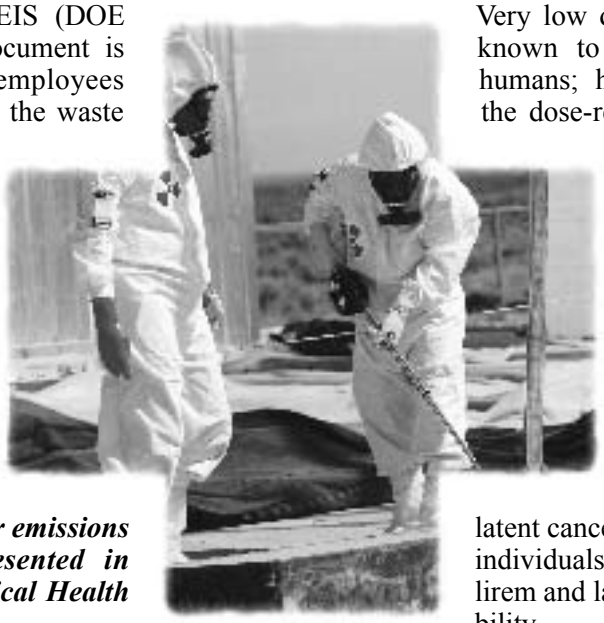
4.11 Health and Safety

This section presents the potential health effects to the public and workers as a result of current operations at INEEL. The discussion includes estimates of impacts from the release of radioactive and nonradioactive material and also includes occupational injury rates. Emphasis is placed on updating information presented in SNF & INEL EIS (DOE 1995) from which this document is tiered. Since INTEC employees would be affected most by the waste processing and facility disposition alternatives, this section emphasizes occupational health and safety at INTEC. Background information related to the material presented in this section and details on the health effects methodology are included in Appendix C.3. ***The baseline radiation dose from air emissions (see Section 4.7) is presented in Section 4.11.1.1, Radiological Health Risk.***



4.11.1 PUBLIC HEALTH AND SAFETY

As discussed in Section 4.7, the primary way in which activities under consideration in this EIS could affect public health is through airborne emissions. There is also a possibility of contamination of groundwater as noted in Section 4.8. Nevertheless, any contamination of soil or groundwater at the INEEL would not be expected to significantly affect the offsite public because of the ***long*** distances between the INTEC area and the offsite public.

A number of independent entities monitor and track both radioactive and nonradioactive releases from INEEL, in air and in water. These entities include the National Oceanic and Atmospheric Administration, the U.S. Geologic Survey, the State of Idaho's INEEL Oversight Program, the EPA, the State of Idaho's Department of Environmental Quality, the Idaho Department of Water Resources, and numerous university research programs and private contractors. Ongoing studies by the Centers for Disease Control and Prevention, an agency of the U.S. Department of Health and Human Services, also carefully tracks possible health effects from past activities at INEEL.

4.11.1.1 Radiological Health Risk

Very low doses of radiation are not known to cause health effects in humans; however, extrapolation of the dose-response relationship from high doses indicates that statistical effects might be observed in large populations. The doses reported in this EIS from INEEL operations are in this very low category. This EIS reports two values: collective dose (in person-rem) and the hypothetical number of latent cancer fatalities. For effects on individuals, DOE reports dose in millirem and latent cancer fatality probability.

Table 4-27 provides doses and latent cancer fatality probabilities from annual exposure due to routine airborne releases for the noninvolved worker ***for 1998*** and maximally exposed individual near the site boundary for years 1995, 1996, ***and 1999***. These doses are well below the current regulatory standard, which limits doses to the maximally exposed member of the public to 10 millirem per year (40 CFR 61).

Table 4-2***8*** provides summaries of the dose ***to the surrounding population*** and number of latent cancer fatalities based on annual exposure for 1995, 1996, ***and 1999***. ***Based on 1990 U.S. Census Bureau data***, the surrounding population ***consisted*** of approximately 120,000 people within a 50-mile radius of INEEL (ESRF 1997). ***(Using 2000 U.S. Census Bureau data, this population has increased to almost 140,000 (Pruitt 2002).)*** The total collective population dose for 1996 of 0.24 person-rem corresponds to much less than one latent cancer fatality within the entire population over the next 70 years

Table 4-27. Annual dose to individuals from exposure to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Maximally exposed individual	Annual dose (millirem)	LCF Probability
Onsite worker ***(1998)***[a]	***0.27***	***1.1×10^{-7}***
Offsite individual (public) (1995) [b]	***0.018***	***9.0×10^{-9}***
Offsite individual (public) (1996) [c]	0.031	1.5×10^{-8}
Offsite individual (public) (1999) [d]	***0.008***	***4.0×10^{-9}***

a. Maximum dose at any onsite area from permanent facility emissions for onsite worker ***(see Section 4.7).***
b. ESRF (1996) for offsite individual, 1995.
c. ESRF (1997) for offsite individual, 1996.
d. ESERP (2002) for offsite individual, 1999.
LCF = latent cancer fatality.

Table 4-28. Estimated increased health effects due to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Year	Population dose (person- rem)	Number of latent cancer fatalities
1995	0.08[a]	4.0×10^{-5}
1996	0.24[b]	1.2×10^{-4}
1999	***0.037***[c]	***1.8×10^{-5}***

a. ESRF (1996) for year 1995.
b. ESRF (1997) for year 1996.
c. ESERP (2002) for year 1999.

(ESRF 1997). The conversion from collective dose to number of latent cancer fatalities is performed using risk factors contained in the *1993 Limitations of Exposure to Ionizing Radiation* (NCRP 1993).

Production wells at INTEC and elsewhere on the INEEL are sampled and analyzed for gross alpha, gross beta, tritium, and strontium-90. ***During 1999, 51 of 60 samples contained gross alpha activities above the minimum detectable concentration. The highest concentration observed was 33 percent of the EPA maximum contaminant level for gross alpha activity in drinking water. Six samples had gross beta activities above the minimum detectable concentration. All samples were within the range for naturally occurring beta activity in the Snake River Plain Aquifer. Five onsite production wells and three drinking water distribution systems showed detectable concentrations of tritium in one or more samples. The highest concentration observed was 66 percent of the EPA maximum contaminant level for tritium in drinking water. There is a*** localized plume of strontium-90 in the groundwater near INTEC, ***which is*** routinely sampled. While samples have historically contained detectable levels of strontium-90, none of the 199***9*** samples indicated detectable concentrations of strontium-90 (***ESERP 2002***).

Potential ***lifetime*** health effects to the offsite population from the groundwater pathway are reported in the SNF & INEL EIS and were calculated as an estimated latent cancer fatality risk of 1 occurrence in 170 million.

4.11.1.2 Nonradiological Health Risk

The potential health risk to workers and the public from exposure to carcinogenic and noncarcinogenic chemicals was assessed in Volume 2, Section 4.12.1 of SNF & INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at INEEL. The three categories of exposed individuals were (1) a maximally exposed offsite individual, (2) population within 50 miles of

INTEC, and (3) noninvolved worker. The potential nonradiological health effects to workers and the public from routine air emissions calculated in DOE (1995) are summarized in the following paragraphs.

For non-occupational exposures to members of the public, data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose response values approved by the EPA (EPA 1993, 1994). The values included slope factors and unit risks for evaluating cancer risks, reference doses and reference concentrations for evaluating exposures to noncarcinogens, and primary National Ambient Air Quality Standards for evaluating criteria pollutants. For the individual noncarcinogenic toxic air pollutants (such as fluorides, ammonia, and hydrochloric and sulfuric acids), all hazard quotients were less than one. (The hazard quotient is a ratio of the calculated concentration in the air to the reference concentration.) This indicates that no adverse health effects would be projected as a result of noncarcinogenic emissions. The offsite excess cancer risk from carcinogenic emissions (such as arsenic, benzene, carbon tetrachloride, and formaldehyde) ranged from 1 in 1.4 million to 1 in 625 million. Current emission rates for some toxic pollutants (carcinogenic and noncarcinogenic) are higher than the baseline levels assessed in the SNF & INEL EIS, but resultant ambient concentrations are expected to remain below reference levels for public and occupational exposure. The hazard quotients for maximum baseline offsite criteria air pollutants were all less than one. These results indicate that no adverse health effects were projected from criteria pollutant emissions (DOE 1995). The recent actual site-wide emissions for criteria pollutants presented in Table 4-***11*** of this EIS would result in similar impacts. For each criteria pollutant except lead, the current (199***6*** and 199***7***) emission rates are less than the levels assessed in the SNF & INEL EIS. Table 4-1***2*** shows that ambient air concentrations offsite are all well below the ambient air quality standards.

For occupational exposures to workers at INEEL, DOE compared modeled chemical concentrations with the applicable occupational standard. The comparison was made by calculating hazard quotients, which for noncarcinogenic and carcinogenic air pollutants at INTEC were less than one. With one exception, the estimated INEEL concentrations of toxic air pollutants were estimated at levels well below those established for protection of workers. The exception was for maximum short-term benzene concentration, which slightly exceeded the standard at the maximum predicted location within the Central Facilities Area. These levels result primarily from emissions associated with petroleum fuel storage, handling, and combustion.

Drinking water from INTEC wells and distribution systems is routinely sampled for volatile organic compounds (***ESERP 2002***). For ***1999***, the EPA maximum contaminant levels and the State of Idaho drinking water limits were not exceeded. For chemical carcinogens, ***this means there would be*** an excess incidence of cancer risk of less than 1 occurrence in 1 million. No adverse health effects are expected as a result of ***noncarcinogenic chemical*** contaminants. Potable water at INEEL was monitored for coliform bacteria. ***Three of 76*** samples showed positive results for coliform at INTEC. ***All systems that tested positive were chlorinated and retested. This process is repeated until two consecutive samples show negative results for coliform bacteria (ESERP 2002).***

4.11.2 OCCUPATIONAL HEALTH AND SAFETY

The radiation doses and nonradiological hazards presented here are based on personnel monitoring data and reported occupational incidences at INEEL. For occupational exposure to ionizing radiation, health effects assessments are based on actual exposure measurements. For routine workplace hazards, the health risk is presented as reported injuries, illness, and fatalities in the workforce.

Risks to the worker are reduced by instituting health and safety programs. DOE relies on a program to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). An effective ALARA program must balance minimizing individual worker doses from external and internal sources with the goal to minimize the collective dose of

all workers in a given group. ALARA evaluations must consider individual and collective doses to ensure the minimization of both within the practical limits associated with minimization balancing. INEEL worker doses have typically been well below DOE worker exposure limits, and DOE will continue to use the ALARA program to maintain this level of safety.

DOE's Voluntary Protection Program was established to promote and recognize highly effective safety and health programs. Through the DOE-Voluntary Protection Program, INEEL's operating contractor has established a cooperative relationship in which management administers a comprehensive program that exceeds mere compliance and employees actively participate in the program and work with management to ensure a safe and healthful work site (LMITCO 1998).

Worker safety is also improved by the new Integrated Safety Management System. The INEEL Integrated Safety Management System Program Description (LMITCO 1999) is a document that defines the safety culture for INEEL. Safety at INEEL has been governed by many different procedures. This new plan outlines how all of the various safety programs, procedures, and documents relate to and integrate with each other. The term "safety" includes all aspects of environmental, safety, and health management including pollution prevention and waste minimization. The Plan covers the issues, responsibilities, methodologies, documents, and training (safety culture) that protects the worker, noninvolved worker, public, environment, and programmatic facilities (environmental targets).

4.11.2.1 Radiological Exposure and Health Effects

Radiological workers are trained to work safely in areas controlled for radiological purposes. Radiological workers at INEEL and INTEC may be exposed either internally (from inhalation and ingestion) or externally (from direct exposure) to radiation. The largest fraction of occupational dose received by INEEL and INTEC workers is from external radiation from direct exposure. The average occupational dose from ***1997*** to ***2000*** to individuals with measurable doses was ***84*** millirem, which results in an average annual collective dose of about ***77*** person-rem (DOE ***2000, 2001***). This collective dose corresponds to ***0.031*** LCFs resulting from each year of exposure to INEEL personnel, including INTEC personnel. The average occupational dose DOE-wide from ***1997*** to ***2000*** to individuals with measurable doses was ***76*** millirem, which results in an average annual collective dose of about ***1,310*** person-rem (DOE ***2000, 2001***); this corresponds to ***0.52*** LCFs resulting from each year of exposure to all DOE workers. For airborne emissions (as shown in Table 4-2***7***), the maximum dose to an onsite worker from permanent facility emissions is 0.***27*** millirem.

4.11.2.2 Nonradiological Exposure and Health Effects to the Onsite Population

At INEEL, occupational nonradiological health and safety programs include industrial hygiene programs and occupational safety programs. Total recordable case rate for injury and illness incidence at INEEL varied from an annual average of 3.1 to 3.7 per 200,000 work hours from 1992 to 1996. During this time, total lost workday cases ranged from 1.3 to 1.8 per 200,000 work hours (DOE 1997). The total recordable case rate for injury and illnesses for INEEL workers is less than that for DOE and its contractors at other facilities, which varied from 3.5 to 3.8 per 200,000 work hours. During this time, total lost workday case rate varied from 1.6 to 1.8 per 200,000 work hours (DOE 1997). Two fatalities have occurred at INEEL between 1992 and July 1998. One incident occurred when a construction worker fell from an elevated area. The second incident occurred when a carbon dioxide fire suppression system activated during routine maintenance in an electrical switchgear building, causing asphyxiation of one employee.