RWMC perimeter fence because of the highly disturbed nature of the facility. Archaeological clearance has been recommended by the SHPO for ongoing and future ground disturbances, with no further archeological survey activities inside of the complex required. Mitigation beyond the clearance resulting from a thorough regulatory review will be achieved through strong "Stop Work" stipulations which have been implemented at the INEEL in the event that cultural resources or human remains are discovered during any project implementation.

5.19.2 Aesthetic and Scenic Resources

Short-term visibility impacts from fugitive dust during construction activities would be minimized using standard dust control measures such as watering. Project related operational emissions would be controlled using air pollutant control equipment incorporating HEPA filters and Best Available Control Technology (BACT) in conjunction with administrative controls. Additional mitigation is not anticipated to be necessary.

5.19.3 Geology

Potential soil erosion in the areas of ground disturbance would be mitigated through minimizing areas of surface disturbance and by utilizing construction engineering measures such as runoff control and soil stockpiling in accordance with permit requirements. Additional mitigation is not anticipated to be necessary.

5.19.4 Air Resources

Specific features have been incorporated into the proposed AMWTP design, which, together with operational controls and practices required by permits, would minimize environmental impacts of releases of air contaminants. Many operating and design features are required by regulations related to hazardous waste treatment, storage and disposal facilities, and State and Federal Rules for the control of air pollution. Other mitigation features, are specifically required by regulation and are necessary elements of the ALARA program to ensure protection of the public, workers, and the environment.

The maximum projected AMWTP stack concentration estimated for mercury ($83mg/m^3$) is higher than the Maximum Achievable Control Technology (MACT) standard ($40mg/m^3$). The mercury emission rate used for analysis in predicting air quality impacts was based on the conservative assumption that the AMWTP waste feed contains 1 percent mercury. Preliminary waste characterization indicates that the actual mercury content to be much less than 1 percent. Feed rate limits or other restrictions would be used to ensure that actual stack emissions comply with the MACT standard.

Modeled criteria pollutant emissions for the proposed AMWTP (see Sections 5.7.3 and 5.7.4) indicate that potential air quality impacts would be well within (in all scenarios less than 45 percent of) the PSD increment, the most conservative air quality criterion. Air quality mitigation beyond pending permit requirements for air pollution control equipment that meets BACT and associated administrative controls is not anticipated to be necessary. Specific mitigation would be inclined in the facility process design as waste characterization and process information become available.

5.19.5 Water Resources

The proposed AMWTP design, prepared in anticipation of the NPDES and Idaho Waste Water Treatment Regulations (see Section 5.8.3), results in no liquid effluent discharges to surface water. Additionally, no liquid effluents from waste treatment processes would be discharged to the subsurface; therefore, no ground water impacts would be expected for any proposed AMWTP alternative. A requirement for additional mitigation of impacts is not anticipated.

5.19.6 Ecological Resources

Unavoidable impacts to biota would include disturbance of a small amount of habitat, and mortality or displacement of some animals (primarily small mammals, reptiles, and birds). Measures implemented to minimize impacts include limiting ground disturbance, and conducting pre-activity surveys of construction areas to determine if candidate or sensitive species or important habitat are present in the area. Potential radionuclide exposure to plant and animal species would be monitored by the INEEL environmental surveillance program.

5.19.7 Transportation

Because the proposed AMWTP will be located within the RWMC of the INEEL, there would be no onsite transportation of radioactive waste outside the RWMC. The transportation impacts associated with the shipment of treated TRU waste from INEEL to WIPP were evaluated in the SEIS-II. The results indicated less than one cancer fatality to worker and the general population. Similarly, transportation impacts associated with possible shipment of LLMW from offsite DOE locations to the INEEL have been assessed in both the DOE INEL EIS and in the WM PEIS (DOE 1997c). Potential cancer fatalities were also very small (<1). These EIS's are incorporated by reference and have been included in the cumulative impacts analyses presented in Section 5.15.

Transport requirements identified for each of the proposed AMWTP alternatives are well within the design capacity of the existing transportation system (see Section 5.11, Traffic and Transportation). A requirement for additional mitigation of impacts is not anticipated.

5.19.8 Occupational and Public Health and Safety

Hazards that exceed health and safety limits specified in permits and operating procedures would be mitigated by shutting down the affected facility operation.

5.19.9 Idaho National Engineering and Environmental Laboratory Services

The proposed AMWTP requirements for utility and infrastructure are well within the existing capabilities of INEEL. A requirement for additional mitigation of impacts is not anticipated.

5.19.10 Accidents

INEEL facilities employ emergency response programs to mitigate impacts of accidents to workers and the public in accordance with the 5500 series of DOE Orders.

For the offsite population, the need for any protective action would be based on the predicted radiation doses, with the emergency response based on the guidance provided in the protective action guides developed by the EPA.

Building on regulatory requirements and associated design features, interdiction activities by INEEL accident recovery personnel are expected to take place following an accident to mitigate doses to offsite individuals at risk. This interdiction would limit ingestion exposure so that the maximally exposed individuals would derive much less than the assumed 10 percent of their diet from locally grown crops and livestock.

5.20 Environmental Justice

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629 February 16, 1994), this section identifies and addresses any disproportionately high and adverse human health or environmental effects on minority or low-income populations from activities described in previous sections of this EIS. Because DOE is still in the process of finalizing its environmental justice guidance, the approach taken in this analysis may differ somewhat from whatever final guidance is eventually issued and from the approach taken in other NEPA documents.

5.20.1 Methodology

Potential environmental justice impacts are assessed using a phased approach. This approach established three thresholds for assessing whether environmental justice issues are likely to arise as a result of proposed DOE activities. As described in DOE's draft guidance on incorporating environmental justice into the NEPA process, the following three questions form the framework and establish the thresholds for the phased approach to environmental justice analysis:

- Are there any potential impacts to human populations?
- Are there any potential impacts to minority populations or low-income populations?
- Are potential impacts to minority populations or low-income populations disproportionately high and adverse?

Environmental justice guidance developed by the CEQ defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997). Minority populations are identified when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census' Current Population Reports, Series P-60 on Income and Poverty.

Environmental justice impacts become issues of concern if the proposed activities result in disproportionately high adverse human and environmental effects to minority or low-income populations. Disproportionately high and adverse human health effects are identified by assessing these three factors to the extent practicable:

- Whether the health effects, which may be measured in risks or rates, are significant (as employed by NEPA) or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
- Whether the risk or rate of exposure by a minority population or low-income population to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

Previous sections in Chapter 4 of this EIS describe employment and income, population, housing, and community services surrounding the site. Income distribution is presented in this section. Impacts to the ROI from implementation of proposed alternatives are analyzed in Chapter 5. Selected ROI demographic characteristics for racial/ethnic minority groups and low-income populations are presented in Table 5.20-1.

Any disproportionately high and adverse human health or environmental effects on minority populations or low-income populations that could result from the Proposed Actions being considered are assessed for a 50-mile area surrounding the site. The shaded areas in Figure 5.20-1 show 1990 census tracts where racial or ethnic minorities comprise 50 percent or more of the total population or where minorities comprise less than 50 percent, but greater than 25 percent of the total population in the census tract. Figure 5.20-2 shows low-income communities generally defined as those where 25 percent or more of the population is characterized as living in poverty (annual income of less than $8,076 for a family of two).

5.20.2 Potential Impacts on Minority and Low-Income Populations from the Consumption of Fish and Wildlife

Section 4-4 of the Executive Order (59 FR 7629 February 16, 1994) directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that federal governments communicate to the public the risks of these consumption patterns."

As noted in the DOE INEL EIS, fishing and hunting are usually not allowed on the INEEL. Depredation hunts negotiated between the Idaho Department of Fish and Game and DOE do allow hunter access to 0.5 mile inside the northern boundary of the INEEL. In addition to the limited hunting on the INEEL, several game species and birds live on and migrate through the INEEL. Game species residing on the INEEL, sheep that have grazed on the INEEL, locally grown foodstuffs, milk, and native plants around the INEEL are routinely sampled for radionuclides (ESRF 1996). Concentrations of radionuclides in the samples have been small and are seldom elevated above concentrations observed at locations distant from the INEEL where the principal likely source of nonnatural radionuclides are very small amounts of residual atmospheric fallout from past nuclear weapons tests. Data from programs monitoring these sources of food are reported annually in the *INEEL Site Environmental Report* (ESRF 1996). No human populations within the immediate vicinity of the INEEL are known to subsist entirely on locally harvested fish, wildlife, and native plants, so no disproportionately high human health effects would arise in minority populations or low-income populations from subsistence on locally harvested game animals.

5.20.3 Impacts from Advanced Mixed Waste Treatment Project Alternatives

As seen in Figure 5.20-1, minority and low-income populations do reside with 50 miles of the INEEL. With the exception of some census districts to the southeast of the site, these populations comprise a relatively small proportion of the total population. As seen in the figure, only Bannock and Power Counties have census tracts in which low-income residents comprise greater than 25 percent of the population and minority residents comprise greater than 50 percent of the population.

Table 5.20-1. Selected demographic characteristics for the INEEL region of influence.

Persons by race/ethnicity	Bannock County (number)	Bingham County (number)	Bonneville County (number)	Butte County (number)	Clark County (number)	Jefferson County (number)	Madison County (number)	Total region of influence (number)	Total region of influence (percent)
White	61,742	32,439	69,246	2,829	688	15,627	22,741	205,312	93.4
Black	431	39	297	0	0	7	43	817	0.4
American Indian	1,678	2,615	391	22	5	122	108	4,941	2.3
Asian/Pacific Islander	712	273	687	50	0	40	296	2,013	0.9
Other	1,463	2,217	1,586	62	69	747	486	6,630	3.0
Hispanic (of any race)	2,740	3,614	3,010	101	79	1,155	753	11,452	5.2
Total 1990 population[a]	66,026	37,583	72,207	2,918	762	16,543	23,674	219,713	--
Low-income persons below poverty (1989)									
Number	8,944	5,804	7,056	392	71	2,353	6,386	31,006	--
Percent[b]	13.8	15.6	9.9	13.5	9.3	14.3	28.6	--	14.4

Source: Census 1993, 1994.

a. Persons of Hispanic ethnicity may be of any race and are included in other racial categories; thus, total 1990 population is not a sum of race/ethnicity categories.

b. In calculating percentages, certain categories of individuals are not included as part of the county population, including inmates of institutions, armed forces members, and unrelated individuals under 15 years of age.

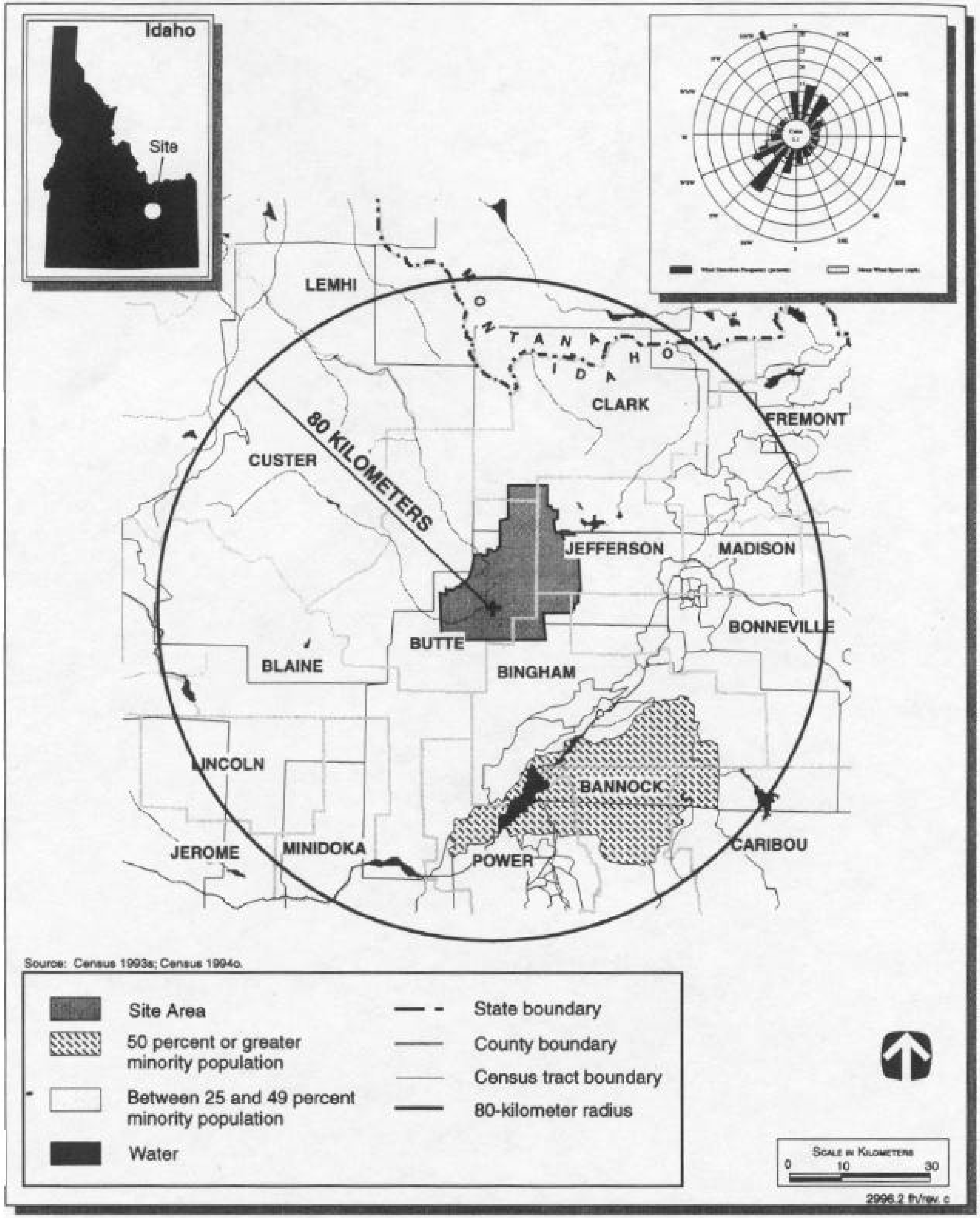


Figure 5.20-1. Minority population distribution for INEEL and surrounding counties.

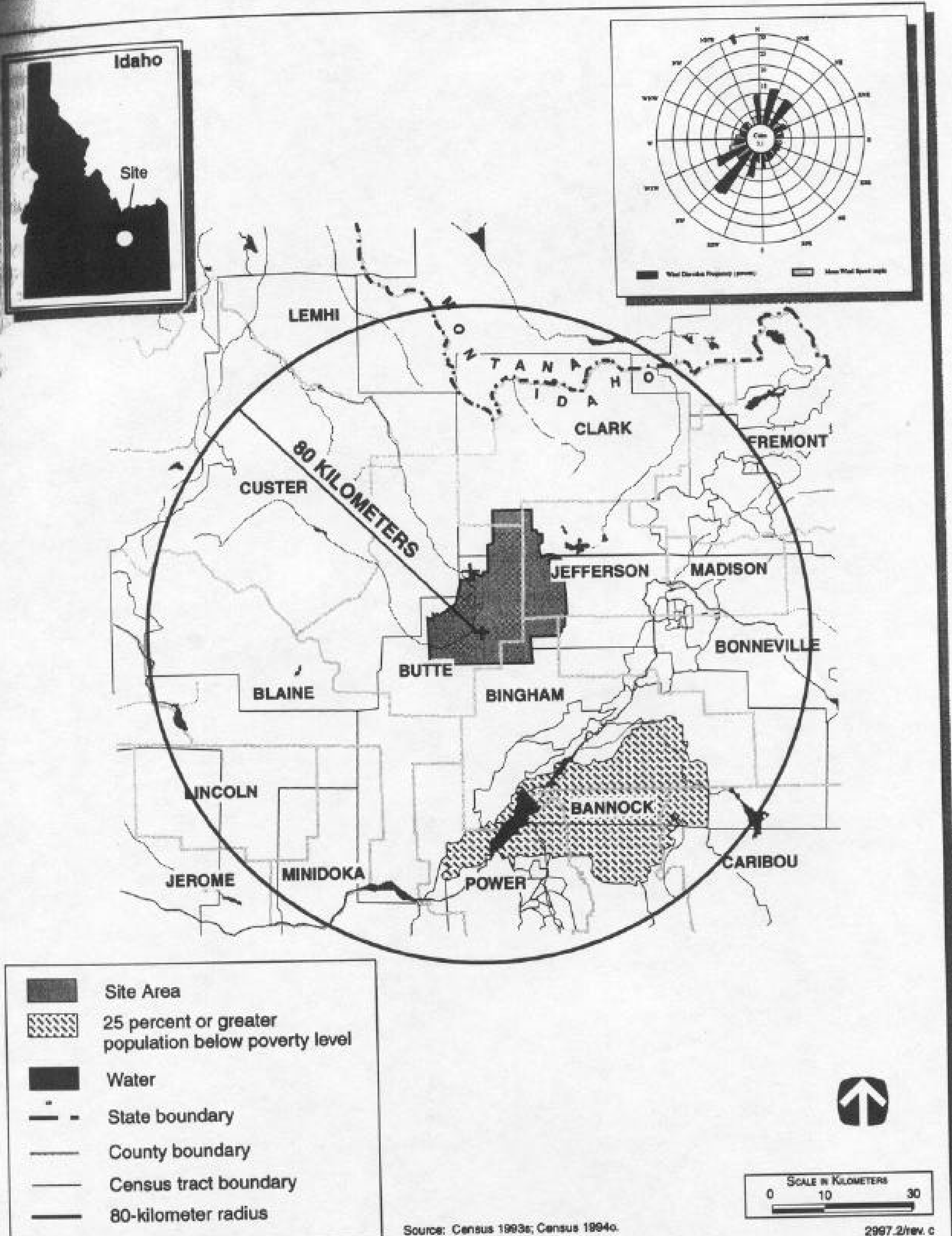


Figure 5.20-2. Low-income distribution by poverty status for INEEL and surrounding counties.

For environmental justice impacts to occur, there must be high and adverse human health or environmental impacts that disproportionately affect minority populations or low-income populations. The public health and safety analyses show that air emissions and hazardous chemical and radiological releases from normal operations for all alternatives would be within regulatory limits and that no latent cancer fatalities would result. The public health and safety analyses also indicate that radiological releases from accidents would not result in significant adverse human health or environmental impacts. Therefore, such accidents would not have disproportionately high and adverse impacts on minority and low-income populations.

The analyses also indicate that socioeconomic changes resulting from implementing any of the proposed alternatives would not lead to environmental justice impacts. Under the No Action Alternative, employment and expenditures would remain unchanged from the baseline. Under the other three alternatives, modest economic benefits would arise from the additional jobs created during construction and operation of the new facility. Secondary effects would include small increases in business activity and would likely increase revenues to local governments. Each of these impacts would be positive and would not disproportionately affect any single group.

5.21 Long-Term Storage Impacts

The analyses of the long-term storage of TRU waste at generator sites, including the INEEL, was included in SEIS-II under the No Action Alternative 2, and No Action Alternatives 1A and 1B. The following discussion of long-term environmental and human health effects has been tiered from Section 5.6.12, Appendix I, and Section 5.5.12 of the SEIS-II.

Basis for Long-Term Impact Analyses

Under the SEIS-II No Action Alternative 2, TRU waste is generated at all sites, including small-quantity sites, over the next 35 years. During this period, waste generated at the small-quantity sites would be consolidated and treated at the 10 major treatment sites. Because 99 percent of the estimated TRU waste volume and inventory that would be generated can be accounted for at seven of the 10 major treatment sites, environmental and human health impacts were estimated at these seven sites only: Hanford, INEEL, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Rocky Flats Environmental Technology Site, and SRS. Both consolidated and generated TRU waste will be put into retrievable storage consistent with current practices. Current storage configurations include soil-covered asphalt or concrete pads, shallow trenches, earthen berms, covered enclosures, storage buildings for contact-handled (CH) TRU waste, and buried caissons for remote-handled (RH) TRU waste. TRU waste would remain in these assumed storage configurations for an institutional control period of 100 years, beginning in 2033. During this period of institutional control, effective monitoring, surveillance, and maintenance would be expected to minimize the risk of contaminant release from the storage configurations.

At the end of the 100 years, following a TRU waste-generation period (i.e., 2133), institutional control is assumed to be lost. As facilities begin to degrade, TRU waste would be introduced into the accessible environment.

Calculations of the long-term consequences resulting from environmental releases from the storage facilities were performed for a 10,000-year period after the loss of institutional control. Environmental and human health impacts as a result of storage-facility releases were not evaluated for the period of institutional control.

Impact Assessment for Intrusion into Waste

The following provides a summary of long-term impacts from stored TRU waste at the INEEL for 10,000 years following the loss of institutional control. The analysis of human health impacts estimated the impacts of TRU waste as a source of direct exposure and as a contaminant source for release to surface and subsurface exposure points in the environment. Scenarios analyzed included exposure to waterborne and airborne releases of contaminants from waste stored in shallow earth-covered trenches or covered by earthen berms and to waste stored in exposed surface pads or in surface enclosures and buildings.

Exposure scenarios evaluated included acute exposures to intruders and chronic exposures to settlers. These exposures were assumed to occur at the site of the original waste storage location, with little dispersion of contamination prior to exposure. Exposure scenarios evaluated for buried waste included an acute exposure of a driller intruder and the chronic exposure of a gardener who was assumed to subsequently settle at the drilling site. Exposure scenarios evaluated for surface-stored waste included the acute exposure of a scavenger intruder and the chronic exposure of a farm family settling on the site of the former waste storage area.

Impacts were also evaluated for the long-term environmental release of stored waste over 10,000 years. Evaluated were scenarios for chronic exposure of a MEI and the population living within 80 kilometers (50 miles) of the former waste storage sites. This individual and population could be exposed from releases from both buried and surface-stored waste. The MEI was assumed to be located 300 meters (980 feet) away from the waste storage site, in the direction of groundwater flow. The distribution of the offsite populations were assumed to be characteristic of current populations around the sites.

Descriptions of these exposure scenarios for intruders and settlers and long-term environmental releases are provided in Appendix I of the SEIS-II.

Impacts of Exposure Scenarios

With the loss of institutional control, individuals could come into direct contact or be inadvertently exposed to waste that had been stored in shallow burial or surface storage facilities. The following describes the impacts at the INEEL that could result from exposure to radionuclides and hazardous chemicals in CH TRU and RH TRU waste for exposure scenarios, where individuals were assumed to be exposed at the original storage locations. Individuals were assumed to be exposed immediately after the loss of institutional control, minimizing reduction of impact through radioactive decay.

Impacts from Exposure to Buried Waste

The driller scenario is one where an individual was assumed to drill a well at the site of the waste storage locations and be exposed over a 5-day work week to waste material brought to the land surface by the drilling process.

Radiological impacts to a hypothetical driller exposed acutely for 5 days (1 work week) from CH TRU waste at the INEEL would have a 5×10^{-6} probability of a latent cancer fatality. Impacts to the driller from RH TRU waste would be 5×10^{-6} probability of a latent cancer fatality. These results are presented in Table 5.21-1. Health impacts from hazardous chemicals would be significant. The RH TRU waste concentration for lead could be up to 3,000 times the PEL.

The gardener scenario is one in which an individual was assumed to prepare a garden at the drilling site and grow produce in soil containing waste material brought to the surface by the drilling. This individual was assumed to ingest produce grown in the contaminated soil for a period of 30 years and exposed while working in the garden.

Radiological impacts to a hypothetical gardener would have a 0.01 probability of a latent cancer fatality at INEEL from buried CH TRU waste. Impacts to the gardener would be 9×10^{-3} probability of a latent cancer fatality at INEEL from buried RH TRU waste. The hazard index for mercury and lead are 77 and 3,900, respectively, for the gardener for RH TRU waste. The lead hazard index is 36 for CH TRU waste.

Impacts from Exposure to Surface-Stored Waste

The scavenger scenario is one where an individual was assumed to come into direct contact with the TRU waste on the surface for a 24-hour period. This intruder was assumed to be exposed by inhalation of resuspended contamination, external radiation, and inadvertent ingestion of contaminated soil while at the site.

Radiological impacts to a hypothetical scavenger from CH TRU waste at INEEL would have a $2x10^{-3}$ probability of a latent cancer fatality. Impacts to the scavenger would be $2x10^{-3}$ probability of a latent cancer fatality at INEEL from buried RH TRU waste (see Table 5.21-1). Significant impacts would be seen from heavy metals. The concentration of heavy metals ranges from 5 times to 1,400 times the PEL for CH TRU waste and up to 160,000 times the PEL for RH TRU waste.

Table 5.21-1. Radiological Impacts to Inadvertent Intruders Following Loss of Institutional Control at INEEL.

	Probability of a Latent Cancer Fatality
CH TRU Waste Impacts	
Buried Waste	
Driller (acute)	5E-6
Gardener (chronic)	0.01
Surface Waste	
Scavenger (acute)	2E-03
Family Farm (chronic)	0.8
RH TRU Waste Impacts	
Buried Waste	
Driller (acute)	5E-6
Gardener (chronic)	9E-3
Surface Waste	
Scavenger (acute)	2E-03
Family Farm (chronic)	1

The farmer scenario is one in which a hypothetical farmer lives and farms on a plot of land at the location of the surface-stored waste. The waste was assumed to have degraded to a point where it was indistinguishable from the surrounding land soil. The maximally exposed farmer was assumed to be exposed by ingestion of contaminated food crops grown in the contaminated soil, inhalation of resuspended contamination, external radiation, and inadvertent ingestion of contaminated soil. Under this scenario, the members of the family would receive very high radiation doses in the first year of farming. The probability of a latent cancer fatality at INEEL would be 0.8 for CH TRU waste. The probability of a latent cancer fatality at INEEL for RH TRU waste would be 1 (see Table 5.21-1). Noncarcinogenic effects such as radiation pneumenitis in the lungs could also occur. Health impacts from hazardous chemicals would be significant as well. The hazard index ranges from 10 to 100,000 for CH TRU waste and up to 5,200,000 for RH TRU waste.

Impacts of Long-Term Environmental Release

For TRU waste stored in shallow burial trenches and surface storage facilities at INEEL contaminants would eventually be released to the surrounding environments after loss of institutional control. Contaminants within the buried or surface-stored waste would be leached and released to underlying soils and aquifer systems in depth. The contaminants would eventually reach groundwater and migrate laterally to a downgradient receptor location. Contaminants might also eventually be discharged into nearby surface water bodies. Once in these surface-water systems, the public would be exposed to dilute concentrations of the contaminants in public water supplies.

Waste stored in surface facilities would also degrade and disperse contaminants in the environmental by the processes of direct waste and air erosion, deposition onto soils surrounding the site, and resuspension of contaminated soils in air. The surrounding populations would be exposed to these contaminants as they were redistributed into the environment by these cyclic and ongoing processes.

Radiological and chemical impacts were evaluated for MEIs and the populations surrounding INEEL. Impacts to the MEI were evaluated for a groundwater exposure scenario and an air pathway exposure scenario. Under the groundwater exposure scenario, the MEI was assumed to be a member of a farm family living 300 meters downgradient of the waste storage areas at the INEEL. It was assumed that the family would engage in farming activities such as growing and consuming its own crops and livestock and would use contaminated groundwater as a source of drinking water and for watering the crops and animals. Under the air pathway exposure scenario the MEI was assumed to live at the point of maximum airborne contaminant concentration. This individual could be exposed via inhalation of resuspended contamination, ingestion of contaminated food crops grown in the contaminated soil, external exposure to the soil, and inadvertent ingestion of contaminated soil.

Impacts to offsite populations were also evaluated from long-term environmental releases to surface water and to air. For analyses of buried waste releases, all CH TRU and RH TRU waste was combined into a single waste disposal unit, and only the groundwater pathway was considered. For analyses of surface-stored waste releases, all CH TRU and RH TRU waste was combined into a single waste storage unit and was allowed to be released to all pathways.

Impacts to the MEIs for the maximum 70-year lifetime over 10,000 years of environmental release of contaminants are presented in Table 5.21-2 for the INEEL. Radiological impacts to the MEI would be 4×10^{-3} probability of a latent cancer fatality at INEEL. Carcinogenic hazardous chemical impacts to the MEI would have a 5×10^{-3} probability of cancer incidence at INEEL due to ingestion of groundwater containing 1,1,2,2-tetrachloroethane. Noncarcinogenic hazardous chemical impacts at the INEEL were estimated using an HI of 0.3 from carbon tetrachloride due to groundwater ingestion. No noncarcinogenic health effects would occur for a HI less than 1.

Table 5.21-2. Maximum Lifetime MEI and Population Impacts at INEEL Under No Action Alternative 2.

	Radiological Impacts		Chemical Carcinogenic Impacts	
Major Sites	Lifetime Latent Cancer Fatalities[a]	Dominant Pathway	Lifetime Cancer Incidence	Dominant Pathway
MEI Impacts				
INEEL	4E-03	Groundwater Ingestion	5E-03	Groundwater Ingestion
Population Impacts				
INEEL	0.07	Inhalation	3E-06	Resuspended Soil Ingestion

a. Probability of a latent cancer fatality for the MEIs; number of latent cancer fatalities for the populations.

Impacts to populations for the maximum 70-year lifetime over 10,000 years of environmental release of contaminants are also presented in Table 5.21-2 for the INEEL. Exposures from the air and groundwater to surface water pathways were included.

Radiological impacts to populations at the INEEL would be 0.07 latent cancer fatalities. Carcinogenic hazardous chemical impacts would be 3×10^{-6} cancers at INEEL.

The aggregate number of latent cancer fatalities that could occur in offsite populations around the INEEL over 10,000 years (approximately 142 70-year lifetimes) from release of the No Action Alternative 2 Basic Inventory was estimated. The aggregate number of latent cancer fatalities for INEEL was estimated to be 3.8 latent cancer fatalities. In addition to the impact from release of the No Action Alternative 2 Basic Inventory, the number of aggregate latent cancer fatalities at the INEEL was estimated for the Additional Inventory of Action Alternative 1 which would also remain in place at the sites under the No Action Alternative 2. An additional 7.7 aggregate latent cancer fatalities were estimated to occur at INEEL from release of the Additional Inventory. Release of the combined inventories would result in about 11.4 latent cancer fatalities at the INEEL. The aggregate hazardous chemical impact at INEEL over 10,000 years was estimated to be about $5.4x10^{-3}$ cancers. These impacts were estimated based on current population distributions. These distributions may change substantially, creating the potential for significant increases over these estimates of aggregate latent cancer fatalities.

Impacts of Long-Term Environmental Release After Thermal Treatment

The SEIS-II analyzed the long-term impacts associated with treatment and storage of TRU waste at the treatment site similar to that described for the AMWTP Treatment and Storage Alternative presented in this EIS.

Under the SEIS-II No Action Alternatives 1A and 1B, TRU waste would continue to be generated and put into monitored, retrievable storage. There would be no shipment of waste to WIPP. DOE would indefinitely maintain institutional control and provide long-term monitoring and maintenance of storage facilities. As a consequence, adverse health effects for the general public while DOE maintained control would be minimal, and the principal adverse effects, which also would be small, would be related to occupational activity at the facility. Health effects would continue at such levels for the indefinite future.

The loss of institutional control is a possibility for any long-term storage alternative. Therefore, an analysis of the potential impacts from long-term environmental release under No Action Alternative 1A and 1B was conducted. (INEEL was a site included in both alternatives 1A and 1B). The analysis was similar to that presented for the No Action Alternative 2; however, the waste form generated by the thermal treatment process would substantially reduce those potential impacts. Radionuclides and heavy metals would be incorporated into a more dense and durable waste form that would limit the release of waste into the accessible environment. VOCs would be removed in the treatment process and would not be present in emplaced waste. Once waste containers degrade, direct release from a thermally-treated waste form (e.g., metal slag or glass) would depend on the rate of corrosion and dissolution of metal or glass and natural forces responsible for erosion rather than leaching.

No radiological or hazardous chemical impacts to individuals or populations would be expected over 10,000 years. The number of aggregate latent cancer fatalities for Hanford, INEEL, Los Alamos National Laboratory, Savannah River Site, Rocky Flats Environmental Technology Site, and Oak Ridge National Laboratory over 10,000 years was estimated to be less than $8x10^{-4}$ latent cancer fatalities for No Action Alternative 1A; and $3x10^{-4}$ latent cancer fatalities for Hanford, INEEL, Savannah River Site, and Oak Ridge National Laboratory under the No Action Alternative 1B for the Total Inventory.