Appendix C.2

Air Resources

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Air Resources

C.2.1 INTRODUCTION

The characterization of air resources and assessment of impacts of waste processing and facility disposition alternatives required an extensive program of emissions estimation, air dispersion modeling, and evaluation of results. The complexity and scope of the required analyses were driven by factors such as the large number of projects encompassed by the waste processing and facility disposition alternatives, the large number of specific air pollutants (including various radionuclides, criteria air pollutants and toxic air pollutants) that are potentially associated with these projects, and the many air-quality related criteria against which impacts should be compared. As a result, the methodology and findings described in the main body of the text are primarily of a summary nature. The purpose of this appendix is to provide supporting information and additional detail to support those findings. In particular, this appendix supports the information presented in the air resources sections pertaining to the affected environment (Section 4.7), and environmental consequences of waste processing alternatives (Section 5.2.6) and facility disposition alternatives (Section 5.3.4).

The air resource assessments performed in support of this environmental impact statement (EIS) relied heavily on information contained in numerous technical reports, project-specific data summaries, and other related documents. The following are among the more important of these information sources:

- The SNF & INEL EIS (DOE 1995) was used as a source of information on existing air resource conditions and projected increases in pollutant emissions as a result of future operations not associated with waste processing. In some cases (e.g., emission rates and offsite radiation dose from existing facilities), the U.S. Department of Energy (DOE) supplemented this information with more recent data. In other cases, the data or assessment results were modified to reflect current conditions. These changes are described in the sections in which they are reported.

- The Idaho National Engineering and Environmental Laboratory (INEEL) radiological National Emission Standards for Hazardous Air Pollutants reports for the calendar years 1995 and 1996 (DOE 1996a, 1997a) were used to establish the existing radiological conditions in terms of airborne radionuclide emissions and highest dose to an offsite receptor. ***Reports for the years 1999 and 2000 (DOE 2000, 2001) were also used to present emissions data for more recent periods during which no waste calcining was performed.***

- INEEL air emissions inventory for the years 1996 and 1997 (DOE 1997b, 1998) were used to update the criteria pollutant emission rates from existing INEEL facilities. These were compared with the emission rates which were used in the SNF & INEL EIS to ensure that the current rates are within the bounds of those used in the SNF & INEL EIS as a basis for characterizing existing conditions through atmospheric dispersion modeling.

- ***The Prevention of Significant Deterioration/Permit to Construct (PSD/PTC) Application for the INTEC CPP-606 Boilers (Lane 2000), and the supporting analyses (Rood 2000a), were used to identify INEEL sources subject to PSD regulation, and as a data source for emission rates and associated release parameters. The amount of PSD increment consumption determined in support of the permit application was used to describe baseline PSD increment consumption from existing INEEL sources.***

- Project data summaries (Appendix C.6) and supporting engineering design files were used as sources of information for emissions-related parameters that pertain to the construction, startup and testing, operation, and decontamination and decommissioning of the proposed projects. These documents, which were prepared specifically for this EIS, provide information such as projected operating schedules, fossil fuel usage, fugitive dust generation, and radiological and non-radiological emission rates.

This appendix integrates the descriptions of methods, assumptions, results, and other key information from the technical evaluations and summaries cited above into a single source, ***as well as integrate newer analyses conducted specifically for this EIS***. The remainder of this section is organized as follows:

- Section C.2.2 contains a description of air quality standards and regulations and a discussion of how they apply to sources at the INEEL.
- Section C.2.3 provides supporting information on the methods and assumptions used to estimate emissions and assess baseline conditions and impacts of proposed facilities.
- Section C.2.4 provides supplemental detail on radionuclide emission rates from waste processing alternatives, as well as the potential radiation dose consequences of these emissions.
- Section C.2.5 provides supplemental detail on nonradiological pollutant emission rates from waste processing alternatives, as well as the potential environmental consequences of these emissions.
- Section C.2.6 describes radiological emissions and potential dose consequences of facility disposition alternatives.
- Section C.2.7 describes nonradiological emissions from facility disposition alternatives and potential environmental consequences of these emissions.

C.2.2 AIR QUALITY STANDARDS AND REGULATIONS

Air quality regulations have been established by Federal and State agencies to protect the public from potential harmful effects of air pollution. The Federal Clean Air Act establishes the framework to protect the nation's air resources and public health and welfare. The U.S. Environmental Protection Agency (EPA) and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the Act. These regulations are based on an overall strategy that incorporates the following principal elements:

- Designation of acceptable levels of pollution in ambient air to protect public health and welfare
- Implementation of a permitting program to regulate (control) emissions from stationary (nonvehicular) sources of air pollution
- Issuance of prohibitory rules, such as rules prohibiting open burning.

Facilities planned or currently operating at the INEEL are subject to air quality regulations and standards established under the Clean Air Act and by the State of ***Idaho Department*** of Environmental Quality, and to internal policies and requirements developed by DOE for the protection of the environment and health. At the INEEL, programs have been developed and implemented to ensure compliance with air quality regulations by (a) identifying sources of air pollutants and obtaining necessary State and Federal permits, (b) providing adequate control of emissions of air pollutants, (c) monitoring emissions sources and ambient levels of air pollutants to ensure compliance with air quality standards, (d) operating within permit conditions, and (e) obeying prohibitory rules. Air quality standards and programs applicable to the INEEL operations are summarized in Table C.2-1 and are described in further detail below. This section also provides information on project design features to mitigate air quality impacts and operate within the bounds of regulatory requirements.

Table C.2-1. Overview of Federal, State, and DOE programs for air quality management.

Clean Air Act		
Federal Program	State of Idaho Administration Program	DOE Compliance Program
National Ambient Air Quality Standards • Set limits on ambient air concentrations of sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, lead, and ozone (criteria pollutants). • Primary standards for protection of public health; secondary standards for protection of public welfare. **Prevention of Significant Deterioration** • Limits deterioration of air quality and visibility in areas that are better than the National Ambient Air Quality Standards. • Requires Best Available Control Technology on major sources in attainment areas. **New Source Performance Standards** • Regulate emissions from specific types of industrial facilities (for example, fossil fuel-fired steam generators and incinerators). **National Emission Standards for Hazardous Air Pollutants** • Control airborne emissions of specific substances harmful to human health. • Specific provisions regulate hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem per year. • Control emission of hazardous air pollutants from combustion of hazardous waste***, as well as other categories of activities that may result in hazardous air pollutant emissions.*** **Clean Air Act Amendments of 1990** • Sweeping changes to the Clean Air Act, primarily to address acid rain, nonattainment of National Ambient Air Quality Standards, operating permits, hazardous air pollutants, potential catastrophic releases of acutely hazardous materials, and stratospheric ozone depletion. • Specific rules and policies not yet fully developed and implemented in all areas (for example, hazardous air pollutants).	**Rules for the Control of Air Pollution in Idaho** Current Regulations of the State of Idaho Department ***of Environmental Quality (IDEQ 2001)*** include: • **Idaho Ambient Air Quality Standards -** Similar to National Ambient Air Quality Standards but also include standards for total fluorides. • **New Source Program** - Permit to Construct is required for essentially any construction or modification of a facility that emits an air pollutant; major facilities require PSD analysis and Permit to Construct. • **Carcinogenic and Noncarcinogenic Toxic Air Pollutant Increments** - Defines acceptable ambient concentrations for many specific toxic air pollutants associated with sources constructed or modified after May 1, 1994; requires demonstration of preconstruction compliance with toxic air pollutant increments. • **Operating Permits** - Required for nonexempt sources of air pollutants; define operating conditions and emissions limitations, as well as monitoring and reporting requirements. **Rules and Standards for Hazardous Waste** • Includes standards for hazardous waste treatment facilities, including limits on emissions. • Consistent with Federal standards.	Policy to comply with applicable regulations and maintain emissions at levels as low as reasonably achievable. Policy implemented through DOE orders: • DOE (Headquarters) orders apply to all DOE and DOE-contractor operations. • DOE-Idaho Operations Office (DOE-ID) supplemental directives provide direction and guidance specific to the INEEL. The most relevant DOE orders and their DOE-ID supplemental directives are: • DOE Order 5400.1 establishes general environmental protection program requirements and assigns responsibilities for ensuring compliance with applicable laws, regulations, and DOE policy. • DOE Order 5400.5 provides guidelines and requirements for radiation protection of the public. • DOE Order 5480.1B establishes the Environment, Safety, and Health Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1). • DOE Order 5480.4 prescribes the application of mandatory Environment, Safety, and Health standards that shall be used by all DOE and DOE-contractor operations (implemented via DOE-ID Supplemental Directive 5480.4). • DOE Order 5480.19 provides guidelines and requirements for plans and procedures in conducting operations at DOE facilities (implemented via DOE-ID Supplemental Directive 5480.19).

C.2.2.1 Ambient Air Quality Standards

The Federal Clean Air Act establishes National Ambient Air Quality Standards to protect public health and welfare. Primary standards define the ambient concentration of an air pollutant below which no adverse impact to human health is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts to public welfare, including aesthetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions that persist for periods ranging from one hour to three months, depending on the toxic properties of the pollutant in question. Ambient standards have been developed for only a few specific contaminants, namely, respirable particulate matter (particles not larger than 10 micrometers in diameter, which tend to remain in the lung when inhaled), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. ***(EPA has also promulgated an ambient air quality standard for fine particulates [particulates not larger than 2.5 micrometers in diameter]. This standard, together with a standard promulgated for ozone averaged over an eight-hour period, have been challenged by ongoing litigation, and as such are not specifically addressed herein.)*** In addition, the State of Idaho has also established an additional State ambient air quality standard for fluorides in vegetation. This standard, however, is less restrictive than more recently promulgated increments for toxic air pollutants. In this EIS, "criteria air pollutant" standards are used in the regulatory compliance evaluations of projected emissions from ***waste*** processing alternatives.

The EPA and State of Idaho have monitored ambient air quality in an attempt to define areas as either attainment (that is, the standards are not exceeded) or nonattainment of the ambient air quality standards, although many areas are unclassified due to a lack of regional monitoring data. The attainment status is specific to each pollutant and averaging time. Designation as either attainment or nonattainment not only indicates the quality of the air resource, but also dictates the elements that must be included in local air quality regulatory control programs. Unclassified areas are generally treated as being in attainment. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that encompasses the INEEL has been classified as attainment or unclassified for all National Ambient Air Quality Standards, meaning that air pollution levels are considered ***healthy***. The nearest nonattainment area lies some 50 miles south of the INEEL in Power and Bannock Counties, which has been designated as nonattainment for the standards related to respirable particulate matter.

As stated, the INEEL lies in an area which is in attainment of all ambient air quality standards. In compliance with state and federal programs, detailed analyses are conducted to demonstrate that implementation of proposed alternatives will not result in violations of ambient air quality standards, or contribute to unacceptable increases in pollutant levels. If the INEEL were located in an area in which the attainment or maintenance of ambient air quality standards is not well established, the proposed alternatives would also be subject to Clean Air Act conformity reviews. A conformity review serves as a means to assure that a federal action does not hinder or interfere with programs developed by state and federal agencies to bring the area into compliance with ambient air standards. Within Idaho, there are currently five federally designated air quality nonattainment areas, and the Idaho Department of Environmental Quality has identified five additional areas of concern based on air monitoring data. Each of these areas is more that 50 miles from the INEEL and will not be impacted under any of the proposed alternatives.

C.2.2.2 Prevention of Significant Deterioration

The Clean Air Act contains requirements to prevent the deterioration of air quality in areas designated as attainment of the ambient air quality standards. These requirements are contained in the PSD amendments and are administered through a program that limits the increase in specific air pollutants above the levels that existed in what has been termed a baseline (or starting) year. The amendments specify maximum allowable ambient pollutant concentration increases, or increments. Increment limits for pollutant level increases are specified for the nation as a whole (designated as Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for designated national resources, such as national forests, parks, and monuments (designated as Class I areas). In Southeastern Idaho, the Craters of the Moon Wilderness Area is the only Class I area. Increment values applicable to the INEEL are presented in Section 4.7 (see Tables 4-1***4*** and 4-1***5***).

The State of Idaho Department of Environmental Quality administers the PSD Program. Proposed new sources of emissions at the INEEL and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEEL is considered a major source ***for the purposes of PSD, and*** as such, a PSD analysis must be performed whenever any modification would result in a significant net increase of any air pollutant. Levels of significance range from very small quantities (less than one pound) to over 100 tons per year, depending on the toxic nature of the substance. Significance levels specified by the State of Idaho for nonradiological pollutants are presented in Table C.2-2. For radionuclides, significance levels range from any increase in emissions to that which would result in an offsite dose of 0.1 millirem per year or greater, depending on total facility emissions.

If an INEEL facility requires a PSD permit, it must be demonstrated that the source:

- Will be constructed using best available control technology (a level of control which is technologically feasible and considered cost-effective) to reduce air emissions
- Will operate in compliance with all prohibitory rules
- Will not cause a detriment to ambient air quality at the nearby Craters of the Moon Wilderness Area, a PSD Class I area
- Will not cause exceedance of Class II increments at locations of ambient air
- Will not adversely affect visibility

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values-visibility, vegetation, and soils. Generally, all PSD projects must go through a public comment period with an opportunity for public review. ***Many sources at the INEEL have undergone PSD reviews, most recently the new INTEC CPP-606 boilers.***

Table C.2-2. Significance levels specified by the State of Idaho for nonradiological pollutants.[a]

Pollutant	Significance level (tons per year)	Pollutant	Significance level (tons per year)
Carbon monoxide	100	Beryllium	4.0×10^{-4}
Nitrogen oxides	40	Mercury	0.1
Sulfur dioxide	40	Vinyl chloride	1
Particulate matter		Fluorides	3
Total particulate matter	25	Sulfuric acid mist	7
Respirable particulates[b]	15	Hydrogen sulfide (H_2S)	10
Volatile organic compounds[c]	40	Total reduced sulfur (including H_2S)	10
Lead	0.6	Reduced sulfur compounds (including H_2S)	10
Asbestos	7.0×10^{-3}		

a. From IDAPA ***58***.01.01.006***.92*** (***IDEQ 2001***).
b. Airborne particulate matter with a particle diameter of 10 micrometers or less.
c. Used as a surrogate for ozone.

C.2.2.3 National Emission Standards for Hazardous Air Pollutants

In addition to ambient air quality standards and PSD requirements, the Clean Air Act designates requirements for sources that emit substances designated as hazardous air pollutants. These requirements are specified in a program termed National Emission Standards for Hazardous Air Pollutants. Title 40 of the Code of Federal Regulations Part 61, Subpart H, *National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities* **directly applies to INEEL operations**. This regulation establishes a limit to the dose that may be received by a member of the public due to operations at INEEL. The annual dose limit (10 millirem) applies to the maximally exposed offsite individual and is designed to be protective of human health with an adequate margin of safety. The regulation also establishes requirements for monitoring emissions from facility operations and analysis and reporting of dose.

The INEEL complies with the requirements of the National Emission Standards for Hazardous Air Pollutants through programs to monitor radionuclide emissions, evaluate dose to nearby residences, and report doses annually to the EPA. Proposed new sources of emissions at the INEEL and modifications are evaluated to identify the expected contribution to dose to nearby residents. If specified levels (fractions of the acceptable dose for combined site operations) are exceeded, a National Emission Standards for Hazardous Air Pollutants permit application is prepared for submittal to the EPA. New sources are also evaluated to determine emissions monitoring requirements.

In addition to radionuclides, emissions standards have been established under the National Emission Standards for Hazardous Air Pollutants Program for several nonradiological hazardous air pollutants, including benzene, asbestos, and others, ***and many activities that may result in emissions of hazardous air pollutants.*** In accordance with Title III of the 1990 Amendments to the Clean Air Act, maximum achievable control technology ***is*** specified by the EPA for various source categories. Maximum achievable control technology ***requires*** a level of control at least as stringent as the best performing (i.e., best controlled) sources within each source category. Sources ***are*** required to implement programs or controls to comply with the maximum achievable control technology by the scheduled implementation date. Several maximum achievable control technology standards have been promulgated or proposed. ***The vast majority of these standards are applicable to major sources of hazardous air pollutants, although some are applicable to area sources. For purposes of this program, a "major source" is one which has a potential to emit 10 tons per year or more of any one of the 188 listed hazardous air pollutants, or 25 tons per year or more of any combination of listed hazardous air pollutants. Facilities that release lesser quantities are designated as "area sources."***

The INEEL currently is not a major source for HAP emissions. However, certain waste processing facilities, including the New Waste Calcining Facility and other facilities that include thermal treatment processes***, may be regulated under*** the maximum achievable control technology rule for hazardous waste combustion facilities, ***which is applicable to both area and major sources. In September 1999, EPA issued standards to control emissions of hazardous air pollutants from hazardous waste combustors (64 FR 52827). However, a number of parties sought judicial review of the rule, and subsequent agreements resulted in the issuance of interim standards on February 13, 2002 (67 FR 6792) somewhat less stringent than those of the September 30, 1999 ruling (see Table C.2-3). Facilities are required to comply with the interim standards by September 30, 2003. Final standards are expected to be issued by EPA by June 14, 2005.***

C.2.2.4 State of Idaho Permit Programs

The Idaho Air Pollution Control Program, administered by the ***Department*** of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt ***[categorical exemptions are listed in IDAPA 58, Title 1, Chapter 1, Sections 220 - 225 of the Rules for Control of Air Pollution in Idaho (IDEQ 2001)]*** from permitting requirements,

Table C.2-3. ***Interim*** **maximum achievable control technology standards for combustion of hazardous waste.**

Hazardous air pollutant or surrogate	Standard[a] Existing Source	New Source
Dioxins and furans (nanograms per dry standard cubic meter, as 2,3,7,8-TCDD equivalent)	0.20	***0.20***
Mercury (micrograms per dry standard cubic meter)	***130***	***45***
Particulate matter[b] (milligrams per dry standard cubic meter)	34	***34***
Hydrogen chloride and chlorine (parts per million by volume as hydrogen chloride equivalents)	*77*	***21***
Semi-volatile metals (total lead and cadmium; micrograms per dry standard cubic meter)	***240***	***120 (24)[c]***
Low-volatile metals (total antimony, arsenic, beryllium, and chromium; micrograms per dry standard cubic meter)	***97***	***97***
Carbon monoxide[d] (parts per million by volume)	100	***100***
Hydrocarbons[d] (parts per million by volume, as propane)	10	***10***

TCDD = Tetrachlorodibenzo-P-Dioxin.

a. All maximum achievable control technology concentrations are based on dry, standard conditions corrected to 7 percent oxygen.

b. Particulate matter is specified as a surrogate for control of non-mercury metals.

c. Interim standard is less stringent than that of the March 30, 1999 final rule (24 micrograms per dry standard cubic meter).

d. Pollutants are specified as surrogate indicators of good combustion control. ***Either pollutant can be used to demonstrate compliance.***

Permits to Construct and Operate must be obtained before a source can be constructed or operated. The permits specify requirements, such as monitoring, reporting and recordkeeping, or limitations on operating conditions, such as emission limits.

In addition to individual source permits, the INEEL is also required to ***comply with*** a sitewide Title V operating permit, as stipulated under the 1990 Clean Air Act Amendments. The INEEL Title V Operating Permit ***contains*** specific emissions limits and conditions for operation. This formal permitting process allows the State to determine that emissions will be adequately controlled, the source will comply with all emission standards and regulations, and public health and safety will be adequately protected. Generally, Operating Permit reviews must go through a public review period with an opportunity for public comment. The maximum achievable control technology program (Title III of the 1990 Clean Air Act Amendments which is discussed above) ***is*** administered under the Title V program and also ***calls*** for public review and comment.

C.2.2.5 State of Idaho Rules for Toxic Air Pollutants

The Idaho ***Department*** of Environmental Quality has promulgated rules and methodologies to estimate and control the potential human health impacts of toxic air pollutants (pollutants which by their nature are toxic to human or animal life or vegetation) from new or modified sources. The method used to assess cancer risk ***and other potential health impacts*** associated with air emissions from current INEEL facilities and proposed alternatives is summarized in Appendix E-4, Health and Safety. These rules are contained in ***IDAPA 58***, Title 1, Chapter 1, Sections 585 and 586 of the Rules for the Control of Air Pollution in Idaho (***IDEQ 2001***) and are implemented through the air quality permit program described above. Threshold emission levels have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected (uncontrolled) emissions above these screening thresholds must be evaluated using standard air dispersion modeling techniques and risk assessment methodologies to assess potential impacts.

As part of the permit evaluation process, requirements related to toxic air pollution control equipment, facility modifications, and materials substitutions may be specified to limit ambient levels of toxic air pollutants.

The State has defined acceptable ambient concentration levels for many toxic air pollutants, including both carcinogenic ***(cancer causing)*** and noncarcinogenic contaminants. These levels are increments over existing levels and apply only to sources that became operational after May 1, 1994. For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen. The acceptable ambient concentration for a carcinogen is based on risk and corresponds to that concentration at which the probability of contracting cancer is one in a million, assuming continuous exposure over a 70-year lifetime. This probability is often described as an "individual excess cancer risk." Excess, in the sense used here, means above the normal cancer incidence rate, which is currently about one in three for the U.S. population. An individual excess cancer risk of one in a million or less is generally considered an acceptable level of risk. The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the EPA. The State will grant a permit if the calculated incremental risk due to project emissions does not exceed the acceptable ambient concentration for a carcinogen (that is, does not result in an individual excess cancer risk greater than one in a million). If this level is expected to be exceeded, a permit may still be granted if (a) the calculated risk does not exceed ten in a million and (b) toxic reasonably achievable control technology (which is similar to best available control technology) is employed to limit emissions of carcinogenic substances.

Many air contaminants do not cause cancer but may contribute to other health impacts, such as respiratory or eye irritants, or impacts to the cardiovascular, reproductive, central nervous or other body systems. Levels of significance for noncarcinogenic substances are called acceptable ambient concentrations. Acceptable ambient concentrations are assigned for each of the listed non-carcinogenic toxic air pollutants based on acceptable exposure limits for occupational workers and other reference sources of information for the contaminant in question. For an added margin of safety, the State generally sets the acceptable ambient concentration at one-hundredth of the acceptable occupational exposure level. Permits are granted if incremental emissions from the new or modified source are expected to result in annual average concentrations below the acceptable ambient concentrations. However, if the acceptable ambient concentrations are expected to be exceeded, a permit may still be granted based on consideration of other factors, such as the toxicity of the substance and anticipated level of exposure.

C.2.2.6 Standards for Hazardous Waste and Toxic Substance Control

In addition to regulations designed specifically for air resource protection, projects which include handling or treatment of hazardous substances are required to comply with various Federal and State environmental regulatory programs, which incorporate certain requirements on releases to air. Among the most important of these requirements for hazardous waste incineration are the standards for the destruction of organic hazardous constituents in solid wastes prescribed by EPA (40 CFR 264, Subpart O) and ***Department of Environmental Quality*** (IDAPA ***58***.01.05.008) ***regulations***. Polychlorinated biphenyl incineration must achieve the minimum 99.9999 percent destruction and removal efficiency of the Toxic Substances Control Act, while incineration of other difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, must achieve a minimum 99.99 percent destruction and removal efficiency. The Resource Conservation and Recovery Act performance standards for hydrogen chloride emissions in IDAPA ***58***.01.05.008 require either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride emission rate during the incineration of chlorinated wastes.

C.2.2.7 U.S. Department of Energy Orders and Guides

DOE has developed and issued a series of orders and guides to ensure that all operations comply with applicable environmental, safety, and health regulations and DOE internal policies, including the concept of maintaining emissions and exposures to the public and workers at levels that are as low as reasonably achievable. The as low as reasonably achievable concept is employed in the design and operation of all facilities and applies to all types of air pollutants (for example, radionuclides, carcinogens, toxic and criteria air pollutants).

C.2.3 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

Several distinct types of evaluations have been performed to assess air quality for existing conditions and future actions. These are:

- Radiological air quality assessments, which are performed for radionuclide emissions from stationary ***(stack and diffuse)*** sources
- Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources
- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources
- Fugitive dust and combustion product emissions associated with construction equipment and some operational sources
- Assessments of criteria pollutant emissions from mobile sources.

This section describes the methodology used in each type of air quality assessment, including the general approach to source term estimation and atmospheric dispersion modeling, and specific information on related assumptions, methods, and data used in the analyses.

C.2.3.1 Source Term Estimation

The type and quantity of pollutants emitted to air from a specific source, or group of sources, is often referred to as the source term. The baseline source term was compiled from INEEL emissions inventory reports (DOE 1996b, 1997b***, 1998***) and National Emission Standards for Hazardous Air Pollutants reports (DOE 1996a, 1997a***, 2000, 2001***), with projected increases as described in the SNF & INEL EIS (Section 5-7, and Appendix F-3). The source term for each of the proposed waste processing alternatives was developed using information contained in the project data summaries and supporting documentation. Emission rates were calculated for each project, and these were compiled, evaluated, and processed for use in dispersion modeling. The assumptions and methods used for specific project emission rate calculations are documented in the engineering data files which have been prepared to support each individual project. Emission rates for each alternative were determined by summing the emission rates for each project associated with that alternative. In the case of the waste processing alternatives, all facilities were assumed to operate concurrently. For some decommissioning activities, however, some corrections were applied to account for the fact that closure activities were sequential.

Process Emissions

The project data sheets and supporting documentation contain estimates of radionuclide and nonradiological pollutant emission rates for those projects that include waste handling or processing. DOE estimated these emissions for each project based on the nature of the process and the composition of process materials. The estimation method includes assumptions regarding the amount of material that could enter the process exhaust and the amount that would pass through air pollution control systems and be released to the atmosphere. Where applicable, release estimates relied on experience with facilities or processes similar to the one being evaluated.

The primary data source for radionuclide emissions from principal waste processing facilities is a report by McDonald (1999). ***This report was subsequently modified to revise information on tritium emissions for the Direct Vitrification Alternative (McDonald 2000). There was no change in the estimated amount of tritium emissions, but rather in the identity of the process facility at which the emissions would occur.*** For radionuclides other than tritium, release estimates are based on actual emissions released from existing waste processing facilities at the Idaho Nuclear Technology and Engineering Center (INTEC). ***This approach assumes that radionuclide concentrations in the gaseous effluent from waste treatment processes will be similar to historical levels (as measured in the INTEC Main Stack), and that the emission rate for these processes will be proportional to volumetric flow rate. This approach takes advantage of actual measurement data gathered during waste processing at INTEC, and does not rely on estimates of radionuclide inventory in the wastes. Thus, revised estimates of radionuclide inventory made since the issuance of the Draft EIS do not affect the validity of these emission rate estimates.***

Emissions released during 1996 (a year in which no calcining was performed) from the waste evaporator and fractionator were used as a basis for estimating emissions from the following projects associated with proposed waste processing alternatives:

- Newly Generated Liquid Waste and Tank Farm Heel Waste Management

- Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility

- No Action Alternative.

For proposed alternatives which involve calcination, emissions are patterned after releases from the INTEC main stack during 1997 (a year in which calcining was performed). The specific projects covered by this estimation method are:

- Calcining SBW including New Waste Calcining Facility Upgrades

- Vitrification of Separated High-Activity Waste

- Denitration and Grouting of Low-Activity, Class A Waste

- Denitration and Grouting of Low-Activity, Class C Waste

- Vitrification of Calcine and SBW.

For these projects, DOE calculated emissions by multiplying the concentration of radionuclides in the 1997 offgas by the annual volume of gas that each of the proposed projects would discharge.

DOE estimated tritium emissions by dividing the current inventory of tritium in mixed transuranic waste/sodium-bearing waste (SBW) (the only waste stream with a significant quantity of tritium) by the number of years that a thermal waste process would be applied to that waste.

For projects other than those listed above, DOE estimated building emissions using a general method based on the assumption that the primary radionuclides in building exhaust are present in the same proportion as in calcine or tank waste (whichever is more appropriate). The total activity is assumed for dose assessment purposes to be divided among strontium-90, cesium-137, and plutonium-239 according to the following table:

	Fraction of total activity	
Radionuclide	Calcine	Tank waste
Strontium-90	0.90	0.49
Cesium-137	0.10	0.51
Plutonium-239	2.6×10^{-5}	3.3×10^{-3}

It was further assumed that for general building ventilation, these radionuclides are present at a concentration of 1 percent of the derived air concentration, which is a limit for radionuclide concentration specified in 10 CFR 835. This general method was used for estimating emissions in general building ventilation during facility operation and dispositioning, as well as for processes associated with projects other than those specified above. This latter category includes projects such as Calcine Retrieval and Transport, Mixing and Hot Isostatic Pressing, and the Direct Cement Process.

Estimates of nonradiological air pollutant releases from thermal waste treatment processes have been performed by Kimmitt (1998) using release data previously developed by Abbott et al. (1999). These estimates are consistent with EPA guidance (EPA 1994) and are based on the following factors:

- Contaminant concentrations in the waste
- Formation of products of incomplete combustion (such as dioxins and furans)
- Material flow rates
- Air pollution control system performance.

Since little data are available on contaminant levels in the waste to be treated (for example, organic content of calcine), DOE assumed that up to 5 percent of the organic contaminants in the original liquid high-level waste (HLW) are retained in the calcine. The performance of air pollution control systems is based on vendor data and technical literature sources.

Fossil Fuel Combustion Byproducts

DOE estimated criteria and toxic air pollutant emissions associated with fossil fuel combustion for each project. These emission rates are based on the amount of fossil fuel that would be burned to produce an amount of steam required by the project for process use and building heating and air conditioning. A similar method was used to estimate emission from diesel fuel-burning equipment (cranes, loaders, haulers, etc.) that would be required to support project construction, operation, and decontamination and decommissioning at the end of its useful life. These calculations are documented in the Project Data Sheets for each project. In addition to the criteria pollutant emissions documented in the Project Data Sheets, the air resource assessment estimated toxic air pollutant emission rates associated with assumed fuel oil combustion rates. These estimates are based on the EPA-recommended emission factors [specified in EPA (1998)] for residual oil-fired boilers.

Table C.2-4 presents the emission factors used for nonradiological pollutant releases from fuel oil combustion. ***Sulfur dioxide emission rates are based on a maximum fuel sulfur content of 0.3 percent, which is a condition of the PSD permit issued for recently installed boilers at the INTEC Service Building Power House (CPP-606). The limit has been voluntarily applied sitewide. The assessment of cumulative sulfur dioxide impacts includes emissions from existing INEEL facilities that are based on a maximum fuel sulfur content of 0.5 percent, and are thus conservative.***

Radionuclide and Toxic Emission Screening

Numerous radionuclides or nonradiological toxic air pollutants could be present in airborne effluents from facilities associated with the waste processing alternatives. Typically, however, relatively few substances contribute significantly to the risk. DOE performed screening evaluations to identify the most significant substances, based on substance toxicity and emission rates, in an attempt to reduce the number of individual pollutants to be quantitatively assessed for impacts. The radionuclide screening was based on a screening factor (SF_{eff}) which is the product of the estimated radionuclide emission rate (Q, in curies per year) and an effective dose factor (DF_{eff}). The dose factors consider all important exposure pathways (inhalation, ingestion and external exposure) and were obtained from National Council on Radiation Protection Report No. 123 II, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground - Work Sheets" (NCRP 1996). Thus, for each radionuclide i:

$$SF_{eff,i} = Q_i \times DF_{eff,i}$$

The radionuclides which collectively accounted for a nominal 99 percent of the effective dose were retained for release modeling and dose assessment.

The inclusion of specific toxic air pollutants in emissions estimates is based on the guidance provided in EPA (1994). The process for selection and characterization of toxics is documented in Abbott et al. (1999).

Fugitive Dust Generation

DOE estimated the amount of fugitive dust generated from construction of facilities based on

Table C.2-4. Emission factors used for criteria and toxic air pollutants from fuel oil combustion.

Criteria pollutants and carbon dioxide	Emission factor (pounds/ 1,000 gallons)[a]	Emission factor (pounds/ 1,000 gallons)[b]	Organic compounds	Emission factor (pounds/ 1,000 gallons)[c]	Metals	Emission factor (pounds/ 1,000 gallons)[d]
	Steam generation	Diesel engines	Steam generation and diesel engines		Steam generation and diesel engines	
Sulfur dioxide	***43***	73	Benzene	2.4×10^{-4}	Antimony	5.3×10^{-3}
Particulate matter	2.0	27	Ethylbenzene	6.4×10^{-5}	Arsenic	1.3×10^{-3}
Carbon monoxide	5.0	470	Formaldehyde	0.030	Barium	2.5×10^{-3}
Nitrogen dioxide	20	400	Naphthalene	1.1×10^{-3}	Beryllium	2.8×10^{-5}
Total organic compounds	0.25	85	1,1,1-Trichloroethane (methyl chloroform)	2.4×10^{-4}	Cadmium	4.0×10^{-4}
Carbon dioxide	2.2×10^{4}	2.3×10^{4}				
			Toluene	6.2×10^{-3}	Chloride	0.35
			o-Xylene	1.1×10^{-4}	Chromium (total)	8.5×10^{-4}
			Acenaphthene	2.1×10^{-5}	Chromium (hexavalent)	2.5×10^{-4}
			Acenaphthylene	2.5×10^{-7}	Cobalt	6.0×10^{-3}
			Anthracene	1.2×10^{-6}	Copper	1.8×10^{-3}
			Benz(a)anthracene	4.0×10^{-6}	Fluoride	0.037
			Benzo(b,k)fluoranthene	1.5×10^{-6}	Lead	1.5×10^{-3}
			Benzo(g,h,i)perylene	2.3×10^{-6}	Manganese	3.0×10^{-3}
			Chrysene	2.4×10^{-6}	Mercury	1.1×10^{-4}
			Dibenzo(a,h)anthracene	1.7×10^{-6}	Molybdenum	7.9×10^{-4}
			Fluoranthene	4.8×10^{-6}	Nickel	0.085
			Fluorene	4.5×10^{-6}	Phosphorus	9.5×10^{-3}
			Indeno(1,2,3-cd)pyrene	2.1×10^{-6}	Selenium	6.8×10^{-4}
			Phenanthrene	1.1×10^{-5}	Vanadium	0.0318
			Pyrene	4.3×10^{-6}	Zinc	0.0291
			Chlorinated dibenzo-p-dioxins	3.1×10^{-9}		

a. Source: Tables 1.3-1, 1.3-3, and 1.3-12 of EPA (1998) ***using 0.3 percent sulfur content of fuel***.
b. Source: Project Data Sheets (Appendix C.6).
c. Source: Table 1.3-8 of EPA (1998).
d. Source: Table 1.3-10 of EPA (1998).

the area of land that would be disturbed. The total amount of fugitive dust is estimated using the EPA-recommended factor of 1.2 tons per acre disturbed for each month of construction (EPA 1998). This same factor was used to estimate dust generation from disposition of facilities. In most cases, it was conservatively assumed that construction and dispositioning would persist for 12 months per year; however, some activities related to Tank Farm and bin set disposition assume that dust-generating activities would occur for only 6 months per year.

C.2.3.2 Radiological Assessment Methodology

This section summarizes information on the data and methods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEEL facilities.

Model Selection and Application

The computer program GENII, Version 1.485 3-Dec-90 (Napier et al. 1988), was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to the total dose from airborne releases. These are:

- External radiation dose from radionuclides in air
- External dose from radionuclides deposited on ground surfaces
- Internal dose from inhalation of airborne radionuclides
- Internal dose from ingestion of contaminated food products.

GENII incorporates algorithms, data, and methods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International Commission on Radiological Protection, as contained in Publications 26 and 30 (ICRP 1977, 1979). It should be noted that newer weighting factors for determination of effective dose are available in International Commission on Radiation Protection Publication 60 (ICRP 1991); however, International Commission on Radiation Protection 26/30 weighting factors are used here since these still form the basis for Federal regulations and DOE Orders (e.g., 10 CFR 20, 10 CFR 834, etc.). The newer weighting factors of International Commission on Radiation Protection 60 have not yet been adopted for use in the U.S., since their use would require a number of adjustments to existing regulations. Also, as pointed out in the Preface to Federal Guidance Report 12 (EPA 1993), for most radionuclides these dose coefficients are not very sensitive to the choice of weighting factors.

The GENII model has several technical advantages over other available methods, including the ability to assess dose from many different release scenarios and exposure pathways. In addition, it conforms to the strict quality assurance requirements of Quality Assurance Program Requirements for Nuclear Facilities [ASME (1989), Basic Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control)], which includes requirements for verification and validation of computer codes.

Release Modeling

Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this EIS, the decision whether to model a given emission point as a stack or ground-level release was based on guidance issued by the EPA (EPA 1995a). This guidance is used by the INEEL in the dose assessments performed annually to assess compliance with the National Emission Standards for Hazardous Air Pollutants dose limit. In general, if the height of the release point is less than or equal to 2.5 times the height of attached or nearby buildings, turbulent (wake and downwash) effects are assumed to influence the release, effectively lowering the release height to ground level. In some cases, stacks at existing facilities were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, in the baseline modeling, elevated sources at the Power Burst Facility (the Waste Experimental Reduction Facility North and South Stacks and the Power Burst Facility

Stack) were modeled as individual elevated releases. Conversely, effluents from various vents at the Naval Reactors Facility were summed and treated as a single ground-level release.

The stack design for many of the proposed waste processing facilities are preliminary; however, it can be assumed that these stacks would conform to "good engineering practice" and would be tall enough to provide good dispersion. The stack parameters used for waste processing facility modeling are presented in Table C.2-5.

Meteorological Data

The atmospheric transport modeling performed as part of these radiological assessments was based on actual meteorological conditions measured at eight different locations at the INEEL. In particular, the data files prepared for these assessments were derived from observations at INEEL weather stations over the period 1987 through 1991. Radionuclide emissions from those current or proposed facilities at INTEC having tall stacks were modeled using meteorological data from the 200-foot (61-meter) level of the Grid III monitoring station, which is located about 1.5 kilometers north of INTEC. These data are presented in a format specifically prepared for the radiological impact assessment modeling as a joint frequency distribution of wind speed, direction, and atmospheric stability class in Table C.2-6. The data set shows the percent of time that the wind is blowing toward specific compass directions (S, SSW, SW, etc.), grouped first by atmospheric stability category and then by wind speed group. Meteorological data sets used in the baseline dose assessments for existing facilities are documented in DOE (1996a, 1997a). Meteorological data sets used in the dose assessments for future facilities not associated with waste processing alternatives are documented in Leonard (1992).

Receptor Locations

Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, as described below.

Maximally Exposed Individual. The offsite individual whose assumed location and habits are likely to result in the highest dose is referred to as the maximally exposed individual. The location of the maximally exposed individual was identified on the basis of the source-receptor distance and direction combination that yielded the highest predicted offsite dose. In the SNF & INEL EIS, radiation dose was calculated for the minimum distance from each of the major INEEL source areas to the site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the major INEEL facility areas, the maximally exposed individual receptor locations are merely points on the INEEL boundary and do not correspond to any actual residences or quarters. The maximum impacts at these points were conservatively summed to derive cumulative impacts, without consideration of the fact that the maximum impact points may be spatially separated. The actual maximally exposed individual locations for five of the eight major INEEL facility areas (INTEC, Central Facilities Area, Radioactive Waste Management Complex, Power Burst Facility/Waste Experimental Reduction Facility, and Test Reactor Area) are all located along a segment of the southern boundary; the maximally exposed individual locations for Naval Reactors Facility, Argonne National Laboratory-West, and Test Area North are all distantly located. Although unrealistic, this summation process served to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low; further resolution of the actual maximally exposed individual location and dose was not necessary.

In this EIS, the dose to the maximally exposed individual from existing facilities (i.e., the baseline case) is taken from the annual National Emission Standards for Hazardous Air Pollutants compliance evaluations (DOE 1996a, 1997a). The highest of the ***values for 1995 and 1996 -*** two ***recent*** years ***when*** no calcining was performed - is used. The dose from reasonably foreseeable projects is assumed to be represented by the dose calculated for the SNF & INEL

Table C.2-5. Stack parameters for facilities associated with waste processing alternatives.

Project/Process	Stack identifier	***Base*** elevation (meters)	Stack height (feet)	Stack diameter (feet)	Exhaust temperature (°Celcius)	Volumetric flow rate (actual cubic feet per minute)	Exit velocity (feet per minute)
Proposed facilities							
Full Separations Stack	P9A	1,498	130	9.5	38	166,180	2,344
Vitrification Facility Stack	P9B	1,498	108	10	38	191,467	2,438
LAWT Facility Stack	P9C	1,498	152	5.0	38	49,639	2,528
Transuranic Separations Stack	P49A	1,498	130	9.5	38	166,180	2,344
Transuranic/Class C LAWT Stack	P49C	1,498	152	5.0	38	49,639	2,528
HIP Facility Stack	P71	1,498	108	10	38	172,000	2,190
Direct Cement Facility Stack	P80	1,498	243	10	38	262,000	3,336
Early Vitrification Facility Stack	P88	1,498	108	10	38	205,407	2,615
Steam Reforming Facility Stack	***P2002A***	***1,498***	***80***	***0.67***	***500***	***1,000***	***2,836***
Direct Vitrification Facility Stack	***P88***	***1,498***	***108***	***10***	***38***	***205,407***	***2,615***
Cs Ion Exchange Stack	P111	1,498	152	5.0	38	49,639	2,528
Alternate SBW Treatment Stack	P115	1,498	130	9.5	38	126,000	***1,778***
Other INTEC facilities							
INTEC main stack[a]	708-001	1,498	250	6.5	33	100,000	3,014
Newly installed boiler[b]	***CPP-606***	***1,499***	***50***	***2.0***	***189***	***14,150***	***4,504***

Ground-level Area Sources

	Elevation (meters)	***Release Height***	***Area size***
Diesel equipment area	***1,498***	***1 meter above ground level***	***100 meters by 100 meters***

a. The INTEC main stack would be the release point for emissions from the Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility ***(as well as from other existing INTEC facilities including the*** Tank Farm and some of the calcine bin sets).

b. Used as a surrogate for future diesel-fuel burning equipment that could replace or supplement existing steam facilities to meet HLW processing steam demand. Stack parameters are patterned after stacks from existing fuel-burning equipment at this location.

Cs = cesium; HIP = Hot Isostatic Press; LAWT = low-activity waste treatment; ***SBW = sodium-bearing waste;*** TRU = transuranic.

Table C.2-6. Joint frequency distribution data set from the 61-meter level of the INEEL Grid III monitoring station for use in radiological impact assessment modeling.

INEL Grid III 61 M Level - 1987-1991

7 6 1 1 61.0[a]

1.04 2.46 4.47 6.93 9.61 13.19 19.00[b]

0.21	0.34	0.31	0.23	0.22	0.20	0.26	0.23	0.19	0.17	0.12	0.12	0.10	0.12	0.09	0.17
0.04	0.06	0.03	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.01
0.04	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
0.17	0.29	0.17	0.09	0.03	0.06	0.05	0.08	0.08	0.08	0.05	0.05	0.06	0.06	0.05	0.10
0.16	0.19	0.17	0.09	0.07	0.08	0.04	0.06	0.06	0.07	0.07	0.05	0.05	0.05	0.07	0.07
0.44	0.51	0.49	0.33	0.25	0.22	0.18	0.20	0.15	0.17	0.17	0.17	0.18	0.17	0.20	0.30
0.25	0.45	0.58	0.49	0.40	0.34	0.31	0.49	0.63	0.66	0.57	0.32	0.24	0.14	0.18	0.18
0.06	0.18	0.21	0.11	0.03	0.02	0.02	0.05	0.08	0.12	0.08	0.05	0.03	0.01	0.01	0.02
0.15	0.35	0.40	0.09	0.02	0.01	0.02	0.05	0.11	0.10	0.12	0.03	0.04	0.02	0.01	0.03
0.55	1.78	1.05	0.20	0.07	0.04	0.08	0.10	0.17	0.30	0.32	0.20	0.10	0.07	0.08	0.12
0.32	0.75	0.52	0.15	0.07	0.04	0.06	0.09	0.09	0.17	0.15	0.18	0.07	0.06	0.07	0.09
0.77	1.65	1.38	0.67	0.34	0.24	0.21	0.27	0.31	0.51	0.47	0.48	0.35	0.32	0.34	0.38
0.02	0.05	0.05	0.03	0.02	0.01	0.02	0.04	0.08	0.10	0.09	0.08	0.02	0.02	0.02	0.01
0.07	0.12	0.16	0.09	0.04	0.03	0.04	0.12	0.20	0.39	0.40	0.20	0.10	0.05	0.08	0.06
0.07	0.19	0.33	0.13	0.02	0.02	0.02	0.08	0.14	0.33	0.58	0.21	0.07	0.05	0.03	0.06
0.45	2.59	2.36	0.33	0.07	0.05	0.08	0.22	0.36	0.91	1.18	0.70	0.22	0.12	0.12	0.21
0.34	1.26	0.93	0.17	0.04	0.03	0.06	0.11	0.21	0.34	0.49	0.38	0.15	0.08	0.12	0.17
0.35	1.20	1.25	0.37	0.12	0.06	0.04	0.15	0.17	0.33	0.43	0.34	0.18	0.08	0.12	0.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.07	0.08	0.03	0.02	0.01	0.02	0.07	0.10	0.23	0.46	0.27	0.10	0.04	0.05	0.04
0.67	1.47	1.60	0.35	0.06	0.03	0.08	0.26	0.40	1.28	2.95	1.78	0.44	0.16	0.08	0.40
0.15	0.80	0.80	0.16	0.03	0.01	0.06	0.13	0.13	0.33	0.88	0.69	0.11	0.02	0.01	0.08
0.05	0.20	0.25	0.07	0.01	0.01	0.00	0.02	0.02	0.01	0.10	0.11	0.01	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
0.64	0.61	0.74	0.16	0.02	0.01	0.04	0.16	0.29	1.10	3.53	1.98	0.38	0.12	0.07	0.26
0.03	0.12	0.17	0.07	0.00	0.00	0.01	0.03	0.03	0.06	0.37	0.28	0.04	0.01	0.00	0.00
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.25	0.18	0.05	0.00	0.00	0.02	0.08	0.16	0.55	2.88	2.13	0.18	0.11	0.01	0.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.47	0.48	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a. Starting from left, these values indicate the number of wind speed data groups in the file, number of atmospheric stability data groups in file, number of seasonal data groups in file, number of time-of-day data groups in file, and the height (in meters) at which the joint frequency data applies.

b. These values represent the average wind speed for each wind speed group, in meters per second.

Preferred Alternative (modified as described below) and the Advanced Mixed Waste Treatment Project.

The maximally exposed individual dose from emissions associated with waste processing or facilities disposition alternatives was modeled using GENII, and then added to the baseline dose and projected increases to determine the cumulative offsite maximally exposed individual dose.

Population Dose. Population dose is not assessed annually as part of the National Emission Standards for Hazardous Air Pollutants assessment, so the baseline dose for this EIS is based on assessments performed for the SNF & INEL EIS. In the SNF & INEL EIS, dose was assessed for the collective population residing in a circular area defined by a radius of 50 miles extending out from each major INEEL facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with SNF & INEL EIS alternatives and projects expected to become operational before June 1, 1995, growth projections for the counties surrounding the INEEL were applied. These growth estimates are approximately 10 percent per decade. The period covered by the SNF & INEL EIS analysis extends to the year 2010, and the population doses reported in Section 5.7, Air Resources, of Volume 2 of that EIS are the highest obtained for any year throughout this period.

For this EIS, the population dose assessment applies only to the population residing within ***50 miles*** of the INTEC, where waste processing and facilities disposition alternatives are proposed to be implemented. The distribution of this population by distance and direction from INTEC, based on 1990 census data, is presented in Table C.2-7. ***Recently, 2000 census data became available, and the total population within this 50-mile radius was reassessed. The population increased from 118,664 in 1990 to 139,018 in 2000 (Pruitt 2002), representing an average growth of about 1.6 percent per year. It was assumed that the change in each distance and direction segment would be proportional to the change in total population, thereby allowing scaling of the dose calculated using the input file shown in Table C.2-7. A correction factor of 2.0 (equivalent to an annual growth rate of about 1.6 percent) was applied to this population dose assessment to account for growth over the period 1990 to approximately 2035.***

Noninvolved INEEL Worker. INEEL workers may be exposed to radiation attributable to INEEL sources both as a direct result of job performance (such as work within a radiologically controlled area) and incidentally (such as from airborne releases from facilities within their work area, as well as more distant sources within the INEEL). Direct job-related occupational exposure is beyond the scope of this section and is discussed in Sections 5.2.10 and 5.3.8 (Health and Safety) of this EIS. ***An INEEL*** worker incidentally exposed to onsite concentrations of radionuclides is referred to here as a "noninvolved worker." Exposures to noninvolved workers were assessed in the SNF & INEL EIS (for existing sources and future projects) and in this EIS (for proposed waste processing and facilities disposition alternatives). ***For this EIS, DOE reassessed the dose to the highest noninvolved worker using the most recently available data (1998) on emissions from existing INEEL facilities (RBA 2000).***

The dose to the maximally exposed noninvolved worker was assessed using the general methodology described in previous sections. However, worker dose calculations did not include the food ingestion pathway (since workers do not consume food products grown onsite), and exposure times were reduced to reflect the amount of time a worker would spend onsite (assumed to be 2,000 hours per year). As in the case of the offsite maximally exposed individual, the maximally exposed worker dose actually applies to a location and not a real individual. It is conservatively assumed that any location within a major INEEL facility area could be occupied by a worker on a full-time basis (i.e., 2000 hours per year). Doses were assessed for locations within INTEC and at ***all*** other ***major INEEL*** areas. ***The highest dose due to the existing sources was found to occur at the*** Radioactive Waste Management Complex.

Baseline Dose and Cumulative Dose Determination

DOE assessed cumulative radiological impacts by summing the doses from existing (baseline)

Table C.2-7. Population distribution within 50 miles of INTEC.[a]

Distance (miles)										Sector	
0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	total	Direction
0	0	0	0	0	0	6	22	350	2,394	2,772	S
0	0	0	0	0	0	0	0	0	29	29	SSW
0	0	0	0	0	0	0	2	0	0	2	SW
0	0	0	0	0	0	3	6	6	97	112	WSW
0	0	0	0	0	0	157	45	10	22	234	W
0	0	0	0	0	0	1,049	914	45	4	2,012	WNW
0	0	0	0	0	0	3	167	317	648	1,135	NW
0	0	0	0	0	0	52	32	11	10	105	NNW
0	0	0	0	0	0	113	46	15	6	180	N
0	0	0	0	0	0	0	0	199	38	237	NNE
0	0	0	0	0	0	0	403	663	196	1,262	NE
0	0	0	0	0	0	0	43	495	2,079	2,617	ENE
0	0	0	0	0	0	0	1	674	66,430	67,105	E
0	0	0	0	0	0	0	26	514	11,473	12,013	ESE
0	0	0	0	0	0	10	413	15,169	4,786	20,378	SE
0	0	0	0	0	0	30	135	1,528	6,758	8,451	SSE
0	0	0	0	0	0	1,423	2,255	19,996	94,970	118,664	Population total

a. Based on 1990 Census; centered on Universal Transverse Mercator (UTM) Coordinates 343,924 meters East; 4,825,948 meters North. Values are number of people residing within sector of specified distance and direction ***(see text for adjustment based on 2000 census)***.

sources, foreseeable increases to the baseline, and projected doses associated with ***waste processing options.*** The bases used to estimate baseline doses and foreseeable increases are described below and summarized in Table C.2-8.

Maximally Exposed Individual. The baseline dose is determined from the 1996 National Emission Standards for Hazardous Air Pollutants evaluation as described above. It is assumed that the annual dose calculated for the SNF & INEL EIS Preferred Alternative and the Advanced Mixed Waste Treatment Project represents foreseeable increases to the baseline. However, the SNF & INEL EIS dose was modified to (a) eliminate the dose contributions that are from facilities that are no longer planned, are located at Test Area North, or are assessed under the waste processing impacts, and (b) add the dose contributions from the proposed Advanced Mixed Waste Treatment Project Preferred Alternative (Micoencapsulation Option). This results in a baseline dose of 0.031 millirem per year and a foreseeable increase of 0.13 millirem per year, resulting in a total baseline dose of 0.16 millirem per year.

Population Dose. The SNF & INEL EIS annual dose from existing sources and increases that were foreseeable at the time the analysis was performed was 0.32 person-rem, and the Preferred Alternative dose was 2.6 person-rem per year. The Idaho Waste Processing Facility (a conceptual facility which has since been replaced by the Advanced Mixed Waste Treatment Project) accounted for more than half of this dose. In addition to project-related modifications, the baseline population dose is also multiplied by ***1.5*** to account for estimated population growth between roughly 2010 and ***2035***. Upon modification, the maximum annual baseline population dose becomes ***1.1*** person-rem.

Noninvolved INEEL Worker. ***The maximum calculated dose for the maximally exposed noninvolved worker due to sitewide emissions in 1998 is 0.27 millirem and occurs at the Radioactive Waste Management Complex. This EIS conservatively assumes that the maximum baseline dose and the dose from projected increases both occur at the same location. Upon modification, the baseline noninvolved worker dose is 0.35 millirem per year (Table C.2-8). Additionally, the cumulative dose is assumed to be the sum of the maximum baseline dose and the maximum dose from waste processing alternative emissions, regardless of the respective locations.***

C.2.3.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by application of air dispersion computer models that incorporate mathematical functions to simulate transport of pollutants in the atmosphere. The modeling methodology conforms to that recommended by the EPA (EPA 1995a) and the State of Idaho (***IDEQ 2001***) for such applications. The models and application methodology are designed to be conservative; that is, they employ data and algorithms designed to prevent underestimating the pollutant concentrations that would actually exist. In general, the methods used to assess consequences of proposed actions were identical to those used in the baseline assessments. Minor exceptions (such as the use of refined versus screening-level modeling) are noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison between alternative courses of action, while also providing a measure of maximum potential impact and an indication of compliance with applicable standards or guidelines. The types of pollutants assessed ***in this EIS*** include the criteria pollutants and toxic air pollutants.

Criteria pollutant concentrations were estimated for locations and over periods of time corresponding to State of Idaho and National Ambient Air Quality Standards. Since these standards apply only to ambient air (that is, locations to which the general public has access), criteria pollutant concentrations were assessed for off-site locations and public roads traversing the INEEL. DOE did not quantitatively assess impacts related to ozone formation, although emissions of volatile organic compounds (which are precursors to ozone formation) were evaluated. ***At the time the EIS analyses were performed, EPA and the State of Idaho were not requiring the quantitative assessment of ozone formation potential, due primarily to the lack of any simple, well-defined model for this use. Further,*** ozone levels in the region are not generally recognized as problematic. This has been

Table C.2-8. Calculation of total baseline dose used in cumulative dose determinations.

Category	Value	Basis
Offsite maximally exposed individual dose in millirem per year		
Baseline	0.031	1996 National Emission Standards for Hazardous Air Pollutants dose assessment[a]
Increases	0.58	SNF & INEL EIS Preferred Alternative[b]
Modifications	-0.018	Waste Immobilization Facility
	-0.42	Idaho Waste Processing Facility
	-0.029	Waste Experimental Reduction Facility (incineration)
	-0.004	Facilities at Test Area North
	0.022	AMWTP Proposed Action (Microencapsulation Option)[c]
Total baseline plus increases	0.16	
Noninvolved worker dose in millirem per year		
Baseline	***0.27***	***Calculated from 1998 emissions data***[d]
Increases	0.14	SNF & INEL EIS Preferred Alternative
Modifications	0.058	AMWTP Proposed Action (Microencapsulation Option)
	-0.0001	Waste Immobilization Facility
	-0.11	Idaho Waste Processing Facility
	-0.007	Waste Experimental Reduction Facility (incineration)
Total baseline plus increases	***0.35***	
Population dose in person-rem per year		
Baseline	0.32	SNF & INEL EIS Table 5.7-4
Increases	2.6	SNF & INEL EIS Preferred Alternative
Modifications	-0.097	Waste Immobilization Facility
	-1.6	Idaho Waste Processing Facility
	-0.2	Waste Experimental Reduction Facility (compacting and sizing)
	-0.23	Waste Experimental Reduction Facility (incineration)
	-0.097	Waste Immobilization Facility
	0.009	AMWTP Proposed Action (Microencapsulation Option)
Total baseline plus increases	0.705	
	1.5	Factor for population growth between 2010 and ***2035***
Modified baseline dose	***1.1***	

a. ***Source: DOE (1997a).***

b. ***Source: DOE (1995).***

c. ***Source: DOE (1999). The Microencapsulation Option included incineration followed by microencapsulation. Currently, only nonthermal treatment is planned for this facility, and actual doses are likely to be less.***

d. ***Value of 0.27 used for Final EIS alternatives as calculated in RBA (2000).***

AMWTP = Advanced Mixed Waste Treatment Project.

confirmed by recent data collected by the National Park Service at Craters of the Moon National Monument where no exceedances of the primary ozone standard have been reported (DOI 1994).

Offsite levels of carcinogenic air pollutants were evaluated on the basis of annual average emission rates and compared to annual average standards (increments) specified by the State of Idaho (***IDEQ 2001***). For noncarcinogenic toxic air pollutants, DOE estimated maximum 24-hour levels at both offsite and public road locations and compared the results to applicable noncarcinogenic standards (***IDEQ 2001***). Air pollutant ***concentrations*** were also assessed for onsite locations because of potential worker exposure to ***chemical*** hazard***s***. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared to occupational exposure limits set for these substances by either the Occupational Safety and Health

Administration or the American Conference of Governmental Industrial Hygienists (the more restrictive of the two limits is used).

Model Description and Application

The EPA Industrial Source Complex-3 (ISCST-3, Version 96113) computer code (EPA 1995b) was the primary model used to evaluate impacts of waste processing alternatives reported in the Draft EIS. For the Final EIS, DOE used more recent releases of ISC together with the most recently available INEEL site meteorological data to assess cumulative impacts of waste processing alternatives. Specifically, DOE used Version 99155 and 00101 for this purpose. Although these models incorporate minor corrections and revisions to specific algorithms, for the types of analyses performed here these revisions do not result in noticeable changes from results obtained with the earlier version. The ISC-3 model incorporates site-specific data (such as meteorological observations from INEEL weather stations), and takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations were calculated over a range of durations, from 1-hour maximum values to annual averages. This allows for comparison of standards based on specific averaging times. In summary, dispersion modeling using ISC-3 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for the comparative evaluation process used in this EIS.

The analyses performed for the SNF & INEL EIS which served to establish the bounding baseline conditions for this EIS made use of some additional models as described in Appendix F-3 of the SNF & INEL EIS. These models included an earlier version of ISC (ISC-2), and SCREEN, a screening-level model which was used in some cases where a source's contribution to toxic air pollutant concentrations was expected to be minimal (that is, well below acceptable standards). The EPA-recommended Fugitive Dust Model (Winges 1991) was used to assess fugitive dust impacts. SCREEN and the Fugitive Dust Model are not used in this EIS, as it was not necessary to repeat these analyses.

To complement the ISC assessments, in response to recommendations made by the U.S. Park Service, DOE performed additional modeling of potential impacts at locations 50 kilometers or more from INTEC using the CALPUFF model (Scire et al. 1999).

CALPUFF is a non-steady state Gaussian puff dispersion model designed for long-range transport and air quality assessment. It is capable of modeling both near- and far-field effects, and can include model domains up to hundreds of kilometers. Land use and topography can be spatially varied across the model domain. The model incorporates features to evaluate chemical reactions involving common air pollutants, and also calculates deposition rates and visibility impairment. In the refined mode of operation, meteorological algorithms generate 3-dimensional wind fields that are both spatially and temporally variable across the model domain. The regional meteorological data sets necessary to take full advantage of all the model's features were not available to DOE at the time these analyses were performed. Therefore, DOE used CALPUFF in the screening mode of operation to estimate impacts at Class I areas; specifically, Craters of the Moon Wilderness Area, Yellowstone National Park, and Grand Teton National Park. The screening mode of operation is acceptable to the National Park Service for impact assessments at Class I areas. The screening methodology used for the CALPUFF simulations is outlined in the text box on the following page.

The model domain used in the CALPUFF simulations is illustrated in Figure C.2-1. Six receptor rings (two for each Class I area) were evaluated; each ring required a separate CALPUFF run. At Craters of the Moon Wilderness Area, the nearest receptor ring is 50 kilometers from INTEC, even though portions of the site are actually closer to INTEC. This was done because the modeling approach applied for this EIS uses ISC-3 for dispersion modeling to distances of 50 kilometers. The simulations used 360 receptors (one receptor for each degree azimuth). Receptor elevations in each ring were determined by calculating the

Major features of CALPUFF run in the screening mode.[a]

Model attributes	
Meteorology	Five years of extended (including precipitation and relative humidity) data from a single surface (meteorological data observation) station and upper air data for the same time period. These data are processed through PCRAMMET (meteorological data preprocessor)
Dispersion	Pasquill-Gifford ISC rural dispersion coefficients for rural environments (applicable to conditions at the INEEL and surrounding Class I areas)
Chemistry	MESOPUFF (dispersion model) II chemistry
Receptors	Polar receptor rings that circle the proposed source and encompass the Class I area.
Terrain elevations	Single elevation for all receptors within a given ring. The elevation used is the average elevation of the arc that extends through the Class I area.
Terrain adjustment	Partial plume path adjustment

Class I area data

Receptor Ring Identifier	Class I Area Represented	Radial Distance from INTEC (kilometers)	Average Elevation within Park Boundaries (meters)
Craters	Craters of the Moon Wilderness Area	50	1,636
Grand Teton	Grand Teton National Park (near)	161	2,422
Moran Junction	Grand Teton National Park (far)	197	2,379
Bechler	Yellowstone National Park (near)	160	2,096
Heart Lake	Yellowstone National Park (far)	226	2,490

a. Source: Rood (2000b).

average elevation in an arc that encompassed each Class I area using U.S. Geological Survey 1:24,000 digital elevation models. A roughness height of 0.1 meters (suitable for tall prairie grass) was used in all simulations.

CALPUFF calculates hourly average concentrations of primary pollutants at each receptor location for each hour in the simulation period. These data are stored for later access by the post-processing program, CALPOST. DOE used the CALPOST program to extract annual average concentrations of NO_2, SO_2, and PM-10, maximum 24-hour concentrations of SO_2 and PM-10, and 3-hour average concentrations of SO_2 at each receptor location in the model domain. It was conservatively assumed that all oxides of nitrogen were converted to NO_2. The maximum concentration determined for each receptor ring, regardless of direction, was selected for comparison with applicable PSD Class I increments.

CALPUFF analyses were performed only for the Planning Basis Option, which is the waste processing option with the highest criteria pollutant emission rates. Impacts for all other options are bounded by these results.

Emission Parameters

The use of air dispersion models requires emission parameters, such as stack height and diameter; exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. The SNF & INEL EIS analysis obtained emission parameter data from the INEEL air emissions inventories discussed above, as well as from project design documents.

As discussed in Section C.2.3.2, precise stack design information was not available for all facilities at the time the analysis was performed. However, DOE considers the data used (see Table C.2-5) to be representative of projected stack conditions, and modeling results based on these data to be valid for purposes of comparative analysis. For area sources such as ground-level emissions from diesel engine equipment, modeling was performed assuming a generic source with dimensions of 100 meters by 100 meters***, and a release height of 1 meter***.

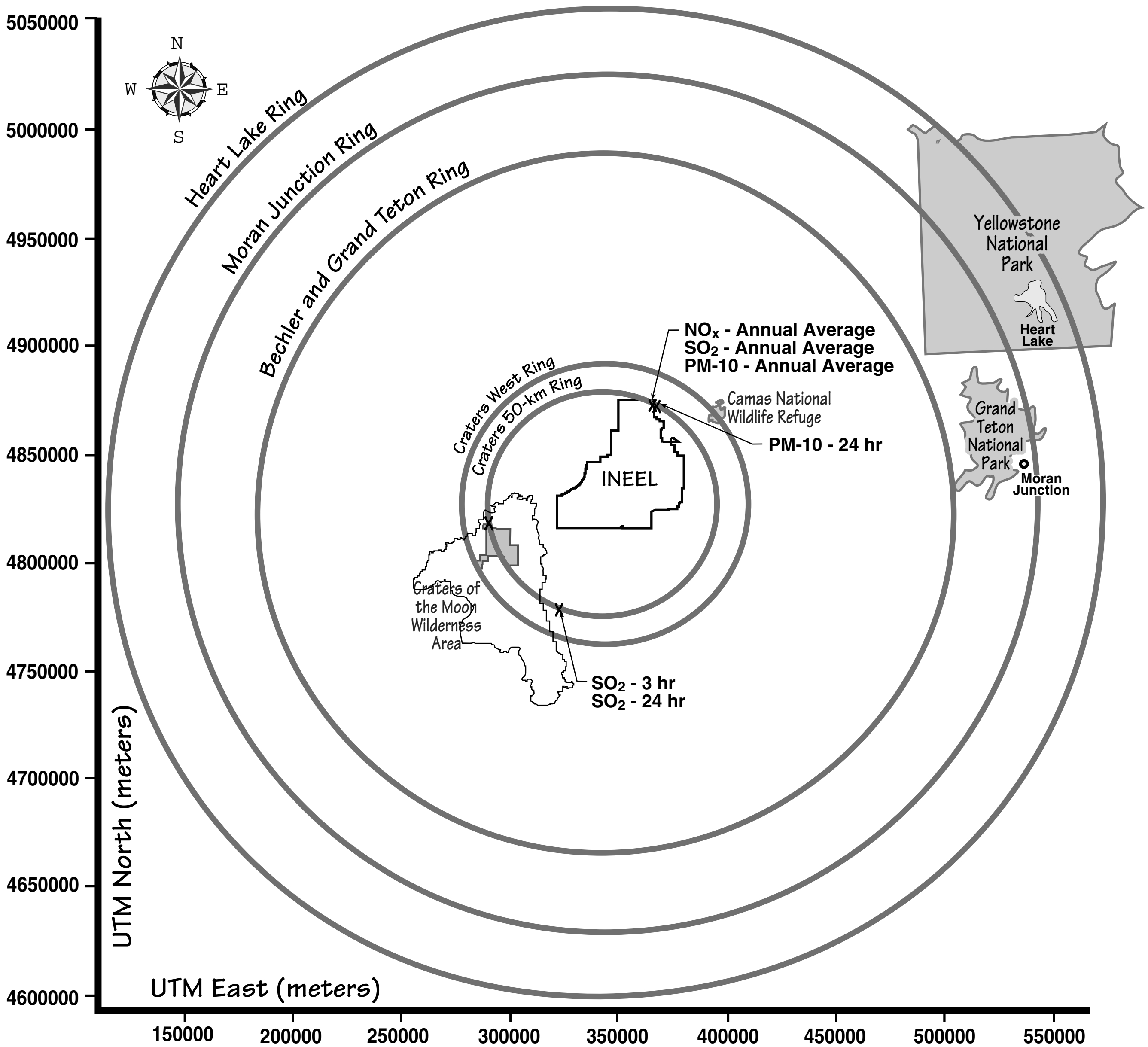

FIGURE C.2-1.
Model domain and polar receptor grid for the CALPUFF screening analysis of Class I Areas in the vicinity of INEEL where x denotes points of maximum impact.

Meteorological Data

DOE modeled emissions from the existing or proposed facilities at INTEC using meteorological data from the Grid III monitoring station. Elevated (tall stack) releases were modeled using observations from the 61-meter (200-foot) level, while ground-level releases were modeled using data from the 10-meter ***(33-foot)*** level of the Grid III monitoring station. These meteorological data sets contain hourly observations of wind speed, direction, temperature, and stability class for the years ***1996 through 1998***. ***DOE performed modeling using meteorological data from each of these years, and the highest of the predicted concentrations was selected.***

DOE used default mixing heights. For short-term assessments, a value of 150 meters, which represents the lowest value measured at the INEEL, was used (DOE 1991). For annual average evaluations, 800 meters was used. This value has been calculated by the National Oceanographic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Evaluations were conducted using meteorological data from each of these years, and the highest of the predicted concentrations was selected.

For the CALPUFF modeling, DOE, in consultation with the National Park Service, used meteorological data from the Pocatello Airport for the years 1986 to 1990. These data were coupled with upper air data taken at the Salt Lake City Airport during the same time period. Salt Lake City upper air meteorological data were obtained from EPA's SCRAM Web Page (www.epa.gov/scram001). Pocatello meteorological data were obtained from the SAMSON database (available from EPA) and provided by the National Park Service. Additional details of the meteorological data are contained in Rood (2000b).

Receptor Locations

The ISC-3 Model is capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. The receptor locations for the dispersion modeling were based on receptor arrays developed for the SNF & INEL EIS (described in Appendix F-3 of that document) and for other INEEL modeling applications. The main purpose of the array is to enable the identification of the point of maximum predicted impact and the quantification of pollutant levels at that location. The array developed for this EIS includes a portion of U.S. 20 as well as a grid that starts at the southwestern INEEL boundary and extends east for about 20 kilometers. The grid contains receptor points at 1,000-meter intervals and extends to a distance of 8 kilometers south of the boundary. The array also includes discrete receptor points at Big Southern Butte, Fort Hall Indian Reservation, and along the eastern and northern boundaries of Craters of the Moon Wilderness Area. The elevation of each receptor location has been included to better account for the effects of elevated terrain.

DOE calculated ambient air concentrations for each location specified in the receptor array; however, the regulatory compliance evaluations for carcinogenic toxic air pollutants were performed only for site boundary locations (and not transportation corridors), as provided by IDAPA ***58***.01.01.210.03.b (***IDEQ 2001***). Criteria and noncarcinogenic toxic air pollutants were assessed at all ambient air locations. DOE also assessed PSD increment consumption for Class II ambient air locations in and around INEEL and Craters of the Moon Wilderness Area, the Class I area nearest the INEEL. Class I area increments were assessed at discrete receptor locations along the eastern and northern boundaries of Craters of the Moon Wilderness Area at intervals of 500 meters.

DOE also assessed onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. Preliminary modeling was performed and the results were used with those of previous assessments (including those performed for SNF & INEL EIS) to identify the onsite areas of highest impact. The area of highest onsite nonradiological impact was found to be within INTEC. This differs from the radiological assessment, which determined that a worker at Central Facilities Area would receive the highest dose. Factors which contribute to this disparity include (a) differences in dispersion models; (b) 8-hour (nonradiological) vs. annual average (radiological) averaging time; and (c) differences in stack parameters for fossil fuel combustion facilities (nonradiological) and waste processing facilities (radiological). The INTEC dose assessment used a grid centered on the main stack and extending to the INTEC area boundary. This grid used closely-spaced (50 meters) receptor points to identify the onsite location of highest impact.

Summation of Project Impacts *and Cumulative Impact Determinations*

The ISC-3 or CALPUFF modeling results for individual sources were summed to determine total impacts for each option. For evaluations performed to assess compliance with Ambient Air Quality Standards, DOE determined cumulative impacts by adding the modeled concentrations from baseline sources and other foreseeable sources to those of the option under evaluation. Foreseeable sources are those that were included in the SNF & INEL EIS Preferred Alternative (DOE 1995) and were still considered viable at the time of analysis. Specifically, these include:

- ***Advanced Mixed Waste Treatment Project (nonthermal treatment option)***
- ***Pit 9 Retrieval Project***
- ***Waste Handling Facility at Argonne National Laboratory-West***
- ***Fuel Cycle Facility at Argonne National Laboratory-West***
- ***Radiological and Environmental Services Laboratory Replacement***
- ***Transuranic Storage Area Enclosure and Storage Project***
- ***Plasma Hearth Process***

The baseline concentrations are presented in Section 4.7 of this EIS.

DOE extended this process for summation of results for PSD increment consumption analyses. In this case, it is assumed that each source group associated with a waste processing option will be subject to regulation under PSD. Cumulative PSD increment consumption was determined by preparing a modeling source term that included (a) sources associated with the SNF & INEL EIS Preferred Alternative and (b) existing sources subject to PSD regulation, including the newly installed boilers at the INTEC CPP-606 steam production facility.

Impacts on Visibility

Atmospheric visibility has been specifically designated as an air quality-related value under the 1977 PSD Amendments to the Clean Air Act. Therefore, in the assessment of proposed projects that invoke PSD review (see Section C.2.2.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. Craters of the Moon Wilderness Area, located approximately *27* miles ***west***-southwest of the INTEC area (and about 12 miles from the nearest INEEL boundary), is the only Class I area in the Eastern Snake River Plain. However, recognizing the importance of the scenic views in and around the Fort Hall Indian Reservation, DOE performed additional analyses for this location.

The EPA has designed methodologies and developed computer codes to estimate potential visual impacts due to proposed emissions sources. The methodologies include three levels of sophistication. Level 1 is designed to be very conservative; it uses assumptions and simplifying methodologies that will predict plume visual impacts larger than those calculated with more realistic input and modeling assumptions. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (Class F) conditions coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind direction that would transport the plume directly adjacent to a hypothetical observer in the Class I or scenic area. The Level 1 analysis is implemented using the computer code VISCREEN to calculate the potential visual impact of a plume of specified emissions for the specified transport and dispersion conditions. If screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions a plume is either imperceptible or, if perceptible, is not likely to be considered objectionable, further analysis of plume visual impact would not be required (EPA 1992). Level 2 visual impact modeling employs more site-specific information than that of Level

1. It is still conservative and designed to overestimate potential visibility deterioration. Level 3 visual impact modeling is even more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. In both the SNF & INEL EIS and this EIS, DOE used Level 1 VISCREEN analyses to ensure conservatism.

Because within a range of wavelengths, a measure of contrast must recognize both intensity and perceived color, the VISCREEN model determines whether a plume would be visible by calculating contrast (brightness) and color contrast. Contrast is calculated at three visual wavelengths to characterize blue, green, and red regions of the visual spectrum to determine if a plume will be brighter, darker, or discolored compared to its viewing background. If plume contrast is positive, the plume is brighter than its viewing background; if negative, the plume is darker. To address the dimension of color as well as brightness, the color contrast parameter, termed "delta E," is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. Delta E provides a single measure of the difference between two arbitrary colors as perceived by humans. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background.

In order to determine whether a plume has the potential to be perceptible to observers under worst-case conditions, the VISCREEN model calculates both delta E and contrast for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Results are provided for two assumed worst-case sun angles (to simulate forward and backward scattering of light), with the sun in front and behind the observer, respectively. If either of two screening criteria is exceeded, more comprehensive and realistic analyses should be carried out. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

The EPA recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration. A value of 0.051 parts per million was assigned as a representative regional value for ozone (DOI 1994; Notar 1998a). DOE used a site-specific annual average background visual range, estimated to be 144 miles based on monitoring programs conducted by the National Park Service at Craters of the Moon Wilderness Area (Notar 1998b).

Visibility impacts were also evaluated with CALPUFF by computing the change (or delta, symbolized by D) in the light extinction coefficient (b_{ext}) relative to background conditions, which can be expressed as:

$$\mathbf{D}b_{ext} = \frac{(b_{ext})_{source}}{(b_{ext})_{bkg}}$$

where $(b_{ext})_{source}$ is the light extinction from the source and $(b_{ext})_{bkg}$ is the light extinction from background sources. Light extinction is caused by the absorption and scattering of light rays and involves hygroscopic and non-hygroscopic components, as well as Rayleigh scattering. The National Park Service provided values for the hygroscopic and non-hygroscopic components for background concentrations of primary pollutants (that is, pollutants that are directly emitted from a source, as opposed to secondary pollutants which are formed in the atmosphere from chemical reactions involving primary pollutants). Annual average hygroscopic background concentrations were set to 1.48 micrograms per cubic meter for Yellowstone National Park, and 1.39 micrograms per cubic meter for Grand Teton National Park and Craters of the Moon National Monument. Non-hygroscopic concentrations were obtained from these values using guidance from the National Park Service (Rood 2000b). In this way, DOE calculated annual average background non-hygroscopic concentrations of 4.48 micrograms per cubic meter for Yellowstone National Park, and 4.9 micrograms per cubic meter for Grand Teton and Craters of the Moon. Background contributions from NO_3 were set to zero. The default

Rayleigh scattering in the CALPOST module of CALPUFF (10 Mm^{-1})[1] was also used in the calculation. These values were then entered for background airborne soil.

Method 2 in the CALPOST visibility model options was used to calculate visibility reduction. This method uses hourly relative humidity values (capped by a maximum of 98%) to calculate a relative humidity-adjusted extinction coefficient for sulfates and nitrates. This is coupled with measured and modeled particulate matter concentrations and Rayleigh scattering to calculate extinction from background and modeled sources. The change in light extinction relative to background is then calculated and reported in the output. Light extinction calculations were based on a 24-hour averaging period. The acceptable target range for Db_{ext} is ≤ 5%. As with the PSD increment consumption, CALPUFF visibility analysis was performed only for the Planning Basis Option.

Methodology for Mobile Source Impacts

The SNF & INEL EIS contained an extensive analysis of the ambient air quality impacts at off-site 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 SNF & 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 SNF & INEL EIS.

The impacts of mobile sources operating at INTEC in support of waste processing operations are qualitatively assessed in Section 5.2.6.7. These impacts are assumed to be bounded by the mobile source impacts assessed in the SNF & INEL EIS.

C.2.4 RADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for airborne radionuclide emissions associated with waste processing alternatives presented in Section 5.2.6.3.

C.2.4.1 Radionuclide Emission Rates

Radionuclide emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1, are presented in Table C.2-9.

C.2.4.2 Radiation Doses

DOE has estimated radiation doses that would result from specific projects associated with waste processing alternatives. Table C.2-10 presents estimated radiation dose from airborne radionuclide emissions, averaged over an operational year, for (a) the offsite maximally exposed individual; (b) the collective offsite population within 80 kilometers of INTEC; and (c) the maximally exposed noninvolved INEEL worker. The organ receiving the highest weighted dose, the most important exposure pathway, and the radionuclide which is the highest contributor to the effective dose are also identified. In each case, the highest predicted noninvolved worker location is the Central Facilities Area.

[1] The units of light extinction are inverse megameters (Mm^{-1})

Table C.2-9. Radionuclide emission rates (curies per year) for projects associated with waste processing alternatives.[a]

Project identifier[b]	P1A	P1B	P1C	P1D	P9A/ P23A	P9B/ P23B	P9C/ P23C	P26	P26	P26	P18	P18MC	P35D or E
Radionuclide	Calcine SBW with MACT	NGLW & Heel Waste Mgmt.	PEW Evap. And LET&D	No Action Alt.	Full Seps.	Vit. Plant	Class A Grout Plant	Tank Farm Closure	Bin sets Closure	Fill with Class A Grout	New Anal. Lab.	Remote Anal. Lab. Operation	Class A Grout Packaging
Americium-241	-	-	-	-	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-
Cobalt-60	1.1×10^{-6}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	-	-	2.8×10^{-8}	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-
Cesium-134	6.2×10^{-6}	8.2×10^{-8}	8.2×10^{-8}	8.2×10^{-8}	-	2.9×10^{-10}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-
Cesium-137[c]	2.4×10^{-3}	2.4×10^{-4}	2.4×10^{-4}	2.4×10^{-4}	2.9×10^{-5}	1.2×10^{-7}	-	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	5.1×10^{-8}	2.6×10^{-8}	4.5×10^{-9}
Europium-154	9.5×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	-	4.5×10^{-11}	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-
Europium-155	-	-	-	-	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-
Hydrogen-3 (tritium)	23	-	9.0	9.0	-	-	45[d]	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-
Iodine-129	***0.058***	***0.031***	***0.031***	***0.031***	7.5×10^{-7}	-	***1.5×10^{-3}***	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-
Nickel-63	-	-	-	-	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	-	-	-
Plutonium-238	5.0×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	-	2.4×10^{-10}	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	-	-	-
Plutonium-239	5.7×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	-	2.7×10^{-11}	-	9.8×10^{-11}	-	5.2×10^{-11}	1.3×10^{-11}	6.4×10^{-12}	1.1×10^{-12}
Plutonium-241	-	-	-	-	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-
Ruthenium-106	6.3×10^{-5}	2.4×10^{-6}	2.4×10^{-6}	2.4×10^{-6}	-	-	1.6×10^{-6}	4.7×10^{-10}	-	2.5×10^{-10}	-	-	-
Antimony-125	1.0×10^{-5}	1.5×10^{-6}	1.5×10^{-6}	1.5×10^{-6}	4.8×10^{-7}	-	2.7×10^{-7}	1.1×10^{-10}	-	5.7×10^{-11}	-	-	-
Samarium-151	-	-	-	-	-	-	-	-	2.0×10^{-7}	-	-	-	-
Strontium-90[e]	3.1×10^{-4}	2.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}	2.1×10^{-9}	1.5×10^{-8}	-	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	4.5×10^{-7}	2.2×10^{-7}	3.9×10^{-8}
Technetium-99	-	-	-	-	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	-	-

Table C.2-9. Radionuclide emission rates (curies per year) for projects associated with waste processing alternatives[a] (continued).

Project identifier[b]	P49A	P49C	P49D	P51	P51	P51	P59A	P71	P80	P88	P111	P117	P133	***P2001***	***P2002A***
Radionuclide	TRU/ Class C Seps.	Class C Grout Plant	Class C Grout Packaging	Tank Farm Closure	Bin sets Closure	Fill with Class ***C*** Grout	Calcine Retrieval/ Transport	HIP Waste Treat.	Direct Cement. Treat.	Early/ Direct Vit.	Treat SBW/ NGLW with CsIX	Calcine/ Resin Packaging	Waste Treatment Pilot Plant	***NGLW Grouting***	***Steam Reforming***
Americum-241	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-	-	2.0×10^{-5}	-	-	-	-
Cobalt-60	-	8.1×10^{-9}	-	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-	2.1×10^{-9}	9.8×10^{-6}	-	-	-	-
Cesium-134	-	4.5×10^{-8}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-	1.2×10^{-8}	2.1×10^{-8}	-	-	-	***7.0×10^{-8}***
Cesium-137[c]	2.9×10^{-5}	1.8×10^{-5}	4.5×10^{-9}	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	***2.2×10^{-3}***	0.09	7.8×10^{-8}	4.7×10^{-6}	2.0×10^{-6}	8.6×10^{-6}	2.9×10^{-9}	***6.2×10^{-9}***	***2.8×10^{-5}***
Europium-154	-	-	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-	1.8×10^{-9}	9.9×10^{-6}	-	-	-	***1.1×10^{-8}***
Europium-155	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-	-	-	-	-	-	-
Hydrogen-3 (tritium)	-	45	-	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-	45[d,f]	45	-	-	-	***45***
Iodine-129	7.5×10^{-7}	4.2×10^{-4}	-	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-	1.1×10^{-3}	1.3×10^{-7}	-	-	-	-
Nickel-63	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-	-	-	-	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	5.2×10^{-5}	-	-	-	-
Plutonium-238	-	-	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	3.2×10^{-5}	-	-	9.5×10^{-9}	5.2×10^{-5}	1.2×10^{-7}	-	-	***5.6×10^{-8}***
Plutonium-239	-	-	1.1×10^{-12}	9.8×10^{-11}	-	5.2×10^{-11}	-	-	2.0×10^{-11}	1.1×10^{-9}	3.1×10^{-6}	-	7.3×10^{-13}	***1.5×10^{-12}***	***6.4×10^{-9}***
Plutonium-241	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-	-	-	-	-	-	-
Ruthenium-106	-	4.6×10^{-7}	-	4.7×10^{-10}	-	2.5×10^{-10}	-	1.1×10^{-5}	-	1.2×10^{-7}	-	-	-	-	-
Antimony-125	4.8×10^{-7}	7.5×10^{-8}	-	1.1×10^{-10}	-	5.7×10^{-11}	-	8.2×10^{-8}	-	***2.0×10^{-8}***	3.8×10^{-6}	-	-	-	-
Samarium-151	-	-	-	-	2.0×10^{-7}	-	-	-	-	-	2.8×10^{-5}	-	-	-	-
Strontium-90[e]	2.1×10^{-9}	2.3×10^{-6}	3.9×10^{-8}	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	***5.8×10^{-3}***	-	6.8×10^{-7}	6.0×10^{-7}	1.6×10^{-3}	2.3×10^{-5}	2.5×10^{-8}	***5.4×10^{-8}***	***3.5×10^{-6}***
Technetium-99	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	1.7×10^{-4}	-	-	8.0×10^{-7}	-	-	-	

a. ***See Section C.6.1 for listing of project names. Source: Project Data Sheets in Appendix C.6 and backup documentation (e.g., duration of air emissions).***
b. ***All other projects contribute less than one percent to the dose.***
c. ***The short-lived decay product Barium-137m would also be present.***
d. ***H-3 emissions for this project occur under Full Separations Option. For Vitrification with Calcine Separations Option, H-3 emissions are assigned to Project P88.***
e. ***An equal amount of the decay product Yttrium-90 would also be present.***
f. ***After SBW processing, tritium emissions cease.***

CsIX = cesium ion exchange; HIP = hot isostatic pressed; LET&D = Liquid Effluent Treatment and Disposal Facility; MACT = maximum achievable control technology; NGLW = newly-generated liquid waste; PEW = process equipment waste; ***SBW = sodium-bearing waste***; TRU = transuranic.

Table C.2-10. Summary of radiation dose impacts associated with airborne radionuclide emissions from waste processing alternatives.

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Case[a] (units)	Applicable Standard	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vit. Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Dose to maximally exposed offsite individual (millirem per year)	10[b]	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	***6.2×10^{-4}***	9.5×10^{-4}	***6.5×10^{-4}***	***6.8×10^{-4}***
Controlling organ		Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	***Thyroid***	Thyroid	***Thyroid***	***Thyroid***
Controlling pathway		Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	***Ingestion***	Ingestion	***Ingestion***	***Ingestion***
Controlling radionuclide		I-129	I-129	I-129	I-129	H-3	I-129	I-129	I-129	***I-129***	I-129	***I-129***	***I-129***
Dose to maximally exposed noninvolved worker (millirem per year)[c]	5,000[d]	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	***2.2×10^{-5}***	1.0×10^{-4}	***2.3×10^{-5}***	***2.3×10^{-5}***
Controlling organ		Thyroid	Thyroid	Bone surface	Thyroid	Bone surface	Thyroid	Thyroid	Bone surface	***Bone surface***	Bone surface	***Bone surface***	***Bone surface***
Controlling pathway		Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	***Inhalation***	Inhalation	***Inhalation***	***Inhalation***
Controlling radionuclide		I-129	I-129	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	***Pu-238***	Pu-238	***Pu-238***	***Pu-238***
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e,f]	N.A.	***0.038***	***0.11***	***6.6×10^{-3}***	***0.11***	***3.6×10^{-3}***	***0.11***	***0.11***	***0.056***	***0.040***	***0.056***	***0.045***	***0.047***

a. Doses are maximum values over any single year during which waste processing occurs; annual doses from waste stored on an interim basis after waste processing is completed would be much less.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. Location of highest INEEL onsite dose is Central Facilities Area.
d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
e. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***
f. Controlling organ, pathway, and radionuclide are the same as for the maximally exposed offsite individual.

C.2.5 NONRADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for nonradiological air consequences of waste processing alternatives presented in Sections 5.2.6.4 through 5.2.6.6.

C.2.5.1 Air Pollutant Emission Rates

This section presents nonradiological air pollutant emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1. The following tabulations are presented:

- Table C.2-11 presents a listing of estimated emissions of total and individual criteria pollutants, total toxic air pollutants, and carbon dioxide from fossil fuel combustion. Emissions are listed for individual projects and are summed for each waste processing alternative. The primary source of these emissions is fuel combustion to generate steam. Burning fuel to operate diesel equipment also contributes to these emissions.

- Table C.2-12 presents a listing of emissions estimates for individual toxic air pollutants produced by fossil fuel combustion.

- Table C.2-13 presents estimates of toxic air pollutant, criteria pollutant, and carbon dioxide emissions resulting from chemical processes (other than fossil fuel combustion) that would be used to treat waste under the proposed alternatives.

C.2.5.2 Concentrations of Nonradiological Air Pollutants at Ambient Air Locations

The following tabulations present the results of assessments for criteria and toxic air pollutant concentrations in ambient air (general public access) locations:

- Table C.2-14 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including at or slightly beyond the INEEL boundary, along public roads traversing the INEEL, and at Craters of the Moon Wilderness Area. The table shows the incremental impacts of each alternative, along with the cumulative impacts when baseline levels are added.

- Table C.2-15 shows the baseline conditions used in cumulative effect determinations. These are the maximum impacts predicted for the indicated locations based on actual 1997 INEEL emissions ***(DOE 1998)*** plus other reasonably foreseeable increases. ***In some cases, 1997 emissions data were not available and 1996 data (DOE 1997b) were used. Forseeable*** increases include projects associated with the SNF & INEL EIS Preferred Alternative, ***which were*** modified to reflect current project plans ***(such as inclusion of the Advanced Mixed Waste Treatment Project). The emissions from the New Waste Calcining Facility (which is evaluated in some alternatives) and the Coal-Fired Steam Generating Facility are not included in the baseline for this EIS.***

- Table C.2-16 presents a summary of the highest predicted impacts of any single carcinogenic (and noncarcinogenic) toxic air pollutant at offsite and onsite locations. In each case, the maximum impact (in terms of percent of applicable standard) among carcinogens is for nickel, while vanadium is the highest noncarcinogen. As previously noted, toxic air pollutant increments promulgated by the State apply only to new or modified sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pol-

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion.[a]

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
				No Action Alternative						
P1D	No Action Alternative	***17***	290	5.2×10^3	***10***	0.48	1.2	4.8	0.061	0.73
P1E	Bin Set 1 Calcine Transfer	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	***1.4***	22	390	***0.79***	0.04	0.16	0.42	0.017	0.055
Totals		***22***	390	6.9×10^3	***14***	0.64	1.7	6.4	0.093	0.96
				Continued Current Operations Alternative						
P1A	Calcine SBW incl. NWCF (MACT) Upgrades	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P1E	Bin Set 1 Calcine Transfer	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	***1.4***	22	390	***0.79***	0.04	0.16	0.42	0.017	0.055
Totals		***46***	620	1.1×10^4	***22***	1.3	7.3	14	0.98	1.5
				Full Separations Option						
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P9A	Full (early) Separations	***130***	2.1×10^3	3.7×10^4	***74***	3.8	14	39	1.5	5.2
P9B	Vitrification Plant	***10***	140	2.5×10^3	***4.9***	0.29	1.7	3.2	0.23	0.34
P9C	Class A Grout Plant	***10***	130	2.4×10^3	***4.7***	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	-[c]	-	-	-	-	-	-	-	-
P18	New Analytical Lab - Full Separations	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P118	Separations Organic Incinerator Project	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility - Full Separations	***1.6***	27	480	***0.95***	0.046	0.13	0.46	0.01	0.067
and										
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
or										
P35E	Class A Grout Packaging and Loading for Offsite Disposal	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals		***170***	2.5×10^3	4.4×10^4	***89***	4.7	21	50	2.4	6.2

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

Alternative and project	Description	Category totals: Criteria (ton/year)	Category totals: Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Criteria pollutants: Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
				Planning Basis Option						
P1A	Calcine SBW including. NWCF Upgrades (MACT)	***27***	290	5.2×10^{3}	***11***	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^{3}	***8.1***	0.38	1.0	3.9	0.056	0.58
P59A	Calcine Retrieval and Transport – Planning Basis	***4.2***	73	1.3×10^{3}	***2.6***	0.12	0.30	1.2	0.015	0.18
P23A	Full Separations	***130***	2.1×10^{3}	3.7×10^{4}	***74***	3.8	14	39	1.5	5.2
P23B	Vitrifcation Plant	***10***	140	2.5×10^{3}	***4.9***	0.29	1.7	3.2	0.23	0.34
P23C	Class A Grout Plant	***10***	130	2.4×10^{3}	***4.7***	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P118	Process Organic Incinerator – Planning Basis	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	4.0×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Plant – Plan Basis	***14***	240	4.2×10^{3}	***8.3***	0.39	1.0	3.9	0.053	0.59
P35E	Class A Grout Packaging and Loading for Offsite Disposal (Planning Basis)	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals		***210***	3.2×10^{3}	5.7×10^{4}	***110***	6.0	26	64	3.0	8.1
				Transuranic Separations Option						
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^{3}	***2.6***	0.12	0.30	1.2	0.015	0.18
P49A	TRU-C Separations	***65***	980	1.8×10^{4}	***35***	1.8	8.1	20	0.93	2.5
P49C	Class C Grout Plant	***10***	130	2.4×10^{3}	***4.7***	0.28	1.7	3.1	0.23	0.33
P39A	Packaging and Loading TRU at INTEC for Shipment to WIPP	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab – Full or TRU Separations	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.030	0.067
P118	Separations Organic Incinerator Project	0.047	0.053	1.0	***3.3×10^{-3}***	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility – TRU Separations	***6.8***	120	2.1×10^{3}	***4.1***	0.20	0.51	2.0	0.029	0.29
and										
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	0.11	0.13	2.4	***7.8×10^{-3}***	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
Totals		***93***	1.3×10^{3}	2.4×10^{4}	***48***	2.6	13	28	1.6	3.3

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

Alternative and project	Description	Category totals: Criteria (ton/year)	Category totals: Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Criteria pollutants: Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
				Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW incl. NWCF Upgrades (MACT)	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P71	Mixing and HIPing	***26***	440	7.9×10^3	***16***	0.74	1.9	7.4	0.10	1.11
P72	HIPed HLW Interim Storage	-	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – HIP	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals		***72***	1.1×10^3	1.9×10^4	***38***	2.0	9.3	22	1.1	2.7
				Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades (MACT)	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P71	Mixing and HIPing	***16***	270	4.9×10^3	***9.6***	0.45	1.2	4.6	0.066	0.68
P81	Unseparated Cementitious HLW Interim Storage	-	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Direct Cement	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.020	4.1×10^{-3}	1.5×10^{-4}
Totals		***62***	900	1.6×10^4	***32***	1.7	8.6	19	1.1	2.2
				Early Vitrification Option						
P1C	PEW Evaporator and LET&D Operations	***3.4***	58	1.0×10^3	***2.0***	0.1	0.29	1.0	0.020	0.14
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.030	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P61	Vitrified HLW Interim Storage	-	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

Alternative and project	Description	Category totals: Criteria (ton/year)	Category totals: Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Criteria pollutants: Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
	Early Vitrification Option (continued)									
P88	Early Vitrification with MACT	***19***	330	5.9×10^{3}	***12***	0.54	1.4	5.4	0.069	0.82
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Early Vitrification	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals		***29***	490	8.7×10^{3}	***17***	0.82	2.2	8.2	0.14	1.2
	Steam Reforming Option									
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***4.8***	***58***	1.0×10^{3}	***2.0***	***0.10***	***0.29***	***1.0***	***0.020***	***0.14***
P18	***New Analytical Laboratory***	***1.9***	***22***	***390***	***0.79***	***0.040***	***0.16***	***0.42***	***0.017***	***0.055***
P59A	***Calcine Retrieval and Transport***	***5.9***	***73***	1.3×10^{3}	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P117A SR	***Calcine Packaging and Loading to Hanford***	***3.1***	***37***	***670***	***1.3***	***0.062***	***0.16***	***0.63***	***0.010***	***0.093***
P2001	***NGLW Grout Facility***	***2.7***	***33***	***580***	***1.2***	***0.054***	***0.14***	***0.54***	***0.007***	***0.082***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***0.11***	***0.13***	***2.4***	7.8×10^{-3}	2.8×10^{-3}	***0.049***	***0.042***	8.8×10^{-3}	3.1×10^{-4}
P2002A	***Steam Reforming***	***4.1***	***22***	***390***	***0.84***	***0.10***	***1.2***	***1.3***	***0.21***	***0.054***
Totals		***23***	***240***	4.4×10^{3}	***8.7***	***0.47***	***2.3***	***5.1***	***0.29***	***0.61***

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
				Minimum INEEL Processing Alternative						
P1C	PEW Evaporator and LET&D Operations	***3.4***	58	1.0×10^3	***2.0***	0.10	0.29	1.0	0.020	0.14
P18	New Analytical Lab	***1.8***	27	480	***1.0***	0.051	0.24	0.55	0.03	0.067
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
P111	SBW Treatment with CsIX	***1.5***	24	430	***0.86***	0.043	0.14	0.44	0.013	0.061
P112A	Packaging and Loading CH-TRU for Transport to WIPP	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Minimum INEEL Processing	***4.1***	71	1.3×10^3	***2.5***	0.12	0.32	1.2	0.019	0.18
and										
P59A	Calcine Retrieval and Transport – Minimum INEEL Processing	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P117A	Packaging & Loading Calcine for Transport to Hanford	***2.2***	37	670	***1.3***	0.062	0.16	0.63	0.010	0.093
or										
P59B	Calcine Retrieval and Transport - JIT	-	-	-	-	-	-	-	-	-
P117B	Packaging & Loading Calcine for JIT Transport to Hanford	***2.5***	38	670	***1.3***	0.071	0.31	0.75	0.036	0.094
Totals		***22***	300	5.3×10^3	***11***	0.61	3.5	6.8	0.48	0.74
				Vitrification without Calcine Separations Option						
P1C	***PEW Evaporator and LET&D Operations***	***3.4***	***58***	***1.0×10^3***	***2.0***	***0.10***	***0.29***	***0.99***	***0.020***	***0.14***
P18	***New Analytical Lab***	***1.8***	***27***	***480***	***0.95***	***0.051***	***0.24***	***0.55***	***0.030***	***0.067***
P59A EV	***Calcine Retrieval and Transport (EV)***	***4.2***	***73***	***1.3×10^3***	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P88	***Vitrification with MACT***	***19***	***330***	***5.9×10^3***	***12***	***0.54***	***1.4***	***5.4***	***0.069***	***0.82***
P133 EV	***Waste Treatment Pilot Plant (EV)***	***0.052***	***0.059***	***1.1***	***$3.7\times10^{-}$***	***1.3×10^{-3}***	***0.023***	***0.020***	***4.1×10^{-3}***	***1.5×10^{-4}***
Totals		***29***	***490***	***8.7×10^3***	***18***	***0.82***	***2.2***	***8.2***	***0.14***	***1.2***

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
	Vitrification with Calcine Separations Option									
P1C	***PEW Evaporator and LET&D Operations***	***3.4***	***58***	***1.0×10^{3}***	***2.0***	***0.10***	***0.29***	***0.99***	***0.020***	***0.14***
P9A	***Full Separations***	***130***	***2.1×10^{3}***	***3.7×10^{4}***	***74***	***3.8***	***14***	***39***	***1.5***	***5.2***
P9C	***Grout Plant***	***10***	***130***	***2.4×10^{3}***	***4.7***	***0.28***	***1.7***	***3.1***	***0.23***	***0.33***
P18	***New Analytical Lab***	***1.8***	***27***	***480***	***1.0***	***0.051***	***0.24***	***0.55***	***0.030***	***0.067***
P35E	***Grout Packaging & Loading for Offsite Disposal***	***0.11***	***0.13***	***2.4***	***7.8×10^{-3}***	***2.8×10^{-3}***	***0.049***	***0.042***	***8.8×10^{-3}***	***3.1×10^{-4}***
P59A Sep	***Calcine Retrieval and Transport (Sep)***	***4.2***	***73***	***1.3×10^{3}***	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P88	***Vitrification with MACT***	***19***	***330***	***5.9×10^{3}***	***12***	***0.54***	***1.4***	***5.4***	***0.069***	***0.82***
P133 Sep	***Waste Treatment Pilot Plant (Seps)***	***14***	***240***	***4.2×10^{3}***	***8.3***	***0.39***	***1.0***	***3.9***	***0.053***	***0.59***
Totals		***190***	***3.0×10^{3}***	***5.3×10^{4}***	***100***	***5.2***	***19***	***55***	***1.9***	***7.4***

a. Emissions are from project data summaries and backup documentation.
b. Carbon dioxide has been associated with potential global warming.
c. Project is not expected to result in any usage of diesel fuel.

Table C.2-12. Projected emission rates (pounds per hour) of toxic air pollutants from combustion of fossil fuels to support waste processing operations.[a]

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carcinogens													
Arsenic	1.5×10^{-6}	9.6×10^{-5}	1.5×10^{-4}	6.2×10^{-4}	8.1×10^{-4}	3.3×10^{-4}	2.7×10^{-4}	2.2×10^{-4}	1.2×10^{-4}	***6.1×10^{-5}***	7.4×10^{-5}	***1.2×10^{-4}***	***7.4×10^{-4}***
Benzene	8.0×10^{-4}	1.6×10^{-5}	2.5×10^{-5}	1.0×10^{-4}	1.3×10^{-4}	5.4×10^{-5}	4.3×10^{-5}	3.6×10^{-5}	2.0×10^{-5}	***9.9×10^{-6}***	1.2×10^{-5}	***2.0×10^{-5}***	***1.1×10^{-4}***
Beryllium	2.8×10^{-5}	2.0×10^{-6}	3.2×10^{-6}	1.3×10^{-5}	1.7×10^{-5}	7.0×10^{-6}	5.6×10^{-6}	4.7×10^{-6}	2.6×10^{-6}	***1.3×10^{-6}***	1.6×10^{-6}	***2.6×10^{-6}***	***1.5×10^{-5}***
Cadmium	3.7×10^{-6}	2.9×10^{-5}	4.6×10^{-5}	1.9×10^{-4}	2.4×10^{-4}	1.0×10^{-4}	8.0×10^{-5}	6.7×10^{-5}	3.7×10^{-5}	***1.8×10^{-5}***	2.2×10^{-5}	***3.7×10^{-5}***	***2.2×10^{-4}***
Chromium (hexavalent)	5.6×10^{-7}	1.8×10^{-5}	2.9×10^{-5}	1.2×10^{-4}	1.5×10^{-4}	6.3×10^{-5}	5.0×10^{-5}	4.2×10^{-5}	2.3×10^{-5}	***1.1×10^{-5}***	1.4×10^{-5}	***2.3×10^{-5}***	***1.3×10^{-4}***
Formaldehyde	5.1×10^{-4}	2.4×10^{-3}	3.9×10^{-3}	0.016	0.02	8.3×10^{-3}	6.6×10^{-3}	5.6×10^{-3}	3.0×10^{-3}	***1.5×10^{-3}***	1.8×10^{-3}	***3.0×10^{-3}***	***0.018***
Nickel	2.7×10^{-5}	6.2×10^{-3}	9.9×10^{-3}	0.04	0.052	0.021	0.017	0.014	7.8×10^{-3}	***3.9×10^{-3}***	4.7×10^{-3}	***7.8×10^{-3}***	***0.047***
Polycyclic Aromatic Hydrocarbons	1.5×10^{-10}	9.6×10^{-7}	1.5×10^{-6}	6.2×10^{-6}	8.0×10^{-6}	3.3×10^{-6}	2.6×10^{-6}	2.2×10^{-6}	1.2×10^{-6}	***6.1×10^{-7}***	7.3×10^{-7}	***1.2×10^{-6}***	***7.4×10^{-6}***
Noncarcinogens													
Antimony	0.033	3.8×10^{-4}	6.1×10^{-4}	2.5×10^{-3}	3.2×10^{-3}	1.3×10^{-3}	1.1×10^{-3}	8.9×10^{-4}	4.8×10^{-4}	***2.4×10^{-4}***	2.9×10^{-4}	***4.8×10^{-4}***	***2.9×10^{-3}***
Barium	0.033	1.9×10^{-4}	3.0×10^{-4}	1.2×10^{-3}	1.6×10^{-3}	6.5×10^{-4}	5.2×10^{-4}	4.3×10^{-4}	2.4×10^{-4}	***1.2×10^{-4}***	1.4×10^{-4}	***2.4×10^{-4}***	***1.4×10^{-3}***
Chloride	0.20	0.025	0.041	0.16	0.21	0.088	0.070	0.059	0.032	***0.016***	0.019	***0.032***	***0.19***
Chromium (total)	0.033	6.2×10^{-5}	9.9×10^{-5}	4.0×10^{-4}	5.2×10^{-4}	2.1×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	7.8×10^{-5}	***3.9×10^{-5}***	4.7×10^{-5}	***7.8×10^{-5}***	***4.7×10^{-4}***
Cobalt	3.3×10^{-3}	4.4×10^{-4}	7.0×10^{-4}	2.8×10^{-3}	3.7×10^{-3}	1.5×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.5×10^{-4}	***2.8×10^{-4}***	3.4×10^{-4}	***5.5×10^{-4}***	***3.3×10^{-3}***
Copper	0.013	1.3×10^{-4}	2.1×10^{-4}	8.3×10^{-4}	1.0×10^{-3}	4.4×10^{-4}	3.5×10^{-4}	3.0×10^{-4}	1.6×10^{-4}	***8.1×10^{-5}***	9.8×10^{-5}	***1.6×10^{-4}***	***9.9×10^{-4}***
Ethyl benzene	29	4.8×10^{-6}	7.7×10^{-6}	3.1×10^{-5}	4.0×10^{-5}	1.7×10^{-5}	1.3×10^{-5}	1.1×10^{-5}	6.0×10^{-6}	***3.0×10^{-6}***	3.7×10^{-6}	***6.0×10^{-6}***	***3.6×10^{-5}***
Fluoride	0.17	2.7×10^{-3}	4.4×10^{-3}	0.018	0.023	9.4×10^{-3}	7.5×10^{-3}	6.3×10^{-3}	3.4×10^{-3}	***1.7×10^{-3}***	2.1×10^{-3}	***3.4×10^{-3}***	***0.020***
Lead	-	1.1×10^{-4}	1.8×10^{-4}	7.1×10^{-4}	9.2×10^{-4}	3.8×10^{-4}	3.1×10^{-4}	2.6×10^{-4}	1.4×10^{-4}	***7.0×10^{-5}***	8.4×10^{-5}	***1.4×10^{-4}***	***8.5×10^{-4}***
Manganese	0.33	2.2×10^{-4}	3.5×10^{-4}	1.4×10^{-3}	1.8×10^{-3}	7.6×10^{-4}	6.0×10^{-4}	5.1×10^{-4}	2.8×10^{-4}	***1.4×10^{-4}***	1.7×10^{-4}	***2.8×10^{-4}***	***1.6×10^{-3}***
Mercury	3.0×10^{-3}	8.2×10^{-6}	1.3×10^{-5}	5.3×10^{-5}	6.9×10^{-5}	2.9×10^{-5}	2.3×10^{-5}	1.9×10^{-5}	1.0×10^{-5}	***5.2×10^{-6}***	6.3×10^{-6}	***1.0×10^{-5}***	***6.3×10^{-5}***
Molybdenum	0.33	5.7×10^{-5}	9.2×10^{-5}	3.7×10^{-4}	4.8×10^{-4}	2.0×10^{-4}	1.6×10^{-4}	1.3×10^{-4}	7.2×10^{-5}	***3.6×10^{-5}***	4.4×10^{-5}	***7.3×10^{-5}***	***4.4×10^{-4}***
Naphthalene	3.3	8.2×10^{-5}	1.3×10^{-4}	5.3×10^{-4}	6.9×10^{-4}	2.9×10^{-4}	2.3×10^{-4}	1.9×10^{-4}	1.0×10^{-4}	***5.2×10^{-5}***	6.3×10^{-5}	***1.0×10^{-4}***	***6.3×10^{-4}***
Phosphorus	7.0×10^{-3}	6.9×10^{-4}	1.1×10^{-3}	4.5×10^{-3}	5.8×10^{-3}	2.4×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	8.7×10^{-4}	***4.4×10^{-4}***	5.3×10^{-4}	***8.7×10^{-4}***	***5.3×10^{-3}***
Selenium	0.013	5.0×10^{-5}	8.0×10^{-5}	3.2×10^{-4}	4.2×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	6.3×10^{-5}	***3.2×10^{-5}***	3.8×10^{-5}	***6.3×10^{-5}***	***3.8×10^{-4}***
Toluene	25	4.5×10^{-4}	7.2×10^{-4}	2.9×10^{-3}	3.8×10^{-3}	1.6×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.7×10^{-4}	***2.9×10^{-4}***	3.5×10^{-4}	***5.7×10^{-4}***	***3.4×10^{-3}***

Table C.2-12. Projected emission rates (pounds per hour) of toxic air pollutants from combustion of fossil fuels to support waste processing operations (continued).

Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	***Non-Separations Alternative: Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Direct Vitrification Alternative: Vitrification without Calcine Separations Option***	***Direct Vitrification Alternative: Vitrification with Calcine Separations Option***
Noncarcinogens (continued)													
1,1,1-Trichloroethane (methyl chloroform)	130	1.7×10^{-5}	2.8×10^{-5}	1.1×10^{-4}	1.4×10^{-4}	6.0×10^{-5}	4.8×10^{-5}	4.1×10^{-5}	2.2×10^{-5}	***1.1×10^{-5}***	1.3×10^{-5}	***2.2×10^{-5}***	***1.2×10^{-5}***
Vanadium	3.3×10^{-3}	2.3×10^{-3}	3.7×10^{-3}	0.015	0.019	8.0×10^{-3}	6.4×10^{-3}	5.4×10^{-3}	2.9×10^{-3}	***1.5×10^{-3}***	1.8×10^{-3}	***2.9×10^{-3}***	***1.7×10^{-3}***
Xylene	29	8.0×10^{-6}	1.3×10^{-5}	5.1×10^{-5}	6.6×10^{-5}	2.8×10^{-5}	2.2×10^{-5}	1.8×10^{-5}	1.0×10^{-5}	***5.0×10^{-6}***	6.1×10^{-6}	***1.0×10^{-5}***	***6.0×10^{-6}***
Zinc	0.067	2.1×10^{-3}	3.4×10^{-3}	0.014	0.018	7.4×10^{-3}	5.9×10^{-3}	4.9×10^{-3}	2.7×10^{-3}	***1.3×10^{-3}***	1.6×10^{-3}	***2.7×10^{-3}***	***1.5×10^{-3}***

a. Source: Project Data Sheets and backup documentation. Includes emissions due to steam production and diesel equipment operation.

b. Screening emission level listed in Rules for Control of Air Pollution in Idaho ***(IDAPA 58.01.01.585-586) (IDEQ 2001)***. Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations.[a]

Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Non-Separations Alternative: ***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Direct Vitrification Alternative: Vitrification without Calcine Separations Option***	***Direct Vitrification Alternative: Vitrification with Calcine Separations Option***
Carcinogens													
Acetaldehyde	3.0×10^{-3}	-[c]	4.1×10^{-7}	3.0×10^{-9}	4.1×10^{-7}	3.0×10^{-9}	4.2×10^{-7}	4.1×10^{-7}	2.6×10^{-9}	-	-	***2.6×10^{-9}***	***5.6×10^{-9}***
Arsenic	1.5×10^{-6}	-	-	3.4×10^{-9}	3.4×10^{-9}	3.4×10^{-9}	7.8×10^{-9}	3.8×10^{-13}	2.9×10^{-9}	-	-	***2.9×10^{-9}***	***6.3×10^{-9}***
Benzene	8.0×10^{-4}	-	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	5.0×10^{-7}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Benzo(a)pyrene	1.5×10^{-10}	-	2.8×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	2.8×10^{-9}	1.2×10^{-6}	-	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Beryllium	2.8×10^{-5}	-	6.2×10^{-12}	2.3×10^{-11}	2.9×10^{-11}	2.3×10^{-11}	5.9×10^{-11}	6.2×10^{-12}	2.6×10^{-11}	-	-	***2.0×10^{-11}***	***4.3×10^{-11}***
1,3-Butadiene	2.4×10^{-5}	-	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	2.1×10^{-8}	1.3×10^{-10}	-	-	***1.3×10^{-10}***	***2.8×10^{-10}***
Cadmium	3.7×10^{-6}	-	-	3.9×10^{-8}	3.9×10^{-8}	3.9×10^{-8}	9.0×10^{-8}	4.3×10^{-12}	3.4×10^{-8}	***8.4×10^{-8}***	7.3×10^{-9}	***3.4×10^{-8}***	***7.3×10^{-8}***
Carbon tetrachloride	4.4×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chloroform	2.8×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chromium (hexavalent)	5.6×10^{-7}	-	-	8.1×10^{-10}	8.1×10^{-10}	8.1×10^{-10}	1.9×10^{-9}	9.0×10^{-14}	6.9×10^{-10}	***5.6×10^{-9}***	1.4×10^{-10}	***6.9×10^{-10}***	***1.5×10^{-9}***
1,2-Dichloroethane	2.5×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Dioxins and furans	1.5×10^{-10}	-	3.1×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	3.1×10^{-11}	4.9×10^{-13}	-	-	***4.9×10^{-13}***	***1.1×10^{-12}***
Formaldehyde	5.1×10^{-4}	-	6.3×10^{-7}	4.7×10^{-9}	6.3×10^{-7}	4.7×10^{-9}	6.4×10^{-7}	6.3×10^{-7}	5.3×10^{-7}	-	-	***5.3×10^{-7}***	***5.3×10^{-7}***
Hydrazine	2.3×10^{-6}	-	4.6×10^{-8}	3.4×10^{-10}	4.6×10^{-8}	3.4×10^{-10}	4.7×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Methylene chloride	1.6×10^{-3}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Nickel	2.7×10^{-5}	-	-	2.0×10^{-8}	2.0×10^{-8}	2.0×10^{-8}	4.7×10^{-8}	2.3×10^{-12}	1.8×10^{-8}	***5.6×10^{-9}***	3.3×10^{-9}	***1.8×10^{-8}***	***3.8×10^{-8}***
Polycyclic aromatic hydrocarbons	1.5×10^{-10}	-	2.1×10^{-8}	3.6×10^{-10}	2.2×10^{-8}	3.6×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	3.1×10^{-10}	-	-	***3.1×10^{-10}***	***6.6×10^{-10}***
Paradioxane	0.71	-	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.0×10^{-6}	4.6×10^{-4}	-	-	***4.6×10^{-4}***	***4.6×10^{-4}***
Perchloroethylene	9.1×10^{-5}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Thiourea	1.2×10^{-5}	-	5.6×10^{-11}	2.0×10^{-9}	2.1×10^{-9}	2.0×10^{-9}	4.8×10^{-9}	1.2×10^{-9}	2.7×10^{-8}	-	-	***2.5×10^{-8}***	***2.7×10^{-8}***
1,1,2-Trichloroethane	4.2×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Trichloroethylene	5.1×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Noncarcinogens													
Acetonitrile	4.5	-	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	1.3×10^{-8}	5.8×10^{-6}	-	-	***5.8×10^{-6}***	***5.8×10^{-6}***
Acrolein	0.017	-	4.9×10^{-8}	3.6×10^{-10}	4.9×10^{-8}	3.6×10^{-10}	5.0×10^{-8}	4.9×10^{-8}	3.1×10^{-10}	-	-	***3.1×10^{-10}***	***6.7×10^{-10}***
Antimony	0.033	-	8.7×10^{-10}	3.2×10^{-10}	1.2×10^{-9}	3.2×10^{-10}	1.6×10^{-9}	8.7×10^{-10}	1.2×10^{-9}	-	-	***8.7×10^{-10}***	***1.2×10^{-9}***
Barium	0.033	-	-	1.4×10^{-9}	1.4×10^{-9}	1.4×10^{-9}	3.2×10^{-9}	1.6×10^{-13}	1.2×10^{-9}	-	-	***1.2×10^{-9}***	***2.6×10^{-9}***
Bromoform	0.33	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations[a] (continued).

Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Non-Separations Alternative: ***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Direct Vitrification Alternative: Vitrification without Calcine Separations Option***	***Direct Vitrification Alternative: Vitrification with Calcine Separations Option***
Noncarcinogens (continued)													
Carbon disulfide	2.0	-	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	1.1×10^{-7}	4.9×10^{-5}	***4.0×10^{-3}***	-	***4.9×10^{-5}***	***4.9×10^{-5}***
Chloride	0.2	-	***0.026***	2.5×10^{-5}	***0.026***	2.5×10^{-5}	***0.026***	***0.026***	***0.039***	***0.017***	0.010	***0.026***	***0.026***
Chlorobenzene	23	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	**-**	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chromium (total)	0.033	-	-	2.7×10^{-8}	2.7×10^{-8}	2.7×10^{-8}	6.3×10^{-8}	3.0×10^{-12}	2.3×10^{-8}	**-**	4.6×10^{-9}	***2.3×10^{-8}***	***5.0×10^{-8}***
Cobalt	3.3×10^{-3}	-	-	-	-	-	-	-	-	**-**	-	-	-
Copper	0.013	-	-	-	-	-	-	-	-	**-**	-	-	-
Diethyl phthalate	0.33	-	3.6×10^{-10}	6.6×10^{-12}	3.7×10^{-10}	6.6×10^{-12}	3.8×10^{-10}	3.6×10^{-10}	1.6×10^{-7}	**-**	-	***1.6×10^{-7}***	***1.6×10^{-7}***
Di-n-butyl phthalate	0.33	-	5.1×10^{-11}	9.4×10^{-13}	5.2×10^{-11}	9.4×10^{-13}	5.3×10^{-11}	5.2×10^{-11}	2.3×10^{-8}	**-**	-	***2.3×10^{-8}***	***2.3×10^{-8}***
di-n-octyl phthalate	0.33	-	5.1×10^{-13}	1.9×10^{-11}	2.0×10^{-11}	1.9×10^{-11}	4.4×10^{-11}	1.1×10^{-11}	2.5×10^{-10}	**-**	-	***2.3×10^{-10}***	***2.5×10^{-10}***
2,4-Dinitrophenol,	-	-	2.2×10^{-8}	2.4×10^{-10}	2.2×10^{-8}	2.4×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	1.0×10^{-5}	**-**	-	***1.0×10^{-5}***	***1.0×10^{-5}***
Ethyl benzene	29	-	-	-	-	-	-	-	-	**-**	-	-	-
Fluoride	0.17	-	***0.057***	***1.4×10^{-3}***	***0.057***	***1.4×10^{-3}***	***0.057***	***0.057***	***0.057***	***0.017***	2.7×10^{-8}	***0.057***	***0.058***
Lead	-	-	9.6×10^{-8}	3.5×10^{-8}	1.3×10^{-7}	3.5×10^{-8}	1.8×10^{-7}	9.6×10^{-8}	1.3×10^{-7}	***1.1×10^{-6}***	6.4×10^{-9}	***9.6×10^{-8}***	***1.3×10^{-7}***
Manganese	0.33	-	-	-	-	-	-	-	-	**-**	-	-	-
Mercury	3.0×10^{-3}	-	1.4×10^{-6}	5.4×10^{-5}	5.5×10^{-5}	5.4×10^{-5}	1.2×10^{-4}	3.0×10^{-5}	4.6×10^{-5}	***7.9×10^{-4}***	5.0×10^{-9}	***4.5×10^{-5}***	***9.7×10^{-5}***
Methyl ethyl ketone	39	-	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	**-**	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Molybdenum	0.33	-	-	-	-	-	-	-	-	**-**	-	-	-
Naphthalene	3.3	-	4.8×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	4.8×10^{-8}	1.2×10^{-6}	**-**	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Pentachlorophenol	0.023	-	2.7×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	2.7×10^{-9}	1.2×10^{-6}	**-**	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Phenol	1.3	-	4.6×10^{-8}	6.8×10^{-10}	4.7×10^{-8}	6.8×10^{-10}	4.8×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	**-**	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Phosphorus	7.0×10^{-3}	-	-	-	-	-	-	-	-	**-**	-	-	-
Propylene (propene)	-	-	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.4×10^{-6}	8.7×10^{-9}	**-**	-	***8.7×10^{-9}***	***1.9×10^{-8}***
Pyridine	1.0	-	3.9×10^{-6}	7.2×10^{-8}	4.0×10^{-6}	7.2×10^{-8}	4.1×10^{-6}	3.9×10^{-6}	***1.8×10^{-3}***	**-**	-	***1.8×10^{-3}***	***1.8×10^{-3}***
Selenium	0.013	-	4.3×10^{-10}	1.6×10^{-10}	5.9×10^{-10}	1.6×10^{-10}	7.9×10^{-10}	4.3×10^{-10}	5.7×10^{-10}	**-**	-	***4.3×10^{-10}***	***5.9×10^{-10}***
Silver	1.0×10^{-3}	-	-	5.3×10^{-10}	5.3×10^{-10}	5.3×10^{-10}	1.2×10^{-9}	5.8×10^{-14}	4.5×10^{-10}	**-**	6.0×10^{-11}	***4.5×10^{-10}***	***9.8×10^{-10}***
Thallium	7.0×10^{-3}	-	4.4×10^{-10}	1.6×10^{-9}	2.0×10^{-9}	1.6×10^{-9}	4.2×10^{-9}	4.4×10^{-10}	1.8×10^{-9}	**-**	-	***1.4×10^{-9}***	***3.0×10^{-9}***
Toluene	25	-	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	2.2×10^{-7}	6.0×10^{-7}	**-**	-	***6.0×10^{-7}***	***6.0×10^{-7}***
1,2,4-Trichlorobenzene	2.5	-	8.1×10^{-11}	3.0×10^{-11}	1.1×10^{-10}	3.0×10^{-11}	1.5×10^{-10}	9.8×10^{-11}	3.7×10^{-8}	**-**	-	***3.7×10^{-8}***	***3.7×10^{-8}***

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations[a] (continued).

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Noncarcinogens (continued)													
1,1,1-Trichloroethane (methyl chloroform)	130	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	**-**	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Vanadium	3.0×10^{-3}	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**
Xylene	29	-	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	1.5×10^{-7}	4.8×10^{-10}	**-**	-	***4.8×10^{-10}***	***1.0×10^{-9}***
Zinc	0.067	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**
Others													
Carbon dioxide	-	-	-	450	450	450	-	-	-	**-**	-	**-**	**-**
Carbon monoxide	-	-	0.19	***2.4×10^{-3}***	0.19	***2.4×10^{-3}***	0.20	0.19	0.28	**-**	-	***0.27***	***0.28***
Oxides of nitrogen	-	-	3.9	2.9	6.8	2.9	16	3.9	0.76	**-**	-	***0.38***	***3.1***
Particulate matter	-	-	1.5×10^{-6}	5.2×10^{-5}	5.4×10^{-5}	5.2×10^{-5}	1.2×10^{-4}	3.1×10^{-5}	4.7×10^{-5}	**-**	-	***4.5×10^{-5}***	***9.7×10^{-5}***
Sulfur dioxide	-	-	9.8	8.3	18	8.3	9.8	9.8	4.8	**-**	-	***2.5***	***11***
Total hydrocarbons	-	-	6.1×10^{-6}	8.8×10^{-8}	6.2×10^{-6}	8.8×10^{-8}	6.3×10^{-6}	6.1×10^{-6}	2.0×10^{-3}	**-**	-	***1.9×10^{-3}***	***1.9×10^{-3}***

a. ***Sources: Kimmit (1998), except for Steam Reforming, which is based on Studsvik (2002).*** Chemical process emissions do not include emissions formed by combustion of fossil fuels ***to support waste processing operations*** (see ***Table C.2-12***).

b. Screening emission level listed in Rules for Control of Air Pollution in Idaho ***(IDAPA 58.01.01.585-586) (IDEQ 2001)***. Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

c. Dash designates that emission rate is either 0 or is not specified in applicable reference.

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
		Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	0.56	1.2	0.050	220	330	8.5	0.54	0.83	0.021
	8-hour	0.18	0.30	0.012	54	69	3.5	0.54	0.69	0.035
Nitrogen dioxide	Annual	0.013	0.031	9.9×10^{-4}	1.1	2.2	0.085	1.1	2.2	0.085
Sulfur dioxide	3-hour	2.3	4.4	0.13	84	140	6.4	6.5	11	0.49
	24-hour	0.43	0.87	0.031	17	32	1.7	4.8	8.7	0.46
	Annual	0.026	0.064	2.0×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.091
Respirable particulates[c]	24-hour	0.022	0.044	1.6×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.3×10^{-3}	3.1×10^{-3}	1.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.086
Lead	Quarterly	2.8×10^{-5}	7.5×10^{-5}	5.0×10^{-6}	5.4×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	0.36	0.37	0.026
Continued Current Operations Alternative										
Carbon monoxide	1-hour	10	28	2.3	220	350	11	0.56	0.86	0.027
	8-hour	3.5	6.8	0.53	56	71	3.9	0.56	0.71	0.039
Nitrogen dioxide	Annual	0.035	0.097	4.1×10^{-3}	1.1	2.3	0.088	1.1	2.3	0.088
Sulfur dioxide	3-hour	5.7	11	0.53	85	140	6.7	6.5	11	0.52
	24-hour	1.2	2.3	0.13	18	32	1.8	4.8	8.7	0.48
	Annual	0.066	0.18	7.6×10^{-3}	0.87	4.5	0.078	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.090	0.22	0.011	9.8	20	0.95	6.5	13	0.63
	Annual	2.4×10^{-3}	6.0×10^{-3}	2.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.086
Lead	Quarterly	1.8×10^{-3}	4.9×10^{-3}	2.9×10^{-4}	5.9×10^{-3}	8.1×10^{-3}	6.7×10^{-4}	0.40	0.54	0.045
Full Separations Option										
Carbon monoxide	1-hour	24	62	5.1	230	370	14	0.59	0.92	0.034
	8-hour	8.0	15	1.17	58	74	4.5	0.58	0.74	0.045
Nitrogen dioxide	Annual	0.11	0.27	9.4×10^{-3}	1.2	2.4	0.093	1.2	2.4	0.093
Sulfur dioxide	3-hour	18	34	1.1	86	140	7.3	6.6	11	0.56
	24-hour	3.5	6.9	0.29	18	32	1.9	4.9	8.8	0.52
	Annual	0.20	0.50	0.018	0.88	4.5	0.088	1.1	5.7	0.11
Respirable particulates[c]	24-hour	0.25	0.61	0.026	9.9	20	0.96	6.6	14	0.64
	Annual	9.1×10^{-3}	0.022	7.3×10^{-4}	0.40	1.3	0.043	0.81	2.6	0.087
Lead	Quarterly	3.8×10^{-3}	0.010	6.0×10^{-4}	6.5×10^{-3}	0.014	9.9×10^{-4}	0.43	0.90	0.066
Planning Basis Option										
Carbon monoxide	1-hour	30	78	6.4	240	380	15	0.60	0.94	0.04
	8-hour	10	19	1.5	59	75	4.8	0.59	0.75	0.05
Nitrogen dioxide	Annual	0.13	0.35	0.013	1.2	2.4	0.097	1.2	2.4	0.10
Sulfur dioxide	3-hour	24	46	1.6	88	150	7.8	6.7	11	0.60
	24-hour	4.7	9.4	0.43	18	32	2.0	5.0	8.9	0.55
	Annual	0.26	0.69	0.026	0.89	4.6	0.096	1.1	5.7	0.12
Respirable particulates[c]	24-hour	0.32	0.76	0.033	9.9	20	0.97	6.6	14	0.64
	Annual	0.011	0.028	9.2×10^{-4}	0.41	1.3	0.044	0.81	2.6	0.09
Lead	Quarterly	4.8×10^{-3}	0.013	7.6×10^{-4}	6.8×10^{-3}	0.016	1.1×10^{-3}	0.45	1.1	0.08

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
Transuranic Separations Option										
Carbon monoxide	1-hour	17	44	3.7	230	360	12	0.57	0.89	0.03
	8-hour	5.6	11	0.84	57	72	4.2	0.57	0.72	0.04
Nitrogen dioxide	Annual	0.064	0.17	6.0×10^{-3}	1.2	2.3	0.090	1.2	2.3	0.09
Sulfur dioxide	3-hour	11	20	0.77	85	140	7.0	6.6	11	0.54
	24-hour	2.1	4.1	0.19	18	32	1.8	4.9	8.8	0.50
	Annual	0.090	0.22	7.0×10^{-3}	0.87	4.5	0.077	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.16	0.39	0.018	9.8	20	0.95	6.6	13	0.64
	Annual	5.0×10^{-3}	0.012	4.1×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	2.8×10^{-3}	7.6×10^{-3}	4.5×10^{-4}	6.2×10^{-3}	0.011	8.3×10^{-4}	0.42	0.72	0.06
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	11	30	2.4	220	350	11	0.56	0.87	0.03
	8-hour	3.8	7.3	0.56	56	71	3.9	0.56	0.71	0.04
Nitrogen dioxide	Annual	0.084	0.22	0.011	1.2	2.4	0.094	1.2	2.4	0.09
Sulfur dioxide	3-hour	8.5	16	0.63	85	140	6.8	6.6	11	0.53
	24-hour	1.7	3.3	0.17	18	32	1.8	4.8	8.7	0.49
	Annual	0.096	0.26	0.010	0.87	4.5	0.081	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.11	0.28	0.012	9.8	20	0.95	6.5	13	0.63
	Annual	3.9×10^{-3}	9.6×10^{-3}	3.2×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	1.8×10^{-3}	5.0×10^{-3}	3.0×10^{-4}	6.0×10^{-3}	8.2×10^{-3}	6.8×10^{-4}	0.40	0.55	0.05
Direct Cement Waste Option										
Carbon monoxide	1-hour	11	29	2.4	220	350	11	0.56	0.87	0.03
	8-hour	3.7	7.2	0.55	56	71	3.9	0.56	0.71	0.04
Nitrogen dioxide	Annual	0.035	0.087	3.0×10^{-3}	1.1	2.3	0.087	1.1	2.3	0.09
Sulfur dioxide	3-hour	7.3	14	0.59	85	140	6.8	6.6	11	0.52
	24-hour	1.5	2.9	0.15	18	32	1.8	4.8	8.7	0.49
	Annual	0.084	0.22	9.0×10^{-3}	0.87	4.5	0.079	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.10	0.26	0.012	9.8	20	0.948	6.5	13	0.63
	Annual	3.3×10^{-3}	8.1×10^{-3}	2.7×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	1.8×10^{-3}	5.0×10^{-3}	3.0×10^{-4}	6.0×10^{-3}	8.2×10^{-3}	6.8×10^{-4}	0.40	0.55	0.05
Early Vitrification Option										
Carbon monoxide	1-hour	1.1	2.3	0.13	220	330	8.6	0.54	0.83	0.02
	8-hour	0.36	0.55	0.030	55	69	3.5	0.55	0.69	0.03
Nitrogen dioxide	Annual	0.019	0.043	1.7×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.09
Sulfur dioxide	3-hour	4.8	7.5	0.24	84	140	6.5	6.5	11	0.50
	24-hour	0.87	1.3	0.071	18	32	1.7	4.8	8.7	0.47
	Annual	0.057	0.11	5.3×10^{-3}	0.86	4.5	0.076	1.1	5.7	0.09
Respirable particulates[c]	24-hour	0.028	0.057	2.0×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.6×10^{-3}	3.8×10^{-3}	1.2×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.3×10^{-5}	2.2×10^{-4}	1.3×10^{-5}	5.4×10^{-3}	5.6×10^{-3}	4.0×10^{-4}	0.36	0.37	0.03

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
		Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
Steam Reforming Option										
Carbon monoxide	1-hour	2.9	7.7	0.64	220	330	9.1	0.55	0.83	0.02
	8-hour	0.98	1.9	0.15	55	69	3.6	0.55	0.69	0.04
Nitrogen dioxide	Annual	0.010	0.024	8.3×10^{-4}	1.1	2.2	0.084	1.1	2.2	0.08
Sulfur dioxide	3-hour	1.7	3.4	0.10	84	140	6.3	6.4	11	0.49
	24-hour	0.32	0.66	0.023	17	32	1.7	4.8	8.7	0.46
	Annual	0.017	0.042	1.3×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.09
Respirable particulates[c]	24-hour	0.028	0.069	3.1×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	9.3×10^{-4}	2.3×10^{-3}	8.0×10^{-5}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	5.5×10^{-4}	1.5×10^{-3}	7.8×10^{-5}	5.6×10^{-3}	5.7×10^{-3}	4.6×10^{-4}	0.37	0.38	0.03
Minimum INEEL Processing Alternative										
Carbon monoxide	1-hour	5.1	14	1.1	220	340	9.6	0.55	0.84	0.02
	8-hour	1.7	3.3	0.26	55	70	3.7	0.55	0.70	0.04
Nitrogen dioxide	Annual	0.013	0.032	1.1×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.08
Sulfur dioxide	3-hour	2.2	4.5	0.16	84	140	6.4	6.5	11	0.49
	24-hour	0.41	0.86	0.030	17	32	1.7	4.8	8.7	0.46
	Annual	0.021	0.051	1.6×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.09
Respirable particulates[c]	24-hour	0.044	0.11	5.3×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.2×10^{-3}	2.9×10^{-3}	1.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.4×10^{-4}	2.3×10^{-3}	1.4×10^{-4}	5.7×10^{-3}	5.8×10^{-3}	5.2×10^{-4}	0.38	0.39	0.03
Vitrification without Calcine Separations Option										
Carbon monoxide	1-hour	1.0	2.3	0.13	220	330	8.6	0.54	0.83	0.02
	8-hour	0.34	0.53	0.029	55	69	3.5	0.55	0.69	0.03
Nitrogen dioxide	Annual	0.017	0.040	1.4×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.09
Sulfur dioxide	3-hour	3.8	6.6	0.18	84	140	6.4	6.5	11	0.49
	24-hour	0.71	1.2	0.052	18	32	1.7	4.8	8.7	0.47
	Annual	0.045	0.097	3.9×10^{-3}	0.86	4.5	0.074	1.1	5.7	0.09
Respirable particulates[c]	24-hour	0.028	0.057	2.0×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.6×10^{-3}	3.8×10^{-3}	1.2×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.0×10^{-5}	2.1×10^{-4}	1.3×10^{-5}	5.4×10^{-3}	5.6×10^{-3}	4.0×10^{-4}	0.36	0.37	0.03
Vitrification with Calcine Separations Option										
Carbon monoxide	1-hour	18	45	3.6	230	360	12	0.57	0.89	0.03
	8-hour	5.9	11	0.81	57	72	4.2	0.57	0.72	0.04
Nitrogen dioxide	Annual	0.12	0.27	0.010	1.2	2.4	0.094	1.2	2.4	0.09
Sulfur dioxide	3-hour	23	41	1.1	87	140	7.4	6.7	11	0.57
	24-hour	4.2	7.7	0.30	18	32	1.9	4.9	8.8	0.53
	Annual	0.25	0.56	0.022	0.89	4.6	0.092	1.1	5.7	0.12
Respirable particulates[c]	24-hour	0.23	0.54	0.020	9.9	20	0.96	6.6	13	0.64
	Annual	0.010	0.025	8.0×10^{-4}	0.40	1.3	0.044	0.81	2.6	0.09
Lead	Quarterly	2.6×10^{-3}	7.2×10^{-3}	4.2×10^{-4}	6.2×10^{-3}	0.010	8.1×10^{-4}	0.41	0.69	0.05

a. Cumulative impacts are assessed as the sum of the baseline plus the impacts of proposed projects. Baseline and standards are provided in Table C.2-15.
b. This summation is conservative since in most cases the highest concentration for each (baseline and alternative) would occur at different locations.
c. Values do not include contributions of fugitive dust.

Table C.2-15. Criteria pollutant ambient air quality standards and baseline used to assess cumulative impacts at public access locations.

Pollutant	Applicable standard[a] (micrograms per cubic meter)	Averaging time	Contribution of baseline and reasonable foreseeable increases[b] (micrograms per cubic meter)		
			At or beyond site boundary	Public roads	Craters of the Moon
Carbon monoxide	40,000	1-hour	***220***	***330***	***8.5***
	10,000	8-hour	***44***	***68***	***3.5***
Nitrogen dioxide	100	Annual	***1.0***	***2.2***	***0.084***
Sulfur dioxide	1,300	3-hour	***30***	***140***	***6.2***
	365	24-hour	***6.1***	***32***	***1.7***
	80	Annual	***0.26***	***4.5***	***0.070***
Respirable particulates	150	24-hour	***9.0***	***20***	***0.94***
	50	Annual	***0.39***	***1.3***	***0.043***
Lead	1.5	Quarterly	$\boldsymbol{1.8\times10^{-3}}$	$\boldsymbol{5.6\times10^{-3}}$	$\boldsymbol{3.9\times10^{-4}}$

a. ***Modeled concentrations are compared to the applicable standards provided above (IDAPA 58.01.01.577) (IDEQ 2001).*** Primary standards are designed to protect public health. Secondary standards are designed to protect public welfare. The most stringent standard is used for comparison.

b. Baseline represents the modeled pollutant concentrations based on an actual operating emissions scenario***. Sources include existing INEEL facilities with actual 1997 INEEL emissions (DOE 1998), plus reasonably foreseeable sources such as the Advanced Mixed Waste Treatment Project. The newly installed CPP-606 steam production boilers are excluded, since they are assessed as elements of the waste processing alternatives (see Section 5.2.6).***

lutant impacts to these increments. For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern INEEL boundary, while maximum noncarcinogenic air pollutant levels would occur along U.S. 20.

C.2.5.3 Concentrations of Toxic Air Pollutants at Onsite Locations

DOE estimated maximum onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. ***All toxic air pollutant concentrations would be less than 10 percent of the applicable standards. Vanadium concentrations were the highest relative to the applicable standard by more than a factor of two compared to other toxic air pollutants. The vanadium concentrations*** are presented by waste processing alternative/option in Table C.2-***16***, and represent the maximum predicted levels at any point within a major INEEL facility area, averaged over an 8-hour period, to which workers might be incidentally 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, whichever standard is more restrictive. Unlike radiological impacts (for which the maximum dose to a non-involved worker occurs at Central Facilities Area), the maximally impacted area for toxic air pollutants is within INTEC. This is due to differences in dispersion models, averaging time (annual average for radionuclides versus 8 hours for toxics) and height of release (elevated releases for radionuclides versus both ground-level and elevated for toxics).

C.2.5.4 Visibility Impairment Modeling Results

DOE assessed cumulative emissions of proposed waste processing sources at the INTEC for potential impacts on the visual resource at Craters of the Moon Wilderness Area and the

Table C.2-16. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations by waste processing alternative.

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Non-Separations Alternative: Steam Reforming Option	Minimum INEEL Processing Alternative at INEEL	Direct Vitrification Alternative: Vitrification without Calcine Separations Option	Direct Vitrification Alternative: Vitrification with Calcine Separations Option
	Highest percentage of applicable standard and identification of controlling pollutant											
Carcinogens: Maximum impact due to nickel[a,b]												
INEEL boundary areas	1.2	1.9	8.1	10	4.5	2.9	1.7	1.0	0.71	1.0	1.7	9.5
Craters of the Moon	<0.2	0.24	0.71	0.71	0.24	0.24	0.24	0.24	<0.2	<0.2	0.24	0.71
INEEL facility area[c]	0.01	0.32	0.69	0.88	0.49	0.33	0.33	0.02	0.08	0.16	0.02	0.49
Noncarcinogens: Maximum impact due to vanadium[a]												
INEEL boundary areas	0.01	0.02	0.09	0.11	0.05	0.04	0.03	0.02	0.01	0.01	0.02	0.10
Public road locations	0.03	0.05	0.18	0.23	0.10	0.08	0.07	0.03	0.02	0.02	0.03	0.20
Craters of the Moon	1.0×10^{-3}	2.0×10^{-3}	6.0×10^{-3}	8.0×10^{-3}	4.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	7.0×10^{-3}
INEEL facility area[c]	0.01	0.24	0.52	0.65	0.38	0.25	0.25	0.01	0.06	0.12	0.01	0.36

a. Applicable ambient air standards are specified in IDAPA 58.01.01.585-586 (IDEQ 2001) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; for existing sources, they are used here as reference values for purposes of comparison.

b. Aside from nickel, the only carcinogenic pollutants exceeding 1 percent of the ambient standard for the option with maximum impacts (Planning Basis Option) are arsenic (3 percent of the standard) and hexavalent chromium (1 percent).

c. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively. Location of highest onsite impacts is within INTEC.

Fort Hall Indian Reservation, in recognition of the importance of scenic views in and around each of these areas. For ***VISCREEN*** assessments, the potential impact of incremental emissions was evaluated using maximum hourly emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area and Reservation. The analysis conservatively assumes that future fossil fuel-burning equipment will not have emission controls that reduce nitrogen dioxide and particulate matter emissions. ***DOE assessed potential visibility impacts from cumulative emissions using both the VISCREEN and CALPUFF models, as described in Section C.2.3.3. Table C.2-17 presents the results of the VISCREEN analysis.*** The results show that none of the alternatives would exceed the maximum screening values of 2.0 for color shift or 0.05 for contrast; that is, none would be expected to result in perceptible changes to visual resources around Craters of the Moon ***Wilderness Area*** or Fort Hall.

CALPUFF visibility impacts were performed only for the Planning Basis Option, which is the option with the highest emission rates of pollutants affecting visibility (nitrogen dioxide, sulfur dioxide, and particulate matter). For this option, the maximum 24-hour light extinction change would exceed the 5-percent criterion for 8 days of the 5-year simulation period, and the maximum value for light extinction change would be 8.4 percent. There are no exceedances at Yellowstone or Grand Teton National Parks under this option (Rood 2002).

C.2.6 RADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the radiological assessment results for facility disposition alternatives presented in Section 5.3.4. These results are presented separately for three categories of facilities: (a) facilities associated with waste processing alternatives; (b) the Tank Farm, calcine bin sets, and related facilities; and (c) other existing INTEC facilities.

C.2.6.1 Facilities Associated with Waste Processing Alternatives

Radionuclide emissions would result from the dispositioning of facilities associated with waste processing alternatives. These emissions are temporary in nature and would persist for a few (1 to 4) years following the operating lifetime of individual facilities. Table C.2-***18*** presents the radionuclide release estimates for the dispositioning of these facilities, while the calculated radiation doses that would result from these emissions are presented in Table C.2-***19***.

C.2.6.2 Tank Farm and Bin Sets

DOE estimated emissions and doses that would result from dispositioning the Tank Farm and calcine storage bin sets under different closure scenarios. These emissions could persist for over 20 years, reflecting the lengthy process of decontaminating and closing the waste storage tanks and calcine storage bins. Table C.2-***20*** presents the radionuclide release estimates for these closure scenarios, while the associated radiation doses are presented in Table C.2-***21***.

C.2.6.3 Other Existing INTEC Facilities

DOE estimated emissions and doses that would result from dispositioning various other facilities that either currently operate or have operated in the past in support of HLW management at INTEC. These estimates are presented in Tables C.2-***22*** and C.2-***23***.

Table C.2-17. Results of VISCREEN analysis for waste processing alternatives.

Option	Plume perceptibility/color shift parameter (delta E) (Maximum acceptable screening value = 2.0)				Contrast parameter (Maximum acceptable screening value = 0.05)			
Plume viewing background →	Horizon sky		Dark terrain object		Horizon sky		Dark terrain object	
Sun position with respect to the observer →	Front[a]	Behind[b]	Front[a]	Behind[b]	Front[a]	Behind[b]	Front[a]	Behind[b]
Maximum acceptable screening value	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05
Craters of the Moon Wilderness Area								
No Action Alternative	0.037	0.023	0.044	0.006	0.000	0.000	0.000	0.000
Continued Current Operations Alternative	0.166	0.117	0.139	0.030	0.000	-0.001	0.001	0.000
Separations Alternative								
Full Separations	0.355	0.218	0.430	0.060	0.002	-0.003	0.003	0.000
Planning Basis Option	0.513	0.349	0.546	0.091	0.003	-0.004	0.004	0.000
Transuranic Separations	0.228	0.144	0.259	0.040	0.001	-0.002	0.002	0.000
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.479	0.345	0.209	0.089	-0.001	-0.003	0.002	0.000
Direct Cement Waste Option	0.192	0.134	0.172	0.035	0.001	-0.001	0.001	0.000
Early Vitrification Option	0.062	0.043	0.057	0.011	0.000	0.000	0.000	0.000
Steam Reforming Option	0.032	0.018	0.047	0.005	0.000	0.000	0.000	0.000
Minimum INEEL Processing Alternative	0.045	0.024	0.069	0.007	0.000	0.000	0.000	0.000
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	0.054	0.037	0.058	0.010	0.000	0.000	0.000	0.000
Vitrification with Calcine Separations Option	0.378	0.237	0.431	0.066	0.002	-0.003	0.003	0.000
Fort Hall Indian Reservation								
No Action Alternative	0.016	0.010	0.018	0.003	0.000	0.000	0.000	0.000
Continued Current Operations Alternative	0.071	0.048	0.056	0.016	0.000	-0.001	0.001	0.000
Separations Alternative								
Full Separations	0.155	0.093	0.174	0.032	0.001	-0.001	0.002	0.000
Planning Basis Option	0.222	0.139	0.222	0.048	0.001	-0.002	0.002	0.000
Transuranic Separations	0.099	0.061	0.105	0.021	0.001	-0.001	0.001	0.000
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.209	0.152	0.085	0.047	0.000	-0.001	0.001	0.000
Direct Cement Waste Option	0.082	0.056	0.069	0.018	0.000	-0.001	0.001	0.000
Early Vitrification Option	0.027	0.018	0.023	0.006	0.000	0.000	0.000	0.000
Steam Reforming Option	0.014	0.007	0.019	0.003	0.000	0.000	0.000	0.000
Minimum INEEL Processing Alternative	0.020	0.009	0.028	0.004	0.000	0.000	0.000	0.000
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	0.023	0.015	0.023	0.005	0.000	0.000	0.000	0.000
Vitrification with Calcine Separations Option	0.165	0.101	0.175	0.035	0.001	-0.001	0.002	0.000

a. With forward scatter, the sun is in front of the observer which will tend to maximize the light scattered by plume particles and maximize the brightness of the plume.
b. With backward scatter, the sun is behind the observer, and the plume will likely appear darkest with such an angle.

Table C.2-*18*. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives.

			Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
			No Action Alternative							
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
			Continued Current Operations Alternative							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
Totals			1.2×10^{-7}	2.3×10^{-7}	1.0×10^{-7}	2.1×10^{-7}	1.2×10^{-8}	2.4×10^{-8}	3.0×10^{-12}	6.0×10^{-12}
			Full Separations Option[b]							
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P9A	Full (early) Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9C	Class A Grout Plant	***2.5***	5.8×10^{-8}	***1.5×10^{-7}***	5.2×10^{-8}	***1.3×10^{-7}***	6.0×10^{-9}	***1.5×10^{-8}***	1.5×10^{-12}	***3.7×10^{-12}***
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			3.5×10^{-7}	***7.9×10^{-7}***	3.2×10^{-7}	***7.1×10^{-7}***	3.6×10^{-8}	***8.1×10^{-8}***	9.0×10^{-12}	***2.0×10^{-11}***
			Planning Basis Option[b]							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P23A	Full Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23C	Class A Grout Plant	***1***	5.8×10^{-8}	***5.8×10^{-8}***	5.2×10^{-8}	***5.2×10^{-8}***	6.0×10^{-9}	***6.0×10^{-9}***	1.5×10^{-12}	***1.5×10^{-12}***
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
Totals			4.1×10^{-7}	***9.4×10^{-7}***	3.7×10^{-7}	***8.4×10^{-7}***	4.2×10^{-8}	***9.6×10^{-8}***	1.1×10^{-11}	***2.4×10^{-11}***

Table C.2-18. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Total radioactivity (curies per year)[a]	Total radioactivity (curies)[a]	Strontium-90/Yttrium-90 (curies per year)[a]	Strontium-90/Yttrium-90 (curies)[a]	Cesium-137 (curies per year)[a]	Cesium-137 (curies)[a]	Plutonium-239 (curies per year)[a]	Plutonium-239 (curies)[a]
			Transuranic Separations Option[c]							
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P49A	Transuranic-C Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P49C	Class C Grout Plant	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P49D	Class C Grout Packaging & Shipping	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class C Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			2.9×10^{-7}	5.9×10^{-7}	2.6×10^{-7}	5.3×10^{-7}	3.0×10^{-8}	6.0×10^{-8}	7.5×10^{-12}	1.5×10^{-11}
			Hot Isostatic Pressed Waste Option							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P71	Mixing and HIPing	5	5.8×10^{-8}	2.9×10^{-7}	5.2×10^{-8}	2.6×10^{-7}	6.0×10^{-9}	3.0×10^{-8}	1.5×10^{-12}	7.4×10^{-12}
P72	HIPed HLW Interim Storage	3	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	7.0×10^{-7}	2.1×10^{-7}	6.3×10^{-7}	2.4×10^{-8}	7.2×10^{-8}	6.0×10^{-12}	1.8×10^{-11}
			Direct Cement Waste Option							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P80	Mixing and FUETEP Grout	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P81	Unseparated Cementitious HLW Interim Storage	3	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	5.8×10^{-7}	2.1×10^{-7}	5.2×10^{-7}	2.4×10^{-8}	6.0×10^{-8}	6.0×10^{-12}	1.5×10^{-11}

Table C.2-18. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Annual emission rate and total project emissions [a]: Total radioactivity (curies per year)	Total radioactivity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
					Early Vitrification Option					
P18	New Analytical Laboratory	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P61	Vitrified HLW Interim Storage	3	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P88	Early Vitrification with MACT	5	7.3×10^{-8}	3.6×10^{-7}	6.5×10^{-8}	3.3×10^{-7}	7.4×10^{-9}	3.7×10^{-8}	1.9×10^{-12}	9.3×10^{-12}
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			1.9×10^{-7}	5.4×10^{-7}	1.7×10^{-7}	4.8×10^{-7}	1.9×10^{-8}	5.5×10^{-8}	4.8×10^{-12}	1.4×10^{-11}
					Steam Reforming Option					
P13	***New Storage Tanks***	***2***	4.0×10^{-8}	8.0×10^{-8}	3.6×10^{-8}	7.2×10^{-8}	4.1×10^{-9}	8.2×10^{-9}	1.0×10^{-12}	2.1×10^{-12}
P59A	***Calcine Retrieval and Transport***	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P117A	***Calcine Packaging and Loading to Hanford***	***3***	-	-	-	-	-	-	-	-
P2001	***NGLW Grout Facility***	***1***	4.0×10^{-8}	4.0×10^{-8}	3.6×10^{-8}	3.6×10^{-8}	4.1×10^{-9}	4.1×10^{-9}	1.0×10^{-12}	1.0×10^{-12}
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P2002A	***Steam Reforming***	***1***	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
Totals			2.5×10^{-7}	4.1×10^{-7}	2.3×10^{-7}	3.7×10^{-7}	2.6×10^{-8}	4.2×10^{-8}	6.5×10^{-12}	1.1×10^{-11}

Table C.2-*18*. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Annual emission rate and total project emissions [a] Total radioactivity (curies per year)	Total radioactivity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
	Minimum INEEL Processing Alternative[d]									
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
P111	SBW Treatment with CsIX	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P59B	Calcine Retrieval and Transport Just in Time	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	***1.0×10^{-7}***	6.0×10^{-9}	***1.2×10^{-8}***	1.5×10^{-12}	***3.0×10^{-12}***
P117B	Calcine Packaging & Loading Just in Time	3	1.7×10^{-7}	5.2×10^{-7}	1.6×10^{-7}	4.7×10^{-7}	1.8×10^{-8}	5.4×10^{-8}	4.5×10^{-12}	1.3×10^{-11}
Totals			3.5×10^{-7}	8.1×10^{-7}	3.1×10^{-7}	***7.3×10^{-7}***	3.6×10^{-8}	***8.3×10^{-8}***	8.9×10^{-12}	***2.1×10^{-11}***
	Vitrification Without Calcine Separations Option									
P13	***New Storage Tanks***	***2***	***4.0×10^{-8}***	***8.0×10^{-8}***	***3.6×10^{-8}***	***7.2×10^{-8}***	***4.1×10^{-9}***	***8.2×10^{-9}***	***1.0×10^{-12}***	***2.1×10^{-12}***
P18	***New Analytical Lab***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P35E	***Class A Grout Packaging & Loading for Offsite Disposal***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P59A	***Calcine Retrieval and Transport***	***1***	***5.8×10^{-8}***	***5.8×10^{-8}***	***5.2×10^{-8}***	***5.2×10^{-8}***	***6.0×10^{-9}***	***6.0×10^{-9}***	***1.5×10^{-12}***	***1.5×10^{-12}***
P88	***Vitrification with MACT***	***5***	***7.3×10^{-8}***	***3.6×10^{-7}***	***6.5×10^{-8}***	***3.3×10^{-7}***	***7.4×10^{-9}***	***3.7×10^{-8}***	***1.9×10^{-12}***	***9.3×10^{-12}***
Totals			***2.9×10^{-7}***	***7.3×10^{-7}***	***2.6×10^{-7}***	***6.6×10^{-7}***	***2.9×10^{-8}***	***7.5×10^{-8}***	***7.4×10^{-12}***	***1.9×10^{-11}***
	Vitrification With Calcine Separations Option									
P9A	***Full Separations***	***3***	***5.8×10^{-8}***	***1.7×10^{-7}***	***5.2×10^{-8}***	***1.6×10^{-7}***	***6.0×10^{-9}***	***1.8×10^{-8}***	***1.5×10^{-12}***	***4.5×10^{-12}***
P9C	***Grout Plant***	***2.5***	***5.8×10^{-8}***	***1.5×10^{-7}***	***5.2×10^{-8}***	***1.3×10^{-7}***	***6.0×10^{-9}***	***1.5×10^{-8}***	***1.5×10^{-12}***	***3.7×10^{-12}***
P13	***New Storage Tanks***	***2***	***4.0×10^{-8}***	***8.0×10^{-8}***	***3.6×10^{-8}***	***7.2×10^{-8}***	***4.1×10^{-9}***	***8.2×10^{-9}***	***1.0×10^{-12}***	***2.1×10^{-12}***
P18	***New Analytical Lab***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P35E	***Grout Packaging & Loading for Offsite Disposal***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P59A	***Calcine Retrieval and Transport***	***1***	***5.8×10^{-8}***	***5.8×10^{-8}***	***5.2×10^{-8}***	***5.2×10^{-8}***	***6.0×10^{-9}***	***6.0×10^{-9}***	***1.5×10^{-12}***	***1.5×10^{-12}***
P88	***Vitrification with MACT***	***5***	***7.3×10^{-8}***	***3.6×10^{-7}***	***6.5×10^{-8}***	***3.3×10^{-7}***	***7.4×10^{-9}***	***3.7×10^{-8}***	***1.9×10^{-12}***	***9.3×10^{-12}***
Totals			***4.0×10^{-7}***	***1.1×10^{-6}***	***3.6×10^{-7}***	***9.5×10^{-7}***	***4.1×10^{-8}***	***1.1×10^{-7}***	***1.0×10^{-11}***	***2.7×10^{-11}***

a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

b. Assumes disposal of Class A grout either offsite or in new INEEL landfill facility; ***emissions from*** disposal in Tank Farm and bin sets are addressed in ***Table C.2-22.***

c. Assumes disposal of Class C grout in new facility; ***emissions from*** disposal in Tank Farm and bin sets are addressed ***in Table C.2-22.***

d. Assumes "just-in-time" shipping scenario; emissions from option involving interim storage of calcine at Hanford would be somewhat less. Includes emissions at INEEL only.

Table C.2-*19*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of facilities associated with waste processing alternatives.

		Impact of alternative[a]											
				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Case (units)	Applicable Standard	No Action Alternative	Continued Current Operations Alternative	Full Separations Option[b]	Planning Basis Option	Transuranic Separations Option[c]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL[d]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Dose to maximally exposed offsite individual (millirem per year)	10[e]	-	1.1×10^{-10}	3.3×10^{-10}	3.9×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	***2.4×10^{-10}***	5.6×10^{-10}	***2.1×10^{-10}***	***3.0×10^{-10}***
Dose to noninvolved worker (millirem per year)[f]	5,000[g]	-	2.0×10^{-11}	6.0×10^{-11}	7.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	***4.3×10^{-11}***	1.6×10^{-10}	***4.3×10^{-11}***	***6.0×10^{-11}***
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[h]	N.A.	-	***4.0×10^{-9}***	***1.2×10^{-8}***	***1.4×10^{-8}***	***1.3×10^{-8}***	***5.7×10^{-9}***	***4.5×10^{-9}***	***4.6×10^{-9}***	***8.8×10^{-9}***	***1.6×10^{-8}***	***7.0×10^{-9}***	***9.9×10^{-9}***

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.
b. Impacts do not include disposal of Class A Grout in Tank Farm and bin sets, which are presented in Table ***5.3-6***.
c. Impacts do not include disposal of Class C Grout in Tank Farm and bin sets, which are presented in Table ***5.3-6***.
d. Assumes "just-in-time" shipping scenario; impacts of option involving interim storage of calcine at Hanford would be somewhat less. Does not include doses at Hanford.
e. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
f. Location of highest onsite dose is Central Facilities Area.
g. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
h. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

Table C.2-20. Airborne radionuclide emissions estimates for disposition of the Tank Farm and bin sets under alternative closure scenarios.

Project number	Description	Duration (years)	Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
			(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Tank Farm										
P59G	Clean Closure	17	8.6×10^{-7}	1.5×10^{-5}	4.2×10^{-7}	7.1×10^{-6}	4.4×10^{-7}	7.4×10^{-6}	2.8×10^{-9}	4.8×10^{-8}
P3B	Performance-Based Closure with Clean Fill	17	1.1×10^{-7}	1.8×10^{-6}	5.2×10^{-8}	8.8×10^{-7}	5.5×10^{-8}	9.3×10^{-7}	3.5×10^{-10}	5.9×10^{-9}
P3C	Closure to Landfill Standards	17	7.8×10^{-7}	1.3×10^{-5}	3.8×10^{-7}	6.4×10^{-6}	4.0×10^{-7}	6.7×10^{-6}	2.5×10^{-9}	4.3×10^{-8}
P26/51	Performance-Based Closure with Class A or C Fill	27	1.1×10^{-7}	2.4×10^{-6}	5.3×10^{-8}	1.2×10^{-6}	5.6×10^{-8}	1.2×10^{-6}	3.6×10^{-10}	7.9×10^{-9}
Bin Sets										
P59F	Clean Closure	20	1.3×10^{-7}	2.6×10^{-6}	1.2×10^{-7}	2.3×10^{-6}	1.3×10^{-8}	2.7×10^{-7}	3.3×10^{-12}	6.7×10^{-11}
P59C	Performance-Based Closure with Clean Fill	20	1.7×10^{-7}	3.4×10^{-6}	***1.5×10^{-7}***	3.0×10^{-6}	1.7×10^{-8}	3.5×10^{-7}	4.3×10^{-12}	8.7×10^{-11}
P59D	Closure to Landfill Standards	20	1.2×10^{-6}	2.4×10^{-5}	1.1×10^{-6}	2.2×10^{-5}	1.2×10^{-7}	2.5×10^{-6}	3.1×10^{-11}	6.2×10^{-10}
P26/51	Performance-Based Closure with Class A or C Fill	18	1.7×10^{-7}	2.5×10^{-6}	1.5×10^{-7}	2.3×10^{-6}	1.7×10^{-8}	2.6×10^{-7}	4.3×10^{-12}	6.5×10^{-11}

a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

Table C.2-*21*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of the Tank Farm and bin sets under alternative closure scenarios.

Case	Applicable Standard	Maximum annual radiation dose[a]			
		Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Tank Farm					
Dose to maximally exposed offsite individual (millirem per year)	10[b]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Dose to maximally exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e]	NA	***3.7×10^-8^*** $\boldsymbol{3.7\times10^{-8}}$	$\boldsymbol{4.6\times10^{-9}}$	$\boldsymbol{3.4\times10^{-8}}$	$\boldsymbol{4.7\times10^{-9}}$
Bin Sets					
Dose to maximally exposed offsite individual (millirem per year)	10[b]	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}
Dose to maximally exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}
Collective dose to population within 80 km of INTEC (person-rem per year)[e]	NA	$\boldsymbol{6.6\times10^{-9}}$	$\boldsymbol{8.6\times10^{-9}}$	$\boldsymbol{6.1\times10^{-8}}$	$\boldsymbol{8.6\times10^{-9}}$

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. Location of highest onsite dose is Central Facilities Area.

d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

e. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

Table C.2-22. Airborne radionuclide emissions estimates for disposition of other existing facilities associated with HLW management.

Facility group	Closure method[b]	Duration (years)	Total Activity (curies per year)	Total Activity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
			Annual emission rate and total project emissions[a]							
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	1.5×10^{-8}	***8.7×10^{-8}***	***7.0×10^{-9}***	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Storage Control House (CPP-628)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste/Station Tank Transfer Bldg. (CPP-638)	Landfill	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
Instrument House (CPP-712)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
STR Waste Storage Tanks (CPP-717)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			***7.3×10^{-8}***	3.8×10^{-7}	3.5×10^{-8}	1.8×10^{-7}	***3.7×10^{-8}***	1.9×10^{-7}	***2.4×10^{-10}***	1.2×10^{-9}
Bin Set Related Facilities										
Instrument Bldg. for Bin Set 1 (CPP-639)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 2nd Set of calcined solids (CPP-646)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 3rd Set of calcined solids (CPP-647)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 4th Set of calcined solids (CPP-658)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 5th Set of calcined solids (CPP-671)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 6th Set of calcined solids (CPP-673)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Total			8.7×10^{-8}	5.2×10^{-7}	7.8×10^{-8}	4.7×10^{-7}	8.9×10^{-9}	5.4×10^{-8}	2.2×10^{-12}	***1.3×10^{-11}***
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Holdup Pumphouse (CPP-641)	Clean	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
PEW Evaporator Bldg. (CPP-604)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Pre-Filter Bldg. (CPP-756)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Blower Bldg. (CPP-605)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Main Exhaust Stack (CPP-708)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			***8.7×10^{-8}***	***6.1×10^{-7}***	***2.6×10^{-7}***	***3.0×10^{-7}***	***2.7×10^{-7}***	***3.1×10^{-7}***	***1.7×10^{-9}***	***2.0×10^{-9}***
Fuel Processing Building and Related Facilities										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Total			1.7×10^{-7}	1.7×10^{-6}	8.5×10^{-8}	8.5×10^{-7}	***8.9×10^{-8}***	8.9×10^{-7}	5.7×10^{-10}	5.7×10^{-9}

Table C.2-22. Airborne radionuclide emissions estimates for disposition of other existing facilities associated with HLW management (continued).

			Annual emission rate and total project emissions [a]							
			Total Activity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Facility group	Closure method[b]	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	- [c]	6	5.8×10^{-8}	3.5×10^{-7}	2.8×10^{-8}	1.7×10^{-7}	***3.0×10^{-8}***	***1.8×10^{-7}***	***1.9×10^{-10}***	***1.1×10^{-9}***
New Waste Calcining Facility										
New Waste Calcining Facility	Perf.-Based or Landfill	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	2.9×10^{-8}	1.7×10^{-7}	1.4×10^{-8}	8.5×10^{-8}	1.5×10^{-8}	8.9×10^{-8}	9.5×10^{-11}	5.7×10^{-10}

a. Annual emissions represent the highest emission rate for any single year and are the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. See Table 3-***3*** for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Project includes deactivation and demolition of the Fluorinel and Storage Facility building (CPP-666) and the associated stack (CPP-767). The Fluorinel and Storage Facility building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

Table C.2-23. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of other existing facilities associated with HLW management.

Case	Applicable Standard	Maximum annual radiation dose[a]							
		Tank Farm Related Facilities	Bin Set Related Facilities	Process Equip. Waste Evaporator and Related Facilities	Fuel Process. Building and Related Facilities	Fluorinel and Storage Facility and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Dose to maximally exposed offsite individual (millirem per year)	10[b]	8.1×10^{-11}	***6.7×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-[c]	4.5×10^{-11}	4.1×10^{-11}
Dose to maximally exposed noninvolved worker (millirem per year)[d]	5,000[e]	8.1×10^{-11}	***1.6×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-	1.0×10^{-11}	4.1×10^{-11}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA	***2.5×10^{-9}***	***4.4×10^{-9}***	***3.7×10^{-9}***	***7.4×10^{-9}***	***2.5×10^{-9}***	-	***3.0×10^{-9}***	***1.2×10^{-9}***

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. There would be no radionuclide emissions for this group under this closure option.

d. Location of highest onsite dose is Central Facilities Area.

e. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

f. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

C.2.7 NONRADIOLOGICAL CONSEQUENCES OF FACILITY DISPOSITION

This section provides detail which supplements the emissions estimates and assessment results for nonradiological air pollutants from the facilities disposition alternatives presented in Section 5.3.4. These emissions arise primarily through the operation of diesel-powered equipment (cranes, loaders, haulers, etc.). The emissions tabulations list the maximum annual and cumulative emissions for each pollutant category (criteria, toxic, and carbon dioxide). Criteria pollutant impacts are presented as concentrations in micrograms per cubic meter at the maximally-impacted location at or beyond the INEEL boundary, along public roads, and at Craters of the Moon Wilderness Area. These are specified both for the alternative or option alone and for the cumulative effect of the alternative added to the baseline conditions. The cumulative impact is also specified as a percent of the applicable standard. Toxic impacts are presented as maximum percent of the applicable standard (for ambient air locations) or occupational exposure limit (for INEEL areas). In all cases, the INEEL area of highest predicted concentration is INTEC.

C.2.7.1 Facilities Associated with Waste Processing Alternatives

The following tables of emissions and impacts are presented for dispositioning of facilities associated with waste processing alternatives. Table C.2-***24*** lists the annual and cumulative emissions estimates for individual projects associated with each alternative. Table C.2-***25*** presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations. Results include both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-***26*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.2 Tank Farm and Bin Sets

The following tables of emissions and impacts are presented for dispositioning of the Tank Farm and bin sets according to alternative closure scenarios. Table C.2-***27*** lists the annual and cumulative emissions estimates for each facility group by closure scenario. Table C.2-***28*** presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-***29*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.3 Other Existing INTEC Facilities

DOE has also assessed emissions and impacts for dispositioning other existing INTEC facilities involved in HLW management. These facilities, which have been arranged in functional groups for purposes of analysis, are listed in Table 3-***3***. The following tables are presented for these facilities. Table C.2-***30*** lists the annual and cumulative emissions estimates. Table C.2-***31*** presents the maximum predicted incremental and cumulative impacts of criteria pollutant emissions at ambient air locations. Table C.2-***32*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives.

Project number	Description	Duration (years)	Annual and cumulative project emissions[a]: Criteria pollutants[b] (tons/ year)	Criteria pollutants[b] (tons)	Toxic air pollutants (pounds per year)	Toxic air pollutants (pounds)	Carbon dioxide[c] (tons/ year)	Carbon dioxide[c] (tons)	Fugitive dust (tons/ year)	Fugitive dust (tons)
					No Action Alternative					
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
					Continued Current Operations Alternative					
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	100	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P1F	Bin Set 1 Closure	2	7	14	8	16	150	307	11	22
Totals			150	200	170	230	3.3×10^3	4.4×10^3	35	51
					Full Separations Option[d]					
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P9A	Full (early) Separations	3	120	360	140	409	2.6×10^3	7.9×10^3	64	190
P9B	Vitrification Plant	3	64	190	73	220	1.4×10^3	4.2×10^3	15	45
P9C	Class A Grout Plant	3	64	160	73	180	1.4×10^3	3.5×10^3	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P35D	Class A Grout Packaging & Shipping to INEEL Landfill	2	11	23	13	26	240	500	2	4
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
Totals			490	1.1×10^3	550	1.3×10^3	1.1×10^4	2.5×10^4	480	1.1×10^3
					Planning Basis Option[d]					
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P23A	Full Separations	3	120	360	140	409	2.6×10^3	7.9×10^3	64	190
P23B	Vitrification Plant	3	64	190	73	220	1.4×10^3	4.2×10^3	15	45
P23C	Class A Grout Plant	3	64	160	73	180	1.4×10^3	3.5×10^3	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	11	23	13	26	250	500	2	4
Totals			590	1.3×10^3	680	1.4×10^3	1.3×10^4	2.8×10^4	190	480

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
Transuranic Separations Option[e]										
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P49A	Transuranic-C Separations	3	94	280	107	320	2.1×10^3	6.2×10^3	64	190
P49C	Class C Grout Plant	2	64	130	73	150	1.4×10^3	2.8×10^3	15	30
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P49D	Class C Grout Packaging & Shipping	2	11	23	13	26	250	500	2	4
P27	Class C Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
Totals			407	840	460	960	9.0×10^3	1.8×10^4	420	890
Hot Isostatic Pressed Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P71	Mixing and HIPing	5	49	250	56	280	1.1×10^3	5.4×10^3	89	450
P72	HIPed HLW Interim Storage	3	38	110	43	130	830	2.5×10^3	43	130
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	29	72	33	82	630	1.6×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			430	900	490	1.0×10^3	9.4×10^3	2.0×10^4	180	650
Direct Cement Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P80	Direct Cement Process	3	72	220	82	250	1.6×10^3	4.8×10^3	51	150
P81	Unseparated Cementitious HLW Interim Storage	3	66	200	75	230	1.4×10^3	4.3×10^3	130	390
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	29	100	33	110	630	2.2×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			480	990	550	1.1×10^3	1.1×10^4	2.2×10^4	230	610

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
			(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
Early Vitrification Option										
P18	Calcine Retrieval and Transport	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P61	Vitrified HLW Interim Storage	3	53	160	61	180	1.2×10^3	3.5×10^3	72	220
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	29	86	33	98	630	1.9×10^3	-	-
P88	Early Vitrification with MACT	5	106	530	120	606	2.3×10^3	1.2×10^4	40	200
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			390	1.1×10^3	440	1.3×10^3	8.5×10^3	2.4×10^4	140	460
Steam Reforming Option										
P13	***New Storage Tanks***	***2***	***8.0***	***16***	***9.1***	***18***	***180***	***350***	***35***	***70***
P59A	***Calcine Retrieval and Transport***	***2***	***57***	***110***	***65***	***130***	1.3×10^3	2.5×10^3	***7.0***	***14***
P117A	***Calcine Packaging and Loading to Hanford***	***3***	***4.9***	***15***	***5.6***	***17***	***110***	***330***	***17***	***51***
P2001	***NGLW Grout Facility***	***1***	***19***	***19***	***22***	***22***	***420***	***420***	***7.2***	***7.2***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***11***	***23***	***13***	***26***	***250***	***500***	***2.0***	***4.0***
P2002A	***Steam Reforming***	***1***	***64***	***64***	***73***	***73***	1.4×10^3	1.4×10^3	***15***	***15***
Totals			***160***	***250***	***190***	***290***	3.6×10^3	5.5×10^3	***83***	***160***

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
Minimum INEEL Processing Alternative[f]										
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
P111	SBW Treatment with CsIX	1	38	38	43	43	840	840	14	14
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	29	130	33	150	630	2.8×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P59B	Calcine Retrieval and Transport Just in Time	2	51	100	58	120	1.1×10^3	2.2×10^3	7	14
P117B	Calcine Packaging & Loading Just in Time	3	47	140	53	160	1.0×10^3	3.1×10^3	21	63
Totals			330	750	370	850	7.2×10^3	1.6×10^4	410	870
Vitrification without Calcine Separations Option										
P13	New Storage Tanks	2	3.8	7.7	4.4	8.8	85	170	17	35
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9.0	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7.0	7.0
P61	Vitrified HLW Interim Storage	3	53	160	61	180	1.2×10^3	3.5×10^3	72	220
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	29	86	33	98	630	1.9×10^3	-	-
P88	Vitrification with MACT	5	110	530	120	610	2.3×10^3	1.2×10^4	40	200
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	17	34
Totals			360	1.1×10^3	410	1.2×10^3	8.0×10^3	2.4×10^4	160	510
Vitrification with Calcine Separations Option										
P9A	Full Separations	3	120	360	140	410	2.6×10^3	7.9×10^3	64	190
P9C	Grout Plant	2.5	64	160	73	180	1.4×10^3	3.5×10^3	15	38
P13	New Storage Tanks	2	3.8	7.7	4.4	8.8	85	170	17	35
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9.0	18
P24	Vitrified Product Interim Storage	2.8	17	48	19	55	370	1.1×10^3	43	120
P35E	Grout Packaging & Loading for Offsite Disposal	2	11	23	13	26	250	500	2.0	4.0
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7.0	7.0

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
Vitrification with Calcine Separations Option(continued)										
P88	***Vitrification with MACT***	***5***	***110***	***530***	***120***	***610***	$\mathbf{2.3\times10^{3}}$	$\mathbf{1.2\times10^{4}}$	***40***	***200***
P133	***Waste Treatment Pilot Plant***	***2***	***31***	***63***	***36***	***71***	***690***	$\mathbf{1.4\times10^{3}}$	***17***	***34***
Totals			***490***	$\mathbf{1.4\times10^{3}}$	***560***	$\mathbf{1.6\times10^{3}}$	$\mathbf{1.1\times10^{4}}$	$\mathbf{3.1\times10^{4}}$	***210***	***650***

a. Maximum annual emissions represent the highest emission rate for any single year; total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

d. Assumes disposal of Class A grout either offsite (Full Separations and Planning Basis Options) or in new INEEL landfill facility (Full Separations Option); impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

e. Assumes disposal of Class C grout in new facility; impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

f. Assumes "just-in-time" shipping scenario; nonradiological emissions impacts of interim storage of calcine at Hanford would be somewhat less.

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) INEEL boundary	Impact of alternative Public roads	Impact of alternative Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a] INEEL boundary	Cumulative impact Public roads	Cumulative impact Craters of the Moon	Percent of standard[b] INEEL boundary	Percent of standard Public roads	Percent of standard Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	-	-	-	220	330	8.5	1	1	<1
	8-hour	-	-	-	44	68	3.5	<1	1	<1
Nitrogen dioxide	Annual	-	-	-	1.0	2.2	0.084	1	2	<1
Sulfur dioxide	3-hour	-	-	-	30	140	6.2	2	11	<1
	24-hour	-	-	-	6.1	32	1.7	2	9	<1
	Annual	-	-	-	0.26	4.5	0.070	<1	6	<1
Respirable particulates[c]	24-hour	-	-	-	9.0	20	0.94	6	13	<1
	Annual	-	-	-	0.39	1.3	0.043	<1	3	<1
Lead	Quarterly	-	-	-	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Continued Current Operations Alternative										
Carbon monoxide	1-hour	130	380	32	350	710	40	<1	2	<1
	8-hour	54	140	5.5	98	210	9.0	<1	2	<1
Nitrogen dioxide	Annual	0.13	0.51	0.012	1.1	2.7	0.10	1	3	<1
Sulfur dioxide	3-hour	14	33	2.3	44	170	8.5	3	13	<1
	24-hour	2.9	7.7	0.29	9.0	40	2.0	2	11	<1
	Annual	0.024	0.092	2.2×10^{-3}	0.28	4.6	0.072	<1	6	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	10	23	1.0	7	15	<1
	Annual	8.7×10^{-3}	0.034	8.0×10^{-4}	0.40	1.3	0.044	<1	3	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Full Separations Option										
Carbon monoxide	1-hour	440	1.3×10^{3}	100	660	1.6×10^{3}	110	2	4	<1
	8-hour	180	470	18	220	530	22	2	5	<1
Nitrogen dioxide	Annual	0.43	1.7	0.040	1.4	3.9	0.12	1	4	<1
Sulfur dioxide	3-hour	46	110	7.4	76	250	14	6	19	1
	24-hour	9.6	25	0.95	16	57	2.6	4	16	<1
	Annual	0.078	0.30	7.1×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.5	9.2	0.35	13	29	1.3	8	19	<1
	Annual	0.029	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.1×10^{-6}	2.0×10^{-5}	5.8×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Planning Basis Option										
Carbon monoxide	1-hour	540	1.5×10^{3}	130	762	1.9×10^{3}	130	2	5	<1
	8-hour	220	570	22	260	640	26	3	6	<1
Nitrogen dioxide	Annual	0.53	2.0	0.048	1.5	4.2	0.13	2	4	<1
Sulfur dioxide	3-hour	56	130	9.1	86	270	15	7	21	1
	24-hour	12	31	1.2	18	63	2.9	5	17	<1
	Annual	0.096	0.37	8.7×10^{-3}	0.36	4.9	0.079	<1	6	<1
Respirable particulates[c]	24-hour	4.3	11	0.43	13	31	1.4	9	21	<1
	Annual	0.035	0.13	3.2×10^{-3}	0.43	1.4	0.046	<1	3	<1
Lead	Quarterly	7.5×10^{-6}	2.4×10^{-5}	7.1×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) INEEL boundary	Impact of alternative Public roads	Impact of alternative Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a] INEEL boundary	Cumulative impact Public roads	Cumulative impact Craters of the Moon	Percent of standard[b] INEEL boundary	Percent of standard Public roads	Percent of standard Craters of the Moon
Transuranic Separations Option										
Carbon monoxide	1-hour	370	1.1×10^{3}	87	590	1.4×10^{3}	96	1	3	<1
	8-hour	150	390	15	190	460	19	2	5	<1
Nitrogen dioxide	Annual	0.37	1.4	0.033	1.4	3.6	0.12	1	4	<1
Sulfur dioxide	3-hour	38	91	6.2	68	230	12	5	18	<1
	24-hour	8.1	21	0.80	14	53	2.5	4	15	<1
	Annual	0.066	0.25	6.0×10^{-3}	0.33	4.8	0.076	<1	6	<1
Respirable particulates[c]	24-hour	3.0	7.7	0.29	12	28	1.2	8	18	<1
	Annual	0.024	0.092	2.2×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	5.1×10^{-6}	1.7×10^{-5}	4.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	390	1.1×10^{3}	91	610	1.4×10^{3}	100	2	4	<1
	8-hour	160	410	16	200	480	19	2	5	<1
Nitrogen dioxide	Annual	0.38	1.5	0.035	1.4	3.7	0.12	1	4	<1
Sulfur dioxide	3-hour	40	95	6.5	70	240	13	5	18	<1
	24-hour	8.5	22	0.84	15	54	2.5	4	15	<1
	Annual	0.069	0.26	6.3×10^{-3}	0.33	4.8	0.076	<1	6	<1
Respirable particulates[c]	24-hour	3.1	8.1	0.31	12	28	1.2	8	19	<1
	Annual	0.025	0.10	2.3×10^{-3}	0.42	1.4	0.045	<1	3	<1
Lead	Quarterly	5.4×10^{-6}	1.8×10^{-5}	5.1×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Direct Cement Waste Option										
Carbon monoxide	1-hour	440	1.2×10^{3}	100	660	1.6×10^{3}	110	2	4	<1
	8-hour	180	460	18	220	530	21	2	5	<1
Nitrogen dioxide	Annual	0.43	1.6	0.039	1.4	3.8	0.12	1	4	<1
Sulfur dioxide	3-hour	45	110	7.3	75	250	14	6	19	1
	24-hour	9.5	25	0.94	16	57	2.6	4	16	<1
	Annual	0.077	0.30	7.0×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.5	9.1	0.34	12	29	1.3	8	19	<1
	Annual	0.028	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.0×10^{-6}	2.0×10^{-5}	5.7×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Early Vitrification Option										
Carbon monoxide	1-hour	350	1.0×10^{3}	83	570	1.3×10^{3}	91	1	3	<1
	8-hour	140	370	14	190	440	18	2	4	<1
Nitrogen dioxide	Annual	0.35	1.3	0.032	1.3	3.5	0.12	1	4	<1
Sulfur dioxide	3-hour	37	86	5.9	67	230	12	5	17	<1
	24-hour	7.7	20	0.76	14	52	2.5	4	14	<1
	Annual	0.063	0.24	5.7×10^{-3}	0.32	4.7	0.076	<1	6	<1
Respirable particulates[c]	24-hour	2.8	7.4	0.28	12	27	1.2	8	18	<1
	Annual	0.023	0.088	2.1×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.9×10^{-6}	1.6×10^{-5}	4.6×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Steam Reforming Option										
Carbon monoxide	1-hour	150	420	35	370	750	44	<1	2	<1
	8-hour	60	160	6.1	100	230	9.6	1	2	<1
Nitrogen dioxide	Annual	0.15	0.56	0.013	1.1	2.8	0.10	1	3	<1
Sulfur dioxide	3-hour	15	36	2.5	45	180	8.7	3	14	<1
	24-hour	3.3	8.5	0.32	9.4	41	2.0	3	11	<1
	Annual	0.026	0.10	2.4×10^{-3}	0.29	4.6	0.072	<1	6	<1
Respirable particulates[c]	24-hour	1.2	3.1	0.12	10	23	1.1	7	15	<1
	Annual	0.010	0.037	8.8×10^{-4}	0.40	1.3	0.04	<1	3	<1
Lead	Quarterly	2.1×10^{-6}	6.7×10^{-6}	2.0×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Minimum INEEL Processing Alternative[d]										
Carbon monoxide	1-hour	300	850	70	520	1.2×10^{3}	79	1	3	<1
	8-hour	120	320	12	160	380	16	2	4	<1
Nitrogen dioxide	Annual	0.29	1.1	0.027	1.3	3.3	0.11	1	3	<1
Sulfur dioxide	3-hour	31	73	5.0	61	210	11	5	16	<1
	24-hour	6.5	17	0.64	13	49	2.3	3	13	<1
	Annual	0.053	0.20	4.8×10^{-3}	0.31	4.7	0.075	<1	6	<1
Respirable particulates[c]	24-hour	2.4	6.2	0.23	11	26	1.2	8	17	<1
	Annual	0.019	0.074	1.8×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.1×10^{-6}	1.3×10^{-5}	3.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Vitrification without Calcine Separations Option										
Carbon monoxide	1-hour	330	940	78	550	1.3×10^{3}	86	1	3	<1
	8-hour	130	350	14	180	420	17	2	4	<1
Nitrogen dioxide	Annual	0.33	1.2	0.030	1.3	3.4	0.11	1	3	<1
Sulfur dioxide	3-hour	34	81	5.6	64	220	12	5	17	<1
	24-hour	7.2	19	0.71	13	51	2.4	4	14	<1
	Annual	0.059	0.22	5.3×10^{-3}	0.32	4.7	0.075	<1	6	<1
Respirable particulates[c]	24-hour	2.6	6.9	0.26	12	27	1.2	8	18	<1
	Annual	0.021	0.082	1.9×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.6×10^{-6}	1.5×10^{-5}	4.3×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

- New Information -

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Vitrification with Calcine Separations Option										
Carbon monoxide	1-hour	450	1.3×10^{3}	100	670	1.6×10^{3}	110	2	4	<1
	8-hour	180	470	18	220	540	22	2	5	<1
Nitrogen dioxide	Annual	0.44	1.7	0.040	1.4	3.9	0.12	1	4	<1
Sulfur dioxide	3-hour	47	110	7.5	77	250	14	6	19	1
	24-hour	9.8	26	1.0	16	58	2.7	4	16	<1
	Annual	0.080	0.30	7.2×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.6	9.4	0.35	13	29	1.3	8	20	<1
	Annual	0.029	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.2×10^{-6}	2.0×10^{-5}	5.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

d. Impacts for the Minimum INEEL Processing Alternative do not include impacts at Hanford.

Table C.2-26. Summary of maximum toxic air pollutant concentrations at onsite and offsite ***locations from disposition of facilities associated with*** waste processing ***alternatives.***

	Highest percentage of applicable standard[a,b]											
			Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Receptor	No Action Alternative	Continued Current Operations	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carcinogens[c,d]												
INEEL boundary areas	-	0.65	2.1	2.6	1.8	1.9	2.1	1.7	***0.72***	***1.4***	***1.6***	***2.2***
Craters of the Moon	-	0.060	0.19	0.24	0.16	0.17	0.19	0.15	***0.066***	***0.13***	***0.15***	***0.20***
INEEL facility area location[e]	-	6.5	21	26	18	19	21	17	***7.2***	***14***	***16***	***22***
Noncarcinogens[c]												
INEEL boundary areas	-	0.051	0.17	0.20	0.14	0.15	0.16	0.13	***0.056***	***0.11***	***0.12***	***0.17***
Craters of the Moon	-	0.005	0.016	0.020	0.014	0.014	0.016	0.013	***0.006***	***0.011***	***0.012***	***0.017***
Public road locations	-	0.13	0.43	0.53	0.36	0.38	0.43	0.35	***0.15***	***0.29***	***0.32***	***0.44***
INEEL facility area location[e]	-	4.9	16	20	13	14	16	13	***5.4***	***11***	***12***	***16***

a. Applicable ambient air standards are specified in IDAPA 58.01.01.585-586 (***IDEQ*** 2001) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. Carcinogenic evaluation and standards are based on annual average concentrations. Noncarcinogens are based on 24-hour maximum concentrations. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Carcinogenic impacts are not evaluated at public highways.

e. Location of highest onsite impacts is within INTEC.

Table C.2-27. Summary of nonradiological air pollutant emissions estimates for Tank Farm and bin set closure scenarios.

		Annual and cumulative project emissions[a]							
	Duration	Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Facilities	(years)	(tons/year)	(tons)	(lb/year)	(lb)	(tons/year)	(tons)	(tons/year)	(tons)
Tank Farm									
Clean Closure	17	43	730	48	820	1,500	2.6×10^4	130	2.2×10^3
Performance-Based Closure with Clean Fill	17	8.5	140	10	160	180	3.0×10^3	19	150
Closure to Landfill Standards	17	6.0	100	6.7	110	130	2.1×10^3	19	150
Performance-Based Closure with Class A or C Fill	27	5.3	110	***5.9***	***120***	110	2.2×10^3	37	670
Bin Sets									
Clean Closure	20	2.1	42	2.4	48	44	870	53	1.1×10^3
Performance-Based Closure with Clean Fill	20	1.8	36	2.0	40	37	740	33	660
Closure to Landfill Standards	20	1.8	36	2.0	40	38	760	33	660
Performance-Based Closure with Class A or C Fill	18	2.7	33	3.0	***30***	55	680	66	860

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions is the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios.

	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Tank Farm Closure Scenarios – Clean Closure										
Carbon monoxide	1-hour	39	***110***	***9.2***	***260***	***440***	***18***	<1	1	<1
	8-hour	16	41	1.6	***60***	110	***5.1***	<1	1	<1
Nitrogen dioxide	Annual	0.04	0.15	***3.5×10^{-3}***	***1.0***	***2.3***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.1	10	0.66	***34***	***150***	***6.9***	***3***	***12***	<1
	24-hour	***0.85***	2.2	***0.084***	***7.0***	***34***	***1.8***	2	***9***	<1
	Annual	***6.9×10^{-3}***	***0.027***	6.3×10^{-4}	***0.27***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.31	0.82	0.031	***9.3***	***21***	1.0	***6***	***14***	<1
	Annual	2.5×10^{-3}	0.010	2.3×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	5.4×10^{-7}	1.8×10^{-6}	5.1×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance-Based Closure										
Carbon monoxide	1-hour	7.7	22	1.8	***230***	***350***	***10***	<1	***<1***	<1
	8-hour	3.1	***8.2***	0.32	***47***	***76***	***3.8***	<1	<1	<1
Nitrogen dioxide	Annual	***7.6×10^{-3}***	***0.029***	***6.9×10^{-4}***	***1.0***	***2.2***	***0.085***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.80	1.9	0.13	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.17	***0.44***	***0.017***	***6.3***	***32***	***1.7***	2	***9***	<1
	Annual	1.4×10^{-3}	***5.3×10^{-3}***	1.2×10^{-4}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.062	0.16	***6.1×10^{-3}***	***9.1***	***20***	***0.95***	***6***	***13***	<1
	Annual	5.0×10^{-4}	1.9×10^{-3}	4.6×10^{-5}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	1.1×10^{-7}	3.5×10^{-7}	1.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	5.5	16	1.3	***230***	***350***	***10***	<1	***<1***	<1
	8-hour	2.2	5.8	0.22	***46***	***74***	***3.7***	<1	<1	<1
Nitrogen dioxide	Annual	5.4×10^{-3}	0.021	4.9×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.57	1.3	***0.092***	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.12	0.31	***0.012***	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	***9.7×10^{-4}***	***3.7×10^{-3}***	8.8×10^{-5}	***0.26***	***4.5***	***0.07***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.044	0.11	4.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	3.5×10^{-4}	1.4×10^{-3}	3.2×10^{-5}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	7.5×10^{-8}	2.5×10^{-7}	7.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	4.8	14	1.1	***220***	***340***	***10***	<1	***<1***	<1
	8-hour	1.9	5.1	0.20	***46***	***73***	***3.7***	<1	<1	<1
Nitrogen dioxide	Annual	***4.7×10^{-3}***	0.018	4.3×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.50	1.2	0.080	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.11	0.27	0.010	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	8.5×10^{-4}	***0***	7.8×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	***0.039***	0.10	***3.8×10^{-3}***	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	3.1×10^{-4}	***1.2×10^{-3}***	2.8×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.6×10^{-8}	2.2×10^{-7}	6.3×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Bin Set Closure Scenarios										
Clean Closure										
Carbon monoxide	1-hour	1.9	5.4	0.45	***220***	***340***	***8.9***	<1	***<1***	<1
	8-hour	0.77	2.0	***0.078***	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	***1.9×10^{-3}***	***7.2×10^{-3}***	1.7×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.20	0.47	***0.032***	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.040	0.11	***4.1×10^{-3}***	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	3.4×10^{-4}	***1.3×10^{-3}***	3.1×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	***0.020***	0.040	1.5×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.2×10^{-4}	4.8×10^{-4}	1.1×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	2.6×10^{-8}	8.6×10^{-8}	2.5×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance Based Closure										
Carbon monoxide	1-hour	1.6	4.7	0.38	***220***	***330***	***8.9***	<1	***<1***	<1
	8-hour	0.66	1.7	***0.067***	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	***6.2×10^{-3}***	1.5×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.036	0.093	3.5×10^{-3}	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	2.9×10^{-4}	***1.1×10^{-3}***	2.6×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	1.6	4.7	0.38	***220***	***330***	***8.9***	<1	***<1***	<1
	8-hour	0.66	1.7	0.067	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	***6.2×10^{-3}***	1.5×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.036	0.093	3.5×10^{-3}	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	2.9×10^{-4}	***1.1×10^{-3}***	2.6×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	2.5	7.0	***0.58***	***220***	***340***	***9.1***	<1	***<1***	<1
	8-hour	1.0	2.6	0.10	***45***	***71***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	2.0×10^{-3}	9.0×10^{-3}	2.2×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.25	0.60	***0.041***	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	***0.054***	0.14	***5.3×10^{-3}***	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	4.4×10^{-4}	***1.7×10^{-3}***	4.0×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.020	***0.051***	***1.9×10^{-3}***	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.6×10^{-4}	6.1×10^{-4}	1.5×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	3.4×10^{-8}	1.1×10^{-7}	3.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

Table C.2-29. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from Tank Farm and bin set closure scenarios.

Case	Highest percentage of applicable standard[a,b]							
	Tank Farm				Bin sets			
	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Carcinogens[c]								
INEEL boundary areas	0.19	0.037	0.026	0.023	9.2×10^{-3}	7.9×10^{-3}	7.9×10^{-3}	0.012
Craters of the Moon	0.017	3.4×10^{-3}	2.4×10^{-3}	2.1×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	1.1×10^{-3}
INEEL facility area location[d]	1.9	0.37	0.26	0.23	0.092	0.079	0.079	0.12
Noncarcinogens[c]								
INEEL boundary areas	0.015	2.9×10^{-3}	2.1×10^{-3}	1.8×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Craters of the Moon	1.4×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Public road locations	0.038	7.6×10^{-3}	5.4×10^{-3}	4.7×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	1.6×10^{-3}	2.4×10^{-3}
INEEL facility area location[d]	1.4	0.28	0.20	0.17	0.069	0.059	0.059	0.089

a. Applicable ambient air standards are specified in ***IDEQ (2001)*** for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Location of highest onsite impacts is within INTEC.

Table C.2-*30*. Summary of nonradiological air pollutant emissions estimates for disposition of other existing INTEC facilities associated with HLW management.

			Annual and cumulative project emissions[a]							
			Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Fugitive dust	
Facility group	Closure method[b]	Duration (years)[c]	Tons/yr	Tons	Lb/yr	Lb	Tons/yr	Tons	Tons/yr	Tons
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
Waste Storage Control House (CPP-628)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	0.72	4.3
Waste /Station Tank Transfer Bldg. (CPP-638)	Landfill	2	13	26	15	***29***	260	520	-	-
Instrument House (CPP-712)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
STR Waste Storage Tanks (CPP-717)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
Total			65	***340***	***73***	***380***	1.3×10^3	***6.7×10^3***	0.72	4.3
Bin Set Related Facilities										
Instrument Bldg. for bin set 1 (CPP-639)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 2 (CPP-646)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 3 (CPP-647)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 4 (CPP-658)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 5 (CPP-671)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 6 (CPP-673)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Total			450	2.7×10^3	500	3.0×10^3	9.3×10^3	5.6×10^4	-	-
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	75	450	84	500	1.5×10^3	9.0×10^3	4.3	26
Waste Holdup Pumphouse (CPP-641)	Clean	2	13	26	15	29	260	520	-	-
PEW Evaporator Bldg. (CPP-604)	Landfill	6	33	200	37	220	660	4.0×10^3	16	96
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	3.3	20
Pre-Filter Bldg. (CPP-756)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	4.3	26
Blower Bldg. (CPP-605)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	3.3	20
Main Exhaust Stack (CPP-708)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	35	210
PEW Equip. Waste and Cell Floor Drain Lines	Landfill	1	9	9	10	10	180	180	-	-
PEW Condensate Lines	Landfill	1	9	9	10	10	180	180	-	-
Total			***440***	2.5×10^3	***490***	2.8×10^3	***8.8×10^3***	***5.0×10^4***	66	390
Fuel Processing Building and Related Facilities[b]										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	49	490
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	10	100
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	12	120
Total			150	1.5×10^3	170	1.7×10^3	3.0×10^3	3.0×10^4	71	710

Table C.2-*30*. Summary of nonradiological air pollutant emissions estimates for disposition of other existing INTEC facilities associated with HLW management (continued).

			Annual and cumulative project emissions[a]							
			Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Fugitive dust	
Facility group	Closure method[b]	Duration (years)[c]	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/year)	(tons)
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	-[f]	6	50	300	56	340	1.0×10^3	6.0×10^3	***120***	690
Transport Lines Group										
Process Off-Gas Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	2.9	2.9
Process (Dissolver) Transport Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	1.4	1.4
High-Level Liquid Waste (Raffinate) Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Calcine Solids Transport Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Total			36	36	40	40	750	750	7.2	7.2
New Waste Calcining Facility[b,g]										
New Waste Calcining Facility	Perf.-Based or Landfill	3	50	150	56	170	1.0×10^3	3.1×10^3	6.3	190
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	33	200	37	220	680	4.1×10^3	8.6	52

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. See Table 3-***3*** for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Duration refers to total number of calendar years during which dispositioning of facilities within the listed groups would occur.

d. The specific pollutants and approximate relative percentages are as follows: carbon monoxide – 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

e. Carbon dioxide is listed because this gas has been implicated in global warming.

f. Project includes deactivation and demolition of the Fluorinel Dissolution Process and Fuel Storage (FAST) building (CPP-666) and the associated stack (CPP-767). The FAST building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

g. The decontamination and decommissioning of this facility is also included in some of the waste processing alternatives.

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) Site boundary	Public roads	Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a] Site boundary	Public roads	Craters of the Moon	Percent of standard[b] Site boundary	Public roads	Craters of the Moon
Tank Farm Related Facilities										
Carbon monoxide	1-hour	59	170	14	280	500	22	<1	1	<1
	8-hour	24	62	2.4	68	130	5.9	<1	1	<1
Nitrogen dioxide	Annual	0.058	0.22	5.3×10^{-3}	1.1	2.4	0.089	1	2	<1
Sulfur dioxide	3-hour	6.1	14	1.0	36	150	7.2	3	12	<1
	24-hour	1.3	3.4	0.13	7.4	35	1.8	2	10	<1
	Annual	0.010	0.040	9.5×10^{-4}	0.27	4.5	0.071	<1	6	<1
Respirable particulates[c]	24-hour	0.47	1.2	0.050	9.5	21	1.0	6	14	<1
	Annual	3.8×10^{-3}	0.015	3.5×10^{-4}	0.39	1.3	0.043	<1	3	<1
Lead	Quarterly	8.2×10^{-7}	2.7×10^{-6}	7.8×10^{-8}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Bin Set Related Facilities										
Carbon monoxide	1-hour	410	1.2×10^{3}	96	630	1.5×10^{3}	100	2	4	<1
	8-hour	170	430	17	210	500	20	2	5	<1
Nitrogen dioxide	Annual	0.40	1.5	0.037	1.4	3.7	0.12	1	4	<1
Sulfur dioxide	3-hour	42	100	6.9	72	240	13	6	18	1
	24-hour	8.9	23	0.88	15	55	2.6	4	15	<1
	Annual	0.073	0.28	6.6×10^{-3}	0.33	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.3	8.5	0.32	12	29	1.3	8	19	<1
	Annual	0.027	0.10	2.4×10^{-3}	0.42	1.4	0.045	<1	3	<1
Lead	Quarterly	5.6×10^{-6}	1.8×10^{-5}	5.4×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Process Equipment Waste Evaporator and Related Facilities										
Carbon monoxide	1-hour	400	1.1×10^{3}	94	620	1.5×10^{3}	100	2	4	<1
	8-hour	160	420	16	210	490	20	2	5	<1
Nitrogen dioxide	Annual	0.39	1.5	0.036	1.4	3.7	0.12	1	4	<1
Sulfur dioxide	3-hour	42	98	6.7	72	240	13	6	18	<1
	24-hour	8.7	23	0.86	15	55	2.6	4	15	<1
	Annual	0.071	0.27	6.5×10^{-3}	0.33	4.8	0.076	<1	6	<1
Respirable particulates[c]	24-hour	3.2	8.4	0.32	12	28	1.3	8	19	<1
	Annual	0.026	0.10	2.4×10^{-3}	0.42	1.4	0.045	<1	3	<1
Lead	Quarterly	5.5×10^{-6}	1.8×10^{-5}	5.3×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	0	<1
Fuel Processing Building and Related Facilities										
Carbon monoxide	1-hour	140	390	32	360	720	41	<1	2	<1
	8-hour	55	140	5.6	99	210	9.1	<1	2	<1
Nitrogen dioxide	Annual	0.13	0.52	0.01	1.1	2.7	0.10	1	3	<1
Sulfur dioxide	3-hour	14	33	2.3	44	170	8.5	3	13	<1
	24-hour	3.0	7.8	0.29	9.1	40	2.0	2	11	<1
	Annual	0.020	0.090	2.0×10^{-3}	0.28	4.6	0.070	<1	6	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	10	23	1.0	7	15	<1
	Annual	9.0×10^{-3}	0.030	8.1×10^{-4}	0.40	1.3	0.044	<1	3	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
FAST and Related Facilities										
Carbon monoxide	1-hour	46	130	11	***270***	***460***	***19***	<1	1	<1
	8-hour	18	48	1.9	***62***	***120***	***5.4***	<1	1	<1
Nitrogen dioxide	Annual	0.040	0.17	4.0×10^{-3}	***1.0***	***2.4***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.7	11	0.76	***35***	***150***	***7.0***	***3***	***12***	<1
	24-hour	1.0	2.6	0.10	***7.1***	***35***	***1.8***	2	***9***	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.04	***9***	***21***	1.0	***6***	***14***	<1
	Annual	3.0×10^{-3}	0.010	2.7×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Transport Line Group										
Carbon monoxide	1-hour	33	93	7.7	***250***	***420***	***16***	<1	1	<1
	8-hour	13	35	1.3	***57***	100	***4.8***	<1	1	<1
Nitrogen dioxide	Annual	0.030	0.12	3.0×10^{-3}	***1.0***	***2.3***	***0.087***	***1***	***2***	<1
Sulfur dioxide	3-hour	3.4	8.0	0.55	***33***	***150***	***6.8***	***3***	***12***	<1
	24-hour	0.72	1.9	0.07	***6.8***	***34***	***1.8***	2	***9***	<1
	Annual	6.0×10^{-3}	0.020	5.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.26	0.68	0.030	***9***	***21***	1.0	***6***	***14***	<1
	Annual	2.0×10^{-3}	8.0×10^{-3}	1.9×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	4.5×10^{-7}	1.5×10^{-6}	4.3×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
New Waste Calcining Facility										
Carbon monoxide	1-hour	46	130	11	***270***	***460***	***19***	<1	1	<1
	8-hour	18	48	1.9	***62***	***120***	***5.4***	<1	1	<1
Nitrogen dioxide	Annual	0.045	0.17	4.0×10^{-3}	***1.0***	***2.4***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.7	11	0.76	***35***	***150***	***7.0***	***3***	***12***	<1
	24-hour	1.0	2.6	0.10	***7.1***	***35***	***1.8***	2	***9***	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.036	***9.4***	***21***	***0.98***	***6***	***14***	<1
	Annual	3.0×10^{-3}	0.011	2.7×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter): Site boundary	Public roads	Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a]: Site boundary	Public roads	Craters of the Moon	Percent of standard[b]: Site boundary	Public roads	Craters of the Moon
Remote Analytical Laboratory										
Carbon monoxide	1-hour	30	85	7.1	***250***	***420***	***16***	<1	1	<1
	8-hour	12	32	1.2	***56***	***100***	***4.7***	<1	***1***	<1
Nitrogen dioxide	Annual	0.030	0.11	3.0×10^{-3}	***1.0***	***2.3***	***0.087***	***1***	***2***	<1
Sulfur dioxide	3-hour	3.1	7.3	0.50	***33***	***150***	***6.7***	***3***	***12***	<1
	24-hour	0.7	1.7	0.060	***6.8***	***34***	***1.8***	2	***9***	<1
	Annual	5.0×10^{-3}	0.02	4.8×10^{-4}	***0.27***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.24	0.60	0.020	***9.2***	***21***	1.0	***6***	***14***	<1
	Annual	2.0×10^{-3}	7.0×10^{-3}	1.8×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	4.1×10^{-7}	1.4×10^{-6}	3.9×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

Table C.2-32. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from disposition of other existing INTEC facilities associated with HLW management.

Receptor	Highest percentage of applicable standard[a,b]							
	Tank Farm Related Facilities	Bin Set Related Facilities	PEW Evaporator and Related Facilities	Fuel Processing Building and Related Facilities	FAST and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Carcinogens[c]								
INEEL boundary areas	0.29	2.0	***1.9***	0.66	0.22	0.16	0.22	0.14
Craters of the Moon	0.026	0.18	***0.18***	0.060	0.020	0.014	0.020	0.013
INEEL facility area location[d]	2.8	20	***19***	6.6	2.2	1.6	2.2	1.4
Noncarcinogens[c]								
INEEL boundary areas	***0.022***	0.15	***0.15***	0.051	0.017	0.012	0.017	0.010
Craters of the Moon	2.2×10^{-3}	0.015	***0.015***	5.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	0.002	1.0×10^{-3}
Public road locations	0.058	0.40	***0.39***	0.13	0.045	0.032	0.045	0.029
INEEL facility area location[d]	***2.1***	15	***15***	4.9	1.6	1.2	1.6	1.1

a. Applicable ambient air standards are specified in ***IDEQ (2001)*** for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Location of highest onsite impacts is within INTEC.

C.2.8 ADDITIONAL ANALYSES

DOE performed additional nonradiological impacts analyses for the State of Idaho's Preferred Alternative (the Direct Vitrification Alternative) using the CALPUFF model. The application of the CALPUFF model is described in Section C.2.3.3.

Prevention of Significant Deterioration - Figure C.2-2 illustrates the receptor "rings" used in the CALPUFF simulations for the Direct Vitrification Alternative. Six receptor rings (two for each Class I area) were evaluated. DOE used the CALPOST program to extract annual average concentrations of NO_2, SO_2, and PM-10, maximum 24-hour concentrations of SO_2 and PM-10, and 3-hour average concentrations of SO_2 at each receptor location in the model domain. It was conservatively assumed that all oxides of nitrogen were converted to NO_2. The maximum concentration determined for each receptor ring, regardless of direction, was selected for comparison with applicable PSD Class I increments. The maximum amount of 3-hour sulfur dioxide increment is consumed within Craters of the Moon; however, maximum consumption of other increments occurs in directions that do not correspond to Class I area locations.

Table C.2-33 presents the results for the CALPUFF simulations. All projected concentrations at INEEL road and boundary locations, Craters of the Moon Wilderness Area, and Yellowstone and Grand Teton National Parks are well within allowable increments.

The amount of increment consumed by the combined effects of the Direct Vitrification Alternative and existing INEEL sources subject to PSD regulation does not differ significantly between the two options. This is because increment consumption is dominated by existing sources that were included in the PSD baseline assessment (see Section 4.7).

Visibility Impairment Modeling Results - The CALPUFF simulation results for Craters of the Moon are presented in Table C.2-34. Under the Vitrification with Calcine Separations Option, the maximum 24-hour light extinction change slightly exceeds the 5-percent criterion for three days in a five-year period. There are no exceedances at Craters of the Moon under the Vitrification without Calcine Separations Option, nor are there any exceedances at Yellowstone or Grand Teton National Parks under either option.

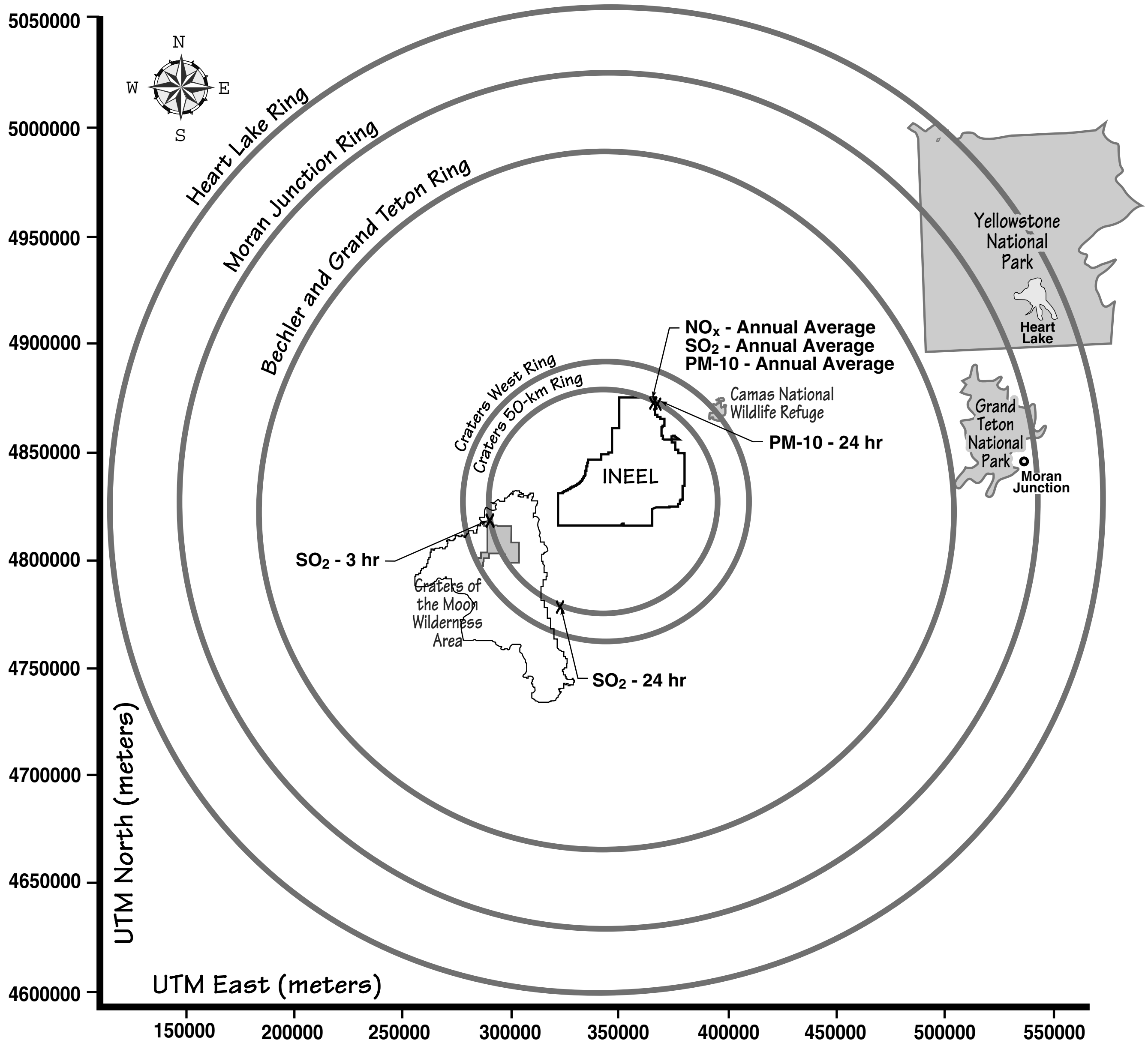

FIGURE C.2-2.
Model domain and polar receptor grid for the CALPUFF screening analysis of Class I Areas in the vicinity of INEEL (Direct Vitrification Alternative) where x denotes points of maximum impact.

Table C.2-33. Prevention of Significant Deterioration increment consumption at Class I Areas beyond 50 kilometers from INTEC for the combined effects of baseline sources and the Direct Vitrification Alternative.[a,b]

		Highest percentage of allowable PSD increment consumed	
	Averaging	Vitrification	
Pollutant	time	Without Calcine Separations	With Calcine Separations
Craters of the Moon[c]			
Sulfur dioxide	3-hour	28	29
	24-hour	40	45
	Annual	8.3	9.6
Particulate matter	24-hour	5.3	5.5
	Annual	0.72	0.75
Nitrogen dioxide	Annual	18	18
Yellowstone National Park			
Sulfur dioxide	3-hour	9.2	9.3
	24-hour	8.8	10
	Annual	1.0	1.2
Particulate matter	24-hour	1.7	1.7
	Annual	0.10	0.11
Nitrogen dioxide	Annual	0.87	0.88
Grand Teton National Park			
Sulfur dioxide	3-hour	8.9	9.0
	24-hour	8.8	10
	Annual	1.0	1.2
Particulate matter	24-hour	1.7	1.7
	Annual	0.10	0.11
Nitrogen dioxide	Annual	0.88	0.89

a. Source: Rood (2000b).
b. Assessed using CALPUFF.
c. Includes only that part of Craters of the Moon National Monument and Wilderness Area that is 50 kilometers or more from INTEC.
PSD = Prevention of Significant Deterioration.

Table C.2-34. Maximum calculated visibility impairment (light extinction change) at Craters of the Moon for the Direct Vitrification Alternative.[a]

	5-year analysis of light extinction change	
Option	Maximum 24-hour value (percent)	Number of days in excess of 5 percent acceptance criterion
Vitrification without Calcine Separations	1.1	0
Vitrification with Calcine Separations	6.7	3

a. Source: Rood (2000b). Performed using CALPUFF.

Appendix C.2 References

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