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**Department of Energy Programmatic
Spent Nuclear Fuel Management
and
Idaho National Engineering Laboratory
Environmental Restoration and
Waste Management Programs
Draft Environmental Impact Statement**

**Volume 2
Part B**

June 1994

**U.S. Department of Energy
Office of Environmental Management
Idaho Operations Office**

MASTER

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APPENDIX A

PRIMER ON RADIOACTIVITY AND TOXICOLOGY

This appendix gives a brief introduction to radioactivity and toxicology. In the radioactivity section, topics covered include radioactive decay, fission, radioactive wastes, and units and categories of exposure [taken from WINCO (1988)]. In the toxicology section, topics covered include a definition of toxic and toxicology, how substances or materials can be toxic, major types of toxic substances and wastes, and major factors in determining toxicity. In addition to the sections covering these topics, a third section discusses exposure pathways, which have the same attributes whether the source of the exposure is radioactive or toxic.

A-1 Radioactivity

Through natural or man-made processes, atoms of elements can be put in an unstable state. When an atom is in an unstable state, its nucleus (which is made up of protons and neutrons) will undergo a process of change by releasing energy in order to achieve stability. This change can come about through either radioactive decay or fission.

Radioactive decay is the process whereby the nuclei (plural of nucleus) of unstable atoms emit energy in the form of subatomic-sized particles or light-like waves in order to become stable. As this emitted energy, termed ionizing radiation, passes through a material, it can change the chemical structure and behavior of the material's atoms. It is through this process of chemical structure change that radiation can lead to biological damage in humans. The level of damage depends on several factors, including the amount of energy absorbed.

Radioactive decay produces three main types of ionizing radiation: alpha particles, beta particles, and gamma rays. None can be detected by our senses. These types can each have different levels of energy and thus have varying abilities to penetrate and harm the human body. Because each type has different characteristics, different amounts of material must be used to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped, or shielded, by thin layers of material such as a single sheet of paper. Shielding for beta particles requires thicker material, such as several reams of paper or several inches of wood or water. For gamma

rays, which are highly penetrating, very thick material is required, such as several feet of paper or several inches of concrete or lead.

Fission is the process whereby a large nucleus (for example, uranium-235) absorbs a neutron and splits into two fragments, resulting in the release of energy. In each fission, two or three neutrons are released, on the average, which may go on to produce fissions of nearby nuclei. If in fact one or more of the released neutrons go on to cause additional fissions, and the process is repeated again and again, the effect is a self-sustained chain reaction, and a condition called criticality. When the tremendous energy released in fission is controlled (as in a nuclear reactor), it can be used for various benefits, such as to propel submarines or to provide electricity that can light and heat homes.

Radiation occurs on Earth in many forms, both natural and man-made. Natural forms include light, heat from the sun, and the decay of radioactive elements in the earth's crust. Radioactivity even exists naturally within the human body, mostly from potassium, which is an essential element for health. Man has also deliberately created sources of ionizing radiation for various uses, such as nuclear-power generation, diagnostic and therapeutic medicine, nondestructive testing of pipes and welds, and nuclear materials related to production of atomic weapons.

Radioactive waste is another possible product of activities dealing with radioactivity. The Department of Energy (DOE) manages various types of radioactive wastes, mostly generated by weapons production and nuclear-power research programs. Such wastes are classified as low-level, transuranic, or high-level. Also managed by DOE is spent nuclear fuel, which has been used as the fuel in a nuclear reactor and is highly radioactive (though not officially regarded currently as "waste"). Low-level waste is the least dangerous of these and can in some cases be handled with no shielding other than that provided by the waste's container. Transuranic waste, high-level waste, and spent nuclear fuel are more dangerous and require special handling procedures, shielding, and other measures to isolate them from people and the environment.

Special units are used to measure radiation and its effects. The most common units are roentgen, radiation absorbed dose (rad), roentgen equivalent man (rem), and person-rem.

The roentgen measures the amount of electrical charge (or ionization) produced by x-rays or gamma radiation in air. Rad is the amount of energy absorbed by a material. Neither the roentgen nor the rad gives an indication of biological damage. The rem equates the biological damage done to organisms regardless of the type of ionizing radiation absorbed. For external radiation exposure from gamma rays, roentgen, rad, rem, and effective dose equivalent are approximately equal. Person-rem is a unit of collective radiological dose, that is, the collective total dose to a population. Person-rem is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, then the collective dose would be 10 person-rem (100 persons x 0.1 rem). Current regulatory limits, as well as limits described in Volume 2, are expressed in effective dose equivalent.

The biological effects of ionizing radiation vary according to the type of radiation, the dose received, and the type of cell affected. Any dose of radiation can damage body cells. However, at low radiation levels, such as those administered to patients receiving x-rays or those received by workers handling radioactive wastes, damage to cells is so slight they can usually either repair themselves or be replaced by the regeneration of healthy cells.

Effective dose equivalent is another key term used in the radiological protection field to describe the damage that radiation exposure can do to the body. The effective dose equivalent measures the damage to the exposed individual's total body due to radiation exposure. The effective dose equivalent can be used to estimate the exposed individual's risk of health effects. effective dose equivalent takes account of variables such as different susceptibilities of body tissues to different forms of radiation. The effective dose equivalent is often referred to simply as dose.

Exposures are often classified into two categories: acute exposure, which is a large dose received over a few hours or less; and chronic exposure, which involves repeated small doses over a long time (months to years). Chronic doses are usually less harmful than acute doses because the time between exposures at low dose rates allows the body time to repair damaged cells.

A-2 Toxicology

When certain natural or man-made materials or substances have harmful effects that are not random or not solely at the site of contact, the materials or substances can be described as toxic (Ottoboni 1991). Toxicology is a branch of science dealing with the toxic effects that chemicals or other substances may have on living organisms.

Chemicals can be toxic for many reasons, including their ability to cause cancer; harm or destroy tissue or organs; or harm body systems such as reproductive, immune, blood-forming, or nervous systems (Ottoboni 1991). The following list gives a brief definition and examples of three types of substances that can be toxic:

- Carcinogens are substances that are known to cause cancer in humans or to cause cancer in animals and therefore may be capable of causing cancer in humans. Examples of generally accepted human carcinogens include asbestos, benzene, and vinyl chloride (Kamrin 1988).
- Some chemicals in controlled studies have been shown to cause a harmful or fatal effect. Examples include metals such as cadmium, lead, and mercury; strong acids such as nitric acid and sulfuric acid; some welding fumes; coal dust; sulfur dioxide; and some solvents (Ottoboni 1991).
- Some biological materials that may be toxic include various body fluids and tissues and infectious agents (Ottoboni 1991).

Some waste materials contain substances that may be toxic if not handled properly. Wastes are substances that are no longer useful or that may be discarded from manufacturing, maintenance, construction, or research operations. Some wastes contain toxic materials to which the public may be exposed if the waste is not treated, stored, or disposed of properly, so their handling and care is especially important.

There are two major types of nonradioactive wastes: industrial/commercial solid waste and hazardous waste. Industrial/commercial solid waste is waste generated by manufacturing or industrial processes that do not contain hazardous ingredients. Hazardous waste is any waste that is either characteristically hazardous or is listed as hazardous by the Resource Conservation and Recovery Act. Examples of hazardous waste include metals, such as selenium, arsenic, lead, and mercury, and organic compounds, such as carbon tetrachloride and trichloroethylene.

Even though chemicals can be toxic, many factors influence whether inhalation or ingestion of a particular substance has a toxic effect on humans (Ottoboni 1991). These factors include (a) how much of the substance the person comes into contact with, (b) whether the person inhales or ingests to a relatively large amount of the substance in a short time (called acute exposure) or a relatively small amount repeatedly (called chronic exposure), and (c) the period of time over which the exposure occurs.

Scientists determine a substance's toxic effect (or toxicity) by performing controlled tests on animals. In addition to environmental and physical factors, these tests help establish three other important factors that are considered when measuring toxicity: dose-response relationship, threshold concept, and margin of safety (Ottoboni 1991). The dose-response relationship is established as a result of controlled tests on animals. It relates percentage of animals with observable toxic effects to dose administered. Once an initial dose is administered, it is increased or decreased until, at the upper end, all animals are affected and, at the lower end, no animals are affected. The threshold concept means that most toxic chemicals will produce no effect if present in small enough amounts. Thus, there is a threshold of effect or a "no-effect level." Margin of safety is an arbitrary separation between the highest exposure level producing no adverse effect in any test animal species and the exposure level that has been estimated to be safe for humans. No margin of safety has been universally established. For some chemicals, a small margin of safety is sufficiently protective but for others a larger margin is required. The importance of margin of safety is that all factors related to use of the chemical are taken into account so a permissible exposure level is set well into the no-effect range.

To ensure protection of the health and safety of workers and the public, companies develop programs that help keep toxic exposures to a minimum. In some cases, specific levels are set by government or professional organizations. In others, the protection guideline is more strict

than a set exposure level. In any case, the greater the health hazard, the greater the level of protection required. For many toxic substances, the level of protection allows no exposure under normal conditions and much effort is made to ensure no exposure will result from accidents.

A-3 Exposure Pathways

Normal and emergency operations at some DOE facilities have the potential to expose workers or members of the public to radioactive or toxic materials. To maintain high levels of safety, specialists analyze exposure scenarios possible for normal operations and accidents. The materials involved and appropriate protective measures are also considered. The term used to describe these scenarios is "environmental exposure pathways." The following describes the four conditions that must exist to form a pathway by which radioactive or toxic materials can be transported through the environment to workers or the public (Maheras and Thorne 1993):

1. **Source term** - This is the material released to the environment, including the amount of radioactivity (if any) or mass of material, the physical form (solid, liquid, gas), particle size distribution, and chemical form.
2. **Environmental transport medium** - This can be air, surface water, ground water, or the food chain.
3. **Exposure route** - This is the method by which a person can come into contact with the material, for example, external exposure from contaminated ground or immersion in contaminated air or internal exposure from inhalation or ingestion of radioactive or toxic material.
4. **Human receptor** - This is the person or persons potentially exposed. The level of exposure depends on such factors as location, duration of exposure, time spent outdoors, and dietary intake.

These four elements define an exposure pathway. For example, one scenario might involve gases released from a stack as the source term, air as the transport medium, external gamma exposure from the passing cloud as the exposure route, and an onsite worker as the human receptor. Another scenario might involve a volatile organic compound as the source term, groundwater as the transport medium, ingestion of contaminated drinking water as the exposure route, and an offsite member of the public as the human receptor. No matter which pathway the scenario involves, local factors, such as water sources, agriculture, and weather patterns, also play a big role in determining the pathway's importance to potential exposures.

A-4 References

- Kamrin, M. A., 1988, *Toxicology--A Primer on Toxicology Principles and Applications*, Chelsea, Michigan: Lewis Publishers, Inc.
- Maheras, S. J. and D. J. Thorne, 1993, *New Production Reactor Exposure Pathways at the Idaho National Engineering Laboratory*, EGG-NPR-8957, EG&G Idaho, Inc., January.
- Ottoboni, M. A., 1991, *The Dose Makes the Poison: A Plain-Language Guide to Toxicology*, second edition, New York: Van Nostrand Reinhold.
- WINCO (Westinghouse Idaho Nuclear Co., Inc.), 1988, *Introduction to Radiological Safety: Study Guide*, Rev. 2, Idaho Falls, Idaho.

APPENDIX B

CONSULTATION LETTERS

This appendix will include consultation/approval letters between the U.S. Department of Energy and the U.S. Fish and Wildlife Service regarding threatened and endangered species, and between other State and Federal agencies as needed. Letters currently supplied are from U.S. Fish and Wildlife Service to the U.S. Department of Energy. Also included are coordination/mailling lists of interested organizations and individuals.

B-1 Consultation/Approval Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Idaho State Office, Ecological Services
4696 Overland Road, Room 576
Boise, Idaho 83705

January 26, 1994

Dr. Tim Reynolds
Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

Subject: INEL Species List Update
SP# 1-4-94-SP-46/updates 1-4-93-SP-362 File # 506.0000

Dear Dr. Reynolds:

The U.S. Fish and Wildlife Service (Service) is writing to update the species list SP-1-4-93-362 for the Department of Energy. That list is enclosed for your information. There are no additions or changes to the list; the previous list continues to fulfill the requirements of the Service under Section 7(c) of the Endangered Species Act of 1973 (Act), as amended. This officially updates the list as of the date of this letter, and provides you with a new reference number SP-1-4-94-46. You should refer to the new species list number in all subsequent correspondence and documentation.

Information regarding Federal agency obligations under the Act, biological assessments, and candidate species has been provided to you in previous correspondence from this office. If you have further questions, or would like the information sent to you again, please contact RICHARD Howard of this office at 208-334-1931.

Thank you for your continued interest in the Endangered Species Program.

Sincerely,

Charles H. Lobdell
State Supervisor

Enclosure

cc: FWS-ES, Portland
IDFG-HQ, Boise
IDFG-Reg. 6, Idaho Falls

LISTED AND PROPOSED ENDANGERED AND THREATENED
SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR
WITHIN THE AREA OF THE INEL PROJECTS
FWS-1-4-94-SP-46/UPDATES 1-4-93-SP-362

LISTED SPECIES

COMMENTS

Bald Eagle
(Haliaeetus leucocephalus)

Wintering area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbitt (C2)
(Brachylagus idahoensis)

Loggerhead Shrike (C2)
(Lanius ludovicianus)

Townsend's Big-eared Bat (C2)
(Plecotus townsendii)

Ferruginous Hawk (C2)
(Buteo regalis)

Long-billed Curlew (3c)
(Numenius americanus)

Painted milkvetch (3c)
(Astragalus ceramicus var. apus)

GENERAL COMMENTS

C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

3c = Category 3 Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

ENCLOSURE 2

FEDERAL AGENCIES' RESPONSIBILITY UNDER SECTIONS 7(a) AND (c)
OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species; or result in destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Major Construction Activities ^{1/}

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action^{2/} on listed and proposed species. The process begins with a Federal agency in requesting from FWS a list of proposed and listed threatened and endangered species (list attached). If the BA is not initiated within 90 days of receipt of the species list, the accuracy of the species list should be informally verified with our Service. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

We recommend the following for inclusion in the BA; an onsite inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

^{1/} A major construction activity is a construction project (or other undertaking having similar physical impacts) which is a major action significantly affecting the quality of human environment as referred to in the NEPA (42 U.S.C. 4332 (2)(c)).

^{2/} "Effects of the action" refers to the direct and indirect effects on an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Boise Field Station
4696 Overland Road, Room 576
Boise, Idaho 83705

December 15, 1992

R. S. Rothman
EIS Project Manager
Department of Energy
785 DOE Place
Idaho Falls, Idaho 83401

Subject: EIS - Environmental Restoration
and Waste Management (506.0110/1019.2036/ER 92/0911)

Dear Mr. Rothman:

The U. S. Fish and Wildlife Service is writing in response to your letter of November 10, 1992 concerning the preparation of an Environmental Impact Statement (EIS) for the Environmental Restoration and Waste Management (ER&WM) activities at the Idaho National Engineering Laboratory. On November 4, 1992 we responded with scoping statements to the Notice of Intent to Prepare an EIS and sent it to your office. This letter amends those scoping statements by providing a list of threatened, endangered and candidate species that are found in the area. For further information please contact Bill Mullins or Rich Howard of my staff at 208/334-1931.

Sincerely,

Charles H. Lobdell
Field Supervisor

cc: BFA (ERT), Washington, D.C.
FWS-FWE, Portland

LISTED AND PROPOSED ENDANGERED AND THREATENED
SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR
WITHIN THE AREA OF THE DEPARTMENT OF ENERGY'S
IDAHO NATIONAL ENGINEERING LABORATORY SITE
FWS-1-4-93-SP-84

LISTED SPECIES

COMMENTS

Bald Eagle
(Haliaeetus leucocephalus)

Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbit (C2)
(Brachylagus idahoensis)

Loggerhead Shrike (C2)
(Lanius ludovicianus)

Townsend's Big-eared Bat (C2)
(Plecotus townsendii)

Long-billed Curlew (3c)
(Numenius americanus)

Ferruginous Hawk (C2)
(Bufo regalis)

Painted milkvetch (3c)
(Astragalus ceramicus var. apus)

OTHER SPECIES

Lemhi milkvetch (<u>Astragalus aquilonius</u>)	USFS/BLM Sensitive
Plains milkvetch (<u>Astragalus gilviflorus</u>)	USFS/BLM Sensitive
Thistle milkvetch (<u>Astragalus kentrophyta</u> var. <u>lessiae</u>)	BLM Sensitive
Winged-seed evening primrose (<u>Camissonia pterosperma</u>)	BLM Sensitive
Nipple cactus (<u>Coryphantha missouriensis</u>)	INPS Monitor Species
Large-flowered gymnostris (<u>Gymnostris nudicaulis</u>)	BLM Sensitive
Spreading gilia (<u>Ipomopsis polycladon</u>)	BLM Sensitive
King's bladderpod (<u>Lesquerella kingii</u> var. <u>cobrensis</u>)	INPS Monitor Species
Tree-like oxytheca (<u>Oxytheca dendroidea</u>)	BLM Sensitive

GENERAL COMMENTS:

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C3 = Category 3 Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

Sensitive Species - USFS Those animal species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Sensitive Species - BLM Sensitive species are those designated by the state director, usually in cooperation with the state agencies responsible for managing the species as sensitive. They are those species that are 1) under status review by USFWS/NMFS; or 2) whose numbers are declining so rapidly that federal listing may become necessary; or 3) with typically small and widely dispersed populations; or 4) those inhabiting ecological refugia or other specialized or unique habitats.

INPS M = Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats.

Department of Energy

Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

April 26, 1994

Charles H. Lobdell
Field Supervisor
US Fish and Wildlife Service
4696 Overland Road, Room 576
Boise ID 83705

SUBJECT: Species List Update Request for the Spent Nuclear Fuel (SNF) and
Environmental Restoration and Waste Management (ER & WM) Environmental
Impact Statement (EIS) (OPE-EIS-94.235)

Dear Mr. Lobdell:

We are in receipt of your letter dated December 15, 1992, which provides a list of threatened, endangered, and candidate species for the above referenced project at the Idaho National Engineering Laboratory (INEL). Due to the length of time since the last request for information, we are formally requesting an update for any changes in species' status or additional available information regarding critical habitats. Thank-you for your consideration.

Sincerely,

A handwritten signature in cursive script, reading "Roger Twitchell".

Roger Twitchell
Acting NEPA Compliance Officer
EIS Project Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Idaho State Office, Ecological Services
4696 Overland Road, Room 576
Boise, Idaho 83705

May 18, 1994

Roger Twitchell
Acting NEPA Compliance Officer
Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

Subject: Species List Update for Environmental Restoration and
Waste Management
(SP# 1-4-94-SP-142/File# 506.0110)

Dear Mr. Twitchell:

The U.S. Fish and Wildlife Service (Service) is writing to provide you with an updated list of threatened, endangered, candidate, and proposed species which may occur on the project site at the Idaho National Engineering Laboratory. You requested the update in a letter to our office on April 26, 1994. There are no additions or changes to the previous list. This letter officially updates species list number 1-4-93-SP-84 and provides you with a new number 1-4-94-SP-142. You should refer to the new number in subsequent correspondence and documents.

Information concerning Federal agency obligations under the Endangered Species Act have been provided to you in the past. If you would like us to send you any of this information again or if you have questions, please contact Alison Beck Haas of my staff at (208)334-1931.

Thank you for your continued interest in the endangered species program.

Sincerely,

Susan B. Marten
for Charles H. Lobdell
State Supervisor, Ecological Services

Enclosure

cc: FWS-ES, Portland

ENCLOSURE

LISTED AND PROPOSED ENDANGERED AND THREATENED
SPECIES, AND CANDIDATE SPECIES THAT MAY OCCUR
WITHIN THE AREA OF THE DEPARTMENT OF ENERGY'S
IDAHO NATIONAL ENGINEERING LABORATORY SITE
SP# 1-4-94-SP-142

LISTED SPECIES

Bald Eagle
(Haliaeetus leucocephalus)

COMMENTS

Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

Pygmy Rabbit (C2)
(Brachylagus idahoensis)

Loggerhead Shrike (C2)
(Lanius ludovicianus)

Townsend's Big-eared Bat (C2)
(Plecotus townsendii)

Long-billed Curlew (3c)
(Numenius americanus)

Ferruginous Hawk (C2)
(Buteo Regalis)

Painted Milkvetch (3c)
(Astragalus ceramicus var. apus)

OTHER SPECIES

Lemhi Milkvetch
(Astragalus aquilonius)

USFS/BLM Sensitive

Plains Milkvetch
(Astragalus gilviflorus)

USFS/BLM Sensitive

Thistle Milkvetch
(Astragalus kentrophyta var.
jessiae)

BLM Sensitive

Winged-seed Evening Primrose (<u>Camissonia pterosperma</u>)	BLM Sensitive
Nipple Cactus (<u>Coryphantha missouriensis</u>)	INPS Monitor Species
Large-flowered Gymnosteris (<u>Gymnosteris nudicaulis</u>)	BLM Sensitive
Spreading Gilia (<u>Ipomopsis polycladon</u>)	BLM Sensitive
King's Bladderpod (<u>Lesquerella kingii</u> var. <u>cobrensis</u>)	INPS Monitor Species
Tree-like Oxytheca (<u>Oxytheca dendroidea</u>)	BLM Sensitive

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Sensitive Species - BLM Sensitive species are those designated by the state director, usually in cooperation with the state agencies responsible for managing the species as sensitive. They are those species that are: 1) under status review by the Service/National Marine Fisheries Service; or 2) whose numbers are declining so rapidly that federal listing may become necessary; or 3) with typically small and widely dispersed populations; or 4) those inhabiting ecological refugia or other specialized or unique habitats.

INPS M = Monitor Taxa that are common within a limited range as well as those taxa which are uncommon, but have no identifiable threats.

Department of Energy

Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

May 26, 1994

Ms. Mollie Beattie, Director
U. S. Fish and Wildlife Service
1849 C Street NW, MIB 3012
Washington, D. C. 20240

Subject: Department of Energy (DOE) Consultation Strategy in Conjunction with the Preparation of a Draft Programmatic Environmental Impact Statement (EIS). (OPE-EIS-94.302)

Dear Ms. Beattie:

The DOE Idaho Operations Office is preparing a draft EIS for DOE Programmatic Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory (INEL) Environmental Restoration and Waste Management (ER&WM) Programs.

The EIS is organized into two separate volumes. Volume I addresses programmatic spent nuclear fuel management for the entire DOE complex. Volume II covers spent nuclear fuel management and ER&WM management actions within the boundaries of the INEL. In order to fulfill our responsibilities to consult under the National Environmental Policy Act (NEPA) and the Endangered Species Act, we requested an updated species list for INEL and the surrounding area from the USFWS Idaho State Supervisor for Ecological Services. Our request was mailed on April 26, 1994 and the updated species list was received in our office May 23, 1994.

Volume I of the EIS deals with Programmatic Spent Nuclear Fuel issues that involve five DOE sites and five Navy sites. We have not specifically requested species lists in conjunction with the preparation of Volume I, although recent USFWS species lists were among the resources used in characterizing the sites and analyzing potential impacts to threatened and endangered species. Site specific NEPA documents will be prepared for actions based on decisions derived from the final programmatic EIS. It is our strategy to request species lists for these more detailed site specific environmental reviews.

We fully recognize our responsibility under NEPA and the Endangered Species Act to consult with your agency. This letter is to inform you of our strategy with regard to the programmatic aspects of this EIS.

Ms. Beattie

-2-

May 26, 1994

The draft EIS will be available for your review in early July 1994 through Lillian Stone's office of the Department of Interior (DOI) and we look forward to your review and comments through DOI's consolidated response. If you have any questions concerning this or related matters please contact me at (208) 526-0776.

Sincerely,

A handwritten signature in cursive script, reading "Roger Twitchell".

Roger Twitchell
Acting NEPA Compliance Officer

B-2 Public Involvement

In scoping this EIS, DOE actively solicited comments from a wide group of interested parties. DOE published a Notice of Intent announcing the scoping period for a programmatic EIS addressing environmental restoration and waste management activities (including spent nuclear fuel management) across the entire DOE complex in the *Federal Register* (see 55 F.R., No. 204; Oct. 22, 1990; p. 42633), as required under the National Environmental Policy Act. Written comments, as well as oral comments received at 23 public scoping meetings, were received in response to this announcement. Comments were received on the Draft Implementation Plan for the DOE Programmatic EIS during six regional workshops held across the country in early 1992. In October 1992, a Notice of Intent was published in the *Federal Register* (see 57 F.R., No. 193; Oct. 5, 1992; p. 45773), addressing the Idaho National Engineering Laboratory (INEL) environmental restoration and waste management and spent nuclear fuel activities. Five scoping meetings were subsequently held throughout Idaho at which additional comments were received.

DOE published a Notice of Opportunity to Comment announcing its intention to expand the scope of the ongoing Spent Nuclear Fuel (SNF) and INEL EIS to include a review of spent nuclear fuel management alternatives across the entire DOE complex (see 58 F.R., No. 170; Sept. 3, 1993; p. 46951). Government agencies and the public were invited to comment on the expanded scope. The Notice of Opportunity included a toll-free telephone number to which comments could be sent by facsimile, oral comments could be recorded for later transcription, or information could be requested. To facilitate the scoping and public involvement process, DOE has compiled a mailing list that contained the addresses of interested agencies, organizations, and individuals. As a result of this effort, numerous comments were received which have contributed to EIS planning.

As a result of the scoping process and related activities, DOE developed its mailing list of potentially interested parties for the initial distribution of the EIS. This list for the draft EIS includes more than 1000 Federal, state, and local agencies; public organizations; and private citizens to whom the EIS (or a Summary only, if so requested) is to be made available for review and comment during the comment period. The list will also be updated based on responses to the

Notice of Availability for the draft EIS. A copy of the most current version of the list can be obtained from the DOE point-of-contact for the EIS.

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INFORMATION SUPPORTING THE ALTERNATIVES

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PROJECT SUMMARIES

INTRODUCTION

This appendix presents summaries for two types of projects in the spent nuclear fuel and environmental restoration and waste management activities at the Idaho National Engineering Laboratory (INEL). These are

- 1. Foreseeable proposed projects where some funding for preliminary planning and/or conceptual design may already be authorized, but detailed design or planning will not begin until the Department of Energy (DOE) has determined that the requirements of the National Environmental Policy Act process for the project have been completed (Section C-1).**
- 2. Planned or ongoing projects not yet completed but whose National Environmental Policy Act documentation is already completed or is expected to be completed before the Record of Decision for this Environmental Impact Statement (EIS) is issued (Section C-2).**

This EIS provides additional National Environmental Policy Act evaluations for 12 of the projects over and above the evaluations provided for all 49 projects. Four the 12 projects would implement portions of the Spent Fuel Program, and 8 of the projects would implement portions of the Waste Management Program. The 12 projects are as follows:

- Expended Core Facility Dry Cell Project**
- Increased Rack Capacity for CPP-666**
- Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping**
- Fort St. Vrain Spent Nuclear Fuel Shipment and Storage**
- Tank Farm Heel Removal Project**

-
- Sodium-bearing and calcine waste treatment technology selection (This treatment selection would be implemented through the Waste Immobilization Facility. Additional analyses would be required for the facility itself.)
 - High-Level Tank Farm New Tanks
 - Shipping/Transfer Station
 - Waste Experimental Reduction Facility Incineration
 - Nonincinerable Mixed Waste Treatment
 - Industrial/Commercial Landfill Expansion
 - Gravel Pit Expansions.

The project summaries describe the projects (both foreseeable proposed and ongoing). They provide specific information necessary to analyze the environmental impacts of these projects. Chapter 3 describes which alternative(s) each project supports. Summaries are included for (a) spent nuclear fuel projects, (b) environmental remediation projects, (c) the decontamination and decommissioning of surplus INEL facilities, (d) the construction, upgrade, or replacement of existing waste management facilities, (e) infrastructure projects supporting waste management activities, and (f) research and development projects supporting waste management activities.

Each project summary contains a narrative and a data sheet. The narrative includes a general project objective, a project description, and project specific options (alternatives) where these differ from the EIS alternatives or are options within an EIS alternative. The data sheets provide the data used in the analysis of the socioeconomics, land use, water resources and geology, traffic and transportation, ecology, energy, waste and materials, health and safety, facilities, and environmental monitoring impacts. Air emission data used in analyses are located in Appendix F, Section F-3, Air Resources.

A generic data sheet is shown in Figure C-1, and a guide to the types of data on these sheets is given in Figure C-2.

Figure C-1. Generic data sheet.

Project Data Sheet			Rev.	Date	
G e n e r a l c o n s t r u c t i o n s	Description/function:	(1)	C	Cultural resource effects:	(16)
	WAG	(2)	o	Pits/ponding created: (m2)	(17)
	EIS Alter. (A, B, C or D):	(3)	n	Water usage: (liters)	(18)
	SNF or Waste stream:	(4)	s	Energy requirements:	(19)
	Action type:	(5)	t	Electrical: (MWH/yr)	
	Structure Type: Size: (m2)	(6)	.	Fossil fuel: (liters)	
				Nightlights used: Y/N	(20)
			Generators: Night Y/N Day Y/N	(21)	
Other features: (Pits, ponds, power /water/sewer lines)		O	Cost(\$): Operation:	(22)	
Location:	(7)	p	Schedule Start /End:		
Inside/outside of fence Inside/outside of bldg.		e	No. of workers: (new/exist)	(23)	
C o n s t r u c t i o n s	Cost(\$): PreConst.	(8)	r	Heavy Equip. Equip. used:	(24)
	Cost(\$): Const.		a	Trips:	
	Schedule Start /End: PreConst.		t	Air Emissions:	(25)
	Schedule Start /End: Const.		l	(None / Ref.)	
	No. of workers: (new/exist)	(9)	o		
	Heavy Equip. Equip. used:	(10)	a	Effluents:	(26)
	Trips:		l	Type:	
	Acres Disturbed: New	(11)	l	Quantity: (liters/yr)	
	Previous		n	Solid wastes:	(27)
	Revegetated		f	Type:	
Air Emissions:	(12)	o	Quantity: (m3/yr)		
(None / Ref.)		r	Haz./Toxic Chemicals:	(28)	
Effluents:	(13)	m	Storage/inventory		
Type:		a	Pits/ponds used: Y/N (m2)	(29)	
Quantity: (liters)		t	Water usage: (liters/yr)	(30)	
Solid wastes:	(14)	l	Energy requirements:	(31)	
Type:		l	Electrical: (MWH/yr)		
Quantity: (m3)		o	Fossil fuel: (liters/yr)		
Haz./Toxic Chemicals:	(15)	n	Nightlights used: Y/N	(32)	
Storage/inventory			Generators: Night Y/N Day Y/N	(33)	

Purpose: The Project Data Sheets provide project specific data for INEL spent nuclear fuel and environmental restoration and waste management activities.

Content: The Project Data Sheets are used for three types of projects: (a) projects with a construction and operations phase, (b) decontamination and decommissioning (D&D) projects, and (c) projects with an operations phase only.

I. Generic Information

- (1) *Description/function:* is the project title.
- (2) *Waste Area Group (WAG):* identifies which INEL grouping is used to facilitate the project's environmental remediation efforts.

<u>Waste Area Group</u>	<u>Operational Area</u>
WAG 1	Test Area North (TAN)
WAG 2	Test Reactor Area (TRA)
WAG 3	Idaho Chemical Processing Plant (ICPP)
WAG 4	Central Facilities Area (CFA)
WAG 5	Power Burst Facility (PBF)/Auxiliary Reactor Area (ARA)
WAG 6	Experimental Breeder Reactor No. 1 (EBR-I)
WAG 7	Radioactive Waste Management Complex (RWMC)
WAG 8	Naval Reactors Facility (NRF)
WAG 9	Argonne National Laboratory-West (ANL-W)
WAG 10	Miscellaneous surface sites and liquid disposal areas throughout the INEL that are not included within other Waste Area Groups.

- (3) *EIS Alternative:* identifies in which EIS Volume 2 alternative the project is to be included.
- Alternative A (No Action)
 - Alternative B (Ten-Year Plan)
 - Alternative C (Minimum Treatment, Storage, and Disposal)
 - Alternative D (Maximum Treatment, Storage, and Disposal)

Figure C-2. Project data sheet guide.

-
- (4) *Spent nuclear fuel or waste stream*: identifies if the project is an spent nuclear fuel project, or which Waste Management Program waste stream the project affects, or if the project is an environmental restoration or infrastructure project.

Spent nuclear fuel (SNF)

High-level waste (HLW)

Transuranic waste (TRU), includes alpha-low-level waste (α -LLW)

Low-level waste (LLW)

Mixed low-level waste (MLLW)

Greater-than-Class-C waste (GTCC)

Hazardous waste (HW)

Environmental restoration (ER)

Infrastructure (Infra).

- (5) *Action type*: identifies the major objective of the project. New - construction of a new facility; D&D - D&D of an existing facility; Expand - expand a facility or process; Modification - modify a facility or process; Operation - operation of an existing capability.

- (6) *Structure type*: identifies the type of structure to be constructed by the project. D&D projects list the facilities that would be affected. The size of the structure (square meters) and significant features are also listed.

- (7) *Location*: identifies the physical location of the project in reference to existing INEL facilities.

II. Construction or D&D information (The D&D Data Sheet is basically the same as the Construction Data Sheet, but does not include an operations section.)

- (8) *Preconstruction (Pre-D&D) costs*: identifies the project costs prior to construction (D&D).

Construction (D&D) costs: identifies all costs associated with construction (D&D).

Schedule dates: for these activities, provided in a calendar year format (for example, 1995).

- (9) *Number of workers*: identifies the projected number of workers that would be required for construction (D&D).

Figure C-2. (Continued).

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- (10) *Heavy equipment*: defines equipment that would be used during construction (D&D) and estimated traffic volumes to and from the construction (D&D) site.
 - (11) *Acres disturbed*: provides a description of projected land use.
 - (12) *Air emissions*: Project specific air emissions for construction (D&D) can be found in the Technical Support Document for Air Resources.
 - (13) *Effluents*: identifies the type and amount of liquid wastes that would be generated during construction (D&D).
 - (14) *Solid wastes*: identifies the type and amount of solid wastes that would be generated during the construction (D&D) of this project.
 - (15) *Hazardous/toxic chemicals*: lists the types and amounts of hazardous and toxic chemicals that would be present at the construction (D&D) site.
 - (16) *Cultural resource effects*: identifies issues that would relate to cultural resources and historic preservation of the construction (D&D) site.
 - (17) *Pits and ponding created*: identifies if a new pit or pond would be used during construction (D&D), and lists its area in square meters.
 - (18) *Water usage*: identifies the total amount of water that would be used during construction (D&D).
 - (19) *Energy requirements*: indicates the amount of electricity and fossil fuels that would be needed during construction (D&D).
 - (20) *Night lights*: identifies if night lights would be used during construction (D&D) activities.
 - (21) *Generators*: identifies if a generator would be required during construction (D&D).

Figure C-2. (continued)

III. Operational Information

- (22) *Operation costs*: identifies the projects operating cost for a given period of time. *Schedule* identifies the start and ending operation dates.
- (23) *Number of workers*: identifies the projected number of workers that would be required for operations.
- (24) *Heavy equipment*: defines equipment that would be used during operations and estimated traffic volumes to and from the operations site.
- (25) *Air emissions*: identifies the reference for the operations air emission analyses, or lists the type and amount of air emissions to the environment during operations.
- (26) *Effluents*: identifies the type and amount of liquid wastes that would be generated during operations.
- (27) *Solid wastes*: identifies the type and amount of solid wastes that would be generated during the operation of this project.
- (28) *Hazardous/toxic chemicals*: lists the types and amounts of hazardous and toxic chemicals that would be present at the operation site.
- (29) *Pits and ponding used*: identifies if a pit or pond would be used during operations.
- (30) *Water usage*: identifies the yearly amount of water that would be used during operations.
- (31) *Energy requirements*: identifies the yearly amount of electricity and fossil fuels that would be needed for operations.
- (32) *Night lights*: identifies if new night lights would be used during operations.
- (33) *Generators*: identifies if a new generator would be required during operations.

Figure C-2. (Continued).

C-1 Foreseeable Projects

Foreseeable projects, for which detailed design or planning would not begin until DOE has determined that the requirements of the National Environmental Policy Act process have been completed for the project, are listed in Table C-1 and are described in this section. Some projects support management of more than one waste stream.

Table C-1. Foreseeable projects associated with programs and waste streams.

Program	Project Name	Facility Location
Spent Nuclear Fuel Projects		
Spent Nuclear Fuel	Expended Core Facility Dry Cell Project	Naval Reactors Facility (NRF)
	Increased Rack Capacity for CPP-666	Idaho Chemical Processing Plant (ICPP)
	Additional Increased Rack Capacity (CPP-666)	ICPP
	Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping	ICPP
	Fort St. Vrain Spent Nuclear Fuel Shipment and Storage	ICPP
	Spent Fuel Processing	ICPP
	Experimental Breeder Reactor (EBR)-II Blanket Processing	Argonne National Laboratory - West (ANL-W)
	Actinide Recycle Demonstration	ANL-W
Decontamination and Decommissioning (D&D) Projects		
Environmental Restoration	Central Liquid Waste Processing Facility D&D	ANL-W
	Engineering Test Reactor D&D	Test Reactor Area (TRA)
	Materials Test Reactor D&D	TRA

	Fuel Processing Complex (CPP-601) D&D	ICPP
	Fuel Receipt and Storage Facility (CPP-603) D&D	ICPP
	Headend Processing Plant (CPP-640) D&D	ICPP
	Waste Calcine Facility (CPP-633) D&D	ICPP
Waste Management	High-Level Waste Projects	
	Tank Farm Heel Removal Project	ICPP
	Waste Immobilization Facility	ICPP
	High-Level Tank Farm New Tanks	ICPP
	New Calcine Storage	ICPP
	Radioactive Scrap/Waste Facility	ANL-W
	Transuranic Waste Projects	
	Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment	INEL
	Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste	Radioactive Waste Management Complex (RWMC)
	Idaho Waste Processing Facility	Idaho National Engineering Laboratory (INEL)
	Shipping/Transfer Station	RWMC
	Radioactive Scrap/Waste Facility	ANL-W
	Low-Level Waste Projects	
	Waste Experimental Reduction Facility Incineration	Power Burst Facility/ Auxiliary Reactor Area (PBF/ARA)
	Idaho Waste Processing Facility	INEL
	Mixed/Low-Level Waste Treatment Facility	INEL
	Mixed/Low-Level Waste Disposal Facility	INEL
	Shipping/Transfer Station	RWMC

Radioactive Scrap/Waste Facility	ANL-W
Mixed Low-Level Waste Projects	
Waste Experimental Reduction Facility Incineration	PBF/ARA
Idaho Waste Processing Facility	INEL
Mixed/Low-Level Waste Treatment Facility	INEL
Nonincinerable Mixed Waste Treatment	TRA/PBF
Mixed/Low-Level Waste Disposal Facility	RWMC
Remote Mixed Waste Treatment Facility	ANL-W
Sodium Processing Project	ANL-W
Shipping/Transfer Station	RWMC
Radioactive Scrap/Waste Facility	ANL-W
Greater-Than-Class-C Projects	
Greater-Than-Class-C Dedicated Storage	TRA or Test Area North (TAN)
Hazardous Waste Projects	
Hazardous Waste Treatment, Storage, and Disposal Facilities	INEL
Infrastructure Projects	
Industrial/Commercial Landfill Expansion	Central Facilities Area (CFA)
Gravel Pit Expansions	INEL
Central Facilities Area Clean Laundry and Respirator Facility	CFA
Research and Development Projects	
Calcine Transfer Project (Bin Set #1)	ICPP
Plasma Hearth Process Project	ANL

C-2 Ongoing Projects

Ongoing projects, not yet completed, but whose National Environmental Policy Act documentation has been completed or is expected to be completed before the Record of Decision for this Environmental Impact Statement is issued, are listed in Table C-2 and are described in this section.

Table C-2. Ongoing projects associated with programs and waste streams.

Program or Waste Stream	Project Name	Facility Location
Spent Nuclear Fuel	Test Area North Pool Fuel Transfer	Test Area North (TAN)
Environmental Restoration (ER) Remediation	Remediation of Groundwater Contamination	TAN
	Pit 9 Retrieval	Radioactive Waste Management Complex (RWMC)
	Vadose Zone Remediation	RWMC
ER Decontamination & Decommissioning	Auxiliary Reactor Area (ARA)-II D&D	Power Burst Facility (PBF)/ARA
	Boiling Water Reactor Experiment (BORAX)-V D&D	Experimental Breeder Reactor (EBR)/BORAX
High-Level Waste	High-Level Tank Farm Replacement (upgrade phase)	ICPP
Transuranic Waste	Transuranic Storage Area Enclosure and Storage Project	RWMC
	Waste Characterization Facility	RWMC
Low-Level, Mixed Low-Level, and Hazardous Waste	Waste Handling Facility	Argonne National Engineering Laboratory - West (ANL-W)
Infrastructure	Health Physics Instrument Lab	Central Facilities Area (CFA)
	Radiological and Environmental Sciences Laboratory Replacement	CFA

PROJECT SUMMARIES
DESCRIPTIONS

**Projects
Related to
Spent Nuclear Fuel**

EXPENDED CORE FACILITY DRY CELL PROJECT

PROJECT NAME: Expended Core Facility Dry Cell Project

GENERAL PROJECT OBJECTIVE: The general project objective of the Expended Core Facility Dry Cell project would be to provide additional capacity for naval spent nuclear fuel module preparation. If implemented, the new Dry Cell would improve module preparation efficiency, minimize transportation, preclude disturbances of other sites, and make efficient use of existing facilities.

The amount of naval spent nuclear fuel removed from ships and prototypes is expected to increase over the next two decades because the growth in the nuclear-powered fleet during the 1970s and 1980s has resulted in an increase in defuelings and refuelings in the 1990s and later. Historically, naval spent nuclear fuel was transported from the defueling location to the Idaho National Engineering Laboratory (INEL) where it was unloaded into water pools at the Expended Core Facility. The spent nuclear fuel modules were prepared for examination and storage by removing the nonfuel structural sections in the Expended Core Facility water pools. After preparation and examination, the fuel bearing sections were shipped to the Idaho Chemical Processing Plant for storage. Removal of nonfuel structural sections is needed to minimize the amount of material managed as spent nuclear fuel. If an alternative in this EIS were implemented that involves continued use of the Expended Core Facility, an increase in existing capacity for preparing modules would be needed to accommodate the projected increase in naval spent nuclear fuel.

PROJECT DESCRIPTION: The Expended Core Facility is located within the confines of the Naval Reactors Facility at the INEL. It is a large laboratory facility used to receive, examine, prepare for storage, and ship naval spent nuclear fuel and irradiated test specimen assemblies. The information derived from the examinations performed at the Expended Core Facility provide engineering data on nuclear reactor environments, material behavior, and design performance. These data are used to develop longer-lived naval fuel and to ensure fuel already in use in warships can be operated as long as possible. Naval spent nuclear fuel is prepared at the Expended Core Facility for storage and shipment to the Idaho Chemical Processing Plant.

The building that houses Expended Core Facility is a concrete block structure approximately 1000 feet by 194 feet. This space provides offices and enclosed work areas, including an array of interconnected reinforced concrete water pools that permit visual observation of naval spent nuclear fuel during handling and inspection while shielding workers from radiation. Adjacent to the water pools are shielded cells used for operations that must be performed dry. Access to Expended Core Facility for receipt and shipping of large containers is provided by large roll-up doors that allow railcar and truck entry.

Expended Core Facility has been specifically designed to provide the unique physical and administrative controls required by the Naval Nuclear Propulsion Program to ensure safe handling of irradiated and contaminated nuclear fuels and components with a high degree of worker safety and protection for the environment.

This project would provide for the design, construction, and operation of a facility for the preparation of naval spent nuclear fuel modules for shipment to processing and storage facilities. The primary function of the facility would be to remove nonfuel structures from the fuel modules, thereby reducing the volume of material that must be managed as fuel. Additionally, control rods would be fastened to the fuel modules to ensure shutdown conditions are maintained. This work would be performed in a shielded, radiologically controlled area with remotely operated equipment utilizing proven fuel handling methods. The facility would be designed for a 40-year life, built of structural steel and concrete, and would be integral with the existing Expended Core Facility building.

The major element of the Dry Cell Facility would be a large reinforced concrete shielded cell with interior dimensions of 22 feet wide by 84 feet long by 21 feet high, containing all the equipment necessary to inspect and disassemble fuel modules. The facility would have the capability to prepare and load one fuel module per shift in a shipping cask. Based on a two shift per day operation (500 shifts per year), and a 25-percent maintenance downtime, the Dry Cell Facility yearly capacity is expected to be about 375 modules. Shielded decontamination and repair cells would be attached to the main shielded cell to allow remote decontamination and repair of equipment used throughout Expended Core Facility.

The cell design would incorporate 4-foot thick, radiation shielding walls constructed of high-density and normal-density concrete. The shielding would be designed to limit radiation levels in normally occupied areas around the cell to 0.1 millirem per hour or less. At the INEL site boundary, there would be no measurable elevation above the naturally occurring background radiation levels. The dry cell design would meet the latest seismic requirements and would include negative pressure air ventilation for radiological contamination control. Shielded lead glass windows and viewing aids would be provided as required at the work stations. Power, lighting, and a fire suppression system would also be provided.

The dry cell would also be designed to facilitate decontamination and decommissioning at some future date. This would be achieved by including cell liner contamination barriers, no fixed embedded piping, a minimum of cracks and crevices, smooth surfaces, and wall penetrations large enough to be radiologically surveyed to verify decontamination effectiveness.

The dry cell would be attached to the existing Expended Core Facility building and provisions would be made to transfer fuel modules between the dry cell and existing water pit facilities where similar work is presently performed. Operations of the dry cell would increase the efficiency of fuel module preparation at the Expended Core Facility by performing the operations dry instead of using the current underwater process. The very small risk of an inadvertent criticality would be further reduced since the spent nuclear fuel would be handled out of water, a neutron moderator.

The principal solid low level waste generated would be the radioactive non-fuel structures removed from the fuel modules in the dry cell. This material would be shipped to the Radioactive Waste Management Complex for disposal.

The work that would be performed in the dry cell facility is comparable to that currently performed in the existing water pools at the Expended Core Facility. Moving this work from the water pools to the dry cell facility is not expected to result in any increases in air emissions, water usage, or energy requirements for the Expended Core Facility as a whole. Air emissions would occur from the dry cell facility; however, these would be offset by corresponding reductions in emissions from the rest of the Expended Core Facility. A similar offset would be expected for water and energy usage. Since the overall emissions from the Expended Core Facility are not

expected to change, no changes in environmental impacts associated with the operation of the dry cell would be expected.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the spent nuclear fuel and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

The option to phase out examinations at the Expanded Core Facility is evaluated in Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) of Volume 2 of this EIS. The following presentation and evaluation of options are specific to meeting the need of increased capacity at the Expanded Core Facility for removing nonfuel structural sections. This need would only exist if an alternative were implemented that involves continued operation of the Expanded Core Facility for examination and preparation for storage of naval spent nuclear fuel.

No Action - Under this option, the Dry Cell would not be constructed. This option corresponds with Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Naval spent nuclear fuel modules would be prepared with existing equipment at the Expanded Core Facility. This option would not efficiently meet the need for greater capacity to accommodate the projected increase of naval spent nuclear fuel that would be received at the Expanded Core Facility over the next two decades. Performing this work in the Expanded Core Facility water pools would be much more expensive.

Remove the Nonfuel Structural Sections at Servicing Facility - If this option were implemented, the naval spent nuclear fuel modules would be prepared at the location where it was removed from the reactor during servicing. This option would meet the needs identified above. This option would require additional handling of the spent nuclear fuel, construction of new facilities with specialized equipment (five facilities instead of one, with no reduction in environmental impact), and additional transportation at each of the five servicing facilities. The Expanded Core Facility already has the trained personnel, proven procedures, and specialized facilities and equipment necessary for this work. If the spent nuclear fuel modules were prepared at the

Expended Core Facility, the fuel section could be transferred to another part of the Expended Core Facility for more detailed examination without having to load it into a transport cask for shipment to another location for examination.

Prepare the Modules at Another Location - If this option were carried out, naval spent nuclear fuel would be transported to a central location where it would be unloaded, the nonfuel structural sections removed, and the fuel section reloaded into a transport cask and shipped to the Expended Core Facility for examination. This option would require additional handling, construction of new facilities, installation of specialized equipment, and additional transportation.

Phase Out Removing Nonfuel Structural Sections - If this option were implemented, naval spent nuclear fuel would be examined and stored without removing the nonfuel structural sections. In some cases, this would make internal examination of the spent nuclear fuel modules more difficult. New equipment and procedures would need to be developed to perform the internal examinations. Implementing this option would increase the amount of material to be managed as spent nuclear fuel since the nonfuel structural sections can be disposed of as low-level waste when removed.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 June 1, '94		
G	Description/function:	ECF Dry Cell Project	C	Cultural resource effects:	None identified
e			o	Pits/ponding created: (m2)	No
n	WAG	8	n	Water usage: (liters)	
e	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	
r	SNF or Waste stream:	SNF	t	Electrical: (MWH/yr)	
l	Action type:	Expand	.	Fossil fuel: (liters)	
c	Structure Type:	Building Expansion		Nightlights used: Y/N	No
	Size: (m2)	172		Generators: Night Y/N	No
l		500 m3 concrete		Day Y/N	Yes
n	Other features:	None	O	Cost(\$): Operation:	(\$3.74 Mil./yr Savings)
f	(Pits, ponds, power		p	Schedule Start /End:	1998 - TBD
o	/water/sewer lines)		e	No. of workers: (new/exist)	no new above current level
.	Location:		r	Heavy Equip. Equip. used:	None
	Inside/outside of fence	Inside NRF	a	Trips:	
	Inside/outside of bldg.	Inside ECF NRF-618	t	Air Emissions:	
C	Cost(\$): PreConst.	\$200 K	l	(None / Ref.)	No Increase from ECF
o	Cost(\$): Const.	\$47.446 Mil.	o		
n	Schedule Start /End: PreConst.	1988 - 1992	n		
s	Schedule Start /End: Const.	1993 / 1996 - 1998	a	Effluents:	
t	No. of workers: (new/exist)	66 Peak Subs.	l	Type:	None
r	Heavy Equip. Equip. used:	Trucks		Quantity: (liters/yr)	
u	Trips:		l	Solid wastes:	
c	Acres Disturbed: New	0	n	Type:	LLW Ind.
t	Previous	0	f	Quantity: (m3/yr)	113 100
l	Revegetated	0	o	Haz./Toxic Chemicals:	None
o	Air Emissions:		r	Storage/inventory	
n	(None / Ref.)	See Belanger et al., 1994	m	Pits/ponds used: Y/N (m2)	No
l	Effluents:		a	Water usage: (liters/yr)	No Increase from ECF
n	Type:	Construction Water	t	Energy requirements:	
f	Quantity: (liters)		l	Electrical: (MWH/yr)	No Increase from ECF
o	Solid wastes:		o	Fossil fuel: (liters/yr)	
.	Type:	Ind.	n	Nightlights used: Y/N	No
	Quantity: (m3)	500		Generators: Night Y/N	No
	Haz./Toxic Chemicals:	None		Day Y/N	No
	Storage/inventory				

INCREASED RACK CAPACITY FOR CPP-666

PROJECT NAME: Increased Rack Capacity for CPP-666

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to ensure the near-term capability of the Idaho Chemical Processing Plant to continuously receive and store nuclear fuel by increasing the capacity for fuel storage in three storage pools in the Fuel Storage Area at CPP-666. This process is commonly called reracking and involves replacing fuel storage racks in Pools #1, #5, and #6. The need for this project comes from an analysis of Idaho Chemical Processing Plant fuel storage requirements that demonstrates additional storage capacity would be required under several of the alternatives. The results of the analysis show the following:

- Fuel Storage Area fuel storage in Pool #6 for aluminum clad (research) fuel would be filled by Spring 1993, but the date can be extended to 1994 or 1995 through revised Fuel Storage Area fuel management and limited, temporary storage of aluminum clad fuel in stainless steel racks.
- Fuel Storage Area fuel storage capacity for zirconium clad (primarily naval) fuel requiring small (that is, 10- or 12-inch square) fuel positions would allow receipt through 1995 and still permit reracking.
- Fuel Storage Area fuel storage capacity for zirconium clad (naval) fuel requiring large (that is, 16-inch or 18-inch square) fuel positions would allow receipt through 1997 and still permit reracking; receipt through 2000 would be accommodated if the safety analysis is approved allowing stacking of fuel.

For the proposed reconfiguration, reracking of CPP-666 fuel storage Pool #1 must occur before the pool is filled beyond the "manageable level"; otherwise, this project cannot be accomplished. The manageable level is dependent on operational safety requirements that restrict the movement of fuel storage racks containing fuel and the movement of heavy objects over, or in proximity to, loaded fuel racks.

PROJECT DESCRIPTION: This proposed project would involve replacing and rearranging existing fuel storage racks in three of the six Fuel Storage Area pools in CPP-666. These pools are in the Fluorinel Dissolution Process and Fuel Storage Facility (CPP-666). The fuel storage capacity would be increased by replacing existing racks in three storage pools with new racks. The new racks would be taller and in some cases would have different storage port dimensions and different spacing dimensions between ports. A minimum of eight feet of water shielding would be maintained over fuel being moved. Criticality safety requirements would be met in the design of the new fuel storage racks, and by criticality analysis of the new reconfigured fuel storage pools and administrative controls on their operation. The new racks would be designed to meet the High Hazard Facility Use Category requirements in DOE Order 6430.1A and other applicable codes, standards, and regulations. Their layout and design would not exceed Fuel Storage Area structural limits. The existing design of the Fuel Storage Facility building provides protection from other natural phenomena, including high winds, tornadoes, and floods. The existing Fuel Storage Area water treatment systems and heating, ventilating, and air conditioning systems are adequate for the proposed reracking.

The project would also include decontamination of the racks being replaced and their disposition. The racks would initially be decontaminated underwater to remove as much of the loose contamination as possible using standard techniques, such as high pressure water jets, brushing, or scrubbing, before they are lifted from the pool. An underwater vacuum system would be used to capture most of the material washed from the racks. Following their removal from the fuel storage pools, local decontamination of hot spots could be performed, if needed, and the racks would be bagged while damp to contain the potential release of airborne radionuclides. To limit free standing water in the bags, the racks would be allowed to drain prior to insertion into the bags and absorbent material may be placed at the bottom of the bags. Additionally, if required, the racks may be dried by circulating air through the bags. The bag exhaust would be through a High Efficiency Particulate Air filter system designed for moist air.

Expanding the storage capacity would involve replacing fuel storage racks in Pools #1, #5, and #6. Increases in storage capacity would result from the following reconfiguration:

Pool #1 would replace 27 racks containing 486 storage locations, which are approximately 10-feet tall, with 35 racks containing 925 storage locations, which are approximately 20-feet tall. The

number of storage locations would increase because the spacing between storage locations would be less than that in the existing configuration.

Pool #5 would replace 24 racks containing 384 storage locations, which are approximately 10-foot tall and 12-inches square, with 21 racks containing 294 storage locations, which are approximately 15-foot tall and 16-inches square. There are fewer storage locations in the proposed configuration, but the proposed storage locations would be larger and taller.

Pool #6 would replace only 20 of the existing 32 racks in Pool #6. The 20 racks occupy only one half of the surface area of Pool #6 and contain 300 storage locations, which are 6-foot tall and 8-inches square. These racks would be replaced with 12 racks containing 300 storage locations, which would be approximately 15-foot tall and 8-inches square.

On the basis of an analysis performed before the Federal District Court decision on 6/28/93 that limited nuclear fuel shipments to Idaho, this project would increase the capacity of Fuel Storage Area to allow fuel receipt and storage to continue as follows:

- Aluminum clad research reactor fuel receipts could be extended from 1995 to between 2001 and 2009 (depending on fuel receipt).
- Naval fuel requiring small storage locations could be extended from 1995 to beyond year 2017.
- Naval fuel requiring large storage locations could be extended from 1997 to the year 2004.

Under current preliminary plans, Pools #1 and #5 would be emptied of fuel before rack replacement. To reduce the consequences of accidentally dropping a rack or rack handling tool in Pool #6, a row of empty storage locations in the loaded racks between the loaded storage locations and the new racks would be used as a buffer zone during fuel rack replacement activities. Pool #6 would contain fuel in most of the 300 unchanged fuel rack storage locations and the storage locations closest to the new racks would remain empty.

Following reracking, operations in Pool #1 would resume in 1997, Pool #6 in 1998, and Pool #5 in 1999.

The 51 fuel racks from Pools #1 and #5 would be decontaminated and dispositioned to a licensed commercial vendor. The 20 racks from Pool #6 may be used in the south basin of Building CPP-603 or be dispositioned like the others. If Pool #6 racks need to be decontaminated and dispositioned, the low-level waste would increase by 235 cubic meters (305 cubic yards). The balance of the radioactive wastes would be packaged and disposed of at the Radioactive Waste Management Complex or incinerated at the Waste Experimental Reduction Facility, whichever is appropriate. The industrial waste would be disposed of in the Central Facilities Area landfill.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the present fuel storage capacity in the Fuel Storage Area fuel storage pools would be retained. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Without changing the racks, the pools would fill to their capacity several years earlier than under the proposed alternative. During a three-year transition period, naval spent nuclear fuel would continue to be received and stored at the INEL. Filling the Fuel Storage Area storage pools beyond the manageable level would also preclude future fuel storage expansion by reracking of the Fuel Storage Area storage pools as an option in DOE evaluations and decisions on fuel management.

Provide New Storage - This option is presented in the Dry Fuel Storage Facility Summary. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. Depending upon the availability of other storage facilities and their appropriateness for the specific fuel types proposed for CPP-666 storage, this new storage could supplant the need for this project.

Use Existing Idaho Chemical Processing Plant Storage Facilities - New fuel receipts could be stored in the water-filled basins of CPP-603. This option is not evaluated in this EIS. This facility has significant environmental safety and health vulnerabilities that would be difficult to correct to allow for suitable interim storage. Storage in CPP-603 would violate the Court Order.

Use an Existing Non-Idaho Chemical Processing Plant Fuel Storage Facility - Existing non-Idaho Chemical Processing Plant storage facilities do not meet the near-term fuel storage requirements; therefore, this option is not evaluated in this EIS. Several miscellaneous fuel storage areas on the INEL were examined including fuel canals associated with the Advanced Test Reactor, the Engineering Test Reactor, the Materials Test Reactor, and the Advanced Reactivity Measurement Facility; and a Test Area North (TAN-607) basin used for storing fuel prior to disassembly and examination in the Test Area North Hot Cell. None were considered feasible because of their limited size and the work that would be required to ready them to store fuel (for example, structural, safety, and environmental evaluations and modifications; security measures for storing naval fuel). Consideration was also given to holding the fuel in storage for several years at the Naval Reactors Facility Expended Core Facility on the INEL.

Since the Expended Core Facility only holds spent nuclear fuel incidental to examination and thus has very limited storage capacity, there is insufficient existing storage space for the amount of fuel to be received under all alternatives without the addition of new racks to the water pools. Alternatives that involve phasing out receipt of naval fuel at the Expended Core Facility would be precluded by storage of fuel at this facility.

Fuel storage facilities at the Savannah River Site [that is, the Receiving Basin for Off-site Fuels and the basins associated with the individual production reactors (K, L, and P)] were also examined. The current unfilled fuel storage space at the Receiving Basin for Off-site Fuels is very limited. New fuel storage facilities or acquisition and upgrade of an existing facility would be required prior to accepting naval reactor fuels or Idaho Chemical Processing Plant research reactor fuels at the Savannah River Site. The spent nuclear fuel would have to be transported to the DOE Savannah River Site from the Naval Reactors Facility at the INEL, where it would be initially received, examined, and prepared for shipment.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs* (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 24, '94		
G	Description/function:	Increased Rack Capacity for CPP-666	C	Cultural resource effects:	N/A
•			o	Pits/ponding created: (m2)	No
n	WAG	3	n	Water usage: (liters)	26,875
•	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	
r	SNF or Waste stream:	SNF	t	Electrical: (MWH/yr)	no increase above current level
l	Action type:	Expand	.	Fossil fuel: (liters)	
c	Structure Type:			Nightlights used: Y/N	N/A
l	Size: (m2)	Fuel Storage Racks		Generators: Night Y/N	No
n	Other features:			Day Y/N	No
f	(Pits, ponds, power		O	Cost(\$): Operation:	no increase above current level
o	/water/sewer lines)		p	Schedule Start /End:	1997 - 2027
.	Location:		•	No. of workers: (new/exist)	no new above current level
	Inside/outside of fence	Inside ICPP	r	Heavy Equip. Equip. used:	None
	Inside/outside of bldg.	Inside CPP-666	a	Trips:	
C	Cost(\$): PreConst.	\$7.8 Mil.	t	Air Emissions:	
o	Cost(\$): Const.	\$15.7 Mil.	l	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1991 - 1993	o		
s	Schedule Start /End: Const.	1994 - 1999	n		
t	No. of workers: (new/exist)	40 Existing	a	Effluents:	
r	Heavy Equip. Equip. used:	Trucks	l	Type:	minimal increase above
u	Trips:	40 across USA, 20 to RWMC		Quantity: (liters/yr)	current level
c	Acres Disturbed: New	0	l	Solid wastes:	
t	Previous	0	n	Type:	LLW (Ion resins) Ind.
l	Revegetated	0	f	Quantity: (m3/yr)	0.3 50
o	Air Emissions:		o	Haz./Toxic Chemicals:	N/A
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	
l	Effluents:		m	Pits/ponds used: Y/N (m2)	No
n	Type:	LLW (water)	a	Water usage: (liters/yr)	no increase above current level
f	Quantity: (liters)	29,000 to PEW	t	Energy requirements:	minimal
o	Solid wastes:		l	Electrical: (MWH/yr)	increase above current level
.	Type:	LLW Ind.	o	Fossil fuel: (liters/yr)	0
	Quantity: (m3)	770 300	n	Nightlights used: Y/N	N/A
	Haz./Toxic Chemicals:	N/A		Generators: Night Y/N	No
	Storage/inventory			Day Y/N	No

ADDITIONAL INCREASED RACK CAPACITY (CPP-666)

PROJECT NAME: Additional Increased Rack Capacity (CPP-666)

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Additional Increased Rack Capacity Project would be to increase the capacity for fuel storage in at least two of the storage pools in the CPP-666 Fuel Storage Area at the Idaho Chemical Processing Plant without increasing the size of the storage pools.

PROJECT DESCRIPTION: This project would involve replacing and rearranging (commonly called reracking) existing fuel storage racks in at least two of the six Fuel Storage Area pools. The Fuel Storage Area pools are in the Fluorinel Dissolution Process and the Fuel Storage Facility (CPP-666). The pools that could be reracked with this project include Pools #2, #3, and #4. In addition, the empty cutting pool, which does not contain racks, would be considered for installation of racks under this project.

This project would increase the capacity of the pools to store spent nuclear fuel to the maximum amount consistent with safety and regulatory requirements. The increased capacity would result from installing or replacing racks without increasing the size of the storage pools. New racks would be taller and in some instances would have different storage port dimensions and different spacing dimensions between ports. The new racks would provide flexibility for storing more fuel of different sizes and shapes in the existing pools.

Included in the project are (a) decontamination and disposition of the racks being removed and replaced and (b) continued operation of these pools with the increased capacity. Facility support functions such as ventilation and water treatment capability have been determined to be adequate for the increased capacity of the facility.

Liquid low-level waste generated by the project would be disposed of in the existing liquid waste processing systems at the Idaho Chemical Processing Plant. The solid radioactive wastes, except for the racks, would be packaged and disposed of at the Radioactive Waste Management Complex or incinerated at the Waste Experimental Reduction Facility, whichever is appropriate. The nonradioactive waste would be disposed of in the Central Facilities Area landfill.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the present fuel storage capacity in the Fuel Storage Area fuel storage pools would be retained. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Without changing the racks, the pools would fill to their capacity several years earlier than under the proposed alternative. As the existing racks approach their capacity, replacing them would no longer be an alternative in the Department of Energy evaluations and decisions on spent fuel management.

Provide New Storage - Under this option, additional spent fuel storage would be constructed. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. This option is presented in the Dry Fuel Storage Facility Project Summary. Depending upon the availability of other storage facilities and their appropriateness for the specific fuel types proposed for CPP-666 storage, this new storage could supplant the need for this project.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 24, '96	
G e n e r a l c o n f e r e n c e	Description/function:	Additional Increased Rack Capacity (CPP-666)	C Cultural resource effects:	None identified
	WAG	3	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	27,000
	SNF or Waste stream:	SNF	s Energy requirements:	
	Action type:	Expand	t Electrical: (MWH/yr)	
	Structure Type:	Storage Racks	. Fossil fuel: (liters)	
	Size: (m2)		Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)	None	Generators: Night Y/N	No
	Location:		Day Y/N	No
	Inside/outside of fence	Inside ICPP	O Cost(\$): Operation:	\$200 k/yr
C o n s t r u c t i o n a l f e a s i b l e n e s s e s	Inside/outside of bldg.	Inside CPP-666	p Schedule Start /End:	2001 - 2021
	Cost(\$): PreConst.	\$2 Mil.	e No. of workers: (new/exist)	No increase
	Cost(\$): Const.	\$50 Mil.	r Heavy Equip. Equip. used:	None
	Schedule Start /End: PreConst.	1994 - 1995	a Trips:	
	Schedule Start /End: Const.	1995 - 1997	t Air Emissions:	
	No. of workers: (new/exist)	40 Existing	l (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	o Effluents:	
	Trips:		l Type:	
	Acres Disturbed: New	0	Quantity: (liters/yr)	
	Previous	0	Solid wastes:	
I n f o r m a t i o n	Revegetated	0	l Type:	LLW Ind.
	Air Emissions:		Quantity: (m3/yr)	0.2 50
	(None / Ref.)	See Belanger et al., 1994	o Haz./Toxic Chemicals:	None
	Effluents:		Storage/inventory	
	Type:	LLW (Water)	m Pits/ponds used: Y/N (m2)	No
	Quantity: (liters)	27,000 to PEW	a Water usage: (liters/yr)	None
	Solid wastes:		t Energy requirements:	
	Type:	LLW Ind	l Electrical: (MWH/yr)	No increase above current level
	Quantity: (m3)	500 300	o Fossil fuel: (liters/yr)	
	Haz./Toxic Chemicals:	N/A	n Nightlights used: Y/N	No
	Storage/inventory		Generators: Night Y/N	No
			Day Y/N	No

DRY FUEL STORAGE FACILITY; FUEL RECEIVING, CANNING/CHARACTERIZATION, AND SHIPPING

PROJECT NAME: Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping

GENERAL PROJECT OBJECTIVE: The general project objective of the proposed Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping project is to provide a multifunctional dry storage facility that would accommodate the various fuel types and configurations in the current inventory of INEL fuels, projected naval and Advanced Test Reactor fuels, and spent nuclear fuel from miscellaneous offsite sources such as government, commercial, and university nuclear reactors. The facility would assist DOE in safe, environmentally sound management of spent nuclear fuel during the estimated 40-year period (1995-2035) until final disposition can be achieved.

While the functions performed by a proposed Dry Fuel Storage Facility and a Fuel Receiving, Canning/Characterization, and Shipping Facility would be the same for several of the Volume 1 alternatives, the magnitude of the facilities would change depending on the alternative. The project cost would also vary with the alternative. Each project would provide for the design, construction, and operation of the facilities.

PROJECT DESCRIPTION: The spent nuclear fuel materials at the Idaho Chemical Processing Plant have historically been stored in wet storage facilities (as has the spent nuclear fuel at other DOE sites) pending their reprocessing to recover the highly enriched uranium. In April 1992, the Secretary of Energy determined that the reprocessing of spent nuclear fuel for recovery of uranium was no longer required. This determination then changed the Idaho Chemical Processing Plant mission from reprocessing to fuel conditioning and interim storage.

The two major facilities of this project would perform the following functions:

- (a) Receive fuel shipping casks from various INEL and/or offsite locations depending on the specific alternative considered.

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- (b) Unload full casks into fuel unloading pools or directly into a dry hot cell depending on the specific alternative considered.
 - (c) Inspect, dry, characterize, can, seal and test cans of fuel.
 - (d) Load canned fuel into dry storage canisters.
 - (e) Ship dry storage canisters to the Dry Fuel Storage Facility.
 - (f) Retrieve dry storage canisters from the Dry Fuel Storage Facility.
 - (g) After interim storage, ship full casks from the facility to a permanent disposal facility or to another facility for additional conditioning prior to disposal in a repository.
 - (h) Monitor storage conditions as required.

The Fuel Receiving, Canning/Characterization, and Shipping Facility would be considered a nonreactor, nuclear facility. The facility would be a multi-level facility with a operating hot cell area near its center surrounded by the auxiliary and support areas. Depending on the required throughput capacity, the facility could range in size from 50,000 to 100,000 square feet. The major areas of the facility would include the following:

- The cask receiving area would contain a washdown capability for rail or truck mounted casks, overhead cranes for cask lifting and movement, transfer carts, cask maintenance area (for minor repairs on casks; for example, replacement of seals), and storage areas for lifting equipment, cask impact limiters, access platforms, and similar equipment.
- Capabilities required for characterization would include nondestructive evaluation of the fuel to determine its physical, chemical, and radiological properties. Sampling equipment would be provided to acquire small samples of fuel to send to the analytical laboratory if required.

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- Common equipment in the hot cell would include shielded viewing windows, master-slave manipulators, electro-mechanical manipulators, and remote-operated bridge crane.
 - An analytical laboratory for complete chemical and radiological analysis of received samples, rubble, or broken spent nuclear fuel. This laboratory would require a hot cell with remote handling capabilities for sample analysis and for removal of waste from the facility.
 - A control room for overview of the automatic operations of the facility including the fuel handling hot cell and manual override of facility functions as required. The control room would contain monitors that report real time data for selected systems and allow access to other parameters as necessary. Other monitors would allow viewing via remote cameras of hot cell activities and other selected activities.
 - The facility would contain cold and hot shop areas to support building activities, such as equipment fabrication, maintenance, repair, and fabrication of new systems.
 - Crane and electro-mechanical manipulator maintenance area for repair and preventive maintenance of this equipment.
 - Administrative support areas (office, conference room, rest rooms, change rooms) and equipment and mechanical/electrical rooms to support overall operations in the facility.

The proposed Dry Fuel Storage Facility would be integrated with the Fuel Receiving, Canning/ Characterization, and Shipping Facility. This integration would alleviate the need to transfer the fuel to the dry storage in a transfer cask. The storage facility would consist of a Modular Aboveground Dry Storage system and a fenced storage yard. This system would eliminate the construction of new buildings or systems to provide active cooling, and would allow additional storage capacity to be purchased and added as needed to support long-term consolidation of the current DOE spent nuclear fuel inventory.

The number of Modular Aboveground Dry Storage units required would depend on the specific EIS alternative considered, as described in the project-specific options below.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal) in this EIS.

No Action - Under this option, no new canning/characterization or dry storage capability would be constructed. This option corresponds to Alternative A (No Action) evaluated in this EIS. Existing facilities (CPP-603 Irradiated Fuel Storage Facility, CPP-749, and CPP-666) would be utilized to consolidate spent nuclear fuel on the INEL. During a three-year transition period, naval spent nuclear fuel would continue to be received and stored in CPP-666. No major upgrades or new facilities would be installed. Minor fuel conditioning would proceed for maintaining safe operation.

Receiving/Canning/Characterization in an Existing Facility. New Dry Storage Facility - Under this option, an existing Idaho Chemical Processing Plant facility would be used for spent nuclear fuel receiving/canning/characterization, and a new dry storage facility would be constructed. This option is comparable to Alternative B (Ten-Year Plan) evaluated in this EIS (Data Sheets on pages SNF4-7 and SNF4-8, attached). The canning/characterization capability would be placed in an existing hot cell facility (CPP-666 Fluorinel Dissolution Process cell). The existing fuel receiving and shipping capabilities of CPP-666 Fuel Storage Area (pool storage with reracking accomplished) would be used for these activities. A new storage facility would be developed for placement of dry storage containers of spent nuclear fuel.

Degradable spent nuclear fuel would be placed into dry storage using a canning facility in the CPP-666 Fluorinel Dissolution Process cell and procurement of modular dry storage containers (1,500 containers). The dry storage containers would be placed inside a concrete biological shield for radiation protection. Appropriate equipment would be provided to move the canned fuel and other fuels that have longer storage life in dry storage, from the CPP-666 Fuel Storage Area to

the dry storage container and concrete shields. The Irradiated Fuel Storage Facility and CPP-749 vaults would continue to be used as appropriate.

Canning/Characterization/Shipping in Existing Facility, No New Dry Storage - Under this option, spent nuclear fuel stored at the INEL would be shipped to another DOE site for conditioning/storage pending disposal. This option corresponds to Alternative C evaluated in this EIS (Data Sheet on page SNF4-9, attached). INEL spent nuclear fuel would be placed into safe shipping packages and shipped to a predetermined offsite location. Some Idaho Chemical Processing Plant fuels that are degraded would need to be canned prior to shipment. This would be performed in the CPP-666 Fluorinel Dissolution Process cell (as described in Alternative B (Ten-Year Plan) above) or in the CPP-603 Irradiated Fuel Storage Facility fuel handling cell (cave).

For shipment of the spent nuclear fuel from the Irradiated Fuel Storage Facility, the facility would need some upgrades to accept the larger truck casks and to properly test the casks for verification that the Safety Analysis Report is complied with. Shipments from the CPP-666 Fuel Storage Area, which has adequate cask handling capacity, may require some shipping cask testing capabilities.

Minor modifications might be needed at other INEL fuel storage facilities to load and test shipping casks. These modifications are expected to be covered by maintenance activities at these facilities.

New Receiving/Canning/Characterization Facility and New Dry Fuel Storage - Under this option, spent nuclear fuel storage in the DOE Complex would be centralized at the INEL. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS (Data Sheets on pages SNF4-10 and SNF4-11, attached). A new Fuel Receiving, Canning/Characterization, and Shipping Facility, as well as a Dry Storage Facility, would be constructed to accommodate the larger number of shipments of spent nuclear fuel from Hanford and Savannah River. Storage capacity in existing CPP-666 pools would be expanded (see Project Descriptions on pages SNF2-1 and SNF3-1 in this appendix) under this alternative in order to provide storage for naval spent nuclear fuel and to provide interim storage capabilities for other spent nuclear fuel waiting transfer to dry storage. The CPP-666 receiving area and pools have a

mission to receive naval fuel on a first-priority basis. Spent nuclear fuel packages that have been prepared for dry shipment should not be placed back into an underwater unloading environment; therefore, the receiving bays in the proposed new facility with a hot cell would be used so that the spent nuclear fuel would be unloaded in a dry environment and placed into the dry storage containers. Under the Centralization alternative (Volume 1), it was assumed that during the phase-in period, the CPP-666 Fluorinel Dissolution Process cell interim canning/characterization capability would be needed for INEL water-stored fuels and potentially for wet-shipped fuels. The proposed dry storage system for this large volume of spent nuclear fuel would be a modular dry storage vault concept (approximately 5,500 modular aboveground dry storage containers).

Wet Storage - An alternative to the above-described dry storage would be to provide any required storage as wet storage. While nuclear industry and DOE experience has demonstrated a general benefit from avoiding the processing, storage, and handling complications in a wet environment, this alternative continues to be considered, but was not evaluated in this EIS.

Locate Facilities Elsewhere on the INEL - Under this option, canning/characterization and dry storage facilities would be constructed at a location other than the Idaho Chemical Processing Plant. This option was not evaluated in this EIS. The Test Area North facility has an existing hot cell with the capability to receive spent nuclear fuel shipments by rail or truck. However, spent nuclear fuel storage is being phased out at Test Area North (see Test Area North Pool Transfer Project Description, page OP1-1 in this Appendix), and the majority of spent nuclear fuel storage at the INEL is approximately 20 miles south of Test Area North at Idaho Chemical Processing Plant, part of the way on a public highway. Spent nuclear fuel canning/characterization and dry storage at Test Area North would probably require upgrade/modification to the Test Area North Hot Cell Complex, and would require construction of dry storage facilities at Test Area North.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 10 May 24, '96	
G e n e r a l c o n f o r m a t i o n	Description/function:	Dry Fuels Storage Facility	C Cultural resource effects:	None
	WAG	3	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B	n Water usage: (liters)	
	SNF or Waste stream:	SNF	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	20
	Structure Type:	Building / Pad	. Fossil fuel: (liters)	6,400 Diesel
	Size: (m2)	4,000	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	1,350 m3 concrete	Generators: Night Y/N	No
	Location:	Inside or Outside ICPP	Day Y/N	Yes
	Inside/outside of fence	Outside	O Cost(\$): Operation:	\$4 Mil./yr
Inside/outside of bldg.		p Schedule Start /End:	2005 - 2035	
C o n s t r u c t i o n	Cost(\$): PreConst.	\$24 Mil.	e No. of workers: (new/exist)	15 Existing
	Cost(\$): Const.	\$287 Mil.	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1994 - 1999	a Trips:	1 per week
	Schedule Start /End: Const.	1999 - 2005	t Air Emissions:	
	No. of workers: (new/exist)	50 Subs.	i (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks / Earthmovers	a Effluents:	
	Trips:		i Type:	LLW
	Acres Disturbed: New	0	Quantity: (liters/yr)	small amounts
	Previous	18.5	Solid wastes:	
	Revegetated	0	n Type:	LLW Ind.
I n f o r m a t i o n	Air Emissions:	See Belanger et al., 1994	f Quantity: (m3/yr)	5 10
	(None / Ref.)		o Haz./Toxic Chemicals:	None
	Effluents:		r Storage/inventory	
	Type:	Construction Water	m Pits/ponds used: Y/N (m2)	None
	Quantity: (liters)		a Water usage: (liters/yr)	
	Solid wastes:		t Energy requirements:	
	Type:	Industrial	i Electrical: (MWH/yr)	200
	Quantity: (m3)	37.5	o Fossil fuel: (liters/yr)	0
	Haz./Toxic Chemicals:	None	n Nightlights used: Y/N	Yes
	Storage/inventory		Generators: Night Y/N	No
		Day Y/N	No	

Project Data Sheet			Rev. 10 May 24, '96	
G • n • r l c l n f o . C o n s t r u c t i o n l n f o . l n f o .	Description/function:	Fuel Receiving, Canning Characterization & Shipping	C Cultural resource effects:	None
	WAG	3	o Pits/ponding created: (m2)	None
	EIS Alter. (A, B, C or D):	B	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	SNF	s Energy requirements:	30
	Action type:	Existing	t Electrical: (MWH/yr)	10,000 Diesel
	Structure Type:	Existing	. Fossil fuel: (liters)	Yes
	Size: (m2)		Nightlights used: Y/N	N
	Other features: (Pits, ponds, power /water/sewer lines)		Generators: Night Y/N	Yes
	Location:		Day Y/N	
	Inside/outside of fence	Inside ICPP	O Cost(\$): Operation:	\$20 Mil./yr
Inside/outside of bldg.	Inside existing facility	p Schedule Start /End:	2005 - 2035	
Cost(\$): PreConst.	\$24 Mil.	e No. of workers: (new/exist)	20 Existing	
Cost(\$): Const.	\$287 Mil.	r Heavy Equip. Equip. used:	Trucks	
Schedule Start /End: PreConst.	1994 - 1999	a Trips:	1 per week	
Schedule Start /End: Const.	1999 - 2005	t Air Emissions:	See Appendix F, Section 3	
No. of workers: (new/exist)	100 Subs.	i (None / Ref.)		
Heavy Equip. Equip. used:	Trucks	o Effluents:		
Trips:		l Type:	LLW	
Acres Disturbed: New	0	Quantity: (liters/yr)	small amounts	
Previous	0	Solid wastes:		
Revegetated	0	Type:	LLW Ind.	
Air Emissions:	See Belanger et al., 1994	Quantity: (m3/yr)	220 490	
(None / Ref.)		Haz./Toxic Chemicals:	None	
Effluents:		Storage/inventory		
Type:	Construction Water	m Pits/ponds used: Y/N (m2)	None	
Quantity: (liters)		a Water usage: (liters/yr)		
Solid wastes:		t Energy requirements:		
Type:	Industrial	l Electrical: (MWH/yr)	1,800	
Quantity: (m3)	37.5	o Fossil fuel: (liters/yr)	300 k Fuel Oil	
Haz./Toxic Chemicals:	None	n Nightlights used: Y/N	Yes	
Storage/inventory		Generators: Night Y/N	No	
		Day Y/N	No	

Project Data Sheet			Rev. 9 May 16, '96	
G • n • r l c l n f o •	Description/function:	Fuel Receiving, Canning Characterization & Shipping	C Cultural resource effects:	None
	WAG	3	o Pits/ponding created: (m2)	None
	EIS Alter. (A, B, C or D):	C	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	SNF	s Energy requirements:	
	Action type:	Modification	t Electrical: (MWH/yr)	10
	Structure Type:	Existing	. Fossil fuel: (liters)	3,000 Diesel
	Size: (m2)		Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)		Generators: Night Y/N	No
			Day Y/N	No
	Location:		O Cost(\$): Operation:	\$10 Mil./yr
Inside/outside of fence	Inside ICPP	p Schedule Start /End:	1996 - 2010	
Inside/outside of bldg.	Inside Existing	e No. of workers: (new/exist)	No new	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.	\$2 Mil.	r Heavy Equip. Equip. used:	None
	Cost(\$): Const.	\$15 Mil.	a Trips:	
	Schedule Start /End: PreConst.	1995	t Air Emissions:	
	Schedule Start /End: Const.	1995 - 1996	l (None / Ref.)	No Increase
	No. of workers: (new/exist)	50 Subs.	o	
	Heavy Equip. Equip. used:	Trucks	n	
	Trips:		a	
	Acres Disturbed: New	0	l	
	Previous	0	l	
	Revegetated	0	n	
Air Emissions:		f		
(None / Ref.)	See Belanger et al., 1994	o		
l n f o •	Effluents:		r	
	Type:	No increase	m	
	Quantity: (liters)		a	
	Solid wastes:		t	
	Type:	Ind.	l	
	Quantity: (m3)	50	o	
	Haz./Toxic Chemicals:	None	n	
	Storage/inventory			

Project Data Sheet			Rev. 10 May 24, '96		
G • n • r l c i n f o .	Description/function:	Dry Fuels Storage Facility (Expanded)	C	Cultural resource effects:	None
	WAG	3	o	Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	D	n	Water usage: (liters)	
	SNF or Waste stream:	SNF	s	Energy requirements:	
	Action type:	New	t	Electrical: (MWH/yr)	20
	Structure Type:	Building / Pad	.	Fossil fuel: (liters)	6,400 Diesel
	Size: (m2)	4,000		Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	1,050 m3 concrete		Generators: Night Y/N	No
				Day Y/N	Yes
	Location:		O	Cost(\$): Operation:	\$4 Mil./yr
Inside/outside of fence	Inside or Outside ICPP	p	Schedule Start /End:	2008 - 2038	
Inside/outside of bldg.	Outside	•	No. of workers: (new/exist)	15 Existing	
C	Cost(\$): PreConst.	\$24 Mil.	r	Heavy Equip. Equip. used:	Trucks
o	Cost(\$): Const.	\$550 Mil.	a	Trips:	1 per week
n	Schedule Start /End: PreConst.	1994 - 1999	t	Air Emissions:	
s	Schedule Start /End: Const.	1999 - 2008	l	(None / Ref.)	See Appendix F, Section 3
t	No. of workers: (new/exist)	75 Subs.	o	Effluents:	
r	Heavy Equip. Equip. used:	Trucks / Earthmovers	i	Type:	LLW
u	Trips:		n	Quantity: (liters/yr)	small amounts
c	Acres Disturbed: New	0	f	Solid wastes:	
t	Previous	15	o	Type:	LLW Ind.
l	Revegetated	0	r	Quantity: (m3/yr)	110 250
o	Air Emissions:		m	Haz./Toxic Chemicals:	None
n	(None / Ref.)	See Belanger et al., 1994	a	Storage/inventory	
i	Effluents:		t	Pits/ponds used: Y/N (m2)	None
n	Type:	Construction Water	l	Water usage: (liters/yr)	
f	Quantity: (liters)		o	Energy requirements:	
o	Solid wastes:		n	Electrical: (MWH/yr)	2,000
.	Type:	Industrial		Fossil fuel: (liters/yr)	225 k Fuel Oil
	Quantity: (m3)	40		Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	None		Generators: Night Y/N	No
	Storage/inventory			Day Y/N	No

Project Data Sheet			Rev. 10		May 24, '94		
G e n e r l c l n f o .	Description/function:	Fuel Receiving, Canning Characterization & Shipping	C	Cultural resource effects:	None		
	WAG	3	o	Pits/ponding created: (m2)	None		
	EIS Alter. (A, B, C or D):	D	n	Water usage: (liters)	Insignificant		
	SNF or Waste stream:	SNF	s	Energy requirements:			
	Action type:	New	t	Electrical: (MWH/yr)	30		
	Structure Type: Size: (m2)	Existing Building / Pad 3,000	.	Fossil fuel: (liters)	10,000 Diesel		
		Other features: (Pits, ponds, power /water/sewer lines)	1000 m3 concrete		Nightlights used: Y/N	Yes	
		Location:			Generators: Night Y/N Day Y/N	No Yes	
	Inside/outside of fence	Inside or outside ICPP	O	Cost(\$): Operation:	\$20 Mil./yr		
	Inside/outside of bldg.	Outside	p	Schedule Start /End:	2008 - 2038		
C o n s t r u c t i o n l f o .	Cost(\$): PreConst.	\$24 Mil.	e	No. of workers: (new/exist)	20 Existing		
	Cost(\$): Const.	\$300 Mil.	r	Heavy Equip. Equip. used:	Trucks		
	Schedule Start /End: PreConst.	1994 - 1999	a	Trips:	1 per week		
	Schedule Start /End: Const.	1999 - 2008	t	Air Emissions:			
	No. of workers: (new/exist)	75 Subs.	l	(None / Ref.)	See Appendix F, Section 3		
	Heavy Equip. Equip. used:	Trucks	o				
	Trips:		n	Effluents:			
	Acres Disturbed: New	0	l	Type:	LLW		
	Previous	15		Quantity: (liters/yr)	small amounts		
	Revegetated	0	l	Solid wastes:			
o n l f o .	Air Emissions:		n	Type:	LLW	Ind.	
	(None / Ref.)	See Belanger et al., 1994	f	Quantity: (m3/yr)	115	250	
	Effluents:		o	Haz./Toxic Chemicals:	None		
	Type:	Construction Water	r	Storage/inventory			
	Quantity: (liters)		m	Pits/ponds used: Y/N (m2)	None		
	Solid wastes:		a	Water usage: (liters/yr)			
	Type:	Industrial	t	Energy requirements:			
	Quantity: (m3)	60	l	Electrical: (MWH/yr)	2,000		
	Haz./Toxic Chemicals:	None	o	Fossil fuel: (liters/yr)	300 k Fuel Oil		
	Storage/inventory		n	Nightlights used: Y/N	Yes		
			Generators: Night Y/N Day Y/N	No No			

FORT ST. VRAIN SPENT NUCLEAR FUEL SHIPMENT AND STORAGE

PROJECT NAME: Fort St. Vrain Spent Nuclear Fuel Shipment and Storage

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Fort St. Vrain Spent Nuclear Fuel Shipment and Storage project would be to complete the transportation, receipt, and storage of up to 1,482 blocks of Fort St. Vrain spent nuclear fuel from the Public Service Company of Colorado spent fuel storage facility in Platteville, Colorado, to the Idaho Chemical Processing Plant Irradiated Fuel Storage Facility at the INEL. In accordance with existing agreements between DOE and Public Service Company of Colorado, the spent fuel would be transported to the INEL by Public Service Company of Colorado in compliance with applicable transportation requirements using shipping casks certified by the U. S. Nuclear Regulatory Commission.

The Fort St. Vrain reactor is a High Temperature Gas-Cooled Reactor owned by Public Service Company of Colorado. The development, construction, and startup of the reactor was co-sponsored by the U.S. Atomic Energy Commission (now DOE) through Contract No. AT(04-3)-63, dated July 1, 1965. As part of the overall research and development effort related to High Temperature Gas-Cooled Reactors, the Atomic Energy Commission had planned to build a facility to demonstrate the reprocessing of High Temperature Gas-Cooled Reactor fuel. The Idaho Chemical Processing Plant was to be the location of the demonstration fuel reprocessing plant. Due to changes in the development of commercial High Temperature Gas-Cooled Reactor facilities, construction plans for the fuel reprocessing demonstration plant were not pursued. However, the Atomic Energy Commission designed and constructed the Irradiated Fuel Storage Facility (CPP-603) in 1975 at the Idaho Chemical Processing Plant to store the spent fuel from Fort St. Vrain. The environmental impacts for this facility were evaluated in the mid-1970s.

In modification No. M010 (effective April 1, 1980) to the 1965 contract, the parties made specific DOE's obligation to accept eight segments of fuel from the Fort St. Vrain reactor. DOE also agreed that, in the sole discretion of DOE and under certain conditions, DOE would accept additional spent fuel elements without further adjustment in the agreement. Effective April 1,

1980, DOE entered into Contract No. DE-SC07-79IDO1370, which incorporated the 1965 contract and defined the procedures and specifications for fuel receipt.

This spent fuel transportation project would involve movement of approximately 16 metric tons of heavy metal (spent Fort St. Vrain fuel) across public highways in U. S. Nuclear Regulatory Commission-licensed shipping casks to the INEL where the spent fuel would be unloaded by remote capabilities into existing storage space (Irradiated Fuel Storage Facility). Each shipment would consist of one cask containing six spent fuel blocks, requiring a total of 247 shipments. Receipt of the fuel at the INEL is an existing DOE contractual commitment.

Three segments of 240 fuel blocks each were shipped and received at the INEL between 1980 and 1987 and are currently in storage at the Irradiated Fuel Storage Facility. Six segments of spent fuel remain at the Fort St. Vrain Fuel Storage Facility, except three shipments that were completed in 1991 following issuance of an Environmental Assessment (DOE/EA-0441). This project would involve shipping of the remaining six spent fuel segments to the INEL by Public Service Company of Colorado, and receipt and storage of the spent fuel in the Irradiated Fuel Storage Facility. Five of these segments contain 240 fuel blocks and one segment is composed of 282 fuel blocks for a total of 1,482 blocks.

PROJECT DESCRIPTION: The Fort St. Vrain fuel is in the form of uranium and thorium carbide particles coated with layers of pyrolytic carbon and silicon carbide, loosely bonded by a carbonaceous matrix material into fuel rods, which are subsequently inserted into graphite blocks. Fresh fuel blocks have variable uranium and thorium contents. The Fort St. Vrain design fuel life is 1800 effective full power days. However, the fuel which has been in the Fort St. Vrain reactor for the longest time has been irradiated to only 890 effective full power days, or less than half of the design life. Because of the designed, tested, and demonstrated retention characteristics of the fuel, and the reduced actual fuel service history, there is a high assurance that the Fort St. Vrain fuel proposed to be received at the INEL will have less than one percent coating failure rate.

Each shipment would consist of one Fort St. Vrain-1A cask containing six spent fuel blocks. The Fort St. Vrain-1A casks were designed by GA Technologies and certified by the U.S. Nuclear Regulatory Commission for transport over public highways using semitractor trailer rigs (Certificate of Compliance No. 6346, Rev. 21). Shipments of spent fuel would arrive at the

Irradiated Fuel Storage Facility unloading facility. A sample of the cask atmosphere would be removed for analysis to verify there is no damage to a fuel block or its container. It should be noted that 726 fuel blocks have been shipped, received, and stored to date and none have been damaged.

Receipt of the six remaining segments of spent fuel at the Irradiated Fuel Storage Facility would require the following operations:

1. Transport of the fuel from Fort St. Vrain to the INEL by Public Service Company of Colorado.
2. Relocation to CPP-749 or a new dry storage facility of some non-Fort St. Vrain fuel currently stored in the Irradiated Fuel Storage Facility.
3. A fuel handling sequence at the Irradiated Fuel Storage Facility to place the spent fuel blocks into storage.
4. Storage of fuel at the Irradiated Fuel Storage Facility.

Because of the previous use of the Irradiated Fuel Storage Facility for storage of other fuels (ROVER, BER-TRIGA, Peach Bottom, and TORY-IIC), space for a portion of the ninth segment will need to be made available. The space would be made available by transferring the ROVER and Peach Bottom fuels to other existing facilities or a new dry storage facility. Some of the Peach Bottom Core II fuel would be transferred to the CPP-749 Underground Dry Vaults where the Peach Bottom Core I is stored. The Peach Bottom fuel transfer would require purchase of stainless steel storage containers that would be loaded in the Irradiated Fuel Storage Facility and transported in existing INEL shipping casks.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the spent nuclear fuel and INEL ER&WM EIS where the project would be implemented.

Retain the Fuel in the Independent Spent Nuclear Fuel Storage Facility at Fort St. Vrain - This option corresponds to Alternative A (No Action) evaluated in this EIS. The Public Service Company of Colorado built a spent nuclear fuel storage facility onsite and transferred all spent fuel from the reactor to that facility, and subsequently began converting the reactor building into a natural gas fueled electric generating facility. This option is not considered responsive to the DOE contractual commitment to take possession of the Fort St. Vrain fuel.

Receive Fort St. Vrain Fuel at Another DOE Facility - This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Under this option, existing or new storage capacity at another DOE site would be used for storage of the Fort St. Vrain fuel.

Receive Fort St. Vrain Fuel at Another INEL Facility - The consequences of this option are not bounded by the analysis performed for this project. No DOE facility other than Irradiated Fuel Storage Facility is specifically designed for dry storage of graphite reactor fuels. However, the Test Area North (TAN) Building TAN-607, built for the Aircraft Nuclear Propulsion Program, has the necessary space to accommodate the Fort St. Vrain fuels. This facility would be difficult to qualify to current standards for seismic performance, compliance with electrical, ventilation, and filtration codes, and other requirements that would be applicable to the storage of spent nuclear fuels. Construction programs would have to be undertaken to upgrade the facility to meet current requirements.

Receive Fort St. Vrain Fuel at Another Idaho Chemical Processing Plant Facility - The consequences of this option are not bounded by the analysis performed for this project. This option is to store some Fort St. Vrain fuel in the Underground Storage Facility or the Unirradiated Fuel Storage Facility, rather than relocate other fuels now stored in the Irradiated Fuel Storage Facility. The Unirradiated Fuel Storage Facility is designed to store only

unirradiated fuel and would not provide proper storage for the Fort St. Vrain fuel which is irradiated. The Underground Storage Facility is designed to provide proper storage for both irradiated and unirradiated fuels. However, before the Underground Storage Facility could be used for the storage of Fort St. Vrain fuel, an upgrade construction project would be needed to construct additional underground dry fuel storage vaults.

Receive Fort St. Vrain Fuel at Newly Constructed Storage - The consequences of this option are not bounded by the analysis performed for this project.

Receive Only Contracted Amount of Fuel - This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. DOE is obligated to receive a total of five of the six fuel segments currently stored at the Fort St. Vrain spent fuel storage facility. Receipt of the sixth segment is at the discretion of the DOE. Under this option, Public Service Company of Colorado would continue to store the balance of the fuel at their spent fuel storage facility. This would require that Public Service Company of Colorado continue to employ a staff of operators, maintenance personnel, and a security force to operate the storage facility. If the sixth segment is not received, the Peach Bottom and ROVER fuels would continue to be stored in the Irradiated Fuel Storage Facility and would not require relocation to CPP-749 or a new dry storage facility. There would be a reduction in the quantity of fuel that the DOE must store.

SUMMARY OF IMPACTS: This summary is based on a previously prepared environmental assessment (DOE/EA-0441). The cask design limits radioactive material releases following hypothetical accidents to satisfy the requirements of 10 CFR 71.51 for Type B packages. These requirements are summarized below:

1. No escape of krypton-85 in one week exceeding ten times the maximum krypton-85 activity value from 10 CFR Part 71, Table A-1.
2. No escape of other radionuclides exceeding the total amount specified in 10 CFR 71, Table A-1.

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3. No external radiation dose rate exceeding one rem per hour at one meter from the external surface of the package.

The cask must be designed and prepared for shipment so that, for a cask transported as exclusive use by highway, radiation levels at any point 2 meters from the later surface of the vehicle must not exceed 10 mrem per hour. The expected maximum number of vehicle round trips that would be required to complete the transfer of fuel from Fort St. Vrain to Irradiated Fuel Storage Facility would not exceed ten per week and would total approximately 250 round trips.

The project does not require new construction or excavation. Small quantities of radioactive, hazardous, or mixed wastes would be generated during cask decontamination activities. These wastes would be treated or disposed of according to procedures that are in compliance with applicable state and federal requirements. Assuming air emissions from the Irradiated Fuel Storage Facility were to increase linearly from previously measured data as the facility were filled with Fort St. Vrain fuel, INEL site emissions would increase by approximately 40 microcuries per year.

Relocation of Peach Bottom and ROVER/Parka fuels from Fort St. Vrain to the Underground Storage Facility and the Unirradiated Fuel Storage Facility would cause no increase in cumulative radioactive airborne emissions. Peach Bottom fuels would be placed inside sealed canisters before relocation to the underground vaults of the Underground Storage Facility. The vaults would be sealed after receiving the Peach Bottom fuel, except for two normally closed sample connections. ROVER/Parka fuel is unirradiated and makes no contribution to radioactive airborne emissions.

REFERENCES:

- Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.
- U.S. Department of Energy, Office of Nuclear Energy, *Environmental Assessment, Transportation, Receipt, and Storage of Fort St. Vrain Spent Fuel at the Irradiated Fuel Storage Facility at the Idaho Chemical Processing Plant*, DOE/EA-0441, Idaho National Engineering Laboratory, February 1991.

Project Data Sheet			Rev. 6 May 16, '94	
General Information	Description/function:	Fort St. Vrain SNF Shipment & Storage	Solid wastes:	
	WAG	3	Type:	None
	EIS Alter. (A, B, C or D):	B, D	Quantity: (m3/yr)	Included in CPP-603 Ops.
	SNF or Waste stream:	SNF	Haz./Toxic Chemicals:	No
	Action type:	Operation	Storage/inventory	No
	Structure Type:	N/A	Pits/ponds used: Y/N (m2)	No
	Size: (m2)		Water usage: (liters/yr)	None
	Other features: (Pits, ponds, power /water/sewer lines)		Energy requirements:	
			Electrical: (MWH/yr)	No increase above current level
			Fossil fuel: (liters/yr)	
Operational Data	Location:		Nightlights used: Y/N	No
	Inside/outside of fence	Inside ICPP	Generators: Night Y/N	No
	Inside/outside of bldg.	Inside CPP-603	Day Y/N	No
	Cost(\$): Operation:	No increase above current level		
	Schedule Start /End:	1996 - 1996		
	No. of workers: (new/exist)	No increase above current level		
	Heavy Equip. Equip. used:	Trucks		
	Trips:	247 FSV to INEL		
	Air Emissions:			
	(None / Ref.)	See Appendix F, Section 3		
Effluents	Effluents:			
	Type:	None		
	Quantity: (liters/yr)	Included in CPP-603 Ops.		

SPENT FUEL PROCESSING

PROJECT NAME: Spent Fuel Processing

GENERAL PROJECT OBJECTIVE: For the purposes of analysis, a hypothetical Spent Fuel Processing project was assumed. The general project objective would be to provide the capability to process highly enriched spent nuclear fuel. Concerns about criticality during interim storage or in a Federal repository may dictate separation of the fissile material (uranium and plutonium) from the highly enriched fuel before storage or disposal. Aqueous dissolution and separation was assumed because DOE has data from past processing that could be used for analysis. This process was intended to be bounding for whatever processing that would actually be developed and used. Processing these fuels would alleviate some of the fuel storage and repackaging needs, as stated in the Dry Fuel Storage Facility; Fuel Receiving, Canning/Characterization, and Shipping Project Summary (page SNF4-1 in this appendix). Fuel processing could be done in order to stabilize the spent nuclear fuel and remove risks associated with storage and disposal, and to safely manage the resultant high-level waste in a cost-effective manner. For analysis purposes, it was assumed that restart of the Idaho Chemical Processing Plant processing and chemical separations facilities to condition the fuel for storage and disposal by removal of the fissile material would be the bounding case.

PROJECT DESCRIPTION: Historically, many DOE spent nuclear fuel types were processed by chemical dissolution and the fissile material segregated. Several processes were used because of the variety of materials making up the fuel elements: aluminum-clad fuels, stainless steel-clad fuels, zirconium-clad fuels, and graphite fuels. Aluminum-clad and zirconium-clad fuels were processed by highly acidic aqueous dissolution. Stainless steel-clad fuels were electrolytically dissolved. Graphite fuels were first burned and then the ash dissolved. These processes generated solutions that included the radioactive fission products and the fissile material, usually U-235, which were subsequently separated to segregate the U-235. Once the fissile material is extracted, the remaining waste solution is referred to as high-level liquid waste.

For analysis purposes, it is assumed that this project would process the current inventory of fuel in the existing Fluorinel Dissolution Process facility (CPP-666) and Fuel Processing Building (CPP-601) in FY 1997 and provide upgraded and new facilities to support long-term fuel

stabilization activities. FY 1997 is the earliest time the facilities could be restarted and was used to maximize the impacts within its ten-year window.

Upgrades and new facilities would be required to support long-term processing of spent fuel. Upgrades have been identified to some facilities that would increase efficiency, safety, or throughput rates. These proposed improvements are described below with estimated costs.

Completion of maintenance activities, operation readiness reviews, and obtaining DOE approvals would be required before the existing facilities could be restarted. About 2 to 3 years would be required to accomplish these activities. Thus, FY 1997 would be the earliest the restart could be accomplished based on a 6/95 decision to start processing. Two or three processing campaigns could be accomplished before the fluorinel dissolution process would be shut down in FY 2000 to accomplish its upgrade.

The following paragraphs summarize the upgrades and new facilities that would be required.

The Fluorinel Dissolution Process was run in the past to process zirconium fuel. For analysis purposes, upgrades were assumed to increase the throughput roughly 2 to 3 times the historical processing rate. The upgrade would be designed to include an electrolytic dissolution process for aluminum and stainless steel fuels. The old electrolytic stainless steel process is no longer operable. The new electrolytic process would also provide a more environmentally acceptable method for processing aluminum fuel. FY 1999 is assumed to be the earliest that a line-item project could be authorized. Hot operation is assumed by 2006. FY 2006 was assumed in this analysis because early processing would be the bounding case for impacts. A rough estimate of the fluorinel dissolution process upgrade including the new electrolytic process is \$700 million.

The Fuel Processing Restoration project that was canceled in 1992 was to provide new facilities to extract the uranium from the dissolver product solutions. The increased capacity for solvent extraction operations would not be required until FY 2006 when fluorinel dissolution process would begin hot operations. Thus, an FY 2001 line-item project would be needed. A current estimate of the cost to restart the project and finish the facility is approximately \$500 million.

Graphite fuel processing would require a new pilot plant/production facility at an estimated cost of \$200 million.

These new and replacement facilities would be sufficient to stabilize essentially all the highly enriched fuels types that are in inventory at the Idaho National Engineering Laboratory (INEL). Other fuels of different materials may require new or modified processes to produce acceptable waste forms.

If this alternative were to be pursued aggressively, the generated wastes may require additional high level waste tankage, which would be covered by the High-Level Tank Farm New Tanks project (page HLW3-1 in this appendix).

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the existing facilities would not be restarted and new facilities would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. The no action option regarding processing of spent fuel is evaluated by each of the spent fuel storage alternatives. Processing fuels not historically processed at INEL (for example, N-Reactor or Fast Flux Test Facility fuels) is not presented here as an alternative, but is included as site-specific alternatives within Volume 1.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet				Rev. 5	May 24, '94
G • n • r l c l n f o .	Description/function:		Spent Fuel Processing		
	WAG		INEL		
	EIS Alter. (A, B, C or D):		D		
	SNF or Waste stream:		SNF		
	Action type:		Use Fuel Processing Restoration Fac		
	Structure Type:		FDP (existing CPP-601)		
	Size: (m2)		FPR (partially complete)		
			Graphite Pilot Plant (GPP)		
	Other features: (Pits, ponds, power /water/sewer lines)				
	Location:				
Inside/outside of fence		Inside ICPP			
Inside/outside of bldg.		Inside FDP, FPR, GPP			
C o n s t r u c t i o n a l f o r m a t i o n	Cost(\$): PreConst.		FDP	FPR	GPP
	Cost(\$): Const.		\$700 M	\$500 M	\$200 M
	Schedule Start /End: PreConst.				
	Schedule Start /End: Const.		99-06	01-06	01-06
	No. of workers: (new/exist)		450 Peak Subs, 50 Existing		
	Heavy Equip. Equip. used:		Trucks		
	Trips:				
	Acres Disturbed: New		0		
	Previous		0		
	Revegetated		0		
I n f o r m a t i o n	Air Emissions: (None / Ref.)		See Belanger et al., 1994		
	Effluents:				
	Type:				
	Quantity: (liters)				
	Solid wastes:		LLW Ind.		
	Type:		HLW LLW Ind.		
	Quantity: (m3)				
	Haz./Toxic Chemicals:				
	Storage/inventory				
C o n s t r u c t i o n	Cultural resource effects:		None identified		
	Pits/ponding created: (m2)		No		
	Water usage: (liters)				
	Energy requirements:				
	Electrical: (MWH/yr)				
	Fossil fuel: (liters)				
	Nightlights used: Y/N		Yes		
	Generators: Night Y/N		No		
	Day Y/N		Yes		
	Cost(\$): Operation:		2006 - TBD		
p e r a t i o n a l f o r m a t i o n	Schedule Start /End:		2006 - TBD		
	No. of workers: (new/exist)		300 Existing, 25 New		
	Heavy Equip. Equip. used:		Trucks		
	Trips:		(from NRF)		
	Air Emissions: (None / Ref.)		See Appendix F, Section 3		
	Effluents:		LLW MLLW		
	Type:				
	Quantity: (liters/yr)				
	Solid wastes:		HLW LLW Ind.		
	Type:				
Quantity: (m3/yr)					
o f f i c i a l f o r m a t i o n	Haz./Toxic Chemicals:				
	Storage/inventory				
	Pits/ponds used: Y/N (m2)		No		
	Water usage: (liters/yr)				
	Energy requirements:				
	Electrical: (MWH/yr)				
	Fossil fuel: (liters/yr)				
	Nightlights used: Y/N		Yes		
	Generators: Night Y/N		No		
	Day Y/N		No		

EXPERIMENTAL BREEDER REACTOR-II BLANKET PROCESSING

PROJECT NAME: Experimental Breeder Reactor-II Blanket Processing

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Experimental Breeder Reactor-II Blanket Processing Project would be to modify the Fuel Cycle Facility to process the Experimental Breeder Reactor-II blanket subassemblies to a suitable form for safe, long term storage. Blanket fuel processing is part of the metal nuclear fuel cycle of the Integral Fast Reactor concept under development at Argonne National Laboratory-West.

The fuel processing project would condition the spent blanket fuel to a stable form for storage. After processing, the recovered material, which is depleted uranium and an actinide alloy, could be stored for future use or converted to a waste form for disposal. This project would have the advantage of neutralizing the reactive constituent in the blanket fuel and would produce material that would be better suited for interim storage. The wastes produced from this activity would be processed for disposal in the same manner as other wastes at Argonne National Laboratory-West and would benefit from the common approach to waste disposal.

PROJECT DESCRIPTION: Argonne National Laboratory-West would process Experimental Breeder Reactor-II blanket subassemblies in the Fuel Cycle Facility following the processing of the Experimental Breeder Reactor-II spent driver fuel assemblies located at either Argonne National Laboratory-West or the Idaho Chemical Processing Plant. The Experimental Breeder Reactor-II core contains 326 blanket subassemblies that will be removed from the core during FY 1994-1996. Other blankets have previously been removed and are stored on the INEL site. The blanket subassemblies contain metallic depleted uranium fuel slugs immersed in sodium, within a stainless steel jacket/can. The sodium improves heat transfer between the fuel and stainless steel. A number of the fuel elements in stainless steel cans are clustered together to form a subassembly. The processing would turn the elemental sodium in the blankets into nonreactive sodium chloride while converting the blanket fuel to a form suitable for storage. The process would require shearing the stainless steel jackets to expose the fuel for processing.

The Fuel Cycle Facility stabilizes the Experimental Breeder Reactor-II metallic spent driver fuel using the following process steps:

-
- A molten salt electrorefining process to separate the fission products from the actinides using an electrochemical cell to drive the process.
 - A salt-metal retorting process that is a batch distillation process to separate the electrorefiner process fluids from the actinide metal products.
 - A blast furnace and injection mold to cast the actinide metal products into a disposable form.
 - Other processes to place the fission products into zeolites, and vitrifying the zeolites into a mineral waste.

The uranium and transuranics would be separated from most of the fission products. The fission products extracted from the fuel would be placed in two stable waste forms: a mineral waste containing the active fission products and a metal waste containing the noble metal fission products and the cladding alloys from the fuel elements. These waste forms would be thoroughly analyzed for subsequent repository disposal. The transuranic elements present in the fuel would be separately recovered and alloyed with the structural stainless steel recovered from the fuel assemblies to produce a stable material that could be stored for later disposition.

This project would modify the Fuel Cycle Facility element chopper to handle the blanket subassemblies, and electrorefiner to handle the larger quantities of depleted uranium from the blankets. The increased capacity would allow the Fuel Cycle Facility to process 400 blanket subassemblies, and would increase the processing rate from 90 to 120 spent driver fuel assemblies per year. The actinides, fission products, and elemental sodium from the blankets would be processed in the same manner as those from the Experimental Breeder Reactor-II driver fuel assemblies. The processing would convert the elemental sodium in the blankets to sodium chloride.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the present practice for blanket handling would be continued. As the blankets are removed from Experimental Breeder Reactor-II, they are transported to the Hot Fuel Examination Facility. The top and bottom section of the subassemblies are machined off and the remaining subassemblies with the blanket fuel elements are placed in a storage can. This can is inserted into another can and transported to the Radioactive Scrap/Waste Facility. The blanket subassemblies would remain at Radioactive Scrap/Waste Facility until a decision is made on processing or treatment for disposal. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

From an environmental perspective, this option would have disadvantages. The blanket fuel contains elemental sodium that will react with water and produce hydrogen gas. This characteristic categorizes this material as reactive. Reactive material is best handled by eliminating or stabilizing the reactive component. The storage option would only isolate the reactive component.

Develop a New Process - This option would be to develop a new process to stabilize the sodium in the blanket subassemblies. This option is not evaluated in this EIS. This option would require a new development program and then implementation of the process into a remote handling facility. This approach would require additional treatment processes and the fuel would have to be stored while this option was being implemented.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9 May 24, '94	
G • n • r l c I n f o .	Description/function:	EBR-II Blanket Processing	C Cultural resource effects:	No
	WAG		o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	No Increase
	SNF or Waste stream:	SNF	s Energy requirements:	
	Action type:	Expand	t Electrical: (MWH/yr)	No Increase
	Structure Type:	Existing	. Fossil fuel: (liters)	No Increase
	Size: (m2)		Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Process Equipment	Generators: Night Y/N	No
			Day Y/N	No
	Location:		O Cost(\$): Operation:	\$1.2 Mil./yr
Inside/outside of fence	Inside ANL-W	p Schedule Start /End:	1997 - 1998	
Inside/outside of bldg.	Inside Bld-765	e No. of workers: (new/exist)	12 Existing	
C o n s t r u c t i o n f o r m a t i o n .	Cost(\$): PreConst.		r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$6 Mil. Total	t Trips:	
	Schedule Start /End: PreConst.	1994 - 1995	i Air Emissions:	
	Schedule Start /End: Const.	1995 - 1996	o (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	10 Existing	n Effluents:	
	Heavy Equip. Equip. used:	Trucks	i Type:	No Increase
			Quantity: (liters/yr)	
	Acres Disturbed: New	0	n Solid wastes:	
	Previous	0	f Type:	HLW MLLW LLW TRU
	Revegetate	0	Quantity: (m3/yr)	3.5 0.4 7.4 4.0
o n f o r m a t i o n .	Air Emissions:		o Haz./Toxic Chemicals:	
	(None / Ref.)	None	r Storage/inventory	No Increase
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	No Liquid Wastes Produced	a Water usage: (liters/yr)	No Increase
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	No Increase
	Type:	None	o Fossil fuel: (liters/yr)	No Increase
	Quantity: (m3)		n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N	No
	Storage/inventory	No Increase	Day Y/N	No

ACTINIDE RECYCLE DEMONSTRATION

PROJECT NAME: Actinide Recycle Demonstration

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to allow the demonstration and testing of new spent nuclear fuel management processes. The goals of the project would be to

- Demonstrate the technical and economic feasibility of pyroprocessing (high temperature metal processing) for spent nuclear fuel.
- Demonstrate a waste product that is potentially compatible with the acceptance criteria for a geologic repository.
- Explicitly quantify the volume reduction of the waste stream components.

PROJECT DESCRIPTION: Argonne National Laboratory-West would perform the process development and demonstrate the conditioning of light-water reactor and Department of Energy (DOE) spent nuclear fuel for either disposal or future energy use. Much of the spent nuclear fuel at the INEL is highly enriched, making direct disposal into a repository potentially unacceptable because of the possibility of an inadvertent criticality. This concern suggests consideration of stabilization treatments such as pyroprocessing.

Presently in storage at the INEL are 72 distinct and different fuel designs owned by the DOE. These designs include hydride, metal alloy sodium bonded, graphite, aluminum, oxide, and naval fuel matrices. These demonstration fuels would be transported from other INEL locations to Argonne National Laboratory-West as needed. Argonne would first complete process development and demonstration with unirradiated oxide fuel containing representative fission product elements and then conduct a pilot scale demonstration of spent nuclear fuel stabilization in the Hot Fuel Examination Facility and Fuel Cycle Facility at the Argonne National Laboratory-West site. This demonstration would include pyroprocessing of representative INEL fuel types and cover the complete range of operations necessary to prepare the fuel for ultimate disposition. The only new equipment required for this demonstration would be the installation of

a vessel for carrying out the reduction of oxide to metal. The waste forms produced in the course of stabilizing oxide fuel would be identical to those produced with other fuel types, except for minor compositional differences in the metal waste forms, which depend on the composition of the structural materials used in the particular fuel types. For metallic spent fuel, additional equipment and modifications to the present equipment would be required to disassemble fuel assemblies and chop the fuel.

Pyroprocessing generally includes processes such as molten salt-metal extractions, molten salt electrorefining and electrowinning, salt-metal retorting, and metal slagging and injection casting. The basic process steps consist of chopping the fuel rods, electrorefining the fuel material, performing cathode processing, and then injection casting the resulting material into metal ingots. The details of the process are as follows:

- The spent fuel assembly is introduced for processing into a remotely operated, shielded room called a hot cell. The assembly is taken apart, and the structural components (everything except the fuel rods themselves) are removed and discarded as waste. The rods are passed through a shear and chopped into short pieces. For oxide fuels, the pieces are placed in a reduction vessel to produce a metal product. This product or chopped metallic fuel segments are placed into an electrorefiner at 500°C. Electrorefining is an established industrial process used to purify metals like nickel. It operates like a battery with an anode, cathode, and electrolyte. At the appropriate cell voltage, uranium or a uranium-plutonium mixture is deposited on a solid metal cathode or into a liquid cadmium cathode. The vast majority of fission products are left in the electrolyte.
- The next step involves raising the temperature of the cathode product in a furnace to a temperature (1000 to 1200°C) that separates the uranium/plutonium from the cadmium and vaporizes the cadmium for collection and reuse.
- Raw metal ingots would then be produced by injection casting, a process similar to that used routinely in the manufacture of many plastic products. The raw fuel ingots would then be removed from molds and placed in storage for a 3 to 5 year period until a decision is made as to their final disposition.

-
- The principal process wastes would be from the electrorefiner. The fission products would be placed in two stable waste forms: a mineral waste containing the active fission products, and a metal waste containing the noble metal fission products and structural alloys from the fuel elements. These waste forms would be evaluated to determine whether they meet acceptance criteria for subsequent repository disposal.

The naval spent nuclear fuel could also be pyroprocessed to recover uranium and separate out the fission products and transuranic elements in the same manner as the other fuel types discussed above. In this instance, an additional dissolution step at the beginning of the process would be required prior to processing. Process development would be required to establish a preferred means for accomplishing this dissolution; preliminary evaluations indicate that material could be readily dissolved by contact with a molten metal at normal process operating temperatures. Development of this process step would be conducted with irradiated fuel in the Hot Fuel Examination Facility and Fuel Cycle Facility. A separate vessel for the dissolution step may be required for this demonstration. The waste form production and product recovery/disposition steps would be the same as with the metal and oxide fuels.

These processes could also apply to other DOE spent nuclear fuel. After the completion of the INEL and light-water reactor demonstrations, the facilities would be used to demonstrate the pyroprocess applicabilities to other DOE sites.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, actinide recycle demonstration would not be provided. This option corresponds to Alternative A (No Action) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 24, '94		
G	Description/function:	Actinide Recycle Demonstration	C	Cultural resource effects:	None
e			o	Pits/ponding created: (m2)	No
n	WAG	8	n	Water usage: (liters)	None
e	EIS Alter. (A, B, C or D):	B, C, D	s	Energy requirements:	
r	SNF or Waste stream:	SNF	t	Electrical: (MWH/yr)	No increase
l	Action type:	Expand	.	Fossil fuel: (liters)	No increase
c	Structure Type:			Nightlights used: Y/N	No
l	Size: (m2)			Generators: Night Y/N	No
n	Other features:	Actinide Process Equipment		Day Y/N	No
f	(Pits, ponds, power		O	Cost(\$): Operation:	\$600 k/yr
o	/water/sewer lines)		p	Schedule Start /End:	1996 - 2024
.	Location:		e	No. of workers: (new/exist)	25 Existing
	Inside/outside of fence	Inside ANL-W	r	Heavy Equip. Equip. used:	Trucks
	Inside/outside of bldg.	Inside Bld-765, & -785	a	Trips:	
C	Cost(\$): PreConst.		t	Air Emissions:	
o	Cost(\$): Const.	\$5 Mil.	l	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1994 - 1995	o		
s	Schedule Start /End: Const.	1994 - 1996	n		
t	No. of workers: (new/exist)		a	Effluents:	
r	Heavy Equip. Equip. used:	Trucks	l	Type:	no increase
u	Trips:			Quantity: (liters/yr)	
c	Acres Disturbed: New	0	l	Solid wastes:	
t	Previous	0	n	Type:	HLW MLLW LLW TRU Ind.
l	Revegetated	0	f	Quantity: (m3/yr)	27 0.4 33 32 212
o	Air Emissions:		o	Haz./Toxic Chemicals:	
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	
l	Effluents:		m	Pits/ponds used: Y/N (m2)	No
n	Type:	no increase	a	Water usage: (liters/yr)	
f	Quantity: (liters)		t	Energy requirements:	
o	Solid wastes:		l	Electrical: (MWH/yr)	
.	Type:	no increase	o	Fossil fuel: (liters/yr)	
	Quantity: (m3)		n	Nightlights used: Y/N	No
	Haz./Toxic Chemicals:	None		Generators: Night Y/N	No
	Storage/inventory			Day Y/N	No

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Projects
Related to
Decontamination and
Decommissioning

CENTRAL LIQUID WASTE PROCESSING FACILITY DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Central Liquid Waste Processing Facility Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to remove excess, obsolete, contaminated equipment from the Central Liquid Waste Processing Area so that the Analytical Laboratory could use this floor space for other missions.

PROJECT DESCRIPTION: The Central Liquid Waste Processing Area is located in the southwest corner of the Analytical Laboratory in the first floor and basement levels of Building 752 at Argonne National Laboratory-West at the INEL. The area occupies approximately 14 square meters (150 square feet) on each floor. The Central Liquid Waste Processing Area was used by the Analytical Laboratory to treat radioactive liquid waste. Central Liquid Waste Processing Area operations were discontinued in July 1983 when the Radioactive Liquid Waste Treatment Facility began operating and partially assumed the previous Central Liquid Waste Processing Area mission. The Central Liquid Waste Processing Area has been declared an excess area per DOE Order 5820.2A, "Radioactive Waste Management." This proposed project would include the surveillance and maintenance and the decontamination and decommissioning of the Central Liquid Waste Processing Area.

The Central Liquid Waste Processing Area system was used to receive, store, and reduce radioactive liquid waste. The system is considered contaminated by mixed fission products, activation products, uranium, thorium and tritium. Interior surfaces of piping, tanks, valves and pumps are likely to be contaminated with radioactive material. Some sludge residue in vessel bottoms and piping low points can be expected. This sludge would be removed only if the components do not meet the definition of an empty tank per 40 CFR 261.7(b)(1)(iii). Any removed transuranic sludge would be qualified to meet waste acceptance criteria for shipment to Radioactive Waste Management Complex. Some asbestos-containing waste may result because asbestos bearing insulation adhesive was permitted during Central Liquid Waste Processing Area construction, even though asbestos was not specified as an insulation material. Other waste would be held at the Argonne National Laboratory-West Mixed Waste Storage Facility.

The Central Liquid Waste Processing Area would contain approximately 140 cubic meters (5,000 cubic feet) of low-level contaminated materials (a low percentage may be mixed waste) to be disposed. Types of media contaminated are (a) concrete; (b) steel in the form of piping, tanks, valves, electrical conduit, etc.; (c) electrical wiring; (d) instrumentation panels; and (e) asbestos.

The tasks for surveillance and maintenance include (a) daily visual inspections, with results, and any necessary preventive or corrective maintenance, documented; (b) monthly radiological surveys to document radiation and contamination levels, and (c) yearly status reports for the Central Liquid Waste Processing Area. These tasks would be continued only until the decontamination and decommissioning field work is begun.

The decontamination and decommissioning tasks would include (a) preparation of National Environmental Policy Act documentation, (b) waste sampling and analysis, (c) Title I and Title II design, and (d) decontamination and decommissioning field work and Title III engineering support. During Title I, preliminary design concepts would be developed to provide the basis for a detailed working cost estimate for the Title II design effort and a rough cost estimate for the decontamination and decommissioning work and Title III. During Title II design a detailed engineering package would be developed. This package would include (a) drawings, procedures, waste packaging and disposal plans for removing the radioactively contaminated process equipment (possibly mixed waste) and (b) a detailed working cost estimate for decontamination and decommissioning work and Title III.

All decontamination and decommissioning work would be done within temporary contamination containment enclosures in Building 752. The enclosures would discharge to existing filter and discharge systems for contaminated air/gases. Some particulates may pass through high efficiency particulate air filters during decontamination and decommissioning operations, but these discharges would be bounded by normal radioactive air emissions at Argonne National Laboratory-West. Other air emissions would be generated by trucks hauling the solid waste to the Radioactive Waste Management Complex, estimated to be 40 shipments.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, decontamination and decommissioning of the Central Liquid Waste Processing Facility would be deferred. This option corresponds with Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel, and this floor space would not be available to the Analytical Laboratory for other missions.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

DOE 1988, *Decommissioning of Radioactively Contaminated Facilities*, DOE Order 5820.2A, Chapter V, U.S. Department of Energy, Washington, DC.

Project Data Sheet			Rev. 7 May 16, '96					
G e n e r i c l i n f o r m a t i o n	Description/function:	Central Liquid Waste Processing Facility D&D	D & D I n f o r m a t i o n	Solid wastes:				
	WAG	9		Type:	MLLW	LLW	Ind.	Haz.
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	0.2	142	60	
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None			
	Action type:	D & D		Storage/inventory				
	Structure Type:			Cultural resource effects:	None			
	Size: (m2)	14		Pits/ponding created: (m2)	No			
	Other features: (Pits, ponds, power /water/sewer lines)	None		Water usage: (liters)				
	Location:			Energy requirements:				
	Inside/outside of fence	Inside ANL-W		Electrical: (MWH/yr)				
Inside/outside of bldg.	Inside Bld-752	Fossil fuel: (liters)						
D & D I n f o r m a t i o n	Cost(\$): Pre D&D	\$110 k	D & D I n f o r m a t i o n	Nightlights used: Y/N		No		
	Cost(\$): D&D	\$1.5 Mil.		Generators: Night Y/N		No		
	Schedule Start /End: Pre D&D	1994 - 1995		Day Y/N		No		
	Schedule Start /End: D&D	2004 - 2005						
	No. of workers: (new/exist)	2 - 4 Existing						
	Heavy Equip. Equip. used:	Trucks						
	Trips:	40 to RWMC						
	Acres Disturbed New	0						
	Previous	0						
	Revegetated	0						
a i o n	Air Emissions: (None / Ref.)	See Belanger et al., 1994						
	Effluents:							
n	Type:	None						
	Quantity: (liters)							

ENGINEERING TEST REACTOR DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Engineering Test Reactor Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Engineering Test Reactor Decontamination and Decommissioning Project would be to remove the Engineering Test Reactor and associated support structures from the INEL Surplus Facilities List in accordance with the DOE directives. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at this facility.

PROJECT DESCRIPTION: The Engineering Test Reactor was a 175-megawatt (thermal) pressurized light water test reactor that operated between 1957 and 1982. This surplus facility consists of the reactor building and about 10 support structures that are candidates for decontamination and decommissioning. The main concentration of radioactive contamination is in the reactor vessel and the experiment cubicles that contained the loop equipment for the various experiments.

The Engineering Test Reactor facility includes the following major buildings/structures:

- (1) **Reactor Building** - This building contains the reactor vessel and shielding, the reactor control room, a large water canal, and several areas and cubicles associated with the experimental in-pile loops. The reactor building is 42 meters (136 feet) in the east-west direction by 34 meters (112 feet) in the north-south direction. It extends 18 meters (58 feet) above grade level and 12 meters (38 feet) below grade level to the basement floor. Significant contamination levels exist and the reactor core components are highly radioactive.
- (2) **Compressor Building** - The compressor building houses the equipment that was used to supply large quantities of heated, hydrocarbon-free air to various experiments. In the building is the process control room that was used to control all plant services to the

reactor and a sample laboratory that was used to conduct chemistry samples on the reactor primary and secondary coolant systems.

- (3) **Heat Exchanger Building** - The building includes (a) main room and lower level, (b) demineralizer wing, (c) degassing tank room, (d) cubicle exhaust booster blower room, and (e) secondary pipe pit. The primary function of the heat exchanger building main room was to house the 12 primary coolant/secondary coolant system heat exchangers and associated piping.
- (4) **Secondary Coolant Pump House** - The building houses four secondary coolant system pumps, four utility cooling water pumps, and a cooling tower fire water control and distribution system. The building also houses switchgear for the cooling tower fans, UCW pumps, a sump pump, and electrical heaters. It also contains the water treatment room which houses the chlorinator, chemical proportioning pumps, chemical day tanks, and chemical storage tanks.
- (5) **Electrical Building** - The electrical building consists of the 13.8-kV, 4160-V, and 480-V switchgear, No. 1 emergency diesel generator, five motor-generator units, and one lead-storage battery bank. The building is a two-level structure consisting of the upper story and a basement level referred to as the cable vault.
- (6) **Engineering Test Reactor Office Building** - This building housed the Reactor Control Room, Amplifier Room, and all the office space. This building continues to be utilized for office space including the control room area.
- (7) **Critical Facility** - This facility consisted of a low-power reactor that was a nuclear mock-up of the Engineering Test Reactor. The critical facility was housed in a building addition on the southeast corner of MTR-635. The critical facility was used to duplicate fuel and experiment arrangements prior to their use in the Engineering Test Reactor to facilitate calculation of neutron flux, flux patterns, excess reactivity, and associated operating parameters.

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- (8) Exhaust Gas - A 76 meter (249 feet) high concrete exhaust stack, a monitoring building, and associated piping are contaminated.
 - (9) Liquid Waste Storage - There are several catch tanks that exist inside the reactor building and are highly contaminated.

Performance of this decontamination and decommissioning project would require a thorough chemical and radiological characterization, a decision analysis to determine the preferred decontamination and decommissioning mode, appropriate project planning documents, a safety analysis and the necessary National Environmental Policy Act documentation, and the execution of the field decontamination and decommissioning activities.

The mode, scope, and detail of the proposed decontamination and decommissioning cleanup activities to be utilized on this project have not been determined and would depend to some extent upon the characterization results. It is expected that cleanup activities would range from the simple decontamination and reuse of a building to total structure demolition and disposal.

All actions related to this project would take place within the Test Reactor Area fenced area and involve about 0.8 hectares (2 acres). Soil disturbance would be caused by the removal of contaminated materials, including underground foundations, vaults, and piping. All soil disturbance would occur in previously disturbed areas (the same areas initially disturbed in the original facility construction in the 1950s), and would be followed by backfill, surface re-contouring, and re-seeding as required.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, decontamination and decommissioning of the Engineering Test Reactor would be deferred. This option corresponds with Alternatives A (No Action) and C

(Minimum Treatment Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7		May 16, '96			
G e n e r a l i n f o r m a t i o n	Description/function:	Engineering Test Reactor D&D	D & D I n f o r m a t i o n	Solid wastes:				
	WAG	2		Type:	LLW	MLLW	Asbestos	Ind.
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	6,178	17	2	12,658
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None			
	Action type:	D&D		Storage/inventory				
	Structure Type:	Buildings (12)		Cultural resource effects:	None			
	Size: (m2)	MTR-642, 643, 644, MTR-645, 647, 648		Pits/ponding created: (m2)	No			
	Other features:	TRA-654, 655, 663, 752, 753, 755		Water usage: (liters)				
	(Pits, ponds, power /water/sewer lines)	None		Energy requirements:				
	Location:			Electrical: (MWH/yr)	0			
Inside/outside of fence	Inside TRA	Fossil fuel: (liters)	0					
Inside/outside of bldg.	Inside ETR	Nightlights used: Y/N	No					
D	Cost(\$): Pre D&D	\$4.8 Mil.	Generators:	Night Y/N	No			
&	Cost(\$): D&D	\$39 Mil.	Day Y/N	Yes				
D	Schedule Start /End: Pre D&D	1994 - 1996						
	Schedule Start /End: D&D	1996 - 2005						
I	No. of workers: (new/exist)	30 - 40 Existing & Subs.						
n	Heavy Equip. Equip. used:	Trucks						
f	Trips:	67 to RWMC / WERF						
o	Acres Disturbed New	0						
r	Previous	5						
m	Revegetated	0						
a	Air Emissions:							
t	(None / Ref.)	See Belanger et al., 1994						
i	Effluents:							
o	Type:	None expected						
n	Quantity: (liters)							

MATERIALS TEST REACTOR DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Materials Test Reactor Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Materials Test Reactor Decontamination and Decommissioning Project would be to remove the Materials Test Reactor and associated support structures from the INEL Surplus Facilities List in accordance with the DOE directives. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at this facility.

PROJECT DESCRIPTION: The Materials Test Reactor was a 40-megawatt (thermal) pressurized light water test reactor that operated between 1952 and 1970. This surplus facility consists of the reactor building and about 14 support structures that are candidates for decontamination and decommissioning. The main concentration of radioactive contamination is in the reactor vessel that has large amounts of beryllium and graphite that were used as reflector materials during operations.

The Materials Test Reactor facility includes the following major buildings and structures:

- (1) **Reactor Building** - This building contains the reactor vessel and shielding, the reactor control room, a large water canal, and several areas and cubicles associated with the experimental in-pile loops and neutron beam holes. The Materials Test Reactor Water Canal (previously entitled the Test Train Assembly Facility) would be a separate decontamination and decommissioning project. The structure is primarily concrete and is 40 meters square (130 feet square), 24 meters (80 feet) high, and has a 5 meter (17 feet) deep basement. Significant contamination levels exist and the reactor core components are highly radioactive.
- (2) **Reactor Building Wing** - This adjacent building was used for laboratory and office space, and remains in use at this time. The basement area has significant problems involving the radiologically contaminated liquid waste storage tanks and associated piping.

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- (3) **Process Water Building** - A concrete structure containing the reactor primary coolant process equipment. This is a two story building with a basement associated with a primary coolant pipe tunnel to the reactor building.
 - (4) **Plug Storage Facilities** - These facilities were used to store highly radioactive materials in horizontal steel tubes shielded by concrete and earth fill.
 - (5) **Compressor Building** - A single level, concrete block structure that originally contained equipment associated with the reactor air systems.
 - (6) **Services Building** - A concrete block building located against the reactor building is currently used for material storage and staging activities.
 - (7) **Liquid Waste Storage** - There are several significant underground structures consisting of catch tanks, concrete vaults and pump pits, pump houses, retention basins, and associated piping that exist outside facility buildings and are highly contaminated.
 - (8) **Exhaust Gas** - A 76-meter high concrete exhaust stack, a monitoring building, and associated piping are contaminated.
 - (9) **Gamma Facilities Building** - A single story, concrete block structure containing a dry canal that was used to perform gamma irradiation experiments.

Performance of this proposed decontamination and decommissioning project would require a thorough chemical and radiological characterization, a decision analysis to determine the preferred decontamination and decommissioning mode, appropriate project planning documents, a safety analysis and the necessary National Environmental Policy Act documentation, and the execution of the field decontamination and decommissioning activities.

The mode, scope, and detail of the proposed decontamination and decommissioning cleanup activities to be utilized on this project have not been determined and would depend to some extent upon the characterization results. It is expected that cleanup activities would range from simple decontamination and reuse of the building to total structure demolition and disposal.

All actions related to this project would take place within the Test Reactor Area fenced area and involve about 2 acres. Soil disturbance would be caused by the removal of contaminated materials, including underground foundations, vaults, and piping. All soil disturbance would occur in previously disturbed areas (the same areas initially disturbed in the original facility construction in the 1950s), and would be followed by backfill, surface re-contouring, and re-seeding as required.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, decontamination and decommissioning of the Materials Test Reactor would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 6		May 16, '96			
G e n e r a l i n f o r m a t i o n	Description/function:	Materials Test Reactor D&D	D & D I n f o r m a t i o n	Solid wastes:				
	WAG	2		Type:	LLW	MLLW	Asbestos	Ind.
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	7,740	10	2	15,598
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None			
	Action type:	D & D		Storage/inventory				
	Structure Type:	Buildings (20)		Cultural resource effects:	None identified			
	Size: (m2)			Pits/ponding created: (m2)	None			
	Other features: (Pits, ponds, power /water/sewer lines)	None		Water usage: (liters)				
	Location:			Energy requirements:				
	Inside/outside of fence	Inside TRA		Electrical: (MWH/yr)	0			
Inside/outside of bldg.	Inside MTR	Fossil fuel: (liters)	0					
D & D I n f o r m a t i o n	Cost(\$): Pre D&D	\$5.8 Mil.	D & D I n f o r m a t i o n	Nightlights used: Y/N	No			
	Cost(\$): D&D	\$34 Mil.		Generators: Night Y/N	No			
	Schedule Start /End: Pre D&D	1994 - 1998		Day Y/N	Yes			
	Schedule Start /End: D&D	1998 - 2003						
	No. of workers: (new/exist)	30 - 40 Existing & Subs.						
	Heavy Equip. Equip. used:	Trucks						
	Trips:	122 on-site						
	Acres Disturbed New	0						
	Previous	2.8						
	Revegetated	0						
a t i o n	Air Emissions: (None / Ref.)	See Belanger et al., 1994						
	Effluents:							
n	Type:	LLW						
	Quantity: (liters)	454,200						

FUEL PROCESSING COMPLEX (CPP-601) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Fuel Processing Complex (CPP-601) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of this proposed project would be to ensure the identified facility would be in a safe configuration, to determine and execute appropriate decontamination activities, and to decommission CPP-601 when it becomes surplus to the DOE's future programmatic needs. This proposed project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, surveillance and maintenance.

PROJECT DESCRIPTION: This proposed project would address the characterization, decontamination and decommissioning of the Fuel Processing Complex (CPP-601) at the Idaho Chemical Processing Plant.

The CPP-601 facility contains chemical processing equipment that was used to recover uranium from various types of nuclear fuel. The facility is essentially rectangular (244 feet by 102 feet) and consists of five levels (up to 95 feet high, mostly below ground). The top level is above grade and contains an unpartitioned area that was used to transfer fuel elements to the process equipment and for chemical storage, makeup, and transfer. The top level is constructed of Transite panels (containing asbestos) and structural steel. The lower levels (largely below ground) are constructed of reinforced concrete with walls up to 5 feet thick.

The lower levels contain 29 process cells (most of which are about 20 feet square and 28 feet high), numerous corridors, and auxiliary cells that house equipment and controls. The largest cell is approximately 60 feet by 20 feet by 40 feet high. The floor and part of the walls of each cell are lined with stainless steel and most of the equipment is stainless steel. Most of the processing equipment in the building is located in the heavily shielded cells and was designed to be operated remotely and maintained hands-on. The in-cell equipment controls were installed in an operating corridor that runs the length of the building between cells. A service (piping) corridor is located below the operating corridor and a cell access corridor is located below the service corridor. Sampling and cell ventilation corridors are located outside the row of cells.

Nuclear fuel reprocessing at CPP-601 was terminated in 1992 making the facility obsolete for its originally intended mission. Phaseout of facility operation is currently being conducted. This phaseout effort will remove all uranium from the facility and leave the facility in a stable, low cost surveillance condition. The facility will be held in this surveillance and maintenance status until a decision is made to convert it to a new use or to dismantle it. The proposed project described in this section assumes no new use for CPP-601 will be identified and dismantlement of the facility would be conducted.

Upon satisfactory completion of the proposed deactivation effort, CPP-601 would be monitored to ensure contamination present in the facility would be contained and public and worker safety would be maintained. During this surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the decontamination and decommissioning operations phase of the project.

For the purposes of this EIS, it is assumed the CPP-601 decontamination and decommissioning project would

- Remove all contaminated equipment except the WG/WH tanks, which are required for Idaho Chemical Processing Plant operation
- Decontaminate the remaining facility surfaces
- Remove the above grade portion of the facility
- Entomb the concrete substructure in place.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan).

No Action - Under this option, decontamination and decommissioning of the Fuel Processing Complex would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Fuel Processing Complex would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds with Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and shipped to the appropriate waste handling facility on the INEL.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 16, '96						
G e n e r a l i n f o r m a t i o n	Description/function:	Fuel Processing Complex (CPP-601) D&D	D & D I n f o r m a t i o n	Solid wastes:					
	WAG	3		Type:	LLW	MLLW	Haz.	TRU	Ind.
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	1800	18	1	10	1800
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None				
	Action type:	D & D		Storage/inventory	None identified				
	Structure Type:	Building CPP-601		Cultural resource effects:	None identified				
	Size: (m2)			Pits/ponding created: (m2)	No				
	Other features: (Pits, ponds, power /water/sewer lines)	None		Water usage: (liters)					
	Location:			Energy requirements:					
	Inside/outside of fence	inside ICPP		Electrical: (MWH/yr)					
Inside/outside of bldg.	Inside CPP-601	Fossil fuel: (liters)							
D & D I n f o r m a t i o n	Cost(\$): Pre D&D	\$1.7 Mil.	D & D I n f o r m a t i o n	Nightlights used: Y/N	No				
	Cost(\$): D&D	\$8.3 Mil.		Generators: Night Y/N	No				
	Schedule Start /End: Pre D&D	1994 - 1996		Day Y/N	Yes				
	Schedule Start /End: D&D	1996 - 2000							
	No. of workers: (new/exist)	50 - 75 Existing & Subs.							
	Heavy Equip. Equip. used:	Trucks							
	Trips:								
	Acres Disturbed New	0							
	Previous	0.6							
	Revegetated	0							
a i r e m i s s i o n	Air Emissions: (None / Ref.)	See Belanger et al., 1994							
	Effluents:								
n	Type:	LLW							
	Quantity: (liters)	423,000							

FUEL RECEIPT AND STORAGE FACILITY (CPP-603) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Fuel Receipt and Storage Facility (CPP-603) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of the proposed CPP-603 Decontamination and Decommissioning Project would be to reduce the risk of radiological exposure and to eliminate the need for extensive long-term surveillance and maintenance.

PROJECT DESCRIPTION: The proposed project would address the characterization and decontamination and decommissioning of the three water filled storage basins and a nuclear Fuel Element Cutting Facility located in the CPP-603 Fuel Receipt and Storage Facility at the Idaho Chemical Processing Plant.

The CPP-603 underwater storage basins became operational in 1953 through 1957 and were constructed of reinforced concrete with no liners or leak detection systems. The basin storage portion of CPP-603, covering approximately 50,000 square feet, provides underwater storage for spent nuclear fuel involving approximately 1,500,000 gallons of filtered water. The three interconnected basins include support processes to treat and maintain the basin water quality, including filtration, ion exchange, chloride removal, reverse osmosis demineralization, and ultraviolet light sterilization. The integrity of the basin portion of the facility and its fuel handling monorail system has become suspect since the facility was constructed to seismic criteria of the late 1940s to early 1950s. The affected facility interior surfaces, equipment, structures, interior cell areas (Fuel Element Cutting Facility), and the building exterior require radiological and hazardous material decontamination.

Activities are currently being conducted that will transfer the spent fuel stored underwater in CPP-603 to newer storage facilities at the Idaho Chemical Processing Plant. Upon satisfactory completion of the spent fuel transfer effort, CPP-603 would be monitored to ensure contamination present in the facility is contained and public and worker safety is maintained. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical

information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed CPP-603 decontamination and decommissioning project would be assumed to

- Remove all contaminated equipment from the underwater storage portion of CPP-603 and its ancillary support systems.
- Decontaminate the remaining affected facility surfaces.
- Fill in (gravel) and seal entry to the affected basins.
- Entomb the affected basins in place.
- Initiate an appropriate level of surveillance and maintenance.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan).

No Action - Under this option, decontamination and decommissioning of the Fuel Receipt and Storage Facility would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Fuel Receipt and Storage Facility would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and shipped to the appropriate waste handling facility on the INEL.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 16, '96					
G e n e r a l i n f o r m a t i o n	Description/function:	Fuel Receipt/Storage Facility (CPP-603) D&D	D & D I n f o r m a t i o n	Solid wastes:				
	WAG	3		Type:	LLW	MLLW	HW	Ind.
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	100	1	1	288
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None			
	Action type:	D & D		Storage/inventory				
	Structure Type:	Building		Cultural resource effects:	None identified			
	Size: (m2)	CPP-603		Pits/ponding created: (m2)	No			
	Other features:	72 (6 x 12 x 5 m)		Water usage: (liters)				
	(Pits, ponds, power /water/sewer lines)	None		Energy requirements:				
	Location:			Electrical: (MWH/yr)				
Inside/outside of fence	Inside ICPP	Fossil fuel: (liters)						
Inside/outside of bldg.	Inside CPP-603	Nightlights used: Y/N	No					
D & D	Cost(\$): Pre D&D	\$2.3 Mil.	Generators: Night Y/N	No				
	Cost(\$): D&D	TBD	Day Y/N	Yes				
D	Schedule Start /End: Pre D&D	1997 - 1998						
	Schedule Start /End: D&D	1998 - 2001						
I	No. of workers: (new/exist)	30 Existing & Subs.						
n	Heavy Equip. Equip. used:	Trucks						
f	Trips:							
o	Acres Disturbed New	0						
r	Previous	0.5						
m	Revegetated	0						
a	Air Emissions:							
t	(None / Ref.)	See Belanger et al., 1994						
i								
o	Effluents:	LLW LLW						
n	Type:	Water NA bearing						
	Quantity: (liters)	7,570 k 370 k						

HEADEND PROCESSING PLANT (CPP-640) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Headend Processing Plant (CPP-640) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of this proposed project would be to ensure the identified facility is in a safe configuration, determine and execute appropriate decontamination activities, and decommission the fuel processing systems within CPP-640 when it becomes surplus to the DOE's future programmatic needs. This proposed project would reduce the risk of radioactive exposure and cost of further surveillance and maintenance.

PROJECT DESCRIPTION: This proposed project would address an assessment and decontamination and decommissioning of two unique nuclear fuel processing systems housed in the CPP-640 facility at the Idaho Chemical Processing Plant. The proposed CPP-640 decontamination and decommissioning project would reduce the risk of radiological exposure, and eliminate the need for extensive long-term facility surveillance and maintenance.

The Headend Processing Plant contains approximately 1,395 cubic meters (15,000 cubic feet) of floor space and houses two unique spent fuel headend processing systems and a liquid waste collection system. The ROVER and ELECTROLYTIC headends operated in heavily shielded concrete and steel hotcell units with remote manipulation capabilities and some remote maintenance capabilities. The liquid waste collection system includes three tanks in heavily shielded concrete vaults situated below the hotcell units.

The processing systems (ROVER and ELECTROLYTIC) have been shutdown since 1984 and 1981, respectively. Although much of the process chemical and radionuclide inventory has been removed from the headend systems, both systems remain highly contaminated and the ROVER system contains significant quantities of fissile material. The liquid waste system is included in the Resource Conservation and Recovery Act Part A permit and is planned for Resource Conservation and Recovery Act closure. A phaseout effort currently in-progress will remove the fissile material entrapped in the ROVER system and leave the facility in a stable, low-cost surveillance and maintenance status until a decision is made to convert it to a new use or to

dismantle it. The proposed project assumes no new use for the CPP-640 will be identified and dismantlement of facility equipment would be conducted.

Upon satisfactory completion of the fissile material removal effort, the CPP-640 would be monitored to ensure contamination present in the facility is contained and public and worker safety is maintained. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. The characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A detailed decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based on results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed CPP-640 decontamination and decommissioning project would be assumed to

- Remove all contaminated equipment remaining after completion of the fissile material removal activity.
- Resource Conservation and Recovery Act close the waste collection system.
- Decontaminate the remaining affected facility surfaces.
- Decommission the empty hot cell units.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan).

No Action - Under this option, decontamination and decommissioning of the Headend Processing Plant would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Headend Processing Plant would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and shipped to the appropriate waste handling facility on the INEL.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8		May 16, '96	
G e n e r a l i n f o r m a t i o n	Description/function:	Headend Processing Plant (CPP-640) D&D	D & D I n f o r m a t i o n	Solid wastes:		
	WAG	3		Type:	LLW	MLLW
	EIS Alter. (A, B, C or D):	B, D		Quantity: (m3)	80	(No Information Available)
	SNF or Waste stream:	E R		Haz./Toxic Chemicals:	None	
	Action type:	D & D		Storage/inventory	None identified	
	Structure Type:	Building		Cultural resource effects:	None identified	
	Size: (m2)	1,400		Pits/ponding created: (m2)	No	
	Other features:	5 levels		Water usage: (liters)		
	(Pits, ponds, power /water/sewer lines)	None		Energy requirements:		
	Location:			Electrical: (MWH/yr)		
Inside/outside of fence	Inside ICPP	Fossil fuel: (liters)				
Inside/outside of bldg.	Inside CPP-640	Nightlights used: Y/N	No			
D & D I n f o r m a t i o n	Cost(\$): Pre D&D	\$500 k	Generators:	Night Y/N	No	
Cost(\$): D&D	\$16.7 Mil.	Day Y/N	Yes			
Schedule Start /End: Pre D&D	1997 - 1999					
Schedule Start /End: D&D	1999 - 2002					
No. of workers: (new/exist)	50 Existing & Subs, 2-3 New					
Heavy Equip. Equip. used:	Trucks					
Trips:						
Acres Disturbed New	0					
Previous	0					
Revegetated	0					
Air Emissions:						
(None / Ref.)	See Belanger et al., 1994					
Effluents:						
Type:	LLW					
Quantity: (liters)	Decon Solution					
	1,900 - 7,600					

WASTE CALCINE FACILITY (CPP-633) DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Waste Calcine Facility (CPP-633) Decontamination and Decommissioning

GENERAL PROJECT OBJECTIVE: The general objectives of this proposed project would be to assure the Waste Calcine Facility is in a safe configuration, determine and execute appropriate decontamination activities, and decommission the facility, which is surplus to the DOE's future programmatic needs.

PROJECT DESCRIPTION: This proposed project would address the assessment and decontamination and decommissioning of the Waste Calcine Facility located in CPP-633 at the Idaho Chemical Processing Plant (ICPP). The Waste Calcine Facility decontamination and decommissioning project would reduce the risk of radiological exposure and eliminate the need for extensive long-term surveillance and maintenance. The project would determine and execute the appropriate decontamination and decommissioning activities at the Waste Calcine Facility.

The Waste Calcine Facility was the world's first plant scale facility built to achieve the safe, efficient disposal of high-level radioactive liquid wastes resulting from processing spent nuclear fuels for uranium recovery. From 1963 through 1981 the Waste Calcine Facility converted high-level radioactive liquid wastes into granular solids that were less corrosive, less mobile, and occupied less storage volume. The Waste Calcine Facility was designed for direct contact (hands-on) maintenance conducted during its periodic shutdowns, with remote capabilities for primary off-gas filter change-out and process control.

The Waste Calcine Facility is a reinforced concrete structure encompassing approximately 1,860 cubic meters (20,000 cubic feet) of floor space. The facility includes a ground level and two subsurface levels which include operating and access corridors. Within the Waste Calcine Facility are several areas of high radiation and extensive radiological contamination. These areas would require extensive remote and semi-remote decontamination efforts. The Waste Calcine Facility process system also includes five (5) Resource Conservation and Recovery Act units (tanks) that are currently permitted under interim status on the Idaho Chemical Processing Plant Part A Resource Conservation and Recovery Act Permit.

Efforts to decontaminate the Waste Calcine Facility equipment and remove the residual hazardous material are currently underway. Upon completion of these ongoing phaseout activities, an assessment would be conducted to identify remaining hazards and ensure those hazards do not endanger the public or worker safety. During the surveillance and maintenance period, a detailed characterization of the facility would be conducted. This characterization effort would gather radiological, chemical, and physical information that would be used to identify and select the most cost-effective decontamination and decommissioning implementation strategy. A decontamination and decommissioning plan and decontamination and decommissioning work packages would be prepared based upon the results of this characterization and analysis. The dismantlement work packages would be implemented during the proposed decontamination and decommissioning operations phase of the project.

For this EIS, the proposed decontamination and decommissioning project would be assumed to

- Remove all contaminated equipment remaining after completion of the phaseout activities.
- Resource Conservation and Recovery Act close the five permitted units (tanks).
- Decontaminate the remaining facility surfaces.
- Decommission the Waste Calcine Facility and demolish to ground level and fill in the subsurface levels.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan).

No Action - Under this option, decontamination and decommissioning of the Waste Calcine Facility would be deferred. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve

the continuation of surveillance and maintenance of the building and essential support systems such as ventilation, filtration, and radiation monitoring within the facility. This option would result in the continuation of potential environmental releases and radiation safety hazards to personnel.

Remediation - Under this option, the Waste Calcine Facility would be decontaminated and decommissioned, followed by the demolition of the building underground structures. This option corresponds to Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. All of the contaminated underground structure and associated embedded piping and electrical conduits would be removed and shipped to the appropriate waste handling facility on the INEL.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 16, '96			
G e n e r a l i n f o r m a t i o n	Description/function:	Waste Calcine Facility (CPP-633) D&D	D & D	Solid wastes: Type: Quantity: (m3)	LLW 521	MLLW 25
	WAG	3	I	Haz./Toxic Chemicals: Storage/inventory	None	
	EIS Alter. (A, B, C or D):	B, D	n	Cultural resource effects:	None	
	SNF or Waste stream:	E R	f	Pits/ponding created: (m2)	No	
	Action type:	D & D	o	Water usage: (liters)	757,000	
	Structure Type: Size: (m2)	Building 1,800	.	Energy requirements: Electrical: (MWH/yr) Fossil fuel: (liters)		
	Other features: (Pits, ponds, power /water/sewer lines)	None		Nightlights used: Y/N	No	
	Location: Inside/outside of fence Inside/outside of bldg.	Inside ICPP Inside CPP-633		Generators: Night Y/N Day Y/N	No Yes	
	D Cost(\$): Pre D&D	\$7 Mil.				
	D Cost(\$): D&D	\$17 Mil.				
D Schedule Start /End: Pre D&D	1994 - 1999					
D Schedule Start /End: D&D	1999 - 2003					
I No. of workers: (new/exist)	20 Existing & Subs.					
n Heavy Equip. Equip. used:	Trucks					
f Trips:						
o Acres Disturbed New	0					
r Previous	0.5					
m Revegetated	0					
a Air Emissions: (None / Ref.)	See Belanger et al., 1994					
i Effluents:						
o Type:	LLW (Decon Solution)					
n Quantity: (liters)	715,000					

**Projects
Related to
High-Level Waste**

TANK FARM HEEL REMOVAL PROJECT

PROJECT NAME: Tank Farm Heel Removal Project

GENERAL PROJECT OBJECTIVE: Liquid waste at the Idaho Chemical Processing Plant has been stored in eleven tanks of a tank farm. Pursuant to a Federal Facilities Compliance agreement among the Environmental Protection Agency, the Department of Energy, and the State of Idaho, use of five tanks (VES-WM-182 through -186) must cease by March 2009, and of the remaining six tanks, by June 2015. A Resource Conservation Recovery Act closure of these tanks and their ancillary systems would be required following the cease use provision. The general objectives of this proposed project would be (a) to design, procure, and install equipment, and to perform necessary tank systems modifications in order to remove the liquid and solids heel from the storage tanks and (b) to support the subsequent closure.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of equipment to perform tank internal rinsing and removal of the 5,000-to-20,000-gallon heel (liquid and solids remaining when tanks have been emptied with currently installed transfer jets) from the eleven 300,000-gallon storage tanks in the Idaho Chemical Processing Plant Tank Farm. The project would also provide for the design and modifications to existing ancillary piping systems to allow flushing and isolation in support of the Resource Conservation Recovery Act Closure actions that would be required following cease use of the eleven tanks.

The special heel removal equipment to be provided would be mixing pumps to mobilize the solids in the heel and keep them in suspension for transfer out of the tanks, and transfer pumps to replace the existing jets and transfer the mobilized heel solution from the tank being cleaned to another tank or to the New Waste Calcining Facility. This technology is currently being developed and used at other sites in the DOE complex.

Rinsing of the tanks interior walls and dome would be accomplished by use of a special utility arm to direct the spray of water or other solution onto the dome and walls. Use of robotic arms currently being developed within the DOE complex would be probable.

A supplemental vessel off-gas system would be provided to maintain a slight vacuum in the tank being worked on. This system, including demisters, high efficiency particulate air filters, blowers and other clean-up components, would discharge into the existing offgas cleanup systems and then up the Idaho Chemical Processing Plant main stack. Because of the tank farm surface load limits (to avoid overloading existing vaults), special structural provisions would be provided to support the required heel removal equipment. Temporary weather enclosures over the work areas would be provided if required to achieve the Consent Order completion schedules.

Conversion of one of the remaining operating tanks to a heel receiver tank, by modifications to install mixing pumps, would be accomplished. A heel receiver tank would be required to allow the heel removal operations to be performed independently of New Waste Calcining Facility operation. Final drying of cleaned tanks would be accomplished by forced evaporation. Special equipment to blow dry air into the tanks and exhaust it through a vessel off-gas system would be provided.

Transfer valving and piping modifications to allow some tanks to remain in service while other tanks are being removed from service would be provided. Provisions to sequentially flush ancillary piping and to physically isolate flushed piping and tanks from the remaining tanks would be provided. A comprehensive sequential action plan, with required supporting equipment and modifications, would be provided.

Handling and storage equipment for the special equipment, including the mixing and transfer pumps and the special utility arm, would be provided.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the tank heels would not be removed. This option corresponds to Alternative A (No Action) evaluated in this EIS because the Finding-of-No-Significant-Impact

portion of the proposed project would not included in Alternative A (No Action). The tanks cannot be emptied to the point that no heel remains. The heel contains high levels of radioactivity and is both toxic and corrosive. By not installing and operating heel removal equipment, the storage tanks would not be emptied. DOE may not be able to comply with the Consent Order entered into by DOE, U.S. Environmental Protection Agency, and the State of Idaho that requires DOE to cease use of the first five storage tanks (VES-WM-182 through -186), and may not be able to complete closure of these Resource Conservation Recovery Act storage tanks.

In Situ Stabilization - This option is not evaluated in this EIS. Under this option, the tank heels would be stabilized in place by adding some form of solidification material (for example, cement) to the tank and mixing with the heel. This option is not further developed since no materials were found that were completely compatible with the tank heels, and the mechanisms required to ensure mixing would be more complicated than simple removal. Also, one cannot ensure that the grout would prevent migration of hazardous elements (that is, heavy metals) into the environment.

Delayed Heel Removal - The tanks would be removed from service per the Notice of Noncompliance cease-use requirement. The heels would then be part of closure and would be removed as the technology and equipment became available. This removal of the heels would then not be driven by the Consent Order dates. This option was not evaluated in this EIS because the Consent Order would need to be renegotiated.

SUMMARY OF IMPACTS: The removal of the final approximately 5,000 to 20,000 gallons of high-level liquid waste (that is, the heel) from the five tanks proposed for replacement (VES-WM-182 through VES-WM-186) would be an existing, normal Tank Farm operation. The heel removal equipment that would be installed by the High-Level Waste Tank Farm Project would tie into existing transfer systems. The heel, and subsequent high-level liquid waste produced during tank cleaning, would be transferred to the other Tank Farm storage tanks, the Process Equipment Waste Evaporator, or directly to the New Waste Calcining Facility, using existing operating procedures that include sampling of the waste to be transferred as appropriate. Drying of the tanks (passively or actively) would be performed after the tanks were cleaned and effluent air from drying would exit through the normal exhaust system. The removal of the heel, cleaning,

and drying of tanks VES-WM-182 through VES-WM-186 would, therefore, be encompassed in the normal operation of the existing Tank Farm and would introduce no new environmental impact.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

U.S. Department of Energy, Idaho Operations Office, *High Level Waste Tank Farm Replacement Project for the Idaho Chemical Processing Plant at the Idaho National Engineering Laboratory*, DOE/EA-0831, June 1993.

Project Data Sheet			Rev. 9 May 24, '94	
G e n e r a l c o n s t r u c t i o n s	Description/function:	Tank Farm Heel Removal Project	C Cultural resource effects:	None
	WAG	3	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	HLW	s Energy requirements:	
	Action type:	(Consent Order Compliance)	t Electrical: (MWH/yr)	
	Structure Type:		o Fossil fuel: (liters)	57 k Diesel
	Size: (m2)	<750 m3 concrete Transfer Equipment	o Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)		o Generators: Night Y/N	No
	Location:		o Day Y/N	Yes
	Inside/outside of fence	Inside ICPP	O Cost(\$): Operation:	
Inside/outside of bldg.	Inside Vaults (11)	p Schedule Start /End:	2000 - 2015	
C o n s t r u c t i o n s	Cost(\$): PreConst.		o No. of workers: (new/exist)	2 Existing
	Cost(\$): Const.	\$37 Mil. total	r Heavy Equip. Equip. used:	None
	Schedule Start /End: PreConst.	1997 - 1999	a Trips:	
	Schedule Start /End: Const.	2000 - 2015	t Air Emissions:	
	No. of workers: (new/exist)	25 Subs. / 2 Existing	l (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	o Effluents:	
	Trips:	Ref. AEC Study	l Type:	
	Acres Disturbed: New	0	o Quantity: (liters/yr)	
	Previous	<10	l Solid wastes:	
	Revegetated	0	n Type:	HLW LLW Ind. 75 20 20
o n l i f o n s	Air Emissions:		o Haz./Toxic Chemicals:	No new
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Ref. EA-0831	a Water usage: (liters/yr)	12 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	
	Type:	Ref. EA-0831	o Fossil fuel: (liters/yr)	
	Quantity: (m3)		n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	No new	o Generators: Night Y/N	No
	Storage/inventory		o Day Y/N	No

WASTE IMMOBILIZATION FACILITY

(Technology Selection for Treatment of Sodium-Bearing and Calcined Wastes)

PROJECT NAME: Waste Immobilization Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Waste Immobilization Facility Project would be to provide the processes and facilities to immobilize Idaho Chemical Processing Plant radioactive wastes (sodium-bearing liquid and solid calcine) into a form(s) suitable for permanent disposal. This Project Summary provides information to be used in the selection of technologies to treat sodium-bearing and calcined wastes. More comprehensive descriptions and analyses of the potential waste treatment technologies, that form the basis of this summary, is in Westinghouse Idaho Nuclear Company, *ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report* (June 1994).

This project would involve mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or U.S Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

DOE has identified two primary treatment technologies to address treatment of sodium-bearing wastes and calcine: (a) vitrification and (b) separation followed by vitrification and grouting. Within the separation technology, three options were identified: (a) radionuclide partitioning, (b) precipitation; and (c) freeze crystallization. Either of the two primary technologies could be implemented through the Waste Immobilization Facility. The emissions, effluents, and final waste forms from processes within the Waste Immobilization Facility would vary depending on the treatment technology selected. This Project Summary provides a preliminary analysis of the impacts of construction and operation of the Waste Immobilization Facility for each of the treatment technologies. The impact analyses presented bound the impacts that would result from each of the treatment technologies, and the options within the treatment technologies. The analyses are intended to support DOE decisions regarding technologies to treat sodium-bearing

waste and calcine. Before a decision is made to proceed with the construction of the Waste Immobilization Facility, further National Environmental Policy Act review would be conducted, as appropriate.

High-activity waste is currently stored at the Idaho Chemical Processing Plant in liquid and granular solid calcine forms. These waste forms require engineered confinement systems because the radionuclides and hazardous materials would be mobile in the environment, and therefore cannot be disposed of directly without treatment. The Waste Immobilization Facility would be developed to process the high-activity waste inventory into a final form that would effectively isolate radionuclides and hazardous materials from the environment and therefore render the waste safer for storage, treatment, transport, and disposal. In addition, there are no certified transportation casks for liquid or calcine wastes, and the development of such casks would take considerable time at great cost. Following immobilization, waste would be stored at INEL pending transport offsite and disposal in a geologic repository.

The need to identify treatment technologies is primarily driven by the Resource Conservation and Recovery Act, and the Federal Facility Compliance Act (which amended the Resource Conservation and Recovery Act). The Federal Facility Compliance Act requires the DOE to identify treatment technologies for mixed waste, if treatment technologies are available. Sodium-bearing wastes and calcine wastes are mixed wastes for purposes of the Federal Facility Compliance Act. These wastes must meet both Resource Conservation and Recovery Act, Land Disposal Restriction requirements because of the hazardous constituents, and applicable U.S. Environmental Protection Agency and Nuclear Regulatory Commission requirements because of the radioactive constituents, before being permanently disposed

PROJECT DESCRIPTION: This proposed project would involve technology selection for calcining or treating sodium-bearing liquid waste and for converting calcine waste into a waste form acceptable for disposal, followed by the design, construction, and operation of a Waste Immobilization Facility for processing these wastes. Such processing would produce a single high-activity waste form suitable for placement in a geological repository and potentially a low-activity waste form. This project is proposed to be located south and east of the existing Fluorinel Dissolution and Storage Facility in a previously disturbed area within the Idaho Chemical Processing Plant boundary, and to occupy an area of approximately 4,000 square meters (43,000

square feet). No disposal facilities would be provided by this project, but suitable interim storage for waste pending disposal would be constructed as part of this facility.

The primary treatment technologies to address Idaho Chemical Processing Plant radioactive liquid examined in this EIS (which consists primarily of sodium-bearing liquid waste) in the proposed Waste Immobilization Facility are direct vitrification [Alternative B (Ten-Year Plan)] and separation/vitrification [Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal)]. Direct vitrification would involve treatment to produce a glass or glass-ceramic final waste form, and would produce a greater quantity of high-activity waste than options involving separation. Separation would be used to partition the waste into high- and low-activity fractions. The separation options include (a) radionuclide partitioning that would produce a small stream of high-activity waste and a large stream of low-activity waste, (b) precipitation that would produce a moderate amount of high-activity waste and low-activity waste, and (c) freeze crystallization that would also produce a moderate amount of high-activity and low-activity waste. Following separation, the high-activity portion of the waste would be prepared for final treatment (perhaps by calcining), followed by vitrification. The low-activity portion would be immobilized by grouting or vitrification and subsequently disposed of in a low-level waste disposal facility.

Radionuclide partitioning involves removing specific actinide and transuranic elements, and therefore the bulk of the radioactivity, by employing a solvent extraction technique previously developed for the recovery of plutonium (that is, TRUEX). Similar to freeze crystallization, this technology would result in a high-activity fraction requiring glass or glass ceramic stabilization. However, unlike freeze crystallization, this technology concentrates on isolating the radioactivity rather than isolating the sodium. This would result in a more concentrated, low-volume, high-activity fraction than freeze crystallization. Radionuclide partitioning would also likely require ion exchange to remove the cesium, employ a solvent-extraction technique for the removal of strontium (that is, SREX), and would require a solvent recovery system.

In the precipitation process, the transuranic elements, heavy metals (mercury, lead, cadmium, etc.) and most of the transition elements would be precipitated by adding the proper proportion of sodium hydroxide (or other neutralizing agent). The sodium, cesium, and some strontium would remain soluble in the liquid phase. The liquid would be separated from the solid and processed

to remove cesium and strontium. Electrohydrolysis would be used to recycle some of the sodium hydroxide and the remainder would be grouted. The resulting high-activity fraction could be calcined without aluminum nitrate additives or it could be vitrified directly.

The freeze crystallization process would separate approximately 66 percent of the sodium from the waste stream; this low-activity fraction would be grouted or could be recycled using electrohydrolysis if productive uses of the solutions are found. The expected high-activity product from the freeze crystallizer could be calcined with aluminum nitrate in a reduced quantity. The low-activity stream would be depleted of transuranics, cesium, and strontium, as well as heavy metals, to produce a low-activity waste. Using transuranic separations, the transuranics could be recovered for re-use or storage in an approved transuranic waste storage facility.

The options for processing solid calcine waste examined in this EIS are direct vitrification and separation and immobilization following dissolution of the calcine. Direct vitrification would produce a larger amount of high-activity waste than options involving separation. Separation would be used to partition the waste into high- and low-activity fractions and if necessary, to remove heavy metals from the low-activity stream. The separation options include (a) radionuclide partitioning that would produce a small stream of high-activity waste and a large stream of low-activity waste and (b) precipitation that would produce a moderate amount of high-activity waste and low-activity waste. The choice of waste form would depend on which waste form type gives the highest waste loading per unit volume with respect to the separation process chemistry and overall cost. The technology for treating the calcine by separation followed by immobilization is considered feasible based on laboratory experiments and full scale application of some processes. However, further development and verification testing of the technology would be required.

The process of directly incorporating the calcine material into a glass-ceramic would involve blending the dry calcine material to obtain a homogenous mixture, stabilizing the mixed calcine in a heated fluidized bed to remove residual nitrates and any absorbed water, and grinding the calcine to improve the glass-ceramic formation step. The pretreated calcine would then be mixed with glass-ceramic forming additives and processed under elevated temperature and pressure to produce the final waste form. The calcine could also be dissolved and slurried with glass-ceramic-forming additives to produce the final waste form. While the glass-ceramic process has been

demonstrated on a laboratory scale using nonradioactive materials, the process would still need to be demonstrated on an engineering scale and verified using actual calcine material.

In the vitrification process, the calcine could be dissolved and slurried with glass-forming sands of varying composition (frit) and introduced to the melter. The dry calcine could also be blended with the frit and fed dry to a melter. In either case, the calcine would first have to be thoroughly mixed with the frit to obtain a homogeneous melter feed and might have to be stabilized and ground to improve the melter operation efficiency. As with the glass-ceramic process, the process of directly immobilizing the calcine to a glass would require further development and verification testing before the technology could be implemented for the wastes at issue.

The high-activity waste form would be glass or glass-ceramic, and the low-activity waste form would be grout, glass, or glass-ceramic. The high-activity waste and the low-activity stream separated from the waste at the INEL would be mixed wastes under Resource Conservation Recovery Act and must be treated prior to disposal. The specified land disposal restriction treatment standard for high-activity mixed waste under Resource Conservation Recovery Act regulations issued by U.S. Environmental Protection Agency (which are implemented by the State of Idaho under the Idaho Hazardous Waste Management Act) is "High-Level Vitrification" (40 CFR Part 268, Subpart D-Treatment Standards). Therefore, the INEL's vitrified high-level waste must be tested and demonstrated to meet the high-level vitrification treatment standard prior to disposal. Both the high-activity and low-activity waste forms could be delisted or, if appropriate, disposed of in a Resource Conservation Recovery Act-approved Subtitle C hazardous waste disposal site. In addition, under the Federal Facility Compliance Act of 1992, DOE and the State of Idaho are developing an INEL site treatment plan, which is scheduled to be issued in February 1995, and will include schedules and milestones for developing and implementing treatment technologies for mixed wastes at the INEL, including high-level mixed wastes. A signed Consent Order between DOE and the State of Idaho containing these schedules and milestones would be issued by October 1995. The selection of a high-level waste treatment technology is being closely coordinated with the State of Idaho as part of the Federal Facility Compliance Act negotiations.

Candidate high-level waste treatment technologies were evaluated by first identifying all technologies with the potential of treating and immobilizing Idaho Chemical Processing Plant sodium-bearing and calcine waste. Those technologies that either could not be developed in time

to meet the regulatory requirements or were inferior to competing technologies were eliminated from further consideration. Examples of eliminated technologies include encapsulation of sodium-bearing waste in silica via the Sol-Gel process, sodium removal by liquid extraction using crown ethers, and sodium removal via bioremediation.

As a result of this preliminary evaluation, a range of feasible candidate technologies were identified for converting sodium-bearing and calcine wastes into acceptable waste forms for disposal. Available information on each candidate technology was collected and documented, including expected range of performance, need for additional process development, facility capital costs, operation labor and material costs, treated waste volumes, interim storage costs, and projected waste disposal costs. This information was obtained from literature sources, benchmarking operating waste treatment systems, and bench-scale laboratory tests conducted at the Idaho Chemical Processing Plant, and is summarized in WINCO (1994).

As an aid to evaluation of the technologies, a systems analysis model was developed to compare the alternative candidate technologies against selection criteria. Selection criteria included (a) compliance with the Resource Conservation Recovery Act, and related Consent Orders with the State of Idaho; (b) five-year and life-cycle costs; (c) time to implement; and (d) expected performance of the final waste form and quantities and waste. In all cases, the comparisons were based on waste forms and waste loadings that would meet the high-level waste durability standards used at several other DOE sites (Savannah River, West Valley, Hanford); see DOE (1993). The durability standard includes testing for metals leachability, waste form stability, and other physical parameters critical to long-term disposal.

Although the final waste acceptance criteria for a repository have not yet been developed, DOE has undertaken initial assessments of repository performance and waste acceptance criteria consistent with requirements already identified by the U.S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission for a final repository. Specifically, an initial repository performance assessment was conducted, and a preliminary waste acceptance criteria developed for the INEL-specific waste form. See *Initial Performance Assessment for the Disposal of Spent Nuclear Fuel and High-Level Wastes Stored at INEL*, Volumes I & II (Report No. SAND 93-2330/1/2) and *Preliminary Waste Acceptance Criteria for Idaho Chemical Processing Plant Spent Fuel and Waste Management Technology Development*, WINCO-1157, September 1993.

Additional information regarding activities conducted to date may be found in the Westinghouse Idaho Nuclear, *ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report*.

After selecting a treatment technology, DOE would need to perform additional bench-scale and pilot-scale testing on actual waste solutions before designing and constructing the Waste Immobilization Facility. The final waste form treatment technologies in all cases would be subject to U.S. Environmental Protection Agency and State of Idaho approval.

Preliminary output from the systems analysis model is provided for four of several possible combinations of sodium-bearing and calcine waste treatment technologies in the attached table and accompanying figures. The combinations presented include the three separations technologies identified for sodium-bearing waste and direct vitrification.

The table contains cost and volume output for each of the four combinations, and the figures describe the technologies and associated waste management assumed for each. Costs are provided for construction and operation, and final waste form disposal. Final volumes are also provided for both the high- and low-activity waste forms. For each of the combinations, output is also provided for a maximum and minimum final waste form volume (glass for high-activity waste and grout for low-activity waste for the maximum case, glass-ceramic for both wastes for the minimum case).

For each of the combinations presented, it is assumed that the existing sodium-bearing waste is first processed through the high-level waste evaporator to minimize the volume of high-activity waste. More detailed information on these and other treatment combinations is in WINCO (1994).

SUMMARY OF IMPACTS: Environmental consequences for this project would involve airborne emissions, generated wastes, and radiation exposures from routine operations and construction. Construction airborne emissions would be nonradioactive and would consist primarily of dust, paint fumes, and exhaust from trucks and construction equipment. Dust generation would be mitigated, and emissions during construction would comply with applicable Federal and state standards.

Nonradioactive airborne emissions during normal operations would consist primarily of NO_x. The amount of NO_x emitted would be approximately 1,650,000 kilograms per year. In addition, the facility may annually emit smaller quantities of other pollutants such as SO₂, particulate matter, hydrofluoric acid and mercury. Particulate emissions would be mitigated using high efficiency particulate air filtration. Annual gaseous radioactive airborne emissions during normal operations would consist primarily of tritium (420 curies) and iodine-129 (0.15 curies). Particulate radioactive emissions are estimated at less than 0.1 curie due to effectiveness of high efficiency particulate air filtration. Total radioactive emissions would result in a maximum exposure to the public well below the U.S. Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants requirement of 10 mrem per year.

Liquid effluents produced during construction would consist of water from cleaning or pumping of trenches, and would be treated as necessary with Idaho Chemical Processing Plant facilities. During operations, all hazardous and radioactive liquid wastes would be treated within the facility or by other existing Idaho Chemical Processing Plant facilities.

Solid nonhazardous wastes in the form of paper, wood, and metal would be generated during the construction phase of the project. During operations, the facility would produce between 20 and 320 cubic meters per year of immobilized high-activity waste and between 10 and 1,250 cubic meters per year of immobilized low-activity waste, based on facility sizing and the technologies chosen. Both high-activity and low-activity wastes would be stored at the Waste Immobilization Facility pending ultimate disposition. It is important to note that these quantities are estimates only, and that the final design capacities could be higher or lower than the stated ranges depending again on the facility's size and the technologies chosen.

PROJECT-SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

No Action - Under the no-action option, a Waste Immobilization Facility would not be constructed, and liquid high-activity waste and sodium-bearing liquid waste would be processed in the existing calciner. Calcine solids would continue to be stored in vaults at Idaho Chemical Processing Plant and would not be processed. This option corresponds with Alternative A (No Action) evaluated in this EIS. This option would not provide for compliance with the following:

- Federal Facility Compliance Act, which requires the development of technologies and facilities for treating/disposing of mixed wastes.
- December 22, 1993, court order (Amended Order Modifying Order of June 28, 1993), which requires that technologies be selected to process sodium-bearing liquid waste and calcine solids.
- The Notice of Non-Compliance Consent Order between the Department of Energy, State of Idaho, and the Environmental Protection Agency requiring DOE to cease use of the existing Idaho Chemical Processing Plant Tank Farm tanks by specified dates, unless alternate tankage is provided.
- Modification of the Notice of Non-Compliance Consent Order between the DOE, March 17, 1994, State of Idaho, and the U.S. Environmental Protection Agency requiring that technologies be selected for processing sodium-bearing liquid waste and calcine solids at the Idaho Chemical Processing Plant into waste forms acceptable for final land disposal.

Direct Vitrification - Under this option, waste would be vitrified into glass or glass-ceramic waste form. This option was used for purposes of analysis for Alternative B (Ten-Year Plan) in this EIS. As previously discussed, direct vitrification would produce the largest amount of high-activity waste (Table HLW2-1). The facility would be constructed at the Idaho Chemical Processing Plant or at an alternative location within the INEL. This option was chosen to bound the high-activity waste generation volume and emissions. Also, since it contains the minimum of pretreatment, it would require the least amount of time to construct and make operational.

Table HLW2-1. Waste immobilization cost and volume data for example options over the operational lifetime of the facility.

Option	Cases ^b	Costs ^a (Million dollars)		Final waste volume (cubic meters)	
		Construction and operating	Waste disposal	High activity	Low activity
1	a	4,200	11,000	19,000	1,500
	b	3,300	2,900	4,400	230
2	a	3,800	5,500	9,000	11,000
	b	4,200	2,200	3,300	2,100
3	a	1,900	860	870	20,000
	b	3,200	300	220	4,700
4	a	4,200	12,000	21,000	None
	b	2,900	3,100	4,700	None

a. All costs are discounted to 1994 dollars.

b. For Case a, the high-activity waste form would be glass and the low-activity waste form would be normal grout. For Case b, the high- and low-activity waste forms would be glass ceramic.

Vitrification with Pretreatment - Under this option, the Waste Immobilization Facility would include pretreatment (a separation step) before vitrification. This option was used for purposes of analysis for Alternatives C (Minimum Treatment, Storage, and Disposal) and D (Maximum Treatment, Storage, and Disposal) in this EIS. Pretreatment would produce less high-activity waste but greater amounts of low-activity waste than direct vitrification (Table HLW2-1). As analyzed, the Waste Immobilization Facility does not reflect the treatment of additional high-activity waste that would be generated by spent nuclear fuel processing under Alternative D (Maximum Treatment, Storage, and Disposal).

Treatment at Another Site - This alternative would require transportation of liquid and/or calcine solids to another site for treatment before disposal. If sited at a location other than the Idaho Chemical Processing Plant, costs would be high because of the need to design and/or certify transportation containers/casks for transport of the liquid and solid wastes. High costs would be

incurred because of the need for extensive modifications to the existing processing facilities at Savannah River or Hanford to accommodate the unique characteristics of the Idaho Chemical Processing Plant wastes. For these reasons, DOE does not regard this as a reasonable alternative.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

WINCO (Westinghouse Idaho Nuclear Company), 1994, *ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Interim Report*, Westinghouse Idaho Nuclear Company, Idaho Falls, ID, June 1994.

DOE (U.S. Department of Energy), 1993, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*, Office of Environmental Restoration and Waste Management, U.S. Department of Energy, Germantown, MD, February.

Initial Performance Assessment for the Disposal of Spent Nuclear Fuel and High-Level Wastes Stored at INEL, Volumes I & II, Report # SAND 93-2330/1/2.

Preliminary Waste Acceptance Criteria for Idaho Chemical Processing Plant Spent Fuel and Waste Management Technology Development, WINCO-1157 (Sept. 1993), Westinghouse Idaho Nuclear Company.

Option 1: Freeze Crystallization of Sodium-Bearing Waste / Direct Vitrification of Calcine

Note: Sodium-bearing waste processing units installed prior to calcined waste processing.

Option 2: Precipitation of Sodium-Bearing Waste / Precipitation of Calcine

Note: Sodium-bearing waste processing units installed prior to calcined waste processing.

Option 3: TRUEX of Sodium-Bearing Waste / TRUEX of High-Activity Waste and Dissolved Calcine

Note: Sodium-bearing waste processing units installed prior to high-activity waste / calcined waste processing.

Option 4: Direct Vitrification of Sodium-Bearing Waste and Calcine

Project Data Sheet			Rev. 8	May 24, '96	
G	Description/function:	Waste Immobilization Facility (WIF)	C	Cultural resource effects:	None identified
e		[DIRECT VITRIFICATION]	o	Pits/ponding created: (m2)	No
n			n	Water usage: (liters)	11,500 k
e	WAG	3	s	Energy requirements:	
r	EIS Alter. (A, B, C or D):	B, C, D	t	Electrical: (MWH/yr)	2,000
l	SNF or Waste stream:	HLW	.	Fossil fuel: (liters)	490 k Diesel, 132 k Propane
c	Action type:	New		Nightlights used: Y/N	Yes
l	Structure Type:	Building		Generators: Night Y/N	No
n	Size: (m2)	4,000		Day Y/N	No
f	Other features:	7 year HLL waste storage	O	Cost(\$): Operation:	\$12 Mil./yr
o	(Pits, ponds, power /water/sewer lines)	7 year LLW storage	p	Schedule Start /End:	Alt B 2008 - 2043
.			e		Alt C & D 2015 - 2050
			r		(Assumed for analysis)
	Location:		a	No. of workers: (new/exist)	70 Existing
	Inside/outside of fence	Inside ICPP	t	Heavy Equip. Equip. used:	Truck / Rail
	Inside/outside of bldg.	Outside FAST (south-east)	l	Trips:	4000 /yr
C	Cost(\$): PreConst.	\$90 Mil.	o	Air Emissions:	
o	Cost(\$): Const.	\$1,400 Mil.	n	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1996 - 2001	a		
s	Schedule Start /End: Const.	2002 - 2006	l		
t		(Assumed for analysis)	l	Effluents:	
r	No. of workers: (new/exist)	300 Peak Subs.	n	Type:	Evap. Overheads / Service water
u	Heavy Equip. Equip. used:	Trucks	f	Quantity: (liters/yr)	10,000 k / 3,500 k
c	Trips:	31,000 TO CFA (8 km)	o	Solid wastes:	
t	Acres Disturbed: New	0	r	Type:	HLW LLW Ind.
l	Previous	0.8	m	Quantity: (m3/yr)	321 10 150
o	Revegetated	0	a	Haz./Toxic Chemicals:	Acids, Bases, misc.
n	Air Emissions:		t	Storage/inventory	115 k liter total
l	(None / Ref.)	See Belanger et al., 1994	l	Pits/ponds used: Y/N (m2)	No
n			o	Water usage: (liters/yr)	150,000 k
f	Effluents:		n	Energy requirements:	
o	Type:	Construction Water		Electrical: (MWH/yr)	50,000
.	Quantity: (liters)	11,500 k		Fossil fuel: (liters/yr)	
	Solid wastes:			Nightlights used: Y/N	Yes
	Type:	Industrial		Generators: Night Y/N	No
	Quantity: (m3)	10,000		Day Y/N	No
	Haz./Toxic Chemicals:	Cutting Fluid 115 liters			
	Storage/inventory	Paint 1,150 liters			

Project Data Sheet			Rev. 8 May 24, '96	
G e n e r a l c o n f o r m a t i o n	Description/function:	Waste Immobilization Facility (WIF) [SEPARATION]	C Cultural resource effects:	None identified
	WAG	3	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	C, D	n Water usage: (liters)	11,500 k
	SNF or Waste stream:	HLW	s Energy requirements:	
	Action type:	New	Electrical: (MWH/yr)	2,000
	Structure Type:	Building	Fossil fuel: (liters)	490 k Diesel, 132 k Propane
	Size: (m2)	4,000	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	7 year HLL waste storage 7 year LLW storage	Generators: Night Y/N Day Y/N	No No
	Location:		O Cost(\$): Operation:	\$29 Mil./yr
	Inside/outside of fence	Inside ICPP	p Schedule Start /End:	Alt B 2008 - 2043 Alt C & D 2015 - 2050 (Assumed for analysis)
Inside/outside of bldg.	Outside FAST (south-east)	a No. of workers: (new/exist)	180 Existing	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.	\$45 Mil.	t Heavy Equip. Equip. used:	Truck / Rail
	Cost(\$): Const.	\$700 Mil.	Trips:	4000 /yr
	Schedule Start /End: PreConst.	1996 - 2001	o Air Emissions:	
	Schedule Start /End: Const.	2002 - 2006 (Assumed for analysis)	(None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	300 Peak Subs.	Effluents:	
	Heavy Equip. Equip. used:	Trucks	Type:	Evap. Overheads / Service water
	Trips:	31,000 TO CFA (8 km)	Quantity: (liters/yr)	10,000 k / 3,500 k
	Acres Disturbed: New	0	Solid wastes:	
	Previous	0.8	Type:	HLW LLW Ind.
	Revegetated	0	Quantity: (m3/yr)	20 1,250 150
n e f f l u e n t s a n d s o l i d w a s t e s	Air Emissions:	See Belanger et al., 1994	Haz./Toxic Chemicals:	Acids, Bases, misc.
	(None / Ref.)		Storage/inventory	115 k liter total
	Effluents:		Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	Water usage: (liters/yr)	150,000 k
	Quantity: (liters)	11,500 k	o Energy requirements:	
	Solid wastes:		Electrical: (MWH/yr)	50,000
	Type:	Industrial	Fossil fuel: (liters/yr)	
	Quantity: (m3)	10,000	Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	Cutting Fluid 115 liters Paint 1,150 liters	Generators: Night Y/N Day Y/N	No No
	Storage/inventory			

HIGH-LEVEL TANK FARM NEW TANKS

PROJECT NAME: High-Level Tank Farm New Tanks

GENERAL PROJECT OBJECTIVE: The general objective of the proposed High Level Tank Farm New Tanks Project would be to provide sufficient replacement storage capacity for liquid high-level waste that would be needed to manage high-level waste under each of the alternatives and options considered in this environmental impact statement.

The purpose of the proposed Idaho Chemical Processing Plant High-Level Waste Tank Farm New Tanks Project would be to reduce the environmental health and safety risks associated with the storage of liquid high-level waste at the Idaho Chemical Processing Plant Tank Farm. The liquid waste would be subject to Resource Conservation Recovery Act requirements, and the existing tanks do not meet all of the requirements for secondary containment. The impacts of this proposed project have been previously evaluated by DOE as part of the environmental assessment on the High Level Tank Farm Replacement project (DOE/EA-0831). The proposed project in the environmental assessment originally included (a) upgrading of existing tank cover gas piping and high-level waste transfer systems, (b) providing for removing the so-called heel (the remaining liquid in each existing tank that cannot be removed by existing equipment), and (c) providing for replacement tankage. However, DOE approved that environmental assessment and issued a Finding of No Significant Impact only for the High-Level Waste Tank upgrades portion of the original proposed action. The system upgrades are under construction (see the High Level Tank Farm Replacement Project Summary in this appendix, page OP7-1). The proposed Tank Farm Heel Removal project is a separate proposed action (see Project Summary in this appendix on page HLW1-1). The larger project to replace the tankage was suspended in 1992, once spent fuel reprocessing was curtailed at the Idaho Chemical Processing Plant, and it was not clear that the new tanks would be required.

PROJECT DESCRIPTION: This project would provide for the replacement of existing tanks in the Idaho Chemical Processing Plant High-Level Waste Tank Farm with four new tanks with a total capacity of up to 2 million gallons.

The proposed action would include construction of four new 500,000-gallon storage tanks. The tanks would be located in separate vaults within a common below-ground concrete containment vault structure. The primary stainless steel storage tanks would be erected inside a secondary containment barrier. The secondary containment barrier would consist of either a free-standing stainless steel vessel between the primary tank and the vault or a stainless steel liner attached directly to the interior of the vault. In either instance, a separate secondary containment system would be designed to accommodate 110 percent of the volume for each of the primary tanks. The primary tanks would be approximately 60 feet in diameter, with a shell height of about 24 feet and a dome height of about 7 feet. The tanks and containment vault structure would be designed for a 50-year life, and would receive a Resource Conservation Recovery Act permit from the State of Idaho.

Support systems for the tank and vaults would include solids handling, tank cooling, waste sampling, vessel offgas with associated high efficiency particulate air filtration, vault ventilation, waste transfer, decontamination, fire protection, and remote maintenance. These systems would provide for the safe operation and maintenance of the proposed new facilities and would facilitate eventual decontamination and decommissioning. Since the new vessel off-gas and vault ventilation systems would produce air flows that exceed the handling capacity of the existing Idaho Chemical Processing Plant main stack, it would be supplemented by a new stack not to exceed 65 meters in height. The new stack would be equipped with emission monitoring instrumentation meeting the specifications set forth in the National Emission Standards for Hazardous Air Pollutants permit and the State of Idaho Permit to Construct and Permit to Operate.

To supply electricity to operate the proposed facilities, two new feeder lines of approximately 13.8 kVA would be constructed from existing circuits. Alternate power would be supplied by a standby diesel generation system. A redundant solid state uninterruptible power supply consisting of batteries is also proposed for instrumentation, safety lighting, etc., that require an uninterruptible power supply. Other electrical systems would include exterior, interior, and emergency lighting; grounding; lightning protection; and cathodic protection system. Other utility interfaces would include demineralized water, potable water, process equipment waste, steam, compressed air, decontamination systems, and steam condensate return.

The largest of three new enclosure buildings would be the weather enclosure building situated directly over the proposed new tanks. The weather enclosure building would support operation, inspection, inspection, and maintenance activities. A mechanical building would house and/or support mechanical systems including vault ventilation and vessel off-gas air filtration systems. An electrical building would house the standby diesel generator and electrical switchgear.

Low-level liquid mixed waste would either be stored at an approved interim mixed waste storage area on the INEL, but outside of the Idaho Chemical Processing Plant facility area, or treated at the existing Process Equipment Waste Evaporator at Idaho Chemical Processing Plant. The radioactive solid wastes would be disposed of at the Radioactive Waste Management Complex. The hazardous substances would be stored, treated, and disposed at permitted Resource Conservation Recovery Act hazardous waste treatment, storage, and disposal facilities.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives C (Minimum Treatment, Storage, and Disposal) and D Maximum Treatment, Storage, and Disposal).

No Action - No replacement waste storage tanks would be provided. This option corresponds to Alternative A (No Action) evaluated in this EIS. Since the existing tank vaults do not meet the secondary containment requirements, a Notice of Noncompliance Consent Order between DOE, the Environmental Protection Agency, and the State of Idaho requires the use of the existing tanks to cease. Adequate treatment must be provided to take waste from the existing tanks to meet the Consent Order dates or the Consent Order would not be met.

Calcining Waste - Since simply calcining the wastes would not allow ceasing use of the tanks by the specified dates, other treatment of the wastes must be provided or the requirements of the Notice of Noncompliance Consent Order may not be met. This option would calcine the liquid waste in the tank farm in a timely fashion to ensure meeting the Notice of Noncompliance Consent Order dates for "cease use" of the tanks. This calcining option corresponds to

Alternative B (Ten-Year Plan) evaluated in this EIS; it is also described in the Waste Immobilization Facility Project Summary of this Appendix, page HLW2-1).

Retrofit Existing Tanks/Vaults - The option of retrofitting the existing tank/vaults to meet current INEL seismic design criteria and secondary containment requirements has been thoroughly evaluated. Options evaluated included internal bracing, driving pilings, removal of overburden, external support of vault roof, excavation and external bracing, filling the annular space, grout curtain, vault column post-tensioning, low-pressure grout, and the installation of a second containment barrier. No retrofit option was determined to be feasible based on the criteria of safety, occupational radiation exposure, reliability, construction risk, schedule, cost, waste minimization, and regulatory requirements. This option has not been included as either a project-specific alternative or an EIS alternative because it has been determined to be not practical or feasible.

Location at Other INEL Facilities - This option has not been pursued due to the requirement to construct transfer piping or transport casks, and tank farm support. The location of existing liquid waste generation facilities and waste processing facilities dictates a close connection to replacement tankage.

SUMMARY OF IMPACTS: During construction of the new tanks, ambient air quality would be impacted by fugitive dust, construction equipment exhaust, and diesel generator exhaust. The combined construction and background concentrations have been estimated (DOE/EA-0831), and would be well within the Idaho ambient air quality standards for all pollutants and averaging times. Impacts to land use would be limited to approximately 15-20 acres outside the Idaho Chemical Processing Plant fence. Potential impacts from wastes produced during construction are expected to be small due to the small amounts of radioactive, hazardous, mixed, and construction wastes produced. Some nonradioactive industrial waste water requiring treatment may be generated during preoperational leak testing.

Operation of the new tanks would result in no measurable increase in air emissions over the existing tanks.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

U.S. Department of Energy, Idaho Operations Office, *Environmental Assessment - High Level Waste Tank Farm Replacement Project for the Idaho Chemical Processing Plant at the Idaho National Engineering Laboratory*, DOE/EA-0831, June 1993.

Project Data Sheet		Rev. 8 May 24, '94			
GENERAL INFORMATION	Description/function:	High-Level Tank Farm New Tanks			
	WAG	3			
	EIS Alter. (A, B, C or D):	C, D			
	SNF or Waste stream:	HLW			
	Action type:	New			
	Structure Type:	Storage Tanks (4)			
	Size: (m2)	757,000 liters each			
	Other features: (Pits, ponds, power /water/sewer lines)				
	Location:				
	Inside/outside of fence	Inside ICPP			
Inside/outside of bldg.	Outside (near existing tanks)				
COSTS AND SCHEDULE	Cost(\$): PreConst.				
	Cost(\$): Const.	\$165 Mil. total			
	Schedule Start /End: PreConst.	1995 - 1996			
	Schedule Start /End: Const.	1996 - 2000			
	No. of workers: (new/exist)	150 Subs			
	Heavy Equip. Equip. used:	Trucks			
	Trips:				
	Acres Disturbed: New	0			
	Previous	<20			
	Revegetated	0			
ENVIRONMENTAL IMPACTS	Air Emissions: (None / Ref.)	See Belanger et al., 1994			
	Effluents: Type:	None			
	Quantity: (liters)				
	Solid wastes: Type:	TRU LLW MLLW Ind.			
	Quantity: (m3)	22 553 20 3,000			
	Haz./Toxic Chemicals: Storage/inventory	None			
	Cultural resource effects:	None			
	Pits/ponding created: (m2)	Temporary			
	Water usage: (liters)	Insignificant			
	Energy requirements: Electrical: (MWH/yr)	300 k Diesel			
Fossil fuel: (liters)					
Nightlights used: Y/N	Yes				
Generators: Night Y/N	No				
Day Y/N	Yes				
OPERATIONAL DATA	Cost(\$): Operation:	TBD			
	Schedule Start /End:	2001 - TBD			
	No. of workers: (new/exist)	no new above current level			
	Heavy Equip. Equip. used:	None			
	Trips:				
	Air Emissions: (None / Ref.)	See Appendix F, Section 3			
	Effluents: Type:	TBD			
	Quantity: (liters/yr)				
	Solid wastes: Type:	LLW	MLLW	HW	Ind.
	Quantity: (m3/yr)	8	2	15	5
Haz./Toxic Chemicals: Storage/inventory	None				
Pits/ponds used: Y/N (m2)	No				
Water usage: (liters/yr)					
Energy requirements: Electrical: (MWH/yr)	450				
Fossil fuel: (liters/yr)	0				
Nightlights used: Y/N	Yes				
Generators: Night Y/N	No				
Day Y/N	No				

NEW CALCINE STORAGE

PROJECT NAME: New Calcline Storage

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Idaho Chemical Processing Plant eighth Calcined Solids Storage Facility New Calcline Storage project would be to provide additional storage for calcine solids produced by the operation of the New Waste Calcining Facility. This storage capacity would be required to allow the continued processing of liquid wastes in the New Waste Calcining Facility until the final waste form is established and implemented.

PROJECT DESCRIPTION: This proposed project would provide for the design, construction, and startup of a new facility for the storage of calcined high-level radioactive waste resulting from the operation of the New Waste Calcining Facility. In the New Waste Calcining Facility, the liquid wastes are converted into granular solids via a fluidized bed process.

Five calcined solids storage facilities are currently filled at the Idaho Chemical Processing Plant, with a sixth currently receiving calcine and a seventh ready to receive calcine. The eighth storage facility, proposed in this project, would be a near copy of the seventh facility, and would have a capacity of approximately 63,000 cubic feet.

The proposed eighth Calcined Solids Storage Facility would consist of seven annular stainless steel storage bins, arranged with six bins in a circle and the seventh in the middle, in a reinforced concrete vault. The vault base would be on bedrock, with approximately the top half of the vault projecting above grade. The vault walls and roof would provide required radiation shielding as well as structural support. The bins would be anchored into the vault base slab; the vault, bins, and all interconnecting piping would be designed to meet all applicable seismic, structural, and thermal requirements.

The calcined solids produced by the New Waste Calcining Facility would be pneumatically transported to the top of the proposed storage facility where the solids would be separated from the transporting air by a cyclone located in a separate cell. The transporting air would be

returned to the New Waste Calcining Facility; the solids would fall by gravity through dual fill lines into each of the seven bins.

A combination natural and forced convection cooling system would be provided to maintain the stored calcine below its caking temperature and the facility structure below temperature limits. The cooling air would enter through a filter, be discharged at the bottom of the vault and flow upward around and through the annular space in the tanks, and be discharged to atmosphere through a stack on top of the vault. Detection of any radioactivity would automatically channel the exhaust air through in-line high efficiency particulate air filters and centrifugal exhaust blowers.

A bins vent and relief system would protect the bins from over or under pressurization. This system, located in a separate cell on top of the vault would vent to the atmosphere via high efficiency particulate air filters. This system would also allow the bins pressure to equilibrate with the atmosphere when the bins are isolated from the New Waste Calcining Facility.

To facilitate eventual retrieval of the calcine, each bin would have four retrieval pipes extending up to access hatches in the vault roof. Corrosion coupons, fabricated from the bins material, would be suspended into two of the bins and into the vault through separate access hatches.

Vault, bin, and calcine temperatures would be monitored by thermocouples installed on the vault wall and bins exterior surfaces, and by multipoint thermocouples installed in thermowells at the maximum calcine temperature zone in each of the bins. Other temperature and pressure instrumentation would be provided to monitor and control the performance of the cooling, pressure relief, and pneumatic transport systems. An instrument room on the vault roof would house the facility instrument recorders and facility control systems.

Plant utilities would provide the required steam, instrument air, and electrical power for facility operation. Special maintenance features, including small jib cranes, access hatches, and inspection ports, would also be provided.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, no additional calcine storage would be constructed. This option corresponds to Alternative A (No Action) evaluated in this EIS.

Eliminate or Reduce Generation of Calcine - Under this option, high-level liquid waste would be stored and not converted to calcine. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Convert Existing Calcine to Another Form - Under this option, a calcine conversion facility would be developed and constructed to convert the existing calcine to another form. This option corresponds to Alternatives B (Ten-Year Plan) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Storage facilities for the other waste form may need to be developed and constructed.

Store Idaho Chemical Processing Plant Calcine at Other DOE Facilities - Under this option, Idaho Chemical Processing Plant calcine would be transferred to another DOE facility for storage. If sited at a location other than the Idaho Chemical Processing Plant, costs would be high because of the need to design and/or certify transportation containers/casks for transport of the solid wastes. This option would involve shipment of wastes that is not allowed by DOE Orders and is not evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Rev. 7 May 24, '96

Project Data Sheet			Rev. 7		May 24, '96	
General Information	Description/function:	New Calcine Storage	C	Cultural resource effects:	None identified in survey	
	WAG	3	o	Pits/ponding created: (m2)	No	
	EIS Alter. (A, B, C or D):	D	n	Water usage: (liters)		
	SNF or Waste stream:	HLW	s	Energy requirements:		
	Action type:	New	t	Electrical: (MWH/yr)	Minimal	
	Structure Type: Size: (m3)	Storage Bin 1,700 933 m3 concrete	.	Fossil fuel: (liters)	60,560 Diesel, 3,400 Propane	
				Nightlights used: Y/N	Yes	
				Generators: Night Y/N Day Y/N	No Yes	
	Other features: (Pits, ponds, power /water/sewer lines)		O	Cost(\$): Operation:	\$200 k/yr	
	Location:		p	Schedule Start /End:	2004 - TBD	
Inside/outside of fence	Inside ICPP	e	No. of workers: (new/exist)	no new		
Inside/outside of bldg.	Outside existing bins	r	Heavy Equip. Equip. used:	None		
Cost and Schedule	Cost(\$): PreConst.	\$5 Mil.	a	Trips:		
	Cost(\$): Const.	\$17 Mil.	t	Air Emissions:		
	Schedule Start /End: PreConst.	2001 - 2004	i	(None / Ref.)	See Appendix F, Section 3	
	Schedule Start /End: Const.	2004 - 2006	o	Effluents:		
	No. of workers: (new/exist)	35 - 40 Subs.	n	Type:	None	
	Heavy Equip. Equip. used:	Trucks	a	Quantity: (liters/yr)		
	Acres Disturbed: New	0	i	Solid wastes:		
	Previous	0.5	n	Type:	LLW Ind.	
	Revegetated	0	f	Quantity: (m3/yr)	8 1	
	Air Emissions:		o	Haz./Toxic Chemicals:	N/A	
(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory			
Environmental	Effluents:		m	Pits/ponds used: Y/N (m2)	No	
	Type:	Construction Water	a	Water usage: (liters/yr)	None	
	Quantity: (liters)		t	Energy requirements:		
	Solid wastes:		i	Electrical: (MWH/yr)	None	
	Type:	Industrial	o	Fossil fuel: (liters/yr)		
	Quantity: (m3)	576	n	Nightlights used: Y/N	No	
	Haz./Toxic Chemicals:	None		Generators: Night Y/N Day Y/N	No No	
	Storage/inventory					

RADIOACTIVE SCRAP/WASTE FACILITY

PROJECT NAME: Radioactive Scrap/Waste Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to qualify the Radioactive Scrap/Waste Facility for interim storage of high-level waste until a high-level waste repository is available.

PROJECT DESCRIPTION: Some of the material that would be a by-product from operation at the Fuel Cycle Facility may be classified as a high-level waste. Since no final repository is presently available for high-level waste, Argonne National Laboratory-West proposes to store the high-level waste generated in the Fuel Cycle Facility at the Radioactive Scrap/Waste Facility until a final repository is available. The existing Radioactive Scrap/Waste Facility has been used since 1965 to store radioactive and radioactive mixed waste and material containing recoverable quantities of nuclear material (that is, scrap) that can be reused or reprocessed. The Radioactive Scrap/Waste Facility is a 1.6-hectare (4-acre) facility in which waste or scrap is stored in carbon steel pipes, called liners. The Radioactive Scrap/Waste Facility has a grid of 27 rows with about 50 storage pipes per row, for a total capacity of approximately 1350 potential storage locations. Storage volume is about 193 cubic meters (6,800 cubic feet).

Because of the radioactive fields that would be associated with the waste (regardless of its classification; for example, mixed, low level, transuranic, or high level) and scrap stored at the Radioactive Scrap/Waste Facility, special handling and storage would be required. The waste and scrap would be placed into containers within shielded hot cells using remote methods. The containers would be sealed remotely and transferred to the Radioactive Scrap/Waste Facility in a shielded cask. The Radioactive Scrap/Waste Facility provides shielding to protect personnel working in the facility from gamma radiation fields associated with the waste or scrap. The necessary shielding is provided by a "shield ring" that provides a tight interface between the cask and the storage liner where the material is placed. Once filled, the liner would be closed with a 76-cm (30-inches) concrete shield plug that is welded to the liner. The top of the shield plug would be a maximum of 10 cm (4 inches) above the ground surface. The ground provides the necessary shielding.

After corrosion was detected in Radioactive Scrap/Waste Facility liners removed in 1988, an upgrade program for the facility was begun. The upgrade program calls for all the existing waste in the Radioactive Scrap/Waste Facility to be relocated into new steel liners equipped with an impressed-current cathodic protection system. In addition to this system, the new steel liners are further protected from the mildly to moderately corrosive nature of the soils at the Radioactive Scrap/Waste Facility by a 10 cm (4 inch) layer of noncorrosive sand slurry. This slurry is backfilled around the steel liners at the time of emplacement.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, high-level waste would be accumulated in the Fuel Cycle Facility or the Hot Fuel Examination Facility. This option corresponds to Alternative A (No Action) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 16, '94		
General Information	Description/function:	Radioactive Scrap/Waste Facility	Implementation	Solid wastes:	
	WAG	9		Type:	None
	EIS Alter. (A, B, C or D):	B, C, D		Quantity: (m3/yr)	
	SNF or Waste stream:	HLW TRU LLW MLLW		Haz./Toxic Chemicals:	None
	Action type:	Operation w/ existing Fac.		Storage/inventory	
	Structure Type:	Use Existing RSWF		Pits/ponds used: Y/N (m2)	No
	Size: (m2)	16,000		Water usage: (liters/yr)	None
	Other features:	(ANL-W Bld-771)		Energy requirements:	
	(Pits, ponds, power /water/sewer lines)	None		Electrical: (MWH/yr)	989
				Fossil fuel: (liters/yr)	2400
Operational Data	Location:		Environmental	Nightlights used: Y/N	Yes
	Inside/outside of fence	Outside ANL-W 0.8 mile N.E.		Generators: Night Y/N	No
	Inside/outside of bldg.	Outside ANL-771 (RSWF)		Day Y/N	480 V, 3 Phase
	Cost(\$): Operation:	no increase above current level			
	Schedule Start /End:	1997 - TBD			
	No. of workers: (new/exist)	5 Project			
	Heavy Equip. Equip. used:	None			
	Trips:				
	Air Emissions:				
	(None / Ref.)	See Belanger et al., 1994			
Effluents	Effluents:				
	Type:	None			
	Quantity: (liters/yr)				

**Projects
Related to
Transuranic Waste**

PRIVATE SECTOR ALPHA-CONTAMINATED MIXED LOW-LEVEL WASTE TREATMENT

PROJECT NAME: Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Project would be to provide private sector treatment of alpha-contaminated mixed low-level wastes, transuranic waste, and possibly small amounts of low-level waste and mixed low-level waste presently stored at the INEL. It might also provide treatment of similar buried wastes that may be retrieved during environmental restoration projects at the INEL. Wastes from other DOE sites and the commercial sector may also be treated at the facility. Treatment of alpha-contaminated mixed low-level wastes would be sufficient to allow disposal in accordance with DOE Order 5820.2A and Resource Conservation and Recovery Act Land Disposal Restrictions. Treatment of transuranic waste would be sufficient to allow disposal in the Waste Isolation Pilot Plant.

PROJECT DESCRIPTION: This project would provide for the processing of alpha-contaminated mixed low-level wastes, transuranic waste, and possibly small amounts of low-level waste and mixed low-level waste by the private sector.

The DOE-Idaho intends to solicit feasibility studies for this endeavor from private industry. The options could range from use of their own existing facility upgraded to treat the waste, to building a commercial regional waste treatment facility. It is expected that a nonreactor nuclear facility would be used to process and package alpha-contaminated mixed low-level wastes (for treatment purposes this is defined as anything less than 100 nanocuries per gram) and transuranic waste as required, as well as small amounts of low-level waste and mixed low-level waste.

The specifics of the treatment process and system components would be determined by the private sector supplier. Expected design throughput volumes would be 4,000 cubic meters per year (5,200 cubic yards per year) of alpha contaminated low-level waste and 6,500 cubic meters per year (8,500 cubic yards per year) of transuranic waste. Based upon current descriptions of INEL wastes, likely requirements for disposal of the treated waste products, and known available

treatment process technologies, the following general treatment process system technical description is provided.

- Treatment would begin upon receipt of the wastes at the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment plant site. A receiving inspection and appropriate characterization of the wastes would be conducted sufficient to ensure the wastes are acceptable for receipt and treatment within the constraints of the facility design and permits. Based upon inspection and characterization, waste containers would be sorted and segregated to expedite subsequent processing. Containers would likely be vented, opened, and contents dumped for further sorting and processing as needed.
- Bulk waste volume processing would proceed involving some combination of physical and chemical processing to remove or destroy hazardous organics, remove or stabilize toxic metals in a solid material, and stabilize radionuclides in a solid material as per specified treated waste disposal acceptance requirements. The most likely bulk volume treatment processes would include a combination of thermal treatments involving desorption and high temperature oxidation/combustion of organics, followed by stabilization of ash and solid residues. A range of potential final stabilization media would be possible, such as cements, polymers, or glass/ceramics. One or more may be used to produce a final solid product for disposal.
- The treated solid waste products would be assayed, certified, and appropriately packaged for return transport from the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment to the Radioactive Waste Management Complex for storage awaiting disposal, or transported directly to an approved permanent repository, if available.

Future private sector initiatives would address additional INEL waste streams. These additional waste streams will be less hazardous and of smaller volume than the alpha-contaminated mixed low-level wastes and transuranic waste wastes. The analysis in the Environmental Impact Statement (EIS) would cover all private sector waste treatment initiatives.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - This option would be the deferral of treatment of alpha-contaminated mixed low-level wastes. This option corresponds to Alternative A (No Action) evaluated in this EIS. This option would involve the continued storage of the waste.

DOE Treatment - Under this option, the waste would be treated at a DOE operated facility. This option also corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. The Idaho Waste Processing Facility (see Project Summary in this appendix, page TRU3-1) would treat the same waste streams and achieve the same treatment requirements as the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment. The primary differences between the Idaho Waste Processing Facility and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility are in how they are funded and operated: The Idaho Waste Processing Facility would be DOE funded and contractor operated, while the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be privately owned and operated. An additional difference is that the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would not process mixed low-level waste or low-level beta/gamma wastes. Upon completion of preliminary designs and associated evaluations, a single facility would be chosen to process the wastes. The selection of the treatment facility is scheduled to occur in 1997.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 10 May 24, '94	
G e n e r a l c o n f o r m a t i o n	Description/function:	Private Sector Alpha-MLLW Treatment	C Cultural resource effects:	TBD
	WAG	Private	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	
	SNF or Waste stream:	TRU Alpha-LLW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	
	Size: (m2)	2,000	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Roads, water, power, sewer	Generators: Night Y/N	No
			Day Y/N	Yes
		Location:		
C o n s t r u c t i o n	Inside/outside of fence	new site	O Cost(\$): Operation:	\$7.8 Mil./yr Private Sector
	Inside/outside of bldg.		p Schedule Start /End:	2000 - 2005
	Cost(\$): PreConst.	\$30 -50 Mil.	e No. of workers: (new/exist)	71 Subs. (Private Sector)
	Cost(\$): Const.	\$250 - 350 Mil.	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1995 - 1997	a Trips:	2,000 /yr
	Schedule Start /End: Const.	1997 - 2000	t Air Emissions:	
	No. of workers: (new/exist)	532 - 768 Subs	i (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	n	
			a	
			i	
E f f l u e n t s	Acres Disturbed: New	200	l Effluents:	
	Previous	0	Type:	None Released
	Revegetated	0	Quantity: (liters/yr)	
	Air Emissions:		n Solid wastes:	
	(None / Ref.)	See Belanger et al., 1994	Type:	TRU LLW MLLW Ind.
			Quantity: (m3/yr)	57 100 170 320
	Effluents:		o Haz./Toxic Chemicals:	
	Type:	Construction Water	r Storage/inventory	
	Quantity: (liters)		m Pits/ponds used: Y/N (m2)	No
			a Water usage: (liters/yr)	
S o l i d w a s t e s	Solid wastes:		t Energy requirements:	
	Type:	Industrial	i Electrical: (MWH/yr)	
	Quantity: (m3)	1,750	o Fossil fuel: (liters/yr)	
			n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N	No
	Storage/inventory		Day Y/N	No

RADIOACTIVE WASTE MANAGEMENT COMPLEX MODIFICATIONS TO SUPPORT PRIVATE SECTOR TREATMENT OF ALPHA-CONTAMINATED MIXED LOW-LEVEL WASTE

PROJECT NAME: Radioactive Waste Management Complex Modifications to Support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide Radioactive Waste Management Complex facility enhancements on a schedule that supports private-sector treatment of alpha-contaminated mixed low-level waste and transuranic waste stored at the INEL.

PROJECT DESCRIPTION: Modifications to the Radioactive Waste Management Complex would be needed to support the shipment of alpha-contaminated mixed low-level waste and transuranic waste to a privately owned and operated waste treatment facility. If such a facility were chosen for implementation, additional waste retrieval, venting, and examination facilities would be required to be operational by October 2000, to support both sending the waste offsite for treatment and receiving it back onsite after treatment.

Approval of treatment of alpha-contaminated mixed low-level waste and transuranic waste at a private facility would require that the following facilities be constructed at the Radioactive Waste Management Complex:

- New examination and assay facilities to supplement the Stored Waste Examination Pilot Plant.
- Transportation facilities to stage drums for shipment to the private facility and to receive returning drums of treated waste.

The new examination and assay facility built to support offsite private waste treatment would have capabilities to examine the contents of drums and other shipping containers and to obtain required samples for waste acceptance analyses. It would also have assay equipment for

certification of low-level waste. The new transportation facility would be required only if treatment services were provided at a significant distance from the Radioactive Waste Management Complex. It would have the capability to stage and ship approximately 680 drum equivalents per day. It would have equipment and facilities for both sending and receiving and for providing necessary administrative support to these activities.

Because sending alpha-contaminated mixed low-level waste and transuranic waste to a private facility would accelerate retrieval of these wastes from storage, air emissions of radioactive and hazardous materials from the Transuranic Storage Area Retrieval Enclosure may increase over those expected during normal retrieval operations. Releases would be expected to occur because of the presence of breached waste containers. Control of any such potential emissions from the Transuranic Storage Area Retrieval Enclosure would be performed as a separate element of this project. Particulate emissions would be controlled by filtration. Volatile organic compound emission controls may also be required to maintain applicable standards. It is unlikely that accelerating the schedule by one order of magnitude would exceed a limit, but the accelerated retrieval schedule may increase the emissions unless control systems are installed.

The air emissions and air concentrations of hazardous constituents from the Transuranic Storage Area Retrieval Enclosure have been compared with applicable standards and in all instances the emissions were at least two orders of magnitude below the Idaho Toxic Air Pollutants Emission Limit. The effective dose equivalent from radiological emissions for this project is several orders of magnitude below the National Emission Standards for Hazardous Air Pollutants. Planned high efficiency particulate air filtration during accelerated retrieval would prevent exceeding regulatory limits for radionuclides.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option Radioactive Waste Management Complex modifications would not be completed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Under this option, the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility (see Project Summary in this appendix, page TRU1-1) would not be constructed, and therefore, the Radioactive Waste Management Complex modifications would not be required to support this effort.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs* (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9 May 24, '94	
G e n e r a l c o n f o r m a t i o n	Description/function:	RWMC Modifications to Support Private Sector Treatment of Alpha-MLLW	C Cultural resource effects:	None identified
	WAG	7	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	TRU Alpha-LLW	s Energy requirements:	Unknown until further definition of action.
	Action type:	New - Expand	t Electrical: (MWH/yr)	
	Structure Type:	Building upgrades & new Examination / Assay Facility	. Fossil fuel: (liters)	
	Size: (m2)		Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Expand RWMC capabilities	Generators: Night Y/N Day Y/N	No Yes
	Location:		O Cost(\$): Operation:	\$188 Mil. Total
	Inside/outside of fence	Inside RWMC	p Schedule Start /End:	2000 - 2005
Inside/outside of bldg.	Outside / Inside	e No. of workers: (new/exist)	100 Existing	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.	\$38 Mil.	r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$85 Mil. total	a Trips:	
	Schedule Start /End: PreConst.	1995 - 2000	t Air Emissions:	
	Schedule Start /End: Const.	1995 - 2000	i (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	60 Subs.	n Effluents:	
	Heavy Equip. Equip. used:	Trucks	i Type:	None
	Trips:		Quantity: (liters/yr)	
	Acres Disturbed: New	0	Solid wastes:	
	Previous	<1	Type:	LLW MLLW Ind.
	Revegetated	0	Quantity: (m3/yr)	50 50 100
o n l i n f o r m a t i o n	Air Emissions:	See Belanger et al., 1994	o Haz./Toxic Chemicals:	None
	(None / Ref.)		r Storage/inventory	
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		i Electrical: (MWH/yr)	
	Type:	Industrial	o Fossil fuel: (liters/yr)	
	Quantity: (m3)	1,500	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N Day Y/N	No No
	Storage/inventory			

IDAHO WASTE PROCESSING FACILITY

PROJECT NAME: Idaho Waste Processing Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Idaho Waste Processing Facility Project would be to design, construct, and operate a facility to provide treatment for alpha-contaminated low-level waste and transuranic waste stored at the INEL. Treatment would produce a final waste form acceptable for land disposal in accordance with applicable regulatory requirements.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: The Idaho Waste Processing Facility would treat and process both alpha-contaminated and transuranic-contaminated wastes to meet applicable requirements for land disposal. The facility would be intended to provide treatment for waste stored at the INEL, but similar waste from other DOE sites and the commercial sector could be treated there. Because other available treatment facilities may lack the necessary capabilities, the INEL's annually generated volume of 60 cubic meters (78 cubic yards) of mixed low-level waste and incidental quantities of low-level beta/gamma wastes may also be treated at the Idaho Waste Processing Facility.

The Idaho Waste Processing Facility would be constructed and operated in two phases: Phase I would treat both mixed and nonmixed alpha-contaminated low-level waste and Phase II would add treatment capabilities for mixed and nonmixed transuranic waste. Treatment of alpha-contaminated mixed low-level waste would be sufficient to allow land disposal in accordance with DOE Orders and Resource and Conservation and Recovery Act Land Disposal Restrictions.

Treatment of transuranic waste would be sufficient to allow disposal at the Waste Isolation Pilot Plant.

A standalone Idaho Waste Processing Facility located near the Radioactive Waste Management Complex has been postulated for planning purposes and environmental impact analyses. Indeed, the required design elements and operational capabilities for the facility are still in the process of being established. The final facility design may consist of a single building or several small buildings housing selected processing or treatment technologies. If multiple buildings were selected, they may be located near the Radioactive Waste Management Complex or at various existing plant sites on the INEL. Existing buildings may be used to house some processing and treatment technologies.

Treatment capabilities for both alpha-contaminated low-level waste and transuranic waste could include opening and sorting, pretreatment and treatment, and immobilization. The design throughput would be 4,000 to 6,500 cubic meters per year (5,200 to 8,500 cubic yards per year). Each of these treatment processes is briefly described below:

Opening and Sorting: Facilities would be provided for the capability to open and sort the various sizes of barrels, boxes, and bins of waste. The waste is both contact-handled and remote-handled; therefore, the systems to handle this waste will require some remote capability. After opening, the waste would be inspected and sorted and segregated for further processing.

Pretreatment and Treatment: In this part of the process, the contact-handled waste would be sized in preparation for treatment of the hazardous constituents. This treatment could be thermal, nonthermal, or a combination of both. A thermal treatment would destruct the hazardous and toxic constituents. A nonthermal treatment could also be provided, similar to a chemical wash system. Treatment would probably also consist of a decontamination process. The decontaminated material could be recycled or sent to the immobilization process. An amalgamation process would probably also be provided for some metals, such as mercury. Some remote-handling capability would also be required in these processes.

Immobilization: Immobilization processes would probably be provided whereby a waste material would be converted to an environmentally stable configuration. Immobilization treatments would probably include sulfur polymer cement, Portland cement, or iron-enriched basalt. These processes would fix loose materials in place within a matrix of stable, inert material. Immobilization is a preferred treatment for a number of waste forms, such as ashes, resin fines, and substances contaminated with heavy metals.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - This option would defer treatment of alpha-contaminated low-level waste. This option corresponds to Alternative A (No Action) evaluated in this EIS. This option would involve the continued storage of the waste.

Shipment Offsite - This option would provide for the shipment and treatment of the waste at another DOE site. This option corresponds to Alternative C evaluated in this EIS. This option would include the construction of a treatment facility at the offsite location.

Private Sector Treatment - A Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment Facility (see Project Summary in this appendix, page TRU1-1) would be designed and evaluated in parallel with the Idaho Waste Processing Facility. This option also corresponds with Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS. The Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility could treat the same waste streams and achieve the same treatment requirements as the Idaho Waste Processing Facility. The primary differences between the Idaho Waste Processing Facility and the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be in how they would be funded and operated. The Idaho Waste Processing Facility would be DOE funded and contractor operated, while the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would be privately owned and operated. An additional difference would

be that the Private Sector Alpha-Contaminated Mixed Low-Level Waste Treatment facility would not process mixed low-level waste or low-level beta/gamma wastes. Upon completion of preliminary designs and associated evaluations, a single facility would be chosen to process the wastes. The selection of the treatment facility is scheduled to occur in 1997.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9 May 24, '94	
G e n e r a l c o n s t r u c t i o n s	Description/function:	Idaho Waste Processing Facility (IWPF) (Phase I) (Alpha-MLLW)	C Cultural resource effects:	None identified
	WAG	NEL	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	
	SNF or Waste stream:	LLW MLLW Alpha-MLLW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	120 k Diesel, 25 k Propane
	Size: (m2)	3,200	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Support Facilities 2 mile road power, water, sewer	Generators: Night Y/N Day Y/N	No Yes
	Location:		O Cost(\$): Operation:	\$40 Mil./yr
	Inside/outside of fence	Outside RWMC	p Schedule Start /End:	2008 - TBD
Inside/outside of bldg.	(2 mile east)	e No. of workers: (new/exist)	167 Existing	
C o n s t r u c t i o n s	Cost(\$): PreConst.		r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$430 Mil. total	a Trips:	520 /yr on-site
	Schedule Start /End: PreConst.	1994 - 2004	t Air Emissions:	
	Schedule Start /End: Const.	2004 - 2008	l (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	145 Peak, 72 Avg Subs	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	l Type:	No Liquids
	Trips:		Quantity: (liters/yr)	
	Acres Disturbed: New	20	n Solid wastes:	
	Previous	0	Type:	LLW TRU MLLW Ind.
	Revegetated	0	Quantity: (m3/yr)	20 26 19 320
I n f o r m a t i o n	Air Emissions:		o Haz./Toxic Chemicals:	
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	20,000 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	
	Type:	Industrial	o Fossil fuel: (liters/yr)	771 k Propane, 2,119 k Fuel Oil
	Quantity: (m3)	1,750	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N Day Y/N	No No
	Storage/inventory			

Project Data Sheet			Rev. 8 May 24, '94		
G	Description/function:	Idaho Waste Processing Facility (IWPF) (Phase II) (TRU)	C	Cultural resource effects:	None identified
e			o	Pits/ponding created: (m2)	No
n	WAG	INEL	n	Water usage: (liters)	
e	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	
r	SNF or Waste stream:	TRU LLW MLLW Alpha-MLLW	t	Electrical: (MWH/yr)	
l	Action type:	New	.	Fossil fuel: (liters)	50 k Diesel, 10 k Propane
c	Structure Type:	Building		Nightlights used: Y/N	Yes
l	Size: (m2)	2,000		Generators: Night Y/N	No
n	Other features:	Support Facilities		Day Y/N	Yes
f	(Pits, ponds, power	2 mile road	O	Cost(\$): Operation:	\$40 Mil./yr
o	/water/sewer lines)	power, water, sewer	p	Schedule Start /End:	2009 - TBD
.	Location:		e	No. of workers: (new/exist)	167 Existing
	Inside/outside of fence	Outside RWMC	r	Heavy Equip. Equip. used:	Trucks
	Inside/outside of bldg.	(2 mile east)	a	Trips:	636 /yr on-site
C	Cost(\$): PreConst.		t	Air Emissions:	
o	Cost(\$): Const.	\$165 Mil. total	l	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1994 - 2007	o		
s	Schedule Start /End: Const.	2007 - 2009	n		
t	No. of workers: (new/exist)	55 Peak, 28 Avg Subs	a	Effluents:	
r	Heavy Equip. Equip. used:	Trucks	l	Type:	No Liquids
u	Trips:			Quantity: (liters/yr)	
c	Acres Disturbed: New	20	l	Solid wastes:	
t	Previous	0	n	Type:	LLW TRU MLLW Ind.
l	Revegetated	0	f	Quantity: (m3/yr)	30 31 24 320
o	Air Emissions:		o	Haz./Toxic Chemicals:	
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	
l	Effluents:		m	Pits/ponds used: Y/N (m2)	No
n	Type:	Construction Water	a	Water usage: (liters/yr)	20,000 k
f	Quantity: (liters)		t	Energy requirements:	
o	Solid wastes:		l	Electrical: (MWH/yr)	
.	Type:	Industrial	o	Fossil fuel: (liters/yr)	771 k Propane, 2,119 kr Fuel Oil
	Quantity: (m3)	1,750	n	Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:			Generators: Night Y/N	No
	Storage/inventory			Day Y/N	No

SHIPPING/TRANSFER STATION

PROJECT NAME: Shipping/Transfer Station

GENERAL PROJECT OBJECTIVE: The general objective of the proposed INEL Shipping/Transfer Station Project would be to provide a centralized facility to accept waste directly from storage or from other INEL facilities for shipment offsite to other DOE sites [EIS Alternative C (Minimum Treatment, Storage, and Disposal)]. The waste types would include alpha-contaminated low-level waste that would be handled the same as the transuranic wastes, low-level waste, and mixed low-level waste. The entire INEL inventory of alpha-contaminated low-level waste is presently stored at the Radioactive Waste Management Complex. This waste needs to be retrieved, inspected, and prepared for transportation before the waste can leave the Radioactive Waste Management Complex boundary. Low-level waste and mixed low-level waste are being generated at many sites throughout the INEL.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a Shipping/Transfer Station. All alpha-contaminated low-level wastes, low-level waste, and mixed low-level waste would be shipped from this facility to treatment, storage, and disposal facilities under Alternative C (Minimum Treatment, Storage, and Disposal). In addition, an expansion of the existing Stored Waste Examination Pilot Plant facility located at the Radioactive Waste Management Complex would be required to identify alpha-contaminated low-level wastes for shipment.

The new Shipping/Transfer Station would be designed to receive and ship all INEL alpha-contaminated low-level wastes, low-level waste, and mixed low-level waste. Waste would be received directly from storage, other INEL facilities, or the Stored Waste Examination Pilot Plant after completion of characterization. The waste would be loaded for shipment offsite. The capability of loading and unloading approximately 6 to 8 semitrailer trucks (680 drum equivalents/day total) each working day would be required. The new building would have four enclosed loading/unloading bays, each about one-half the size of the Stored Waste Examination Pilot Plant bay, and office and utility spaces. The new facility would be a pre-engineered metal structure with a total floor area of 2,800 square meters (30,000 square feet).

Under this project the Stored Waste Examination Pilot Plant building would be expanded (approximately three times) or a new, enlarged building of a similar type would be constructed. The expanded Stored Waste Examination Pilot Plant facility is needed to inspect waste packages (including boxes) to identify whether the waste is transuranic waste or alpha-contaminated low-level waste. The expanded Stored Waste Examination Pilot Plant facility would examine waste boxes that are not able to be examined in the existing Stored Waste Examination Pilot Plant facility. The building would be separated into three general areas: a two story office and utility area, including a control room that overlooks the other two areas; an enclosed examination and testing area; and a large enclosed bay for transferring waste to and from the Shipping/Transfer Station. There would be three cranes in the building: a 5-ton bridge crane; a 3-ton gantry crane; and a 1-ton monorail crane.

The shipping facility would be located at the Radioactive Waste Management Complex (centralized shipping facility) where approximately 60 percent of the waste to be shipped originates. The remaining 40 percent of the waste would be accumulated in existing storage facilities until subsequent transfer to the Shipping/Transfer Station and final shipment to the offsite treatment, storage, and disposal facility. The expanded Stored Waste Examination Pilot Plant facility would be located at the Radioactive Waste Management Complex since characterization of alpha-contaminated low-level waste is required prior to transportation activities.

A similar project is considered (for shipment of waste to the private sector) as part of modifications to the Radioactive Waste Management Complex to support Private Sector Treatment of Alpha-Contaminated Mixed Low-Level Waste (see Project Description in this appendix, page TRU2-1).

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative C (Minimum Treatment, Storage, and Disposal).

No Action - Under this option, the Shipping/Transfer Station would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Direct Shipment of Low-Level Waste and Mixed Low-Level Waste - This option locates the shipping facility (for alpha-contaminated low-level wastes only) at the Radioactive Waste Management Complex and requires the existing sites to store and ship low-level waste and mixed low-level waste from the existing facilities (distributed shipping facilities). The expanded Stored Waste Examination Pilot Plant facility would be located at the Radioactive Waste Management Complex since this process is required prior to transportation activities. This option is bounded by the analysis in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

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C	Cultural resource effects:	None identified		
o	Pits/ponding created: (m2)	None		
n	Water usage: (liters)	3,200 k		
s	Energy requirements:			
t	Electrical: (MWH/yr)	4,000		
.	Fossil fuel: (liters)	85 k Diesel, 17 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		
O	Cost(\$): Operation:	\$2.0 Mil/yr		
p	Schedule Start /End:	2004 - 2030		
e	No. of workers: (new/exist)	12 Existing, 10 new		
r	Heavy Equip. Equip. used:	Trucks		
a	Trips:	1,200 trips/yr		
t	Air Emissions:			
l	(None / Ref.)	See Appendix F, Section 3		
o	Effluents:			
n	Type:	TBD		
a	Quantity: (liters/yr)			
l	Solid wastes:			
n	Type:	LLW	MLLW	Ind.
f	Quantity: (m3/yr)	50	50	100
o	Haz./Toxic Chemicals:			
r	Storage/inventory	200 liters		
m	Pits/ponds used: Y/N (m2)	No		
a	Water usage: (liters/yr)	2,000 k		
t	Energy requirements:			
l	Electrical: (MWH/yr)	4,000		
o	Fossil fuel: (liters/yr)	150 k Diesel, 30 k Propane		
n	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		

RADIOACTIVE SCRAP/WASTE FACILITY

(See description under High-Level Waste starting on page HLW5-1)

**Projects
Related to
Low-Level Waste**

WASTE EXPERIMENTAL REDUCTION FACILITY INCINERATION

PROJECT NAME: Waste Experimental Reduction Facility Incineration

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide volume reduction of low-level waste and treatment of mixed low-level waste to render it non-hazardous, or to meet land disposal restriction regulations.

The purpose of the proposed DOE action is to provide Resource Conservation Recovery Act compliant treatment capability for DOE mixed low-level waste and to reduce the volume of low-level waste before disposal. The action would reduce the volume and toxicity of mixed low-level waste and comply with Resource Conservation Recovery Act regulations (40 CFR Part 268) and Idaho Hazardous Waste Management Act requirements. In addition, the action would support continued compliance with the following DOE Order 5820.2A requirement: "Waste treatment techniques such as incineration, shredding, compaction, and solidification or other Resource Conservation Recovery Act approved treatments to reduce volume and provide more stable waste forms shall be implemented as necessary to meet disposal facility performance requirements." The proposed action would also aid DOE in fulfilling its responsibility for providing long-term management of mixed low-level waste and low-level waste using methods that are technically and environmentally sound.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

DOE needs to treat mixed low-level waste to comply with Resource Conservation Recovery Act requirements for storage and disposal, and to provide support for ongoing DOE activities that generate mixed low-level waste. Low-level waste volume reduction activities are part of Alternative A (No Action). DOE prepared an Environmental Assessment for operations at this

facility that do not involve incineration at Waste Experimental Reduction Facility (Idaho National Engineering Laboratory Low-Level and Mixed Waste Processing, DOE/EA-0843). Impacts of offsite supplemental volume reduction are being assessed in the Waste Experimental Reduction Facility Environmental Assessment (DOE/EA-0843). Analyses in the Waste Experimental Reduction Facility Environmental Assessment are incorporated by reference.

Disposal of mixed low-level waste is constrained because of a shortage of treatment facilities and disposal sites. To dispose of mixed low-level waste in accordance with Resource Conservation Recovery Act land disposal restrictions, the hazardous constituents must be treated unless the disposal site(s) can demonstrate to U. S. Environmental Protection Agency that migration of hazardous constituents in the untreated waste will not occur. No site has been approved for disposal of mixed low-level waste without treatment. Certain types of mixed low-level waste must be incinerated to comply with the U. S. Environmental Protection Agency's technology-based treatment standards (40 CFR Part 268). Incineration is the technology-based treatment standard for most of the mixed low-level waste at the INEL.

Mixed low-level waste is currently stored at various INEL facilities. The current inventory includes 100 cubic meters (130 cubic yards) of incinerable mixed low-level waste. Based on Land Disposal Restrictions requirements, this waste may be stored solely for the purpose of accumulating quantities sufficient to facilitate treatment. Currently, the Waste Experimental Reduction Facility is the only operable DOE facility capable of incinerating INEL mixed low-level waste; commercial incineration of INEL mixed low-level waste is not available. Future INEL activities are expected to generate approximately 1,500 cubic meters (1,950 cubic yards) of incinerable mixed low-level waste each year. Treatment capacities must be available for this newly generated mixed low-level waste.

Waste Experimental Reduction Facility operations were suspended in February 1991 to upgrade safety documentation, operating procedures, and management systems. The documentation is being revised to reflect actual Waste Experimental Reduction Facility configurations and to comply with recently issued DOE orders. The documentation and facility operational readiness would be evaluated and approved by DOE and contractor oversight teams before waste reduction operations are resumed.

PROJECT DESCRIPTION: This project would provide low-level waste and mixed low-level waste incineration at the Waste Experimental Reduction Facility. It will also modify the existing organic liquid waste injection system to (a) provide the capability to incinerate either organic or aqueous waste through direct injection into the Waste Experimental Reduction Facility incinerator, and (b) provide a location for liquid waste sampling, blending, and repackaging operations.

The Waste Experimental Reduction Facility is an existing Resource Conservation Recovery Act interim status facility. The Waste Experimental Reduction Facility is being modified to the organic liquid waste injection system, as part of the Resource Conservation Recovery Act Part B permitting process.

The INEL generates, and under all alternatives, is expected to continue generating low-level waste and mixed low-level waste during energy, defense, and environmental restoration missions. In 1982, the Waste Experimental Reduction Facility was established to develop and demonstrate low-level waste volume reduction and stabilization processes. The Waste Experimental Reduction Facility began low-level waste incineration in 1984. Most of the waste processed at the Waste Experimental Reduction Facility has been low-level waste; however, a trial burn was conducted in 1986 for mixed low-level waste, demonstrating the Waste Experimental Reduction Facility's ability to meet Resource Conservation Recovery Act incineration requirements, and eight pilot mixed low-level waste incineration campaigns were performed during 1989 and 1990. No incineration is currently being done. Incineration at the Waste Experimental Reduction Facility has been deferred pending the Record of Decision for this EIS.

The incinerator is a dual-chambered, controlled-air, combustion unit with a maximum rated combustion capacity of 5.5 million Btu per hour. The incinerator system consists of the following:

- A solid waste feed system that automatically conveys the solid waste containers of low-level waste, hazardous waste, and mixed low-level waste.
- A liquid waste feed system and a burner assembly for incinerating waste in the primary (lower) chamber.

-
- Automatic waste feed cutoff systems for both solid and liquid wastes.
 - A primary (lower) chamber, where liquid and solid wastes are introduced and where combustion takes place at starved air conditions for solid waste and excess air conditions for liquid wastes.
 - A secondary (upper) chamber that acts as an afterburner for the unburned volatile gases from the wastes in the primary chamber.
 - A combination of two dilution air streams and a shell-and-tube heat exchanger for cooling combustion gas before it reaches the air pollution control equipment.
 - An air pollution control system using baghouse and high efficiency particulate air filters.
 - A bottom-ash removal system to remove ash through a cooling hopper located in the rear of the lower chamber.

Solid wastes would be charged from a conveyor system. The wastes would be packed in cardboard boxes up to 2 x 2 x 2 feet. Boxes typically contain clothing, rags, plastics, and other combustible materials.

Liquid wastes would be fed to the incinerator through above-ground piping that is connected to drums located in the liquid waste feed shelter. The injection nozzle is designed to provide high efficiency combustion by atomizing the liquid waste into fine droplets.

Liquid wastes would be repackaged in boxes before incineration, as appropriate. This would typically be done for wastes that cannot be fed through the liquid feed system. The in-box method of liquid waste incineration would consist of placing liquids in an approved absorbent and then processing them as solid waste.

To provide a greater capability for processing not only hazardous and mixed organic liquid waste, but also aqueous wastes, modifications to the existing organic liquid injection system would be

required. These modifications would include (a) a dedicated ventilation system with redundant blowers exhausting to the Waste Experimental Reduction Facility north stack, (b) the capability to process flammable liquids (as defined in 29 CFR 1910.106), (c) the capability to sample, blend, and/or repackage liquid wastes in support of waste management/processing activities, (d) the capability to inject up to 30 gallons per hour of aqueous wastes as a finely atomized stream into the lower chamber of the Waste Experimental Reduction Facility incinerator, and (e) the capability to install blend and hold tanks.

The automatic waste feed cutoff system would prevent the feeding of waste into the incinerator primary chamber when key incineration conditions fall outside the predetermined range. The system would automatically lock out operation of the solid feed system and close valves in the liquid feed system until proper operating conditions are restored. All automatic waste feed cutoff parameters would be set up to cause solid and liquid waste feed to be interrupted. Additionally, parameters that require an immediate reduction in heat and/or offgas generation could be set up to also interrupt auxiliary burner operation. The parameters chosen for the automatic waste feed cutoff system are those listed as "Group A" in the U.S. Environmental Protection Agency's Hazardous Waste Incinerator Guidance. The operating limits for the automatic waste feed cutoff system (parameter set points) would be determined from conditions demonstrated in the trial burn.

PROJECT SPECIFIC OPTIONS: A summary of comparative impacts between the options is provided in Table LLW1-1.

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented.

No Action - The no-action alternative would be to continue storing INEL mixed low-level waste at INEL and process incinerable low-level waste at a commercial facility. Incineration of low-level waste and mixed low-level waste would not be performed at Waste Experimental Reduction Facility. Therefore, existing and future generated INEL mixed low-level waste, ash from offsite low-level waste incineration, and small quantities, less than 5 cubic meters, of offsite-generated mixed low-level waste would require continued storage.

Table LLW1-1. Option impacts.^a

Impact	Option 1 Continue to store INEL- generated mixed low-level waste	Option 2 Treat mixed low-level waste by methods other than incineration	Option 3 Construct and operate a new mixed low-level waste incinerator	Option 4 Treat mixed low-level waste at another DOE incinerator
Environmental compliance	Existing and future generated INEL mixed low-level waste would require continued storage	Treatments other than incineration may not meet RCRA standards for mixed low-level waste. During the U.S. Environmental Protection Agency approval process, INEL generated mixed low-level waste would require continued storage.	A new incinerator would require a RCRA Part B and State Air Permits. RCRA compliant mixed low-level waste treatment would be delayed 5-10 years. Existing and future generated INEL mixed low-level waste would require continued storage.	Compliance would be similar to incineration at Waste Experimental Reduction Facility if other DOE incinerators were licensed to treat INEL mixed low-level waste.
Socioeconomic	Small work force needed to operate mixed low-level waste storage facilities	Similar work force to incineration.	New mixed low-level waste incinerator would operate intermittently (1-3 months/yr) for INEL waste. Small additional work force may be needed for extended operation if waste is received from other DOE sites.	Small workforce needed to operate mixed low-level waste storage facilities.
Land use	Possible increase for storage of mixed low-level waste awaiting treatment.	Possible increase for storage of mixed low-level waste awaiting treatment.	Additional land would be required for new incinerator and ingress/egress.	No change.
Health effects	Near term risks would be less than for incineration; long term risks would be higher than for incineration.	Near term risks would be less than for incineration. Due to the possibility of reclaiming waste, long term risks would be higher than for incineration.	Near term risks would be less than for incineration. Due to the possibility of reclaiming waste, long term risks would be higher than for incineration.	Processing risks would be similar to incineration. Mixed low-level waste transportation risks would increase.
Terrestrial ecology	Possible loss of habitat due to expanded mixed low-level waste storage.	Possible loss of habitat due to expanded mixed low-level waste storage.	Increased habitat loss for construction of new incinerator.	None.
Archaeological and historical sites	Possible impacts due to expanded mixed low-level waste storage.	Possible impacts due to expanded mixed low-level waste storage.	Possible impacts/mitigation requirements depending on new incinerator site.	None.
Accidents and occupational risks	Mixed low-level waste near term risk is less than for incineration; long term risk is greater due to extended storage.	Mixed low-level waste near term risk is less than for incineration; long term risk is greater due to extended storage.	Increased risks from continued mixed low-level waste storage/ monitoring until treatment capacity is available. Processing risk would be similar to Waste Experimental Reduction Facility incineration mixed low-level waste (when new mixed low-level waste incinerator becomes operable).	Processing risks would be similar to incineration at Waste Experimental Reduction Facility. Mixed low-level waste transportation risks would increase.

a. With respect to Waste Experimental Reduction Facility incineration, any discussion of mixed low-level waste in this table encompasses low-level waste except where the Resource Conservation and Recovery Act is involved.

Through 1994, approximately 1,100 cubic meters (1,400 cubic yards) of mixed low-level waste would be stored at the INEL. Based on projected generation rates, the INEL would exceed mixed low-level waste storage capacity by 1996. This would require curtailment of waste generation or new construction of additional mixed low-level waste storage. This option corresponds with Alternative A (No Action) evaluated in this EIS.

Treat Mixed Low-Level Waste by Methods Other than Incineration - The treatment standards for most mixed low-level waste that have been established by the U.S. Environmental Protection Agency are based upon the demonstrated capabilities of incineration. Incineration is the technology-based treatment standard for most of the mixed low-level waste on the INEL. Few other technologies have been demonstrated that meet the standards. Therefore, the application of other technologies (that is, stabilization and biological or chemical treatments) would require a period of time for testing, demonstration, and implementation on a production scale.

Construct and Operate a New Mixed Low-Level Waste Incinerator - This alternative would involve constructing a new incinerator to provide production-scale treatment of INEL mixed low-level waste. The incinerator would treat characteristic and listed hazardous constituents in mixed low-level waste. Mixed low-level waste would continue to be stored until the incinerator is operational, and thereafter, mixed low-level waste would be stored for a short time until sufficient quantities were accumulated for incineration. Long-term storage of mixed low-level waste would not be necessary after the incinerator became operational. The incinerator would require an approved Resource Conservation Recovery Act Part B Permit, including a trial burn, before mixed low-level waste treatment operations commence. Construction of a new incinerator was included as part of Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

Treat Mixed Low-Level Waste and Low-Level Waste at Another DOE Incinerator - In addition to Waste Experimental Reduction Facility, DOE has several existing or planned radioactive waste incinerators at defense program sites throughout the U.S. that could potentially be used for processing some wastes proposed for the Waste Experimental Reduction Facility. Incinerators are located at the Rocky Flats Plant in Colorado, Los Alamos National Laboratory in New Mexico, and Oak Ridge Reservation in Tennessee. Currently, Waste Experimental Reduction Facility and the Toxic Substance Control Act incinerator at the Oak Ridge Reservation K-25 site are the only

operable incinerators in the DOE system capable of treating many forms of mixed low-level waste. The Rocky Flats Plant and Los Alamos National Laboratory incinerators are not presently operating. The Oak Ridge Reservation incinerator is not suitable for beta/gamma-contaminated wastes and is scheduled to operate at or near capacity for onsite wastes. DOE has also prepared an Environmental Assessment and issued a Finding-of-No-Significance Impact for the Consolidated Incineration Facility, a proposed hazardous and mixed waste incinerator at the Savannah River Site. However, DOE will not operate the Consolidated Incineration Facility unless and until decisions on its future mission are made based on the Savannah River Site Specific Waste Management EIS. The designated missions and Resource Conservation Recovery Act permits for other DOE incinerators generally prohibit receiving and treating INEL generated wastes.

SUMMARY OF IMPACTS:

Atmospheric Emissions During Operations - Projected air emissions from Waste Experimental Reduction Facility would result in air pollutant loading of both radiological and nonradiological emissions. The projected dose to the maximally exposed individual due to Waste Experimental Reduction Facility emissions is less than 0.01 mrem per year, below the applicable National Emission Standards for Hazardous Air Pollutants limit of 10 mrem per year. Nonradiological pollutant levels are below standards in all cases.

Transportation Impacts - The potential impacts of the proposed low-level waste shipments to and from the Waste Experimental Reduction Facility would be extremely small. The maximum cumulative radiological health risk to transportation workers from incident-free waste shipping over the 20-year campaign is estimated to be 0.09 deaths. The maximum radiological and nonradiological health risk to the public from incident-free waste shipping over 20 years is estimated to be 0.82 deaths. Up to 0.77 deaths may also occur from transportation accidents. The analysis is considered conservative; actual effects would likely be less.

Because these shipments would involve very small quantities of mixed low-level waste, it is assumed that radiological impacts from shipping mixed low-level waste would be bounded radiological impacts from transporting low-level waste. Transportation impacts from the hazardous (nonradioactive) component of mixed low-level waste would result only if an accident

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involving a spill were to occur. About 0.02 accidents per year, or one accident in 50 years, would be expected involving mixed low-level waste shipments to the INEL. This low frequency, along with the very low quantities, makes the likelihood of injuries from hazardous material releases in an accident very low.

Impact of Accidents - DOE considered a range of reasonably foreseeable accidents at Waste Experimental Reduction Facility, including earthquakes, an ash spill, a compactor fire, and a baghouse high efficiency particulate air filter fire (DOE/EA-0843). The maximum reasonably foreseeable accident associated with Waste Experimental Reduction Facility operations would be an earthquake near the end of an incineration campaign. The probability of occurrence is estimated to be 8.5×10^{-5} . Based on conservative estimates, a nearby worker would receive a dose of 1.3 rem, and doses to the public would be 2.7 mrem. No health effects are expected to anyone onsite or offsite resulting from radiation doses. Concentrations of metals would be less than levels that would be immediately dangerous to life and health. Workers would be expected to exit the area before exposure levels above occupational limits would be reached. No health effects would result to other individuals onsite or offsite.

REFERENCES:

- Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.
- DOE (U.S. Department of Energy), 1993, *Environmental Assessment, Idaho National Engineering Laboratory Low-Level and Mixed Waste Processing*, DOE/EA-0843, Office of Environmental Restoration and Waste Management, Washington, DC, June.
- DOE (U.S. Department of Energy), 1988, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington, DC, September.

Project Data Sheet			Rev. 8 May 24, '94	
GENERAL INFORMATION	Description/function:	WERF Incineration	Cultural resource effects:	None
	WAG	5	Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	Water usage: (liters)	0
	SNF or Waste stream:	LLW MLLW	Energy requirements:	
	Action type:	Expand, Operations	Electrical: (MWH/yr)	0
	Structure Type:		Fossil fuel: (liters)	0
	Size: (m2)	N/A	Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)	Incinerator upgrades	Generators: Night Y/N	No
			Day Y/N	No
	Location:		Cost(\$): Operation:	\$9 Mil./yr
Inside/outside of fence	Inside PBF	Schedule Start /End:	1996 - 2015	
Inside/outside of bldg.	Inside PBF-609	No. of workers: (new/exist)	60 Existing	
COSTS AND SCHEDULE	Cost(\$): PreConst.	\$100 k	Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$500 k	Trips:	2 / day
	Schedule Start /End: PreConst.	1995 - 1996	Air Emissions:	
	Schedule Start /End: Const.	1996 - 1997	(None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	N/A	Effluents:	
	Heavy Equip. Equip. used:	None	Type:	No Liquids
	Trips:		Quantity: (liters/yr)	
	Acres Disturbed: New	0	Solid wastes:	
	Previous	0	Type:	LLW MLLW Ind.
	Revegetated	0	Quantity: (m3/yr)	15 15 100
ENVIRONMENTAL IMPACTS	Air Emissions:		Haz./Toxic Chemicals:	None
	(None / Ref.)	N/A	Storage/inventory	
	Effluents:		Pits/ponds used: Y/N (m2)	No
	Type:	N/A	Water usage: (liters/yr)	600 k
	Quantity: (liters)		Energy requirements:	
	Solid wastes:		Electrical: (MWH/yr)	3,600
	Type:	Ind.	Fossil fuel: (liters/yr)	750 k Diesel
	Quantity: (m3)	10-	Nightlights used: Y/N	No
	Haz./Toxic Chemicals:	None	Generators: Night Y/N	No
	Storage/inventory		Day Y/N	250 KW - 30 Min/wk

IDAHO WASTE PROCESSING FACILITY

(See description under Transuranic Waste starting on page TRU3-1)

MIXED/LOW-LEVEL WASTE TREATMENT FACILITY

PROJECT NAME: Mixed/Low-Level Waste Treatment Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide for the design, construction, and operation of a new facility to treat low-level wastes and mixed low-level waste (Resource Conservation and Recovery Act wastes mixed with low-level beta-gamma wastes). The waste would be treated before disposal at the Radioactive Waste Management Complex or other facility. This project is proposed under Alternative D (Maximum Treatment, Storage, and Disposal).

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U.S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: The Mixed/Low-Level Waste Treatment Facility would provide a permitted treatment facility that would treat both mixed low-level waste and low-level waste at the INEL.

Mixed low-level waste has both a radioactive constituent and a Resource Conservation Recovery Act hazardous constituent. This waste is generated during operations at the INEL and is being stored for treatment. Under Alternative D (Maximum Treatment, Storage, and Disposal), mixed low-level waste would be received from other DOE sites. Mixed wastes are required to be treated before disposal in accordance with U. S. Environmental Protection Agency Land Disposal Restrictions regulations. U. S. Environmental Protection Agency regulations prohibit storage of Land Disposal Restrictions waste unless the storage is for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment or disposal.

Under Alternative D (Maximum Treatment, Storage, and Disposal), the needed treatment capacity would exceed currently planned low-level waste and mixed low-level waste treatment facilities without the addition of the Mixed/Low-Level Waste Treatment Facility.

The Mixed/Low-Level Waste Treatment Facility would include several processes to treat low-level waste and mixed low-level waste, including incineration, thermal desorption, stabilization, decontamination, macroencapsulation, chemical precipitation, neutralization, and amalgamation.

Incineration: A process that consumes combustible waste materials. It can destroy toxic and biological components and minimize organic content in the noncombustible residue and ash. Incineration can greatly reduce the mass and volume of waste. This is the proposed treatment for many organic solvents, aqueous solutions, material contaminated with organic constituents, and combustible debris.

Thermal Desorption: A process that consists of heating the feed material in the first (primary) chamber of a two-chamber device. Water and volatile (usually organic) compounds are vaporized in the primary chamber and flow to the secondary chamber where the volatiles are combusted. The feed usually consists of inert material like soil, contaminated with aqueous or volatile substances. This is the proposed treatment for mixed low-level waste debris (parts of pipes, glass, bricks, pieces of concrete, soil) contaminated with toxic organic material.

Stabilization: A process where waste is converted to a more stable or environmentally safe configuration. This can include chemical reaction, to transform the waste to a less chemically active form; solidification, to make a liquid into a solid; and immobilization, which takes loose material and fixes it in place within a matrix of inert material. This is the proposed treatment for ash, resin fines, and substances contaminated with heavy metals not amenable to other treatments.

Decontamination: A process that removes radioactive, toxic, or organic substances from the surfaces of structures, parts, components, or debris. Waste stream decontamination generally deals with debris and rubble composed of metal, plastics, concrete, rubber, glass, or ceramic material.

Macroencapsulation: A process where a waste piece or agglomerate is isolated by enclosure in another substance such as a polyethylene epoxy. This is the proposed treatment for lead, cadmium solids, and debris that cannot be decontaminated.

Chemical Precipitation: A process where a soluble substance is converted to an insoluble form by a chemical reaction or by changes in the solvent. The precipitated solids are removed. This process is applied to the removal of toxic metals from aqueous wastes. Such metals include mercury, lead, arsenic, and cadmium.

Neutralization: A process where corrosive wastes, both acidic and caustic, are chemically deactivated to meet pH standards.

Amalgamation: A process where a base metal such as zinc or copper is blended with liquid elemental mercury to form a solid alloy. Amalgamation is the specified treatment for liquid mercury containing waste.

The Mixed/Low-Level Waste Treatment Facility might be located at an existing site or at a previously undisturbed site. For planning purposes, a typical location was assumed about 2.5 miles east of the Radioactive Waste Management Complex.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - This option would defer construction of the Low-Level Waste and Mixed Low-Level Waste Treatment Facility. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Modify and Operate the Waste Experimental Reduction Facility - This option would modify the Waste Experimental Reduction Facility. This option corresponds to Alternative B (Ten-Year

Plan) and supplements Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

Offsite Treatment - This option would provide for the private sector treatment of low-level waste and mixed low-level waste. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

May 24, '94

C	Cultural resource effects:	None identified		
o	Pits/ponding created: (m2)	No		
n	Water usage: (liters)	20,000 k		
s	Energy requirements:			
t	Electrical: (MWH/yr)	4,000		
.	Fossil fuel: (liters)	300 k Diesel, 60 k Propane		
	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	Yes		
O	Cost(\$): Operation:	\$25 Mil./yr		
p	Schedule Start /End:	2010 - 2035		
e	No. of workers: (new/exist)	42 Existing + 15 New		
r	Heavy Equip. Equip. used:	Trucks		
a	Trips:	100 /yr on-site		
t	Air Emissions:			
i	(None / Ref.)	See Appendix F, Section 3		
o	Effluents:			
n	Type:	None		
a	Quantity: (liters/yr)			
l	Solid wastes:			
n	Type:	LLW	MLLW	Ind.
f	Quantity: (m3/yr)	195	300	200
o	Haz./Toxic Chemicals:			
r	Storage/inventory	380 liters		
m	Pits/ponds used: Y/N (m2)	No		
a	Water usage: (liters/yr)	4,600 k		
t	Energy requirements:			
i	Electrical: (MWH/yr)	4,400		
o	Fossil fuel: (liters/yr)	1,000		
n	Nightlights used: Y/N	Yes		
	Generators: Night Y/N	No		
	Day Y/N	No		

VOLUME 2

MIXED/LOW-LEVEL WASTE DISPOSAL FACILITY

PROJECT NAME: Mixed/Low-Level Waste Disposal Facility

GENERAL PROJECT OBJECTIVE: The Mixed/Low-Level Waste Disposal Facility would meet the future INEL disposal needs for low-level waste, mixed low-level waste, and alpha-contaminated low-level waste. In addition, under Alternative D (Maximum Treatment, Storage, and Disposal), the Mixed/Low-Level Waste Disposal Facility would provide disposal for selected DOE complex low-level waste, mixed low-level waste, and alpha-contaminated low-level waste.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a new permanent radioactive waste disposal facility. The facility would provide permanent disposal capacity for waste generated from routine operations, waste generated from environmental restoration activities, waste generated from decontamination and decommissioning activities, and waste that is currently in storage at the INEL. Under EIS Alternative D (Maximum Treatment, Storage, and Disposal), the Mixed/Low-Level Waste Disposal Facility would receive waste for disposal from other DOE sites.

The proposed facility would be designed and permitted to accept low-level waste; treated mixed low-level waste, which is low-level waste mixed with hazardous contaminants, as defined by the Resource Conservation and Recovery Act; and alpha-contaminated low-level waste, which is low-level waste (or mixed low-level waste) that contains transuranic isotopes at concentrations ranging from 10 to 100 nanocuries per gram of waste.

Resource Conservation and Recovery Act requires that waste containing hazardous contaminants be treated to meet certain criteria before it can be accepted for disposal.

The Mixed/Low-Level Waste Disposal Facility would have acceptance criteria established before operation. All wastes accepted for disposal would have to meet applicable parts of the acceptance criteria. These criteria would include the Resource Conservation and Recovery Act criteria for mixed low-level waste. Types of treatment that could be required before acceptance include sorting and segregation, characterization, repackaging, macroencapsulation, melt recycling, decontamination, chemical precipitation, stabilization, size reduction, and incineration.

The facility would use a combination of waste forms (such as immobilized in calcine, glassite, or concrete); engineered barriers (such as enclosures, pads, layers of clay, or uses of other nonpermeable material); and hydrogeologic setting (soil characteristics, distance above aquifer, and area of low rainfall) to provide for isolation of waste.

An effort is currently underway to identify acceptable sites. The Mixed/Low-Level Waste Disposal Facility would need 200 acres (400 for Alternative D (Maximum Treatment, Storage, and Disposal)) and could be at an existing site or at a previously undisturbed site.

For planning purposes, a typical location was assumed about 2.5 miles east of the Radioactive Waste Management Complex, although the final location could be anywhere.

As the Mixed/Low-Level Waste Disposal Facility would be starting up, the current disposal site (Radioactive Waste Management Complex) would be reaching capacity and cutting back. The Radioactive Waste Management Complex is currently accepting low-level waste for disposal. Even though it contains a large amount of mixed waste and alpha-contaminated low-level waste, the Radioactive Waste Management Complex is no longer accepting mixed low-level waste or alpha-contaminated low-level waste for disposal.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, no changes would be made to current low-level waste disposal practices at the INEL. This option corresponds to Alternative A evaluated in this EIS. Shallow land burial of low-level waste would continue until all available space at the Radioactive Waste Management Complex is occupied. Once available space at the Radioactive Waste Management Complex was used up, either generation of the waste would have to cease, or alternative storage or disposal practices would have to be investigated. This alternative would not provide Resource

Conservation and Recovery Act permitted disposal capacity for treated mixed low-level waste, and would not allow disposal of the INEL's inventory of alpha-contaminated low-level waste. This alternative also would not provide for projected low-level waste and mixed low-level waste inventories generated from potential decontamination and decommissioning activities.

Expand Radioactive Waste Management Complex - Under this option, the boundaries of the current Radioactive Waste Management Complex would be expanded. This option is not evaluated in this EIS. The expansion would include additional space for future quantities of low-level waste, permitted space for treated mixed low-level waste, and space for alpha-contaminated low-level waste. This alternative requires many of the same programmatic steps as the proposed action, including National Environmental Policy Act review, safety analysis, Resource Conservation and Recovery Act permitting, and performance assessment. This alternative would allow use of the existing Radioactive Waste Management Complex infrastructure, including support facilities, utilities, and roads, but would not allow potential benefits of a different site with more favorable hydrogeologic characteristics, such as flooding elevation with respect to the 100-year probable flood, and distance from basalt formations.

Ship to Offsite Facility for Disposal - Under this option, INEL low-level waste and mixed low-level waste would be packaged and shipped to a non-INEL facility for disposal. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would require acceptance by the "host" state and would require shipping the waste across hundreds of miles of public roads, introducing some new health and safety risks to the public. This option would also require a change in current restrictions that DOE-generated waste be disposed of at the site where generated or at another DOE site.

Indefinite Storage Onsite - Under this option, the waste would be put into monitored storage until a permanent disposal option is identified. This option is not evaluated in this EIS. The monitoring would check the integrity of the storage configuration and verify compliance with a large number of recent requirements applicable to such storage. This option would require design and construction of monitored storage buildings at some location on the INEL. Impacts from construction would be similar to those anticipated for the proposed action. This option allows additional time to implement permanent disposal of the waste.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 24, '96	
G e n e r a l c o n f o r m a t i o n	Description/function:	Mixed/Low-Level Waste Disposal Facility	C Cultural resource effects:	None identified
	WAG	7	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B	n Water usage: (liters)	2,000 k
	SNF or Waste stream:	LLW MLLW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	5,000
	Structure Type:	Building 2,462	. Fossil fuel: (liters)	600 k Diesel, 140 k Propane
	Size: (m2)	Vaults 10,173	Nightlights used: Y/N	Y
	Other features: (Pits, ponds, power /water/sewer lines)	13,904 m3 concrete	Generators: Night Y/N	N
	Location:		Day Y/N	Y
	Inside/outside of fence	Outside RWMC	O Cost(\$): Operation:	\$247 Mil./40 yr
Inside/outside of bldg.		p Schedule Start /End:	2004 - 2044	
C o n s t r u c t i o n	Cost(\$): PreConst.	\$7 Mil.	e No. of workers: (new/exist)	50 Existing
	Cost(\$): Const.	\$79 Mil.	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1996 - 2000	a Trips:	
	Schedule Start /End: Const.	2002 - 2004	t Air Emissions:	
	No. of workers: (new/exist)	174 Subs.	l (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	a Effluents:	
	Trips:		l Type:	Waste Water (sewer)
	Acres Disturbed: New	1.5 bldg. (200 area)	Quantity: (liters/yr)	2,500 k
	Previous	0	l Solid wastes:	
	Revegetated	0	Quantity: (m3/yr)	LLW Ind. 17 150
o n l i n g	Air Emissions:		o Haz./Toxic Chemicals:	
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	380 liters
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	2,500 k
	Quantity: (liters)	2,000 k	t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	17,000
	Type:	Industrial	o Fossil fuel: (liters/yr)	40 k
	Quantity: (m3)	1,000	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	Paint, curing compounds	Generators: Night Y/N	No
	Storage/inventory	4,000 liters	Day Y/N	No

Project Data Sheet			Rev. 10 May 24, '94		
G	Description/function:	Mixed/Low-Level Waste Disposal Facility (Expanded)	C	Cultural resource effects:	None identified
•			o	Pits/ponding created: (m2)	No
n	WAG	7 or Offsite	n	Water usage: (liters)	4,000 k
•	EIS Alter. (A, B, C or D):	D	s	Energy requirements:	
r	SNF or Waste stream:	LLW MLLW	t	Electrical: (MWH/yr)	5,000
i	Action type:	New	.	Fossil fuel: (liters)	800 k Diesel, 140 k Propane
c	Structure Type:	Building 5,000		Nightlights used: Y/N	Yes
i	Size: (m2)	Vaults 25,000		Generators: Night Y/N	No
n	Other features:			Day Y/N	Yes
f	(Pits, ponds, power	13,904 m3 concrete	O	Cost(\$): Operation:	\$350 Mil./40 yr
o	/water/sewer lines)		p	Schedule Start /End:	2008 - 2048
.	Location:		e	No. of workers: (new/exist)	50 Existing, 30 New
	Inside/outside of fence	Outside RWMC or Offsite	r	Heavy Equip. Equip. used:	Trucks
	Inside/outside of bldg.		a	Trips:	
C	Cost(\$): PreConst.	\$7 Mil.	t	Air Emissions:	
o	Cost(\$): Const.	\$110 Mil.	i	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1998 - 2004	o		
s	Schedule Start /End: Const.	2004 - 2008	n		
t	No. of workers: (new/exist)	174 Subs.	a	Effluents:	
r	Heavy Equip. Equip. used:	Trucks	i	Type:	Waste Water (sewer)
u	Trips:			Quantity: (liters/yr)	4,000 k
c	Acres Disturbed: New	1.5 bldg. (400 area)	i	Solid wastes:	
t	Previous	0	n	Type:	LLW Ind.
i	Revegetated	0	f	Quantity: (m3/yr)	340 1,500
o	Air Emissions:		o	Haz./Toxic Chemicals:	
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	380 liters
i	Effluents:		m	Pits/ponds used: Y/N (m2)	No
n	Type:	Construction Water	a	Water usage: (liters/yr)	4,000 k
f	Quantity: (liters)	2,000 k	t	Energy requirements:	
o	Solid wastes:		i	Electrical: (MWH/yr)	30,000
.	Type:	Industrial	o	Fossil fuel: (liters/yr)	50 k
	Quantity: (m3)	1,100	n	Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	Paint, curing compounds		Generators: Night Y/N	No
	Storage/inventory	5,000 liters		Day Y/N	No

SHIPPING/TRANSFER STATION

(See description under Transuranic Waste starting on page TRU4-1)

RADIOACTIVE SCRAP/WASTE FACILITY

(See description under High-Level Waste starting on page HLW5-1)

**Projects
Related to
Mixed Low-Level Waste**

WASTE EXPERIMENTAL REDUCTION FACILITY INCINERATION

(See description under Low-Level Waste starting on page LLW1-1)

IDAHO WASTE PROCESSING FACILITY

(See description under Transuranic Waste starting on page TRU3-1)

MIXED/LOW-LEVEL WASTE TREATMENT FACILITY

(See description under Low-Level Waste starting on page LLW3-1)

NONINCINERABLE MIXED WASTE TREATMENT

PROJECT NAME: Nonincinerable Mixed Waste Treatment

GENERAL PROJECT OBJECTIVE: The general objectives of this project would be to upgrade existing facilities at the Waste Experiment Demonstration Facility and provide treatment capabilities for some of the mixed low-level wastes that are not suitable for incineration. Mixed low-level wastes are required to be treated before disposal in accordance with U. S.

Environmental Protection Agency Land Disposal Restrictions regulations. Quantities and types of specific waste streams that would be treated in this facility would depend on the outcome of the Federal Facility Compliance Act process.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U. S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

DOE needs to treat specific waste types that cannot be treated at the Waste Experimental Reduction Facility because they don't meet the Waste Acceptance Criteria for the facility. Also, incineration would not be appropriate for all waste types such as soils. U. S. Environmental Protection Agency regulations prohibit storage of Land Disposal Restrictions waste unless the storage is for the sole purpose of accumulating sufficient quantities to facilitate proper recovery, treatment, or disposal. Mixed waste is generated during operations at the INEL, and is being stored. Under Alternative D (Maximum Treatment, Storage, and Disposal), similar waste would be received from other DOE sites and increase the waste volumes that would be treated.

PROJECT DESCRIPTION: Treatment developed to meet Land Disposal Restrictions standards would be implemented at the Waste Experimental Demonstration Facility near the Power Burst Facility. While full-scale, these modules would be of modest size. The Waste Experimental

Demonstration Facility would possibly be modified to implement new technology as larger treatment facilities are constructed and operated under Alternative D (Maximum Treatment, Storage, and Disposal).

The Waste Experimental Demonstration Facility is located at the Power Burst Facility in the former Special Power Excursion Reactor Test-II reactor building. The building is a two story structure with masonry exterior walls, and a concrete and steel frame. The reactor high bay area is about 9 meters (30 feet) high. The facility was previously used for severe-damage testing of nuclear fuels and materials used in nuclear reactors.

The main floor would be used for receiving, storage, and inspection areas. The various Waste Experimental Demonstration Facility processes would be installed in the basement as the processes were developed and implemented. The main floor is approximately 510 square meters (5,500 square feet), and the basement floor space is about 320 square meters (3,500 square feet). There is an 11-foot, 10-inch rollup door on each end of the building. A 10-ton overhead bridge crane is already installed in the Special Power Excursion Reactor Test-II building and is currently used to lower drums into the basement through access hatches.

Approximately 880 cubic meters (1,100 cubic yards) of the total mixed low-level wastes in storage would be treated under this program; 290 cubic meters (380 cubic yards) would be solidified. About 550 cubic meters (720 cubic yards) would be decontaminated or macroencapsulated; ten cubic meters would be neutralized or deactivated; 40 cubic meters (50 cubic yards) would be processed by ion-exchange. A small quantity of waste would be processed by mercury roast or retorting. Mercury roasting, retorting is a process where waste is heated to evaporate the mercury that is condensed and recovered for reuse.

Treatment processes for this type of stored waste and for similar mixed low-level wastes to be generated in the future are being developed and would be implemented at Waste Experimental Demonstration Facility and the associated Portable Water Treatment Unit. The Portable Water Treatment Unit is designed to treat Resource Conservation and Recovery Act regulated aqueous waste generated at the INEL. The system utilizes a five-stage process consisting of different types of filters and ion-exchange columns. These U. S. Environmental Protection Agency-approved

treatment processes include ion exchange, stabilization, macroencapsulation, gamma-ray degradation treatment for polychlorinated biphenyls, neutralization, and amalgamation.

Ion exchange: This process removes dissolved ions from aqueous wastes. Ion exchange treatment is provided by the existing processes at the Portable Water Treatment Unit.

Stabilization: In this process, waste is converted to a more stable or environmentally safe configuration. This process can include chemical reaction to transform the waste to a less chemically active form; solidification to make a liquid into a solid; and immobilization to fix loose material in place within a matrix of inert material. Immobilization is the proposed treatment for ash, resin fines, and substances contaminated with heavy metals that are not amenable to other treatments.

Lead Decontamination: Several decontamination techniques are being evaluated. However, insufficient data are available at this time to select a specific option. Sufficient information is expected to be available by the time the Final EIS is submitted.

Macroencapsulation: In this process, a waste piece or agglomerate is isolated by enclosure in another substance such as polyethylene epoxy. This treatment is proposed for lead, cadmium solids, and debris that cannot be decontaminated.

Gamma-ray Degradation for Polychlorinated Biphenyls Compounds: This process exposes polychlorinated biphenyls contaminated mixed waste to gamma-rays from spent fuel.

Neutralization: In this process, corrosive wastes, both acidic and caustic, are chemically deactivated to meet pH standards.

Amalgamation: In this process a base metal, such as zinc or copper, is blended with liquid elemental mercury to form a solid alloy. Amalgamation is the specified treatment for liquid mercury containing waste.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the Nonincinerable Mixed Waste Treatment project would not be constructed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. Resource Conservation Recovery Act regulations require that treatment be developed for mixed low-level wastes in storage. Not performing this project would be in violation of U. S. Environmental Protection Agency regulations.

Offsite Treatment at Another DOE Facility - Under this option, the waste would be treated at an offsite DOE facility. This option is not evaluated in this EIS. At this time, no offsite or other DOE facility for treatment of the mixed low-level wastes in storage is available. These plans would become more fully developed through ongoing efforts under the Federal Facility Compliance Act, at other DOE sites, INEL, and DOE Headquarters. Several sites have announced plans to construct facilities with the same or similar capability. Transportation of the waste offsite is evaluated in Alternative D (Maximum Treatment, Storage, and Disposal).

Offsite Treatment at a Private Sector Facility - Under this option, stabilization would be performed at a private sector treatment unit. Available treatment capabilities would not meet the requirement of treating all waste types; therefore, this option was not analyzed.

Use Other Technologies at Waste Experimental Demonstration Facility - A number of technology options were considered for implementation at the INEL. Technologies were ranked based on their relative complexity, their level of development, and their amenability to variations in waste. Based on the overall ranking in all three of these areas, the proposed technologies were selected. As options for stabilization and ion exchange, technologies such as chemical extraction, precipitation, chemical reduction, and biological extraction were considered. As alternatives for

carbon absorption and gamma degradation, thermal desorption, biodegradation, wet oxidation, ozone and ultra-violet radiation oxidation were considered.

Macroencapsulation, amalgamation, and neutralization are specified technologies. Since substitutes for these technologies would require additional U. S. Environmental Protection Agency approval, such substitutes were not considered.

Locate the Proposed Activities or Other Technologies Onsite at Facilities Other than the Waste Experimental Demonstration Facility - Other onsite locations considered for permitted treatment operations include Waste Experimental Reduction Facility; Power Burst Facility; Manufacturing, Assembly, and Hot Shop/Cells at Test Area North; New Waste Calcining Facility at the Idaho Chemical Processing Plant; and the Fuel Cycle Facility and Hot Fuel Examination Facility at Argonne National Laboratory-West. These facilities were not deemed as available for these proposed activities.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9 May 24, '94	
G e n e r a l i n f o r m a t i o n	Description/function:	Non-Incinerable Mixed Waste Treatment	C Cultural resource effects:	N/A
	WAG	INEL	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	MLLW	s Energy requirements:	
	Action type:	Expand	t Electrical: (MWH/yr)	
	Structure Type:	Treatment Processes (Using Existing Facilities)	. Fossil fuel: (liters)	
	Size: (m2)		Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)	None	Generators: Night Y/N	No
	Location:		Day Y/N	No
	Inside/outside of fence	Inside PBF	O Cost(\$): Operation:	\$500 K/yr
Inside/outside of bldg.	Inside WEDF	p Schedule Start /End:	1996 - 2006	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.		e No. of workers: (new/exist)	4-6 Existing
	Cost(\$): Const.	\$2.93 Mil total	r Heavy Equip. Equip. used:	Trucks 2 - 4 trips/wk off-site
	Schedule Start /End: PreConst.	1994 - 1995	a Trips:	1 - 2 trips/wk on-site
	Schedule Start /End: Const.	1994 - 1996	t Air Emissions: (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	4-6 Existing	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	l Type:	None
	Trips:		Quantity: (liters/yr)	
	Acres Disturbed: New	0	n Solid wastes:	
	Previous	0	l Type:	LLW MLLW Ind. Haz.
	Revegetated	0	Quantity: (m3/yr)	4 5 100 <1
I n f o r m a t i o n	Air Emissions: (None / Ref.)	None	o Haz./Toxic Chemicals: Storage/inventory	Portland cement, Acids, Bases, & precipitation reagents
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	None	a Water usage: (liters/yr)	200 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	
	Type:	Industrial	o Fossil fuel: (liters/yr)	
	Quantity: (m3)	430	n Nightlights used: Y/N	No
	Haz./Toxic Chemicals: Storage/inventory	N/A	Generators: Night Y/N	No
			Day Y/N	No

Project Data Sheet			Rev. 9 May 24, '94	
G e n e r a l c o n f o r m a t i o n	Description/function:	Non-Incinerable Mixed Waste Treatment	C Cultural resource effects:	N/A
	WAG	INEL	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	D	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	MLLW	s Energy requirements:	
	Action type:	Expand	t Electrical: (MWH/yr)	
	Structure Type:	Treatment Processes (Using Existing Facilities)	. Fossil fuel: (liters)	
	Size: (m2)		Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)		Generators: Night Y/N	No
	Location:		Day Y/N	No
	Inside/outside of fence	Inside PBF	O Cost(\$): Operation:	\$1 Mil./yr
Inside/outside of bldg.	Inside WEDF	p Schedule Start /End:	1996 - 2006	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.		e No. of workers: (new/exist)	8-12 Existing
	Cost(\$): Const.	\$6 Mil total	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1994 - 1995	a Trips:	
	Schedule Start /End: Const.	1994 - 1996	t Air Emissions: (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	4-6 Existing	o Effluents:	
	Heavy Equip. Equip. used:	Trucks 4 - 8 trips/wk off-site	i Type:	None
	Trips:	2 - 4 trips/wk on-site	l Quantity: (liters/yr)	
	Acres Disturbed: New	0	n Solid wastes:	
	Previous	0	f Type:	LLW MLLW Ind. Haz.
	Revegetated	0	o Quantity: (m3/yr)	8 10 200 1
I n f o r m a t i o n	Air Emissions: (None / Ref.)	None	r Haz./Toxic Chemicals: Storage/inventory	Portland cement, Acids, Bases, & precipitation reagents
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	None	a Water usage: (liters/yr)	400 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	
	Type:	Industrial	o Fossil fuel: (liters/yr)	
	Quantity: (m3)	430	n Nightlights used: Y/N	No
	Haz./Toxic Chemicals: Storage/inventory	N/A	Generators: Night Y/N	No
			Day Y/N	No

MIXED/LOW-LEVEL WASTE DISPOSAL FACILITY

(See description under Low-Level Waste starting on page LLW4-1)

REMOTE MIXED WASTE TREATMENT FACILITY

PROJECT NAME: Remote Mixed Waste Treatment Facility

GENERAL PROJECT OBJECTIVE: The general objective of the proposed Remote Mixed Waste Treatment Facility Project would be to construct and operate a facility to remove sodium metal from radioactive wastes and convert the sodium to a disposable waste form.

PROJECT DESCRIPTION: This project would design, construct, and operate a new facility to remove and convert sodium and other hazardous waste from radioactive scrap and waste components. The facility's size and handling capabilities would meet all requirements for removing sodium metal from the Experimental Breeder Reactor-II components (up to the size of a cold trap), items stored at the Radioactive Scrap/Waste Facility, and items stored at the Hot Fuel Examination Facility. The method proposed to remove and process sodium from the scrap and waste is the melt-drain-evaporation-carbonation process. This process would remove sodium metal from components by melting and draining bulk sodium, followed by evaporating residual sodium under vacuum conditions, and finally, by converting the removed sodium to sodium carbonate (Na_2CO_3).

Waste disposal and storage sites, including Radioactive Waste Management Complex at the Idaho INEL, do not accept sodium-containing wastes. The same policy also exists for the storage of transuranic waste at the Waste Isolation Pilot Plant.

Reprocessing sites do not accept sodium-containing fissile materials. Savannah River does not accept plutonium fuel fused with sodium, and the Idaho Chemical Processing Plant does not accept uranium fuel fused with sodium. Therefore, a facility is needed to remove sodium from transuranic and non-transuranic waste and scrap so that it can be handled and processed.

The waste sodium carbonate from the proposed process could be discarded at a disposal site or could be made into a glass or other form suitable for storage. The sodium-free low-level radioactive waste would be suitable for disposal at the Radioactive Waste Management Complex and the sodium-free fissile material could be stored or reprocessed. Until final repositories become available, contact-handled transuranic waste would be shipped to the Radioactive Waste

Management Complex, and remote-handled transuranic waste would be stored at Argonne National Laboratory-West in the Radioactive Scrap/Waste Facility.

The proposed facility would be 50 meters (164 feet) long, 26 meters (84 feet) wide, and 13 meters (44 feet) high. The Remote Mixed Waste Treatment Facility would have an inert-atmosphere cell, hot repair area, covered truck loading area, equipment access area, control room and operating corridor, equipment transfer tunnel, and a decontamination cell. The use of existing Argonne National Laboratory-West capabilities in conjunction with Remote Mixed Waste Treatment Facility, such as shielded radioactive material shipping casks and the Radioactive Liquid Waste Treatment Facility, would result in a simpler facility.

The inert-atmosphere cell would be gas-tight and would contain the sodium process equipment in a nitrogen atmosphere. Some of the nine standard hot-cell work stations in the cell would be fully equipped with a viewing window and master-slave manipulators. The remaining stations would be available for processing other forms of mixed waste debris. Functions for these stations would include waste can unloading, waste sorting, fuel subassembly dismantling, fuel-rod decanning, and waste packaging.

Direct transfers could be made to and from this cell from either top- or bottom-loading casks. Remote transfers could be made between the hot cell and the decon cell for decontamination of equipment before contact maintenance in the hot-repair area or packaging for shipment.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, a remote mixed waste treatment facility would not be implemented. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Offsite Treatment - This option would provide for the shipment of mixed low-level waste to an offsite treatment facility. This option corresponds to Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. A treatment facility would need to be constructed at an offsite location for this option.

Modify Existing Facility - This option would modify an existing facility to treat mixed low-level waste. This option corresponds to Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 24, '96	
G e n e r a l c o n f o r m	Description/function:	Remote Mixed Waste Treatment Facility	C Cultural resource effects:	None identified
	WAG	9	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	Insignificant
	SNF or Waste stream:	MLLW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	209 k Diesel, 47 k Propane
	Size: (m2)	1,280	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)		Generators: Night Y/N	No
			Day Y/N	Yes
	Location:		O Cost(\$): Operation:	\$5 Mil./yr
Inside/outside of fence	Inside ANL-W	p Schedule Start /End:	2000 - 2020	
Inside/outside of bldg.	Outside HFEF (north)	e No. of workers: (new/exist)	12 Existing	
C o n s t r u c t i o n a l i n f o r m	Cost(\$): PreConst.	\$2.8 Mil.	r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$49.3 Mil.	a Trips:	25 per year to RWMC
	Schedule Start /End: PreConst.	1981 - 1997	t Air Emissions:	
	Schedule Start /End: Const.	1997 - 2000	i (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	300 Peak, 160 Avg Subs	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	i Type:	Cleaning Solutions (to RLWTF)
	Trips:		f Quantity: (liters/yr)	
	Acres Disturbed: New	0	Solid wastes:	
	Previous	1	i Type:	MLLW LLW Ind.
	Revegetated	0	f Quantity: (m3/yr)	3 7 25
I n f o r m	Air Emissions:		o Haz./Toxic Chemicals:	Lead Sodium
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	5,000 lb 2,000 lb
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		i Electrical: (MWH/yr)	
	Type:	Industrial	o Fossil fuel: (liters/yr)	
	Quantity: (m3)	2,000	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N	No
	Storage/inventory	None	Day Y/N	No

SODIUM PROCESSING PROJECT

PROJECT NAME: Sodium Processing Project

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to construct and operate a process system to convert sodium hydroxide to a disposable waste form, sodium carbonate.

This project would involve the treatment of mixed wastes. Under the Federal Facility Compliance Act of 1992, DOE is required to negotiate with states or the U. S. Environmental Protection Agency, as appropriate, to develop site treatment plans, including schedules and milestones, to develop treatment technologies and construct facilities that would treat mixed wastes. Decisions on these treatment technologies and related facilities would be made in conjunction with negotiations already underway with the State of Idaho pursuant to the Federal Facility Compliance Act, and after appropriate National Environmental Policy Act review has been completed.

PROJECT DESCRIPTION: This project would provide for the modification of the Sodium Processing Facility to provide a system to convert sodium hydroxide to sodium carbonate. The sodium conversion system would be sized to process sodium hydroxide at the equivalent rate that elemental sodium is converted to sodium hydroxide in the Sodium Processing Facility.

The Sodium Processing Facility was designed and built to convert the FERMI Reactor sodium to 50 weight percent sodium hydroxide, which would be used for neutralizing acidic plutonium, uranium extraction waste at the Hanford Site. DOE terminated all plutonium, uranium extraction operations before any processing of FERMI sodium could be accomplished. This facility could be used to convert sodium hydroxide to sodium carbonate from other sources.

Sodium hydroxide is considered a "characteristic hazardous waste" for disposal by the U. S. Environmental Protection Agency. Therefore, it is desirable to convert the sodium hydroxide to a nonhazardous waste for disposal. This could be accomplished by modifying the Sodium Processing Facility to include a process system to perform the necessary conversion.

The process for the conversion would consist of a system to process the sodium hydroxide through a thin-film evaporator operating under a carbon dioxide atmosphere. The sodium hydroxide upon exposure to the carbon dioxide atmosphere would be converted to a sodium carbonate compound. The excess water would be evaporated in the thin-film evaporator and the sodium carbonate would be discharged into a 55-gallon drum as a solid. The water would be condensed and recovered for reuse in the conversion of sodium to sodium hydroxide.

The process system would be located in the Sodium Processing Facility caustic loading room if sufficient space were available. If not, it would be located on the south side of the Sodium Processing Facility. The proposed facility would be approximately 8 meters (25 feet) wide, 8 meters (25 feet) long, and 5 meters (15 feet) high. The facility would contain all the equipment for converting sodium hydroxide to sodium carbonate, for packaging the sodium carbonate for disposal, and for recovering the water from the process and transferring the water to the sodium-sodium hydroxide process.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the sodium processing project would not be implemented. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 24, '94		
G	Description/function:	Sodium Processing Project	C	Cultural resource effects:	N/A
e			o	Pits/ponding created: (m2)	No
n	WAG	8	n	Water usage: (liters)	Insignificant
e	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	
r	SNF or Waste stream:	MLLW	t	Electrical: (MWH/yr)	
l	Action type:	New	.	Fossil fuel: (liters)	2.7 k Diesel, 583 Propane
c	Structure Type:	Building		Nightlights used: Y/N	No
	Size: (m2)	60		Generators: Night Y/N	No
				Day Y/N	No
l	Other features:	Sodium Process Equipment	O	Cost(\$): Operation:	\$4.91 Mil./3 yrs.
f	(Pits, ponds, power		p	Schedule Start /End:	1997 - 1999
o	/water/sewer lines)		e	No. of workers: (new/exist)	20 Existing
.	Location:		r	Heavy Equip. Equip. used:	Trucks
	Inside/outside of fence	Inside ANL-W	a	Trips:	91
	Inside/outside of bldg.	Outside SPF (South)	t	Air Emissions:	
C	Cost(\$): PreConst.	\$365 K	l	(None / Ref.)	See Appendix F, Section 3
o	Cost(\$): Const.	\$1.5 Mil.	o		
n	Schedule Start /End: PreConst.	1994 - 1995	n		
s	Schedule Start /End: Const.	1995 - 1996	a	Effluents:	
t	No. of workers: (new/exist)	6 Existing	l	Type:	None
r	Heavy Equip. Equip. used:	Trucks		Quantity: (liters/yr)	
u	Trips:		l	Solid wastes:	
c	Acres Disturbed: New	0	n	Type:	LLW Ind.
t	Previous	0.03	f	Quantity: (m3/yr)	30 2
l	Revegetated	0	o	Haz./Toxic Chemicals:	
o	Air Emissions:		r	Storage/inventory	
n	(None / Ref.)	See Belanger et al., 1994	m	Pits/ponds used: Y/N (m2)	No
l	Effluents:		a	Water usage: (liters/yr)	
n	Type:	Water	t	Energy requirements:	
f	Quantity: (liters)		l	Electrical: (MWH/yr)	
o	Solid wastes:		o	Fossil fuel: (liters/yr)	
.	Type:	Industrial	n	Nightlights used: Y/N	Yes
	Quantity: (m3)	30		Generators: Night Y/N	No
				Day Y/N	No
	Haz./Toxic Chemicals:				
	Storage/inventory				

SHIPPING/TRANSFER STATION

(See description under Transuranic Waste starting on page TRU4-1)

RADIOACTIVE SCRAP/WASTE FACILITY

(See description under High-Level Waste starting on page HLW5-1)

**Projects
Related to
Greater-Than-Class-C Waste**

GREATER-THAN-CLASS-C DEDICATED STORAGE

PROJECT NAME: Greater-Than-Class-C Dedicated Storage

GENERAL PROJECT OBJECTIVE: The objective of this proposed project would be to provide for the DOE receipt and storage of greater-than-Class-C low-level waste sealed radiation sources from the commercial sector. Other greater-than-Class-C low-level waste would also be received on an as-needed basis.

Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240), the Federal government is responsible for the disposal of greater-than-Class-C low-level waste generated by licensees of the U. S. Nuclear Regulatory Commission and Agreement States. DOE was identified as the Federal agency responsible for this effort. In February 1989, a report to Congress (DOE/LLW-77T) stated that DOE plans to accept and manage limited quantities of greater-than-Class-C low-level waste until a disposal facility is developed. DOE has assigned the management responsibility for greater-than-Class-C low-level waste to the INEL.

PROJECT DESCRIPTION: This project would provide for the design, construction, and operation of a Greater-Than-Class-C Low-Level Waste Dedicated Storage Facility. The Greater-Than-Class-C Storage Facility would provide for the consolidated management and storage of the greater-than-Class-C low-level waste at one centralized storage location.

Greater-than-Class-C low-level waste is low-level waste that contains long-lived and/or short-lived radionuclides in concentrations greater than the Class C concentrations as specified in 10 CFR Part 61. Class C is the most radioactive low-level waste that is acceptable for disposal by shallow land burial, while greater-than-Class-C low-level waste is generally unacceptable for shallow land burial.

DOE plans to accept and manage greater-than-Class-C low-level waste only on an as-needed basis before the time that a greater-than-Class-C low-level waste disposal facility becomes available. Estimates indicate that only a small fraction of the projected greater-than-Class-C low-level waste inventory (if any) would require transfer to DOE before disposal. However, a need for DOE acceptance of excess sealed radiation sources has been stated by the U. S. Nuclear Regulatory

Commission, based on public health and safety concerns. The receipt and management of these sources would be the primary near-term function of this project. Most of the sealed sources to be received would be classified as greater-than-Class-C low-level waste if disposal were intended. However, nearly all of these sealed sources would be received and managed as radioactive material suitable for recycle and reuse, rather than as greater-than-Class-C low-level waste, because of their continuing functionality and value.

The U. S. Nuclear Regulatory Commission has estimated that DOE acceptance of up to 2,000 sealed sources over a five-year period may be required. Under this limited receipt scenario, any needed facility modifications or expansions would be much less extensive than the estimates presented in this project summary. Because these sealed sources are now planned to be managed as reusable material rather than waste, they could be stored in existing facilities without special pre-storage packaging operations. Over 1,000 similar DOE-owned sealed sources are already being managed and stored at the INEL.

For conservatism in assessing the environmental impacts of this project, a receipt scenario of 30,000 sealed sources over a 30-year period was assumed, for a baseline rate of 1,000 sources per year. This quantity is considered to be a bounding case because it represents approximately the total inventory of commercially held sealed sources that would be classified as greater-than-Class-C low-level waste if they were to become waste.

The sealed sources would be received inside the devices in which they were used. The sources are typically small leaktight capsules containing Sr-90, Cs-137, AmBe, PuBe, or other radionuclides. These devices are planned to be stored in existing facilities without further dismantling or packaging. However, to provide a conservative bounding case for the environmental impact assessments, the design basis in this project includes a repackaging operation and storage in casks on a concrete pad.

The design basis for the Greater-Than-Class-C Storage Facility would be an outdoor above-grade concrete laydown pad on which appropriately shielded casks would be placed. For storage, the project would involve the expansion of an existing concrete pad, or the construction of a new concrete pad, and the procurement of numerous concrete storage casks. Existing facilities and

grounds could be modified and used for waste receiving and handling operations; for example, the Test Area North or Test Reactor Area hot cells could be used for the waste handling operations.

One cask design adapted from the Test Area North Pool Fuel Transfer Project (see Project Description in this appendix, page OP1-1) would nominally be 9 feet outside diameter by 16 feet high. It has an internal cavity of 7 feet diameter by 12 feet high. Ninety-four (94) casks would be needed if each one holds thirty-two (32) 55-gallon drums (four layers of eight drums each). Each drum would hold an average of ten (10) sealed sources/devices within an appropriate packaging medium.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be bounded by Alternative B (Ten-Year Plan) and implemented under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, DOE would continue to store the greater-than-Class-C low-level waste at a variety of sites. This option corresponds to Alternative A (No Action) evaluated in this EIS. Under this option, no new storage facilities would be constructed, nor would any existing facilities be expanded for storage.

Offsite Storage - Under this option, DOE would ship all greater-than-Class-C low-level waste to another DOE site. This option corresponds with Alternative C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

Multiple Storage Sites - Under this option, DOE would transfer greater-than-Class-C low-level waste to regional storage locations created at two to five DOE sites. New storage facilities would be constructed at each regional site as required. If the INEL were selected as one of the sites, this option is bounded by Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

DOE (U.S. Department of Energy), 1989, *Commercial Greater-Than-Class-C Low-Level Radioactive Waste Long-Range Planning Document*, DOE/LLW-77T, Revision 0, National Low-Level Radioactive Waste Management Program, February.

Project Data Sheet			Rev. 7 May 24, '96	
G • n • r l c l n f o •	Description/function:	GTCC Dedicated Storage	C Cultural resource effects:	None identified
	WAG	INEL	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	n Water usage: (liters)	
	SNF or Waste stream:	GTCC-LLW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	25,550 Diesel
	Size: (m2)	3,344	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Storage Vaults & Concrete Pad	Generators: Night Y/N	No
	Location:		Day Y/N	Yes
	Inside/outside of fence	Inside TRA or TAN	O Cost(\$): Operation:	\$1 Mil./yr
Inside/outside of bldg.	Outside	p Schedule Start /End:	1998 - 2028	
C o n s t r u c t i o n a l i n f o r m a t i o n	Cost(\$): PreConst.	\$1.5 Mil.	e No. of workers: (new/exist)	20 part-time Existing
	Cost(\$): Const.	\$50 Mil.	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1994 - 1996	a Trips:	300/yr from off-site
	Schedule Start /End: Const.	1997 - 1998	t Air Emissions:	
	No. of workers: (new/exist)	15 Subs.	l (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	o	
	Trips:		n	
	Acres Disturbed: New	0	a Effluents:	
	Previous	1.7	l Type:	LLW Ind.
	Revegetated	0	f Quantity: (liters/yr)	No information available
o n l n f o •	Air Emissions:		l Solid wastes:	
	(None / Ref.)	See Belanger et al., 1994	n Type:	LLW Ind.
	Effluents:		f Quantity: (m3/yr)	25 100
	Type:	None	o Haz./Toxic Chemicals:	None
	Quantity: (liters)		r Storage/inventory	
	Solid wastes:		m Pits/ponds used: Y/N (m2)	No
	Type:	Ind.	a Water usage: (liters/yr)	
	Quantity: (m3)	28	t Energy requirements:	
	Haz./Toxic Chemicals:	None	l Electrical: (MWH/yr)	
	Storage/inventory		o Fossil fuel: (liters/yr)	
•			n Nightlights used: Y/N	Yes
			Generators: Night Y/N	No
			Day Y/N	No

**Projects
Related to
Hazardous Waste**

HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

PROJECT NAME: Hazardous Waste Treatment, Storage, and Disposal Facilities

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to provide facilities necessary to treat, store, and dispose of hazardous waste generated onsite as a result of INEL operations [Alternative D (Maximum Treatment, Storage, and Disposal)].

PROJECT DESCRIPTION: Facilities would consist of a modern hazardous waste storage facility, and treatment facilities capable of treating INEL Resource Conservation and Recovery Act regulated hazardous waste streams so that onsite disposal can be achieved at a Resource Conservation and Recovery Act approved INEL facility.

The storage facility would be a Resource Conservation and Recovery Act permitted facility that is also in compliance with all applicable DOE orders and guidance. The facility would include the following features not in the present facility: eight segregation areas separated by fire walls, containment for hazardous waste leaks, fire protection areas, collection systems for firewater in the event of system activation, appropriately ventilated spaces for sampling and inspection, safety showers, change rooms, and safety equipment.

The treatment facility would use organic destruction stabilization, neutralization, and organic removal/recovery technologies to treat approximately 80 percent of INEL-generated hazardous waste (100 percent of organic hazardous waste).

The disposal facility would use a combination of waste form (such as immobilization in concrete); engineered barriers (such as enclosures, pads, layers of clay, or uses of other nonpermeable material); and hydrologic setting (soil characteristics, distance above aquifer, and area of low rainfall) to provide for isolation of waste.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the Hazardous Waste Treatment, Storage, and Disposal Facility would not be constructed. This option corresponds to Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve the continued use of the Hazardous Waste Storage Facility, and the continued shipment of the waste to an offsite disposal facility.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 8 May 24, '94		
G • n • r l c l n f o .	Description/function:	Hazardous Waste Treatment, Disposal & Storage Facilities	C	Cultural resource effects:	None identified
	WAG	INEL	o	Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	D	n	Water usage: (liters)	10,000 k
	SNF or Waste stream:	Haz.	s	Energy requirements:	
	Action type:	New	t	Electrical: (MWH/yr)	2,000
	Structure Type:	Buildings (2)	.	Fossil fuel: (liters)	78 k Diesel, 16 k Propane
	Size: (m2)	2,000 & 560 390 m3 concrete		Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Roads, power, water. sewer		Generators: Night Y/N	No
	Location:			Day Y/N	Yes
	Inside/outside of fence		O	Cost(\$): Operation:	\$6.2 Mil. /yr
Inside/outside of bldg.	Outside	p	Schedule Start /End:	2008 - 2032	
C	Cost(\$): PreConst.	\$11 Mil.	•	No. of workers: (new/exist)	15 New
o	Cost(\$): Const.	\$105 Mil.	r	Heavy Equip. Equip. used:	Trucks
n	Schedule Start /End: PreConst.	1999 - 2002	a	Trips:	101 /yr on-site
s	Schedule Start /End: Const.	2005 - 2008	t	Air Emissions:	
t	No. of workers: (new/exist)	50 Peak, 15 Avg. Subs	l	(None / Ref.)	See Appendix F, Section 3
r	Heavy Equip. Equip. used:	Trucks/cranes/misc.	o		
u	Trips:		n	Effluents:	
c	Acres Disturbed: New	5	l	Type:	None
t	Previous	0		Quantity: (liters/yr)	
l	Revegetated	0	n	Solid wastes:	
o	Air Emissions:		f	Type:	Industrial HW
n	(None / Ref.)	See Belanger et al., 1994	o	Quantity: (m3/yr)	500 5
l	Effluents:		r	Haz./Toxic Chemicals:	
n	Type:	Construction water	m	Storage/inventory	41.6 k Liters
f	Quantity: (liters)	2,000 k	a	Pits/ponds used: Y/N (m2)	No
o	Solid wastes:		t	Water usage: (liters/yr)	None
.	Type:	Industrial	l	Energy requirements:	
	Quantity: (m3)	500	o	Electrical: (MWH/yr)	3,000
	Haz./Toxic Chemicals:	Paint, curing compound	n	Fossil fuel: (liters/yr)	10 k
	Storage/inventory	2000 liter		Nightlights used: Y/N	Yes
				Generators: Night Y/N	No
				Day Y/N	No

**Projects
Related to
Infrastructure**

INDUSTRIAL/COMMERCIAL LANDFILL EXPANSION

PROJECT NAME: Industrial/Commercial Landfill Expansion

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to provide continued solid waste disposal for the INEL for a 30-year landfill life by (a) disposing the waste in landfills that comply with regulatory requirements, (b) monitoring for hazardous and radioactive contaminants in the waste, and (c) closing and monitoring for the existing INEL sanitary landfill. The Landfill Complex would comply with federal regulations 40 CFR Parts 257 and 258 as applicable, and the State of Idaho Department of Health and Welfare regulations.

PROJECT DESCRIPTION: This project would extend the boundaries of the Central Facilities Area Landfill Complex to provide 91 additional hectares (225 acres) of land for commercial and industrial solid waste disposal and operations through the year 2025 as a minimum. The complex would use the existing administrative facilities. The landfill complex extension would encompass activities and operations associated with INEL solid waste disposal including recycling. The facility would accommodate at least 48,000 cubic meters per year (63,000 cubic yards per year) of waste.

The Landfill Complex extension would provide a centralized area for the following functions:

- Landfill operations with disposal cells for nonradioactive, nonhazardous commercial/industrial solid waste and asbestos.
- Waste minimization area including recycling and volume reduction operations.
- Ancillary operations functions including construction/maintenance of roads; litter control; utilities; cover and closure of completed landfill cells; drainage control; seeding and erosion control; and traffic control.
- Treatment and disposal of petroleum-contaminated media.

-
- **Waste or recyclable collection/transportation to and from the landfill complex.**

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, an Industrial/Commercial Landfill Expansion would not be provided and landfill needs would continue with incremental assessments under the National Environmental Policy Act, as is the current practice. This option corresponds to Alternative A (No Action) evaluated in this EIS. The existing solid waste disposal cells would continue to operate for this option. Under the current estimate, these cells would fill to capacity during 1998, thus leaving the INEL without a waste disposal area.

Transfer Station - Under this option, a waste transfer station would be constructed to consolidate the waste prior to transport to an off-site landfill. This option is not evaluated in this EIS. A commercial/industrial landfill would continue to be operated for disposal of bulky waste items such as concrete and asphalt. Two pre-engineered metal buildings would be constructed to house the waste transfer operations and to provide offices and support facilities. The transfer station would be designed to receive 48,600 cubic meters (64,000 cubic yards) of solid waste annually, of which 20 percent would be recycled or disposed at the commercial/industrial landfill with the remaining to be consolidated for transport to a licensed off-site landfill operated by others. This option would be subject to the continued availability of an off-site landfill. The 30-year cost for construction and operation of this option is estimated at \$105 million.

Municipal Landfill - Under this option, a municipal landfill would be provided instead of a commercial/industrial landfill. The environmental impacts of this option are bounded by the proposed project evaluated in this EIS. This option would be similar to the proposed action for operations and extension of disposal operations. However, the landfill would be operated in compliance with additional regulatory requirements (40 CFR 258, "Criteria for Municipal Solid

Waste Landfills"). The 30-year cost for construction and operation of this option is estimated at \$180 million.

Incineration - Under this option, a solid waste incinerator would be constructed at the INEL. This option is not evaluated in this EIS. This option was eliminated from further study because the volume of solid waste generated at the INEL is too low to efficiently operate an incinerator. The volume of waste could be increased by shipping solid waste from the surrounding communities to the INEL, but incinerating this waste would have potential environmental and liability issues because it contains hazardous waste materials.

Shipment to Another DOE Site - Under this option, the INEL solid waste would be shipped to another DOE site for disposal. This option is not evaluated in this EIS. This option was eliminated from further study because of the high cost of constructing a transfer station and shipping the waste to the other site.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 24, '94	
G	Description/function:	Industrial / Commercial	C	Cultural resource effects:
e		Landfill Expansion	o	Pits/ponding created: (m2)
n	WAG	4	n	Water usage: (liters)
e	EIS Alter. (A, B, C or D):	B, C, D	s	Energy requirements:
r	SNF or Waste stream:	Infrastructure	t	Electrical: (MWH/yr)
l	Action type:	Expand	.	Fossil fuel: (liters)
c	Structure Type:	Excavations		Nightlights used: Y/N
l	Size: (m2)	in old gravel pit		Generators: Night Y/N
n	Other features:	Land treatment of PCM		Day Y/N
f	(Pits, ponds, power		O	Cost(\$): Operation:
o	/water/sewer lines)		p	Schedule Start /End:
.	Location:		e	No. of workers: (new/exist)
	Inside/outside of fence	Inside CFA	r	Heavy Equip. Equip. used:
	Inside/outside of bldg.	Outside	a	Trips:
C	Cost(\$): PreConst.	\$30 k (Ops. Plan)	t	Air Emissions:
o	Cost(\$): Const.	N/A	l	(None / Ref.)
n	Schedule Start /End: PreConst.	1992 - 1993	o	
s	Schedule Start /End: Const.	N/A	n	
t	No. of workers: (new/exist)	N/A	a	Effluents:
r	Heavy Equip. Equip. used:	N/A	l	Type:
u	Trips:		f	Quantity: (liters/yr)
c	Acres Disturbed: New	112	l	Solid wastes:
t	Previous	168	n	Type:
l	Revegetated	225	f	Quantity: (m3/yr)
o	Air Emissions:		o	Haz./Toxic Chemicals:
n	(None / Ref.)	N/A	r	Storage/inventory
l	Effluents:		m	Pits/ponds used: Y/N (m2)
n	Type:	N/A	a	Water usage: (liters/yr)
f	Quantity: (liters)		t	Energy requirements:
o	Solid wastes:		l	Electrical: (MWH/yr)
.	Type:	N/A	o	Fossil fuel: (liters/yr)
	Quantity: (m3)		n	Nightlights used: Y/N
	Haz./Toxic Chemicals:	N/A		Generators: Night Y/N
	Storage/inventory			Day Y/N

GRAVEL PIT EXPANSIONS

PROJECT NAME: Gravel Pit Expansions

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to expand existing gravel borrow pit operations to provide gravel and fill material for existing and future road and other construction activities at the INEL during the ten-year period of June 1995 to June 2005.

The pits provide sand, gravel, and aggregate for construction and maintenance, and the spreading area provides borrow material consisting primarily of soil, silt, and sand for lining ponds and capping areas such as Radioactive Waste Management Complex Pad A and landfills.

PROJECT DESCRIPTION: This project would reopen and/or expand the use of natural resources contained within several gravel pits and one borrow area on the INEL. These natural resources consist of sand, gravel, aggregate, and borrow (eolian and alluvial sediments). Future operations would be conducted under "Infrastructure" and "Excavation" programs that would be managed by facility landlords, operating contractors, and waste management and environmental restoration organizations. The following describes the gravel pits and borrow area that are located on the INEL:

1. Test Area North gravel pit - This pit is located approximately 0.75 miles north of the Test Area North Containment Test Facility. The excavation has an approximate area of 60 acres. The pit would be expanded approximately 0.4 acres.
2. Lincoln Boulevard pit - This pit is located along Lincoln Boulevard approximately 8 miles north of the Naval Reactors Facility. The excavation at this pit has an approximate area of 70 acres. The pit would be expanded approximately 0.34 acres.
3. Naval Reactors Facility pit - There are three small pits in the Naval Reactors Facility area. Pit #1 is located near the intersection of Lincoln Boulevard and

Washington Boulevard. Pit #2 is located just south of the Naval Reactors Facility fence adjacent to the railroad tracks. Pit #3 is located approximately 0.25 miles west of Washington Boulevard. The excavations at these pits have a total approximate area of 5 acres. No expansion of the Naval Reactors Facility pits is proposed.

4. Test Reactor Area/Idaho Chemical Processing Plant pit - This pit is located near the intersection of Lincoln Boulevard and Monroe Street between Test Reactor Area and the Idaho Chemical Processing Plant. The excavation at this pit has an approximate area of 30 acres. The pit would be expanded approximately 0.65 acres.
5. Central Facilities Area pit - This pit is located east of Lincoln Boulevard approximately 0.5 miles north of the intersection with Portland Ave. The excavation of this pit has an area of less than 10 acres. The pit would be expanded approximately 2.4 acres.
6. Boiling Water Reactor Experiment pit - This pit is located north of Adams Boulevard approximately 0.4 miles west of the intersection with Van Buren Boulevard. The excavation of this pit has an approximate area of 30 acres. The pit would be expanded approximately 3.7 acres.
7. Radioactive Waste Management Complex pit - This pit is located approximately 3 miles west of Radioactive Waste Management Complex on the T-12 road. The excavation of this pit has an approximate area of 30 acres. The pit would be expanded approximately 3.8 acres.
8. Radioactive Waste Management Complex Spreading Area B - This spreading area is located approximately 3 miles south of Radioactive Waste Management Complex. This excavation has an approximate area of 200 acres. The pit would be expanded approximately 120 acres.

Under all alternatives, minor fugitive dust emissions would be produced during onsite loading of gravel/borrow and transportation on unpaved roads. Expansion of existing gravel pits or opening of new gravel/borrow area would not impact INEL wetlands, floodplains, surface water, or groundwater. A stormwater discharge plan would be prepared for all active gravel/borrow pits. DOE-ID has prepared a Clean Water Act Section 404 permit application for the continued removal of borrow material from INEL Spreading Area B. These activities become subject to Section 404 permitting requirements August 23, 1994, as a result of regulations that modified the definition of discharge of dredged materials.

No known critical wildlife habitats are located on the INEL and there are no known resident endangered or threatened species on the INEL. An additional 40 acres at each gravel pit and 60 acres at Spreading Area B have been intensively surveyed for cultural resources. Removal of resources from existing gravel pits under all alternatives within the surveyed area would not disturb significant cultural resources. However, nine prehistoric resources were identified in Spreading Area B. Therefore, as recommended by the Idaho State Historic Preservation Office, a program of subsurface archaeological testing has been initiated to formally determine the National Register eligibility of these resources and thereby assess the effects of borrow activities within Spreading Area B under all alternatives.

Under all alternatives, excavation from gravel/borrow pits would be sloped in accordance with Occupational Safety and Health Administration regulations. Soil erosion and stormwater discharge would be controlled as identified in a stormwater discharge plan written to address a consolidated source of stormwater requirements for gravel/borrow users and for all active gravel/borrow pits.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternative B (Ten-Year Plan) and expanded under Alternative D (Maximum Treatment, Storage, and Disposal).

No Action - This alternative (A) is evaluated because it represents baseline conditions against which the potential impacts of the other alternatives are compared. Under this alternative, infrastructure and excavation projects would maintain schedule, cost, and staffing at current levels. These operations would require approximately 226,000 cubic meters (295,400 cubic yards) gravel/borrow onsite.

Ten-Year Plan - Under this alternative (B) and in support of SNF and INEL ER&WM activities, infrastructure, and excavation projects would increase schedule, cost, and staffing above current levels. These operations would require approximately 408,000 cubic meters (534,600 cubic yards) gravel/borrow onsite through project life cycles.

Minimum Treatment, Storage, and Disposal - Under this alternative (C) and in support of SNF and INEL ER&WM activities, infrastructure and excavation projects would maintain schedule, cost, and staffing at nearly current levels. These operations would require approximately 285,000 cubic meters (372,500 cubic yards) gravel/borrow onsite through project life cycles.

Maximum Treatment, Storage, and Disposal - Under this alternative (D) and in support of INEL spent nuclear fuel and ER&WM activities, infrastructure and excavation projects would require schedule modifications and an increase in cost and staffing levels above Alternatives A (No Action), B (Ten-Year Plan), and C (Minimum Treatment, Storage, and Disposal). These operations would require approximately 1,772,000 cubic meters (2,317,000 cubic yards) gravel/borrow onsite through project life cycles and necessitate the expansion of existing pits and the opening of a new borrow area. The preparation of a storm water pollution prevention plan, and the determination of an air permitting action would be required for each gravel pit and borrow area before proposed actions commence.

Cease Use of Gravel/Borrow - This option would cease use of gravel/borrow resources on the INEL. This option was not evaluated in this EIS. Maintenance of the INEL infrastructure and performance of environmental restoration and waste management activities require these resources, even under the No-Action alternative.

Obtain Gravel/Borrow from an Offsite Commercial Source - Under this option, DOE would purchase and import 5,000 cubic yards or less of crushed gravel for roadbase material,

concentrated aggregate (screened), and gravel for plant mix from an outside source. Over 5,000 cubic yards becomes more cost efficient to allow subcontractor access to INEL gravel and an onsite crusher.

Identify New. Onsite Sources of Gravel/Borrow - This option would allow DOE to develop a new borrow source. Terreton Lake beds south of Test Area North are an example. These lake beds are largely sandy and clayey silt, with lesser amounts of relatively pure clay and would suffice as an alternative to Spreading Area B.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet					Rev. 9 May 24, '94				
G o n e r l c	Description/function:	Gravel Pit Expansions				C o n s t r u c t i o n s m a t e r i a l s	Gravel Removed (m3)	Alt B	Alt D
	WAG	INEL					NFF	1,950	1,950
	EIS Alter. (A, B, C or D):	B, D (expanded)					TAN	7,646	8,143
	SNF or Waste stream:	Infrastructure					TRA/ICPP	29,666	29,666
	Action type:	Expand					CFA	41,320	41,320
	Structure Type:	Pits					Lincoln Blvd.	12,157	12,157
C o n s t r u c t i o n s m a t e r i a l s	Location:	Outside TAN, NRF, TRA, CFA, & RWMC				i o n	Air Emissions:	See Appendix F, Section 3	
	Inside/outside of fence Inside/outside of bldg.						(None / Ref.)		
	Cost(\$): PreConst.	N/A				l i n	Effluents:	None	
	Cost(\$): Const.						Type:		
	Schedule Start /End: PreConst.					Quantity: (liters)			
	Schedule Start /End: Const.					f o r	Solid wastes:	None	
	No. of workers: (new/exist)	No increase above current level					Type:		
	Heavy Equip. Equip. used:	Trucks				Quantity: (m3)			
	c t i o n s	Acres Disturbed:	Alt B	Alt D	Depth	m a t e r i a l s	Haz./Toxic Chemicals:	None	
		All disturbed areas new:			(m)		Storage/inventory		
		NFF	0.05	0.05	8.8		Cultural resource effects:	Yes	
		TAN	0.4	0.4	4.6		Pits/ponding created: (m2)	Yes	
		TRA/ICPP	0.6	0.6	11.3		Water usage: (liters)	N/A	
		CFA	2.1	2.1	4.3		Energy requirements:	N/A	
		Lincoln Blvd.	0.3	0.3	8.8		Electrical: (MWH/yr)		
Borax		0.7	3.2	4.0	Fossil fuel: (liters)				
RWMC Pit Run		1.27	3.3	4.9	Nightlights used: Y/N		No		
RWMC Spreading Area B		14.7	89.6	3.2	Generators: Night Y/N Day Y/N		No No		

CENTRAL FACILITIES AREA CLEAN LAUNDRY AND RESPIRATOR FACILITY

PROJECT NAME: Central Facilities Area Clean Laundry and Respirator Facility

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project would be to use an existing facility for a new use, continue use as intended, or to decontaminate and decommission the facility.

PROJECT DESCRIPTION: This project would provide several alternatives for the existing Building CFA-617, Clean Laundry and Respirator Facility located in the northeast part of the Central Facilities Area at the INEL. Other than for No Action, the selection of an appropriate alternative for Building CFA-617 is a "proposed action." This project would implement one of the following five alternative actions:

1. Hazardous Waste Storage Facility
2. Quality Assurance Testing Facility
3. Radiological Development & Research Laboratory Facility
4. Decontaminate and decommission the Facility
5. Resume operation of the Clean Laundry and Respirator Facility.

The Clean Laundry and Respirator Facility is a one-story, cement block building built in 1981 with an area of 1,067 square meters (11,494 square feet). Seven functional areas are within this area:

1. Respirator processing
2. Hot laundry processing
3. Special hot laundry monitoring
4. Health Physics office and monitoring area
5. Cold laundry processing
6. Office, lunch room, and rest rooms
7. Mechanical system room.

A parking lot is on the west side of the building, with three loading docks on the east and north sides. The facility is presently not operating and in an interim shutdown condition per a National Environmental Policy Act categorical exclusion.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the Central Facilities Area Clean Laundry and Respirator Facility would not be reused. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS. This option would involve continued surveillance and maintenance of an existing facility under a National Environmental Policy Act categorical exclusion status. The National Environmental Policy Act categorical exclusion was not written to support such a long-term action.

Build Treatment, Storage, and Disposal Facility - Under this option, the facility would not be available (except possibly on an interim basis) for use as a Hazardous Waste Storage Facility if the Hazardous Waste Treatment and Storage and Disposal Facility were to be built. This option corresponds with Alternative D (Maximum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9	May 16, '94	
G	Description/function:	CFA Laundry & Respirator Facility	C	Cultural resource effects:	None
o			o	Pits/ponding created: (m2)	No
n	WAG	NEL	n	Water usage: (liters)	Depends on option selected.
o	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	Depends on option selected.
r	SNF or Waste stream:	Infrastructure	t	Electrical: (MWH/yr)	
i	Action type:	Expand	.	Fossil fuel: (liters)	
c	Structure Type:	Existing		Nightlights used: Y/N	No
	Size: (m2)	1,067		Generators: Night Y/N	No
				Day Y/N	No
i	Other features:		O	Cost(\$): Operation:	No increase
n	(Pits, ponds, power		p	Schedule Start /End:	1998 - TBD
f	/water/sewer lines)		e	No. of workers: (new/exist)	existing / no new
o			r	Heavy Equip. Equip. used:	Trucks
.	Location:		a	Trips:	101 on-site trips/yr
	Inside/outside of fence	Inside CFA	t	Air Emissions:	Depends on option selected.
	Inside/outside of bldg.	Inside CFA-617	i	(None / Ref.)	
C	Cost(\$): PreConst.		o		
o	Cost(\$): Const.	\$1.8 Mil. Total	n	Effluents:	None
n	Schedule Start /End: PreConst.	1995	i	Type:	
s	Schedule Start /End: Const.	1995 - 1997	l	Quantity: (liters/yr)	
t	No. of workers: (new/exist)		n	Solid wastes:	Ind. 100
r	Heavy Equip. Equip. used:	Trucks	f	Type:	
u	Trips:		o	Quantity: (m3/yr)	
c	Acres Disturbed: New	0	r	Haz./Toxic Chemicals:	See Project Summary HWSF Source Term data sheet
t	Previous	0	m	Storage/inventory	
i	Revegetated	0	a	Pits/ponds used: Y/N (m2)	No
o	Air Emissions:	Depends on option selected.	t	Water usage: (liters/yr)	0
n	(None / Ref.)			i	Energy requirements:
i	Effluents:		l	Electrical: (MWH/yr)	
n	Type:	LLW	o	Fossil fuel: (liters/yr)	
f	Quantity: (liters)		n	Nightlights used: Y/N	No
o	Solid wastes:			Generators: Night Y/N	No
.	Type:	LLW		Day Y/N	No
	Quantity: (m3)	(No info. avail) 400			
	Haz./Toxic Chemicals:	Decon Solutions			
	Storage/inventory				

**Projects
Related to
Research and Development**

CALCINE TRANSFER PROJECT (BIN SET #1)

PROJECT NAME: Calcine Transfer Project (Bin Set #1)

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to provide facilities and equipment for the safe retrieval and transport of high-level waste calcine from the existing storage at Bin Set #1 to a fully qualified storage facility.

PROJECT DESCRIPTION: Retrieval of calcine from Bin Set #1 is necessary to comply with an existing Federal Court Order, Federal laws, and DOE orders governing the handling, storage, and disposal of high-level waste. The retrieval of calcine from Bin Set #1 and transport to a fully qualified location would entail the following tasks. The top of the vault chamber would be accessed by removing the support structure, backfilled soil, and equipment housed above the vault. The vault roof would be thickened with an additional reinforced concrete slab for shielding and increased support capacity. A containment structure would be placed over the vault. A pneumatic transport line and support facilities at the receiving location would be constructed concurrently. Within the containment structure, penetrations would be made through the vault roof and access risers would be remotely attached at appropriate locations to the enclosed bins and pressure tested. The bins would then be penetrated through the riser, and retrieval devices would be deployed via the riser to remove the 8,000 cubic feet of calcine. The components would be designed to be portable and compatible with all bin sets at the Idaho Chemical Processing Plant as these calcine solids would be retrieved and treated as part of the Idaho Chemical Processing Plant High Level Waste Calcine Immobilization Program.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the technology to transfer calcine from older bin sets would not be demonstrated. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 9 May 24, '94	
Description/function:	Calcine Transfer Project (Bin Set #1)		Cultural resource effects:	None identified
	WAG	3	Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	B, D	Water usage: (liters)	Insignificant
	SNF or Waste stream:	HLW	Energy requirements:	
	Action type:	New, Demonstration	Electrical: (MWH/yr)	
	Structure Type:	Containment Enclosure	Fossil fuel: (liters)	11.3 k Diesel, 760 Propane
	Size: (m2)	200	Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)	Transfer equipment	Generators: Night Y/N Day Y/N	No Yes
	Location:		Cost(\$): Operation:	
	Inside/outside of fence	Inside ICPP	Schedule Start /End:	2006 - 2007
Cost(\$): PreConst.		No. of workers: (new/exist)	no new above current level	
Cost(\$): Const.	\$65 Mil. total	Heavy Equip. Equip. used:	None	
Schedule Start /End: PreConst.	1994 - 1999	Trips:		
Schedule Start /End: Const.	1999 - 2004	Air Emissions:	See Appendix F, Section 3	
No. of workers: (new/exist)	15 Subs.	(None / Ref.)		
Heavy Equip. Equip. used:	Trucks			
Trips:		Effluents:		
Acres Disturbed: New	0	Type:	None	
Previous	0.5	Quantity: (liters/yr)		
Revegetated	0	Solid wastes:		
Air Emissions:		Type:		
(None / Ref.)	See Belanger et al., 1994	Quantity: (m3/yr)		
Effluents:		Haz./Toxic Chemicals:	None	
Type:	Construction water	Storage/inventory		
Quantity: (liters)		Pits/ponds used: Y/N (m2)	No	
Solid wastes:		Water usage: (liters/yr)	No	
Type:	LLW Ind.	Energy requirements:		
Quantity: (m3)	10 100	Electrical: (MWH/yr)	minimal	
Haz./Toxic Chemicals:		Fossil fuel: (liters/yr)		
Storage/inventory	None	Nightlights used: Y/N	No	
		Generators: Night Y/N Day Y/N	No No	

PLASMA HEARTH PROCESS PROJECT

PROJECT NAME: Plasma Hearth Process Project

GENERAL PROJECT OBJECTIVE: The general objective of this proposed project is to demonstrate the full-scale Plasma Hearth Process on actual mixed low-level waste that is difficult to treat by conventional thermal technologies.

PROJECT DESCRIPTION: The Plasma Hearth Process is a high temperature thermal treatment process using a plasma arc torch in a refractory lined chamber that destroys organics and stabilizes the residuals in a nonleaching, vitrified waste form. Plasma arc technology is used commercially, primarily for production of high purity alloys. This project would involve the adaptation of that existing, commercially available technology. The key elements of this technology are (a) extremely high temperature operation that completely destroys organics while stabilizing inorganics; (b) the ability to accept a very wide range of waste types without pretreatment; (c) the ability to treat waste without removing it from the container; (d) generation of separate slag and metallic phases, allowing segregation and possible reuse of the metal; and (e) the preference of many radionuclides (especially the actinides) and toxic heavy metals to migrate to the stable slag phase.

The term "plasma" refers to a highly ionized gas. The type of plasma that would be considered in this application is known as a dc arc-generated plasma. This type of plasma would be generated with a plasma "torch." Basically, the torch uses a flowing gas to stabilize an electrical discharge (arc) between two electrodes. One or both of these electrodes is contained within the torch. For treatment of solid materials, the second electrode is usually the material being processed. Energy is dissipated in the form of heat and light as the electrical current flows through the gas. Through resistance heating (Joule heating), this process creates a high temperature gas as well as directly heating the work piece.

The plasma hearth process system would consist of the following functional units: a feed system, a primary plasma chamber, a secondary combustion chamber, an offgas treatment system, and a slag removal system. Waste would be fed to the primary chamber where heat from the plasma torch would be used to initiate a variety of chemical and physical changes. Organic compounds in

the waste would be decomposed, volatilized, pyrolyzed, and/or oxidized. The remaining inorganic material in the waste would be heated to a high temperature where it would melt and separate into molten slag and metal phases. Actinides and oxidized heavy metals would migrate to the slag phase; cooling and solidification of this material would result in the final waste form.

Offgas from the primary process chamber would be transported to a secondary chamber where high temperature, excess oxygen, turbulence, and delay time of the offgas in the secondary chamber would ensure 99.99 percent destruction and removal efficiency of any remaining organic compounds. The offgas would then be cooled by use of an evaporative cooler prior to entry into the system baghouse and high efficiency particulate air filters where particulate would be filtered from the offgas at an efficiency of 99.97 percent per filter.

The Plasma Hearth Process technology is chiefly applicable to solid or sludge wastes where a stabilized byproduct is required for disposal. The application for which the Plasma Hearth Process is currently being developed is both solid mixed low-level waste and transuranic waste.

The Transient Reactor Test reactor building (Building 720) is a metal-sided, steel-framed structure and features two high bay sections (north and south) and two low bay sections (east and west). The Plasma Hearth Process field-scale unit (that is, plasma furnace system, offgas system, and support equipment) would be sized and configured for installation in the south high bay area (70 feet wide x 114 feet long x 75 feet high) of the building and would tie into the reactor offgas system at a location not yet determined. Field-scale unit experiments would be conducted as non-reactor experiments in the Transient Reactor Test facility.

PROJECT SPECIFIC OPTIONS:

Note: The above project description was used for the analysis of potential consequences in Chapter 5 of Volume 2 of the SNF and INEL ER&WM EIS where the project would be implemented under Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal).

No Action - Under this option, the Plasma Hearth Process would not be developed. This option corresponds to Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal) evaluated in this EIS.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7	May 24, '94	
G	Description/function:	Plasma Hearth Process Project	C	Cultural resource effects:	N/A
e			o	Pits/ponding created: (m2)	None
n	WAG	8	n	Water usage: (liters)	30 k
e	EIS Alter. (A, B, C or D):	B, D	s	Energy requirements:	
r	SNF or Waste stream:	MLLW HW	t	Electrical: (MWH/yr)	1
l	Action type:	New	.	Fossil fuel: (liters)	0
c	Structure Type:	N/A		Nightlights used: Y/N	No
l	Size: (m2)			Generators: Night Y/N	No
n	Other features:	Hearth		Day Y/N	No
f	(Pits, ponds, power		O	Cost(\$): Operation:	\$10 Mil. Total
o	/water/sewer lines)		p	Schedule Start /End:	1996 - 2000
.	Location:		e	No. of workers: (new/exist)	6 Subs.
	Inside/outside of fence	Inside ANL-W	r	Heavy Equip. Equip. used:	Truck
	Inside/outside of bldg.	Inside Bld-720	a	Trips:	257 on-site
C	Cost(\$): PreConst.	\$4 Mil.	t	Air Emissions:	
o	Cost(\$): Const.	\$11 Mil.	l	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1994 - 1995	o		
s	Schedule Start /End: Const.	1995 - 1996	n		
t	No. of workers: (new/exist)	5 - 10 Subs. (3 months)	a	Effluents:	
r	Heavy Equip. Equip. used:	Truck	l	Type:	None
u	Trips:	2 from off-site		Quantity: (liters/yr)	
c	Acres Disturbed: New	0	l	Solid wastes:	
t	Previous	0	n	Type:	LLW Ind.
l	Revegetated	0	f	Quantity: (m3/yr)	23 50
o	Air Emissions:		o	Haz./Toxic Chemicals:	None
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	
l	Effluents:		m	Pits/ponds used: Y/N (m2)	No
n	Type:	None	a	Water usage: (liters/yr)	70,855
f	Quantity: (liters)		t	Energy requirements:	
o	Solid wastes:		l	Electrical: (MWH/yr)	4,688
.	Type:	Ind.	o	Fossil fuel: (liters/yr)	69,822 Propane
	Quantity: (m3)	20	n	Nightlights used: Y/N	No
	Haz./Toxic Chemicals:	None		Generators: Night Y/N	No
	Storage/inventory			Day Y/N	No

Ongoing Projects

TEST AREA NORTH POOL FUEL TRANSFER

PROJECT NAME: Test Area North Pool Fuel Transfer

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Test Area North Pool Fuel Transfer Project are (a) to provide a low-cost, environmentally sound alternative to submerged storage of the Three Mile Island, Loss-of-Fluid-Test, and commercial spent fuels in the Test Area North Hot Shop storage pool and (b) to ensure compliance with applicable codes and regulations regarding interim storage of spent nuclear fuel.

PROJECT DESCRIPTION: The Test Area North Hot Shop storage pool currently contains greater than 7.5 million curies (Ci) of spent fuel and fuel debris consisting primarily of 342 canisters of core debris from the Three Mile Island reactor accident. The storage pool also contains fuel and fuel remnants from the Loss-of-Fluid-Test facility tests and DOE- and U.S. Nuclear Regulatory Commission (NRC)-owned commercial fuel rods and assemblies.

DOE proposes to remove all of these materials from the storage pool and place them in suitable interim dry storage.

The Three Mile Island fuel canisters must be dried before placing them in dry storage casks to prevent canister corrosion. The dryer system is located inside the TAN-607 Hot Shop. The canisters would be individually transferred to the dryer system using the existing Three Mile Island canister grapple and overhead crane. The water would then be removed from the canisters by purging the interior with hot (300°F) nitrogen and heating the exterior with heating blankets. This nitrogen would be supplied from an existing liquid nitrogen storage system and filtered and vented through the existing Hot Shop filter system after passing through the canister. Four canisters would be dried at a time.

When seven canisters are ready, they would be loaded into the NRC-certified 125B shipping cask and moved to Test Area North or Idaho Chemical Processing Plant for storage.

At the Idaho Chemical Processing Plant, the shipping cask would be up-ended and the canisters unloaded into a new storage facility via a shielded transfer cask for safe interim storage. The Alternate Fuel Storage Facility would be an aboveground concrete monolith with individual storage vault positions for each canister. The concrete monolith would provide for seismic stability, shielding, and monitoring of monolith and vault conditions. The individual vaults would be cylindrical in section and would be sealed to the environment. Provisions for monitoring the interior of the individual vaults would be provided. The canisters would be retrievable for future transfer or maintenance activities.

The Loss-of-Fluid-Test and commercial fuel would be removed from the water, washed to remove surface contamination, and suspended in the Hot Shop to dry. These fuels would be stored dry at the Idaho Chemical Processing Plant or at Test Area North in unvented storage containers. The fuel could be dried further by using the nitrogen drying process described above.

Approximately 3 million liters (780,000 gallons) of water would remain in the storage pool following removal of the spent fuel and fuel debris. Spectroanalysis of the pool water conducted in 1991 and 1992 identified a total radionuclide concentration of approximately 3 curies in the pool. The nonfuel solid low-level waste, approximately 485 cubic meters (635 cubic yards) consisting of Three Mile Island hardware and metals, would be removed from the pool and transferred to the Radioactive Waste Management Complex after the fuel and fuel debris have been removed. The pool water would be treated via demineralization, filtration, and ion-exchange until it meets the criteria for discharge to a surface impoundment. The water would then be discharged to a surface impoundment area. The pool would remain empty of material and water and would be dispositioned in a separate project.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 24, '96		
G	Description/function:	TAN Pool Fuel Transfer	C	Cultural resource effects:	None identified
e			o	Pits/ponding created: (m2)	None
n	WAG	1 & 3	n	Water usage: (liters)	Insignificant
e	EIS Alter. (A, B, C or D):	A, B, D	s	Energy requirements:	
r	SNF or Waste stream:	SNF	t	Electrical: (MWH/yr)	
I	Action type:	New	.	Fossil fuel: (liters)	12,800 l diesel
c	Structure Type:	Storage Facility		Nightlights used: Y/N	No
I	Size: (m2)	380 (30x12)		Generators: Night Y/N	No
n	Other features:	Storage Pad 18 m x 91 m x 30 cm		Day Y/N	No
f	(Pits, ponds, power	Existing Pool (7x21x7 m deep)	O	Cost(\$): Operation:	\$1.7 Mil/yr for first two years
o	/water/sewer lines)	Road/Power Lines	p	Schedule Start /End:	1997 - 1998
.	Location:		e	No. of workers: (new/exist)	No new
	Inside/outside of fence	Inside ICPP	r	Heavy Equip. Equip. used:	Trucks
	Inside/outside of bldg.	Outside CPP-749 South or East	a	Trips:	66 TAN to ICPP & back
C	Cost(\$): PreConst.	\$4.12 Mil.	t	Air Emissions:	
o	Cost(\$): Const.	\$16.48 Mil	I	(None / Ref.)	See Appendix F, Section 3
n	Schedule Start /End: PreConst.	1993 - 1994	o		
s	Schedule Start /End: Const.	1995 - 1996	n	Effluents:	
t	No. of workers: (new/exist)	8 (Existing)	I	Type:	None
r	Heavy Equip. Equip. used:	Trucks		Quantity: (liters/yr)	
u	Trips:		I	Solid wastes:	
c	Acres Disturbed: New	0	n	Type:	None
t	Previous	0.8	f	Quantity: (m3/yr)	
I	Revegetated	0	o	Haz./Toxic Chemicals:	None
o	Air Emissions:		r	Storage/inventory	
n	(None / Ref.)	See Belanger et al., 1994	m	Pits/ponds used: Y/N (m2)	No
I	Effluents:		a	Water usage: (liters/yr)	Insignificant
n	Type:	None	t	Energy requirements:	
f	Quantity: (liters)		I	Electrical: (MWH/yr)	<0.1
o	Solid wastes:		o	Fossil fuel: (liters/yr)	
.	Type:	Ind.	n	Nightlights used: Y/N	Yes
	Quantity: (m3)	8.5		Generators: Night Y/N	No
	Haz./Toxic Chemicals:	None		Day Y/N	No
	Storage/inventory				

REMEDIATION OF GROUNDWATER CONTAMINATION

PROJECT NAME: Remediation of Groundwater Contamination

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general project objective of the Remediation of Groundwater Contamination Project is to reduce contamination in the immediate vicinity of an injection well that is located in the Test Area North Technical Support Facility.

PROJECT DESCRIPTION: The Remediation of Groundwater Contamination Project is an Interim Action being implemented under the INEL Federal Facility Agreement and Consent Order. The Interim Action would be implemented in accordance with a Comprehensive Environmental Restoration and Compensation Liability Act Record of Decision signed by the Department of Energy (DOE-ID), the Idaho Department of Health and Welfare, and the U.S. Environmental Protection Agency (Region 10).

This project would reduce the concentrations of trichloroethylene, tetrachloroethylene, dichloroethylene, lead, and strontium-90 in the groundwater surrounding the TSF-05 injection well at the Technical Support Facility. This well was used from 1955 until 1972 to dispose of Test Area North liquid wastes into the Snake River Plain Aquifer. On at least one occasion, concentrated evaporator sludges from the processing of low-level radioactive and process wastes were disposed of through injection down the well. The liquid wastes injected through the well included organic, inorganic, and low-level radioactive wastewaters that were added to industrial and sanitary wastewater.

Contaminants have been found in the aquifer down to 122 meters (400 feet) below the ground surface. The contaminant plume is estimated to have spread up to 2.5 kilometers (1.5 miles) in the direction of groundwater flow and continues to grow. TSF-05 has been identified as a main source of these contaminants, and the highest concentration of groundwater contaminants is

found near the TSF-05 injection well. These levels drop rapidly as the distance from the well increases.

The current remediation plan calls for extraction of groundwater with a pump placed in the existing TSF-05 well casing, removal of contaminants from the groundwater in a treatment facility, and discharge of the cleaned water to a surface impoundment. The Interim Action treatment facility includes an air stripper, a multimedia sand filter, carbon off-gas treatment, and an ion-exchange system. Groundwater would be extracted from two new monitoring wells, TAN-25 and TAN-26, if it is determined that their use would improve the efficiency of the remediation effort or if more water is needed to operate the treatment facility. Additional groundwater could be obtained by pumping existing Test Area North and United States Geological Survey (USGS) wells, including USGS-24 and TAN-18.

Because additional water may have to be added to meet treatment system requirements, extracted groundwater would be stored awaiting treatment in a 75,700-liter (20,000-gallon) surge tank. The first step of actual treatment would be by processing through an off-the-shelf-design air stripper unit. Air discharge from the air stripper unit would be filtered through granular activated carbon to capture volatile organic compounds removed from the groundwater. The groundwater would then be filtered through a multimedia sand filter to remove any solids or sediments. As a polishing step, the groundwater would be processed through an ion-exchange column to remove radionuclides. Finally, processed groundwater would be discharged to the Test Area North disposal pond (TSF-07).

Wastes generated during the treatment of contaminated groundwater would include spent carbon, ion exchange resins, and filter sediment. Each of these solid wastes would be disposed of in approved disposal facilities. The treatment site would include a contaminated waste storage area for the storage of processing wastes that are classified as hazardous, low-level radioactive, or mixed low-level radioactive wastes.

A Final Action to further remediate the contaminant plume is being proposed to follow the Interim Action. Information and analytical data gathered during the Interim Action on contaminant concentration response to pumping would be used in selecting and designing the Final Action. The Final Action could modify/expand the Interim Action, resulting in significant

changes to scope, cost, and schedule. A separate Comprehensive Environmental Restoration and Compensation Liability Act Record of Decision would be signed for the Final Action.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 10 May 24, '96		
G	Description/function:	Remediation of Groundwater Contamination	C	Cultural resource effects:	None identified
e	WAG	1	o	Pits/ponding created: (m2)	Yes
n	EIS Alter. (A, B, C or D):	A, B, C, D	n	Water usage: (liters)	No information available
e	SNF or Waste stream:	ER	s	Energy requirements:	
r	Action type:	New	t	Electrical: (MWH/yr)	
l	Structure Type:	Building	.	Fossil fuel: (liters)	56,775 diesel, 5,678 propane
c	Size: (m2)	925		Nightlights used: Y/N	Yes
l	Other features:	Pond		Generators: Night Y/N	No
n	(Pits, ponds, power			Day Y/N	Yes
f	/water/sewer lines)		O	Cost(\$): Operation:	\$5 Mil /yr
o	Location:		p	Schedule Start /End:	1994 - TBD
.	Inside/outside of fence	Inside TAN	e	No. of workers: (new/exist)	10 Existing
	Inside/outside of bldg.	Outside	r	Heavy Equip. Equip. used:	Trucks
C	Cost(\$): PreConst.		a	Trips:	86 on site
o	Cost(\$): Const.	\$5 Mil / yr	t	Air Emissions:	
n	Schedule Start /End: PreConst.	Complete	l	(None / Ref.)	See Appendix F, Section 3
s	Schedule Start /End: Const.	1993 - 1994	o		
t	No. of workers: (new/exist)	34 Subs.	n	Effluents:	
r	Heavy Equip. Equip. used:	None	l	Type:	Water
u	Trips:			Quantity: (liters/yr)	9.90E+07
c	Acres Disturbed: New	3	l	Solid wastes:	
t	Previous	0	n	Type:	LLW MLLW Haz. Ind.
l	Revegetated	0	f	Quantity: (m3/yr)	66 100 21
o	Air Emissions:		o	Haz./Toxic Chemicals:	
n	(None / Ref.)	See Belanger et al., 1994	r	Storage/inventory	None
l	Effluents:		m	Pits/ponds used: Y/N (m2)	Yes
n	Type:	Construction Water	a	Water usage: (liters/yr)	9.90E+07
f	Quantity: (liters)		t	Energy requirements:	No information available
o	Solid wastes:		l	Electrical: (MWH/yr)	
.	Type:	Industrial	o	Fossil fuel: (liters/yr)	
	Quantity: (m3)		n	Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:			Generators: Night Y/N	No
	Storage/inventory	None		Day Y/N	No

PIT 9 RETRIEVAL

PROJECT NAME: Pit 9 Retrieval

This previously evaluated and approved project (DOE 1993) is expected to be in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Pit 9 Retrieval Project are to reduce the potential for exposure of workers, the public, and the environment to contaminants disposed in Pit 9; to expedite the overall cleanup of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory; and to reduce the potential for migration of Pit 9 wastes to the Snake River Plain Aquifer.

PROJECT DESCRIPTION: The Pit 9 Retrieval Project is an Interim Action initiated under the INEL's Federal Facility Agreement and Consent Order. The Pit 9 Retrieval Project would excavate and treat wastes contaminated with radioactive and hazardous substances disposed of at Pit 9 of the Subsurface Disposal Area of the Radioactive Waste Management Complex. Included in the project would be the design, construction, and operation of a double-containment retrieval enclosure, treatment facilities, waste storage facilities, and an office facility for project personnel.

Pit 9 is approximately 5 meters (17 feet) deep, 39 meters (127 feet) wide, and 116 meters (379 feet) long. Materials disposed in Pit 9 include soils, sludges, graphite, combustibles, plastics, wood, metals, and drums. Radioactive contaminants include plutonium and americium. Organic hazardous contaminants include trichloroethylene and carbon tetrachloride.

Proof-of-process testing would be performed for the proposed remediation technologies before construction of the facilities is begun. Results of the proof-of-process testing would then be performed with the completed facilities before full-scale remediation would begin. Key elements of the proof-of-process testing and the limited production test would include showing that the primary steps of the remedial process would work as an integrated system, proving that material cleaned during processing meets the treatment standards for material returned to the pit, and

demonstrating that the final waste material could be safely stabilized and meet all disposal and/or storage criteria.

The design approved in the Comprehensive Environmental Response, Compensation, and Liability Act Interim Action Record of Decision would require that waste and contaminated materials requiring treatment be removed from Pit 9 using remotely operated excavators. After sorting and characterizing, wastes would be placed into a treatment unit. Treatment could include physical separation, chemical extraction, and/or stabilization processes. Physical separation technologies would be used to separate mixtures of solids and to concentrate the contaminants before further treatment. The physical separation treatment could include mechanical methods, such as wet or dry screening, flotation, gravity concentration, sedimentation, and filtration. Chemical extraction is the treatment technology selected to remove contaminants from soils and sludges. A final stabilization process would add solidifying agents or use thermal technologies to reduce the concentrated waste contaminants to an unleachable form.

After treatment, concentrated waste contaminants would be placed in drums. These drummed wastes would then be placed into storage at the Radioactive Waste Management Complex Transuranic Storage Area. All such drummed wastes would remain in storage until they were sent offsite for disposal at an acceptable facility.

Cleaned soils and waste materials meeting standards would be returned to the Pit 9 excavation for permanent disposal. Any waste being returned to the pit would be required to meet an average concentration of transuranic isotopes of less than 10 nanocuries per gram and to meet all other applicable regulatory requirements, including land disposal restrictions under the Resource Conservation and Recovery Act. The land disposal restrictions would be met for these wastes through delisting (that is, they would be demonstrated to be nonhazardous). Nonhazardous wastes are not subject to Subtitle C hazardous waste disposal and site closure requirements of the Resource Conservation and Recovery Act. After treatment operations were completed, Pit 9 would be closed in accordance with applicable requirements, including Subpart D of the Resource Conservation and Recovery Act and State of Idaho solid waste disposal requirements.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

DOE 1993, *Environmental Assessment for the Interim Action for Cleanup of Pit 9 at the Radioactive Waste Management Complex*, Idaho National Engineering Laboratory, U.S. Department of Energy, DOE/EA-0854.

Project Data Sheet			Rev. 8	May 24, '96	
G	Description/function:	PIT 9 Retrieval	C	Cultural resource effects:	None identified
e			o	Pits/ponding created: (m2)	No
n	WAG	7	n	Water usage: (liters)	Insignificant
e	EIS Alter. (A, B, C or D):	A, B, C, D	s	Energy requirements:	
r	SNF or Waste stream:	BR	t	Electrical: (MWH/yr)	
l	Action type:	New -- Remediation	.	Fossil fuel: (liters)	136 k Diesel, 27 k Propane
c	Structure Type:	Buildings (4)		Nightlights used: Y/N	Y
	Size: (m2)	4,830		Generators: Night Y/N	N
		467 m3 concrete		Day Y/N	Y
I	Other features:	Utilities	O	Cost(\$): Operation:	\$29 Mil.
n	(Pits, ponds, power		p	Schedule Start /End:	1999 - 2000
f	/water/sewer lines)		e	No. of workers: (new/exist)	100 Existing, 100 New
o	Location:		r	Heavy Equip. Equip. used:	
.	Inside/outside of fence	Inside RWMC	a	Trips:	
	Inside/outside of bldg.	Outside	t	Air Emissions:	
C	Cost(\$): PreConst.	\$16 Mil.	l	(None / Ref.)	See Appendix F, Section 3
o	Cost(\$): Const.	\$49 Mil.	o		
n	Schedule Start /End: PreConst.	1993 - 1994	n		
s	Schedule Start /End: Const.	1995 - 1999	a	Effluents:	
t	No. of workers: (new/exist)	150 Peak Subs.	l	Type:	None
r	Heavy Equip. Equip. used:	Trucks		Quantity: (liters/yr)	
u	Trips:		l	Solid wastes:	
c	Acres Disturbed: New	0	n	Type:	LLW HW Ind.
t	Previous	5.2	f	Quantity: (m3/yr)	No Information Available
l	Revegetated	0	o	Haz./Toxic Chemicals:	Nitric Acid
o	Air Emissions:		r	Storage/inventory	
n	(None / Ref.)	See Belanger et al., 1994	m	Pits/ponds used: Y/N (m2)	No
			a	Water usage: (liters/yr)	
I	Effluents:		t	Energy requirements:	
n	Type:	Construction Water	l	Electrical: (MWH/yr)	
f	Quantity: (liters)		o	Fossil fuel: (liters/yr)	
o	Solid wastes:		n	Nightlights used: Y/N	Yes
.	Type:	Industrial HW		Generators: Night Y/N	No
	Quantity: (m3)	416 0.1		Day Y/N	No
	Haz./Toxic Chemicals:	None			
	Storage/inventory				

VADOSE ZONE REMEDIATION

PROJECT NAME: Vadose Zone Remediation

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of the Remediation of Organic Contamination of the Vadose Zone Project is to prevent organic contaminant migration to the Snake River Plain Aquifer that underlies the Idaho National Engineering Laboratory (INEL) in groundwater contaminant concentrations exceeding acceptable risk levels and/or Federal and State maximum contaminant levels.

PROJECT DESCRIPTION: The Remediation of Organic Contamination of the Vadose Zone project would remove volatile organic contamination found in the unsaturated hydrogeologic zone (vadose zone) beneath the Subsurface Disposal Area of the Radioactive Waste Management Complex at the INEL by removing vapors of volatile organic contaminants from soils and underlying rock. Cleanup goals would be established as vadose zone contaminant concentrations that would not result in groundwater contaminant concentrations exceeding maximum contaminant levels or resulting in unacceptable risks to future groundwater users.

Organic contaminant concentrations have been detected in soil vapor, surficial soils, perched water, and groundwater beneath the Subsurface Disposal Area in concentrations ranging from 1 part per million to 2800 parts per million. The primary contaminants of concern are carbon tetrachloride, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane. Most of these contaminants were shipped to the INEL for disposal in the form of solidified lubricants, solvents, used oils, and degreasing agents. A small quantity of contaminants have reached the Snake River Plain Aquifer in concentrations that are lower than Federal and State safe drinking water standards. The Snake River Plain Aquifer has been designated as a sole-source, or irreplaceable, aquifer by the U. S. Environmental Protection Agency.

Vapor vacuum extraction has been chosen as the remediation technology to be used to remove organic vapors from the vadose zone. In implementing this technology, extracted vapors would be treated at the ground surface to capture any hazardous substances. This program would use the existing vapor vacuum extraction well and several additional extraction wells that would be located in areas of the Subsurface Disposal Area known to have significant levels of organic vapors in the vadose zone.

The complexities of the subsurface environment and uncertainty associated with modeling contaminant response to extraction make it difficult to predict how many wells would eventually be required, and for what period of time they would need to operate to achieve cleanup goals. Initially, three phases of cleanup activity would be implemented over 6 years. The first phase of the project would include the installation of five additional extraction wells, vapor treatment units, and vapor monitoring wells. Subsequent phases may include more vapor extraction wells, monitoring wells and vapor treatment units. The maximum number of vapor extraction wells and accompanying vapor treatment units is expected to be 14.

Each vapor extraction well would be linked to a catalytic oxidation unit or equivalent vapor treatment system with a treatment efficiency approaching 99 percent and capable of maintaining an airflow that would range between 125 and 150 cubic feet per minute. No residual treatment wastes would result from use of this treatment system.

Long-term groundwater and soil vapor monitoring would be performed to confirm the ability of the vapor vacuum extraction system to prevent contaminants from migrating to the Snake River Plain Aquifer at levels that would result in unacceptable groundwater contaminant concentrations. Monitoring of soil vapor and groundwater would continue after remediation is complete to verify that organic contaminant concentrations in the vadose zone remain below acceptable levels.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 24, '96	
G o n o r l c l n f o .	Description/function:	Vadose Zone Remediation	C Cultural resource effects:	None identified
	WAG	7	o Pits/ponding created: (m2)	TBD
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	ER	s Energy requirements:	
	Action type:	Remediation	t Electrical: (MWH/yr)	TBD
	Structure Type:	TBD	. Fossil fuel: (liters)	TBD
	Size: (m2)		Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)		Generators: Night Y/N	No
	Location:		Day Y/N	Yes
	Inside/outside of fence	Inside RWMC	O Cost(\$): Operation:	\$6 Mil./yr
Inside/outside of bldg.	TBD	p Schedule Start /End:	TBD	
C o n s t r u c t i o n a l f o r m a t i o n	Cost(\$): PreConst.	\$4 Mil.	o No. of workers: (new/exist)	10 Existing
	Cost(\$): Const.	\$7 Mil.	r Heavy Equip. Equip. used:	None
	Schedule Start /End: PreConst.	1993 - 1994	a Trips:	
	Schedule Start /End: Const.	TBD	t Air Emissions:	
	No. of workers: (new/exist)	10 Subs.	i (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks / Crane	o Effluents:	
	Trips:		i Type:	TBD
	Acres Disturbed: New	0	l Quantity: (liters/yr)	
	Previous	2.1	n Solid wastes:	
	Revegetated	0	f Type:	Ind. HW
o l f o r m a t i o n	Air Emissions:	See Belanger et al., 1994	o Quantity: (m3/yr)	10 2
	Effluents:		r Haz./Toxic Chemicals:	See SARA
	Type:	Construction Water	Storage/inventory	
	Quantity: (liters)	TBD (Minimal)	m Pits/ponds used: Y/N (m2)	TBD
	Solid wastes:		a Water usage: (liters/yr)	
	Type:	Industrial	t Energy requirements:	
	Quantity: (m3)	TBD (Minimal)	i Electrical: (MWH/yr)	TBD
	Haz./Toxic Chemicals:		o Fossil fuel: (liters/yr)	TBD
	Storage/inventory	TBD	n Nightlights used: Y/N	Yes
			Generators: Night Y/N	No
		Day Y/N	No	

AUXILIARY REACTOR AREA (ARA)-II DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning

This previously evaluated and approved project (DOE-ID 1993) is expected to be in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Auxiliary Reactor Area (ARA)-II Decontamination and Decommissioning Project are to ensure that the identified facilities are in a safe configuration, to determine and execute appropriate decontamination activities, and to decommission the facilities that are surplus to DOE's future programmatic needs. This project would reduce the risk of radioactive exposure and eliminate the need for, and cost of, further surveillance and maintenance at these sites.

PROJECT DESCRIPTION: This project would decontaminate and decommission the radiologically contaminated buildings, structures, utilities, and other miscellaneous items at Auxiliary Reactor Area (ARA)-II at the INEL.

The Auxiliary Reactor Area is composed of Auxiliary Reactor Area-I, -II, -III, and -IV. ARA-II was the site of the Stationary Low-Power Reactor No. 1 (SL-1). An accident occurred at SL-1 in 1961 that resulted in three deaths. Following the accident, the SL-1 building was disassembled and buried 1/2 mile east of the ARA-II facility boundary, and the reactor was buried at the Radioactive Waste Management Complex. Remaining support buildings at ARA-II were decontaminated and converted to laboratories and welding shops. During the 1980s, the use of these buildings was discontinued. All buildings, structures, and utilities at ARA-II would be demolished and removed and the site recontoured and reseeded.

Contaminated building materials would be cut up to reduce bulk and packaged and shipped to the Radioactive Waste Management Complex for disposal. Conventional radiological decontamination methods, such as surface wiping and scabbling (which is the mechanical or

hydraulic removal of surfaces), would be used to decontaminate buildings, structures, and utilities. During scabbling, effluent air would be passed through high-efficiency particulate air filters to minimize releases of particulate materials to the atmosphere.

At Auxiliary Reactor Area (ARA)-II, about 114 liters of fuel oil remain in the 3,800-liter ARA-705 underground storage tank. This oil may be contaminated and, therefore, classified as mixed waste. If contaminated, it would be disposed of at the Waste Experimental Reduction Facility or taken to the INEL Radioactive Mixed Waste Storage Facility for storage. Fifty-five cubic meters (70 cubic yards) of contaminated asbestos has been removed from ARA-II and would be shipped to the Radioactive Waste Management Complex.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, Idaho, May.

DOE-ID (U.S. Department of Energy, Idaho Operations Office), 1993, *Environmental Assessment for Decontamination and Selective Demolition of Auxiliary Reactor Areas II and III*, Idaho DOE/EA-0858, Idaho National Engineering Laboratory, U.S. Department of Energy, Idaho Falls, Idaho.

Project Data Sheet			Rev. 7 May 16, '96				
G • n • r l c l n f o .	Description/function:	ARA-II D&D	D & D i n f o .	Solid wastes:			
	WAG	5		Type:	LLW 1004	Asbestos 11	IND 276
	EIS Alter. (A, B, C or D):	A, B, C, D		Quantity: (m3)	None		
	SNF or Waste stream:	ER		Haz./Toxic Chemicals:	None		
	Action type:	D & D		Storage/inventory	None identified		
	Structure Type:	Building (5)		Cultural resource effects:	No		
	Size: (m2)	ARA-602, 606, 613, 614, 615		Pits/ponding created: (m2)	Insignificant		
	Other features: (Pits, ponds, power /water/sewer lines)	Tanks, Utilities		Water usage: (liters)	0		
	Location:	Inside ARA-II		Energy requirements:	0		
	Inside/outside of fence	Inside Bldg.		Electrical: (MWH/yr)	No		
D & D i n f o r m a t i o n	Inside/outside of bldg.		Fossil fuel: (liters)	No			
	Cost(\$): Pre D&D	\$817 k	Nightlights used: Y/N	No			
	Cost(\$): D&D	\$4.06 Mil.	Generators: Night Y/N	No			
	Schedule Start /End: Pre D&D	1985 - 1993	Day Y/N	Yes			
	Schedule Start /End: D&D	1993 - 1997					
	No. of workers: (new/exist)	50 Existing & Subs.					
	Heavy Equip. Equip. used:	Trucks					
	Trips:	77 to RWMC / WERF / CFA					
	Acres Disturbed: New	0					
	Previous	6.5					
Revegetated	all ARA-II						
Air Emissions: (None / Ref.)	See Belanger et al., 1994						
Effluents:							
Type:	LLW	MLLW					
Quantity: (liters)	1,900	114 cont. oil					

BOILING WATER REACTOR EXPERIMENT (BORAX)-V DECONTAMINATION AND DECOMMISSIONING

PROJECT NAME: Boiling Water Reactor Experiment (BORAX)-V Decontamination and Decommissioning

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objectives of the Boiling Water Reactor Experiment (BORAX)-V Decontamination and Decommissioning Project are to remove the Boiling Water Reactor Experiment (BORAX)-V facility from the list of surplus facilities, remove or stabilize potential sources of contamination, and either eliminate or significantly reduce the requirement of future surveillance and maintenance of the facility.

PROJECT DESCRIPTION: This project would decontaminate and decommission the remaining Boiling Water Reactor Experiment (BORAX)-V facility by one of two alternatives:

1. Dismantlement would restore the Boiling Water Reactor Experiment (BORAX)-V site at the Idaho National Engineering Laboratory to its natural condition. Dismantling would involve the removal of the Boiling Water Reactor Experiment (BORAX)-V and Boiling Water Reactor Experiment (BORAX)-II/III/IV reactor vessels and removal of remaining facility systems (including a sump and associated structural material) from the basements. After removal of the reactor vessels, piping, and equipment, the walls of the reactor building and adjacent areas would be decontaminated to acceptable release limits. The reactor building foundation would be demolished to a minimum of 6 feet below grade. The site would then be backfilled, graded to resemble existing contours in the area, and revegetated.
2. Entombment would involve limited removal of wastes followed by backfilling the reactor vessels and building and installing a concrete cap. Because this action would not involve excavation, cultural resources would not be impacted, airborne pollutant emissions would

be minimal, industrial hazards to workers would be reduced, and residual contamination and radiation fields would remain in place under concrete containment.

Entombment would generate significantly less airborne pollutant emissions because minimal excavation would be conducted. Also, significantly less solid waste would be generated, consisting of lead shielding, instruments containing mercury, and a small amount of combustible material that would not be contaminated.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May.

Project Data Sheet			Rev. 7 May 16, '96			
G • n • r l c l n f o .	Description/function:	BORAX-V D & D	D	Solid wastes:		
	WAG	10	&	Type:	LLW	MLLW
	EIS Alter. (A, B, C or D):	A, B, C, D	D	Quantity: (m3)	460	3.0
	SNF or Waste stream:	BR		Haz./Toxic Chemicals:		HW
	Action type:	D & D (May use entombment)		Storage/inventory		Ind.
	Structure Type:	Building		Cultural resource effects:		
	Size: (m2)	Borax-717 (12 x 26 m)		Pits/ponding created: (m2)		
	Other features: (Pits, ponds, power /water/sewer lines)	None		Water usage: (liters)		
	Location:			Energy requirements:		
	Inside/outside of fence	Inside EBR-I		Electrical: (MWH/yr)		0
Inside/outside of bldg.	Inside Borax-V		Fossil fuel: (liters)			
D & D I n f o r m a t i o n	Cost(\$): Pre D&D	\$1.3 Mil.		Nightlights used: Y/N		No
	Cost(\$): D&D	\$1.6 Mil.		Generators: Night Y/N		No
	Schedule Start /End: Pre D&D	1993 - 1994		Day Y/N		Yes
	Schedule Start /End: D&D	1995 - 1996				
	No. of workers: (new/exist)	6 - 8 Existing				
	Heavy Equip. Equip. used:	Trucks				
	Trips:	25 to RWMC/WERF				
	Acres Disturbed: New	0				
	Previous	0.2				
	Revegetated	all				
Air Emissions:						
(None / Ref.)	See Belanger et al., 1994					
Effluents:						
Type:	LLW	MLLW				
Quantity: (liters)	3,000	100 - 500				

HIGH-LEVEL TANK FARM REPLACEMENT (UPGRADE PHASE)

PROJECT NAME: High-Level Tank Farm Replacement (Upgrade Phase)

This previously evaluated and approved project is expected to be in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to design, construct, and start up modifications to the existing Idaho Chemical Processing Plant high-level waste tank farm ancillary systems. These modifications would (a) provide compliance with the Notice of Noncompliance Consent Order, (b) provide compliance with the Notice of Violation Consent Order, and (c) resolve other maintenance and as low as reasonably achievable issues. The Notice of Noncompliance Consent Order compliance date is December 31, 1995; the Notice of Violation Consent Order compliance date is December 31, 1996.

PROJECT DESCRIPTION: Design for this project has been completed. The construction contract was awarded June 1993; construction is currently in progress.

All valve boxes, transfer piping and pressure/vacuum relief piping being upgraded by this project are for Idaho Chemical Processing Plant tank farm systems that must remain in service through at least the "cease use" dates (March 2009 for five tanks; June 2015 for six tanks) established in the Consent Order for the eleven existing high-level waste storage tanks. Some transfer lines and valves would remain permanently in service if new replacement tanks are constructed.

Detailed upgrade requirements and actions are the following:

1. Two valve boxes (B2 and B3) require secondary containment improvement. Secondary containment piping is being installed.
2. Five valve boxes (C28, C29, C30, C31, C38) require a second form of leak detection. Conductivity probes are being installed.

-
3. Twenty-five valve boxes require replacement valves because of as low as reasonably achievable and other maintenance considerations. The existing valves have exceeded their useful life, have become highly failure prone, and are no longer supported by the manufacturer. New top loading ball valves, with remote maintenance capability, are being installed.
 4. Six valve boxes (A6, B2, B3, B4, B5, B9) must have their tops raised to grade to accommodate the new valve systems and to allow the secondary containment improvements in boxes B2 and B3.
 5. The tile-encased pipe from Building CPP-641 to valve box C-29 must be replaced because of incompatibility of the secondary containment. A new double-encased, stainless steel transfer pipe is being installed.
 6. Tile-encased pipes at Building CPP-604 must be replaced because of incompatibility of the secondary containment. This action would be accomplished by providing a new valve box C-40 and the associated double encased stainless steel replacement piping. Five existing valve boxes are being demolished.
 7. The pressure/vacuum relief pipe from all eleven tanks must be replaced to resolve radiation safety and as-low-as-reasonably-achievable considerations. The existing pipe is carbon steel and physically deteriorated. New stainless steel pipe is being installed.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

DOE-ID (U.S. Department of Energy, Idaho Operations Office), 1993, *Environmental Assessment - High-level Waste Tank Farm Replacement Project for the Idaho Chemical Processing Plant at the Idaho National Engineering Laboratory*, DOE/EA-0831, U.S. Department of Energy, Idaho Falls, Idaho, June.

Project Data Sheet				Rev. 7	May 16, '96	
G	Description/function:	High-Level Tank Farm Replacement (upgrade phase)		C	Cultural resource effects:	None identified
e				o	Pits/ponding created: (m2)	No
n	WAG	3		n	Water usage: (liters)	None
e	EIS Alter. (A, B, C or D):	A, B, C, D		s	Energy requirements:	
r	SNF or Waste stream:	HLW		t	Electrical: (MWH/yr)	
l	Action type:	Upgrade		.	Fossil fuel: (liters)	170 k Diesel, 3.8 k Propane
c	Structure Type:	Piping & Valves			Nightlights used: Y/N	No
l	Size: (m2)				Generators: Night Y/N	No
n	Other features:	None			Day Y/N	No
f	(Pits, ponds, power /water/sewer lines)			O	Cost(\$): Operation:	Operations will continue with no increase in cost or personnel
o				p	Schedule Start /End:	
.	Location:			e	No. of workers: (new/exist)	
	Inside/outside of fence	Inside ICPP		r	Heavy Equip. Equip. used:	
	Inside/outside of bldg.	Outside Tanks		a	Trips:	
C	Cost(\$): PreConst.	\$7 Mil.		t	Air Emissions:	
o	Cost(\$): Const.	\$45 Mil.		l	(None / Ref.)	
n	Schedule Start /End: PreConst.	1991 - 1993		o		
s	Schedule Start /End: Const.	1993 - 1996		n		
t	No. of workers: (new/exist)	67 - 100 Subs.		a	Effluents:	
r	Heavy Equip Equip. used:	Trucks		l	Type:	
u	Trips:	4 to RWMC			Quantity: (liters/yr)	
c	Acres Disturbed: New	0		l	Solid wastes:	
t	Previous	2.8		n	Type:	
l	Revegetated	0		f	Quantity: (m3/yr)	
o	Air Emissions:			o	Haz./Toxic Chemicals:	
n	(None / Ref.)	See Belanger et al., 1994		r	Storage/inventory	
l	Effluents:			m	Pits/ponds used: Y/N (m2)	
n	Type:	MLLW		a	Water usage: (liters/yr)	
f	Quantity: (liters)	200		t	Energy requirements:	
o	Solid wastes:			l	Electrical: (MWH/yr)	
.	Type:	LLW	MLLW	o	Fossil fuel: (liters/yr)	
	Quantity: (m3)	300	10	n	Nightlights used: Y/N	
			HW		Generators: Night Y/N	
			10		Day Y/N	
	Haz./Toxic Chemicals:	None				
	Storage/inventory					

TRANSURANIC STORAGE AREA ENCLOSURE AND STORAGE PROJECT

PROJECT NAME: Transuranic Storage Area Enclosure and Storage Project

This previously evaluated and approved project (DOE 1992) is expected to be in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to construct a facility to retrieve and re-store transuranic waste to allow compliance with Resource Conservation and Recovery Act storage requirements and the Idaho National Engineering Laboratory's Part B Resource Conservation and Recovery Act Permit.

PROJECT DESCRIPTION: This project would provide for the retrieval and re-storage of Transuranic Storage Area waste by constructing and operating the Retrieval Enclosure, Waste Storage Facility, support facilities, and associated upgrades to utilities. Transuranic Storage Area waste is located in the Radioactive Waste Management Complex.

This project summary describes both the Transuranic Storage Area Enclosure Facility Project and the Storage Facility Project. The projects are described together because the Environmental Assessment included both activities and to facilitate documentation and review activities.

Since 1970, Department of Energy defense-generated and other contact-handled transuranic waste has been placed in 20-year retrievable storage at the Transuranic Storage Area. Presently, approximately 65,000 cubic meters (850,000 cubic yards) of contact-handled transuranic waste is stored in drums and boxes that are stacked on three asphalt pads (Transuranic Storage Area-1, -2, -R) and in two nearby air support weather shield buildings at the Transuranic Storage Area. Approximately 80 percent of the waste is on these pads and is covered with 1 to 1.5 meters (3 to 4 feet) of soil and/or with a fabric tarpaulin. The remaining 20 percent of the waste is stored in two air support weather shield buildings.

Approximately 95 percent of the waste stored at the Transuranic Storage Area is estimated to be contaminated with chemically hazardous substances regulated under the Resource Conservation and Recovery Act, Toxic Substances Control Act, and the Idaho Hazardous Waste Management Act. The existing storage methods and configurations do not comply with these and other Federal and State requirements and regulations.

Because retrievable storage of Transuranic Storage Area waste began in 1970 at the Radioactive Waste Management Complex, some of the waste containers have been stored for over 20 years. It has been conservatively estimated, based on limited container integrity inspections and deterioration studies, that up to 10 percent of the Transuranic Storage Area waste containers may be breached. This possibility of breached waste containers presents the problem of potential radiological and hazardous chemical contamination of the environment unless retrieval and re-storage occur and increases the need for an enclosure during retrieval.

This project would provide capabilities to retrieve and re-store wastes in new permitted storage buildings designed to meet requirements of the Resource Recovery Conservation Act/Toxic Substances Control Act/Idaho Hazardous Waste Management Act. The design would incorporate the flexibility required to accommodate future modifications and adaptations for various waste forms and compositions present at the Radioactive Waste Management Complex. The facility and support equipment would have a minimum design life of 25 years. Wastes characterized and repackaged at the Waste Characterization Facility would be transferred to the Waste Storage Facility for permitted storage until the waste can be disposed of at either a geologic repository such as the Waste Isolation Pilot Plant, as low-level waste at another disposal facility, or until appropriate treatment can be performed.

The Retrieval Enclosure would be a metal building that would enclose Transuranic Storage Area Pads 1, 2, and R. The Waste Storage Facility would consist of a series of individual preengineered metal buildings. The Waste Storage Facility would replace the current air support weather shield buildings and would be a Resource Conservation and Recovery Act-permitted storage facility providing a larger storage capacity. The support facilities would include an operations control building. Utility upgrades to support the project would include fire water, potable water, electric power, communications, alarms, and sewage.

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The retrieval process would consist of four steps:

1. Removing and disposing of the soil covering the waste (not applicable for waste retrieved from the Air Support Weather Shield buildings).
2. Removing the waste containers from the Air Support Weather Shield buildings (which would be done as part of Radioactive Waste Management Complex operations) and from Transuranic Storage Area Pads 1, 2, and R (which would take place within the Retrieval Enclosure).
3. Surveying the containers during retrieval for contamination and integrity and decontaminating or overpacking the containers, if necessary.
4. Re-storing the waste in the weather-protected, Resource Conservation and Recovery Act-permitted Waste Storage Facility.

Transuranic Storage Area enclosure waste would be retrieved at a rate of approximately 2,100 cubic meters, (2,750 cubic yards) or 10,000 drum equivalents per year [1 drum equivalent = 0.21 cubic meters (0.275 cubic yards)]. This activity would continue for approximately 25 years. This throughput may be expanded if breached or contaminated containers are encountered at a lower rate than the 10 percent assumed for design analyses. Should greater numbers of breached or contaminated containers be encountered, the retrieval rate of 10,000 drum equivalents per year would not be exceeded.

Of the storage modules in the Waste Storage Facility, three would be complete by 1994; all would be complete by 1996. The Retrieval Enclosure would be complete by 1996, and the Operations Control Building would be complete by 1994.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

DOE, 1992, *Environmental Assessment for the Retrieval and Re-Storage of Transuranic Storage Area Waste*, Idaho National Engineering Laboratory, U.S. Department of Energy, DOE/EA-0692.

Project Data Sheet			Rev. 7 May 24, '96	
G • n • r l c l n f o .	Description/function:	TSA Enclosure and Storage Project	C Cultural resource effects:	None identified
	WAG	7	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	1,420 k
	SNF or Waste stream:	TRU	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Ops. Building 2,200	. Fossil fuel: (liters)	920 k Diesel, 184 k Propane
	Size: (m2)	Enclosure 29,430	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Storage 24,080	Generators: Night Y/N	No
		Utilities	Day Y/N	Yes
	Location:		O Cost(\$): Operation:	\$5 Mil./yr
Inside/outside of fence	Inside RWMC except 2 acres	p Schedule Start /End:	1994 - 2025	
Inside/outside of bldg.	Outside	e No. of workers: (new/exist)	47 New	
C o n s t r u c t i o n a l f o r m a t i o n .	Cost(\$): PreConst.	Completed	r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$139.2 Mil.	a Trips:	
	Schedule Start /End: PreConst.	Completed	t Air Emissions:	
	Schedule Start /End: Const.	1993 - 1996	l (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	150 Peak Subs.	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	l Type:	None
			Quantity: (liters/yr)	
	Acres Disturbed: New	2	n Solid wastes:	
	Previous	10.4	l Type:	LLW Ind.
	Revegetated	0	Quantity: (m3/yr)	1 85
o n l f o r m a t i o n .	Air Emissions:		o Haz./Toxic Chemicals:	
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	None
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	1,325 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	5,000
	Type:	Industrial	Fossil fuel: (liters/yr)	415 k
	Quantity: (m3)	800	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:		Generators: Night Y/N	No
	Storage/inventory		Day Y/N	No

WASTE CHARACTERIZATION FACILITY

PROJECT NAME: Waste Characterization Facility

This project (DOE 1994) is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to provide the INEL with a waste characterization facility for transuranic waste and reclassified low-level waste as required by the Resource Conservation and Recovery Act.

PROJECT DESCRIPTION: This project would provide the design, construction and operation of a Waste Characterization Facility at the Radioactive Waste Management Complex on the INEL. The Waste Characterization Facility would provide facilities to open containers of contact-handled transuranic waste, reclassified low-level waste, and mixed low-level waste; obtain and examine samples; and repackage the characterized waste in an environment designed to contain alpha-type radiation.

The facility would perform the following specific functions:

- Verify waste forms and radionuclides contained in representative samples of waste stored in containers that have been certified using nondestructive examination techniques at the Stored Waste Examination Pilot Plant.
- Sample waste in containers for characterization and analysis required by the Waste Isolation Pilot Plant Waste Acceptance Criteria. Data would be used to assign and verify waste codes, complete labels and manifests, and to prepare waste profile data forms required for shipment and disposal.
- Identify waste forms and composition to aid in planning future treatment and disposal facilities for wastes that do not meet certification criteria for Waste Isolation Pilot Plant.

-
- Demonstrate container opening, waste handling, and packaging equipment required for future treatment facilities.
 - Provide experimental and pilot-scale treatment process mockup and testing to support future treatment facilities.
 - Provide facilities for visual characterization of unknown waste contents.
 - Provide facilities for removal of items from containers that otherwise could be certified for disposal.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

DOE (U.S. Department of Energy), 1994, *Environmental Assessment (draft) for Waste Characterization Facility*, Idaho National Engineering Laboratory, U.S. Department of Energy, DOE/EA-0906.

Project Data Sheet			Rev. 7 May 24, '96	
G • n • r l c l n f o .	Description/function:	Waste Characterization Facility	C Cultural resource effects:	None identified
	WAG	7	o Pits/ponding created: (m2)	2 lagoons (3,200 m2 each)
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	TRU	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	128 k Diesel, 25.5 k Propane
	Size: (m2)	4,200	Nightlights used: Y/N	No
	Other features: (Pits, ponds, power /water/sewer lines)	Utilities	Generators: Night Y/N Day Y/N	No Yes
	Location:		O Cost(\$): Operation:	\$5 Mil./yr
	Inside/outside of fence	Inside RWMC	p Schedule Start /End:	1998 - 2023
C o n s t r u c t l o n f o r m a t i o n	Inside/outside of bldg.	Outside	e No. of workers: (new/exist)	36 Existing
	Cost(\$): PreConst.	\$8.6 Mil.	r Heavy Equip. Equip. used:	Trucks
	Cost(\$): Const.	\$29.4 Mil.	a Trips:	6 trips/week
	Schedule Start /End: PreConst.	1990 - 1995	t Air Emissions:	
	Schedule Start /End: Const.	1995 - 1997	l (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	80 Subs.	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	l Type:	LLW
	Trips:	1,000 trips in 4 months 1995	Quantity: (liters/yr)	1,000
	Acres Disturbed: New	0	l Solid wastes:	
	Previous	2.1	Type:	LLW MLLW TRU HW Ind.
l f o n f o r m a t i o n	Revegetated	0	Quantity: (m3/yr)	66 1 0.5 1 20
	Air Emissions:		o Haz./Toxic Chemicals:	None
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	
	Effluents:		m Pits/ponds used: Y/N (m2)	Yes (lagoons)
	Type:	Construction Water	a Water usage: (liters/yr)	360 k
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	10,000
	Type:	Industrial	. Fossil fuel: (liters/yr)	5.5 k Diesel, 900 k Propane
	Quantity: (m3)	1,200	n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	None	Generators: Night Y/N Day Y/N	No No
.	Storage/inventory			

WASTE HANDLING FACILITY

PROJECT NAME: Waste Handling Facility

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of this project is to construct and operate a Waste Handling Facility at Argonne National Laboratory-West that has the following seven proposed objectives:

1. Provide an indoor storage area for low-level waste and mixed low-level waste that is already packaged and awaiting shipment for final disposal.
2. Provide an indoor 90-day storage and repackaging area [as defined in 40 CFR 262.34(a)] for hazardous waste and for polychlorinated biphenyl wastes regulated by the Toxic Substances Control Act per 40 CFR 761.65(b).
3. Provide an indoor storage area for recyclable excess items awaiting shipment to the INEL excess area, including Resource Conservation and Recovery Act-regulated recyclable materials, such as batteries and lead scrap.
4. Provide an area and equipment for the sorting, segregation, and dumpster loading of solid wastes.
5. Provide monitoring equipment for performing bulk radiological surveys of all nonradioactive wastes to ensure that no radiological wastes are released to the environment or shipped to a nonpermitted facility.
6. Provide controlled aboveground outdoor tank systems for storage of waste oil and ethylene glycol awaiting recycling.

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7. Provide a controlled outdoor storage area for nonradioactive metal and wood scrap.

PROJECT DESCRIPTION: The Waste Handling Facility at Argonne National Laboratory-West would provide a central point for waste receipt, sorting, storage, and transportation from Argonne National Laboratory-West. The wastes would include low-level radioactive waste, mixed low-level waste, hazardous waste, polychlorinated biphenyl-contaminated waste, and solid (non-radioactive, non-hazardous) waste. The facility would contain the following:

- Hazardous waste storage area
- Municipal sanitary waste (cold waste) sorting area
- Contact-handled radioactive waste storage area
- Excess items (nonradioactive, nonhazardous) storage area
- Offices.

The 650 cubic meter (7,000 cubic foot) Waste Handling Facility would provide room for the monitoring of all solid waste generated at Argonne National Laboratory-West for radioactive contamination and presence of hazardous materials.

- Hazardous wastes are accumulated at over 40 hazardous waste satellite accumulation areas located throughout the Argonne National Laboratory-West site. In the hazardous waste storage area, the new facility would accept hazardous wastes from the satellite accumulation areas following the filling of the waste container or termination of the waste process. The Waste Handling Facility would store the wastes in a dedicated hazardous waste storage room until shipment from Argonne National Laboratory-West. A smaller room (the Drum Fill Room) would be dedicated to the combining of like wastes into a single container, reducing the number of shipments offsite. Hazardous wastes with recycle potential would be combined and identified.

-
- The municipal sanitary waste sorting area would provide for (a) monitoring all solid waste generated at Argonne National Laboratory-West for radioactive contamination and presence of hazardous materials and (b) sorting waste to recover recyclable materials. In anticipation of Resource Conservation and Recovery Act proposed Subtitle D requirements and to assist in meeting DOE waste minimization requirements, this facility would provide a means of establishing a maximum recycling effort. Tank storage for waste oil and ethylene glycol would also be provided.
 - The Waste Handling Facility would include a storage area for contact-handled low-level radioactive wastes generated at Argonne National Laboratory-West. Radioactive materials would be packaged at the Argonne National Laboratory-West generating facility and sent to the Waste Handling Facility for storage pending shipment to the Radioactive Waste Management Complex, the Waste Experimental Reduction Facility, or the Radioactive Mixed Waste Storage Facility, all located on the INEL. Covered storage of radioactive materials would satisfy requirements of DOE Orders 5400.5 and 5820.2A to protect personnel and the environment from releases of radioactive materials.
 - The Waste Handling Facility would include controlled (fenced) outdoor storage areas for scrap wood and metal that have been verified to be nonradioactive/nonhazardous. Scrap wood/metal segregation would allow for recycling.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryat., 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

Rev. 8

May 24, '96

Project Data Sheet			Rev. 8	May 24, '96
General Information	Description/function:	Waste Handling Facility	C Cultural resource effects:	None identified
	WAG	9	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	LLW MLLW HW	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	o Fossil fuel: (liters)	18 k Diesel, 3.6 k Propane
	Size: (m2)	650	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	360 m3 concrete None	Generators: Night Y/N	No
	Location:		Day Y/N	Yes
	Inside/outside of fence	Inside ANL-W	O Cost(\$): Operation:	\$550 k/yr
Inside/outside of bldg.	Outside	p Schedule Start /End:	1997 - 2017	
Construction	Cost(\$): PreConst.	\$130 K	e No. of workers: (new/exist)	5 Existing
	Cost(\$): Const.	\$2.7 Mil.	r Heavy Equip. Equip. used:	Trucks
	Schedule Start /End: PreConst.	1995 - 1996	a Trips:	148/yr to RWMC / WERF / CFA / PBF
	Schedule Start /End: Const.	1996 - 1997	t Air Emissions:	
	No. of workers: (new/exist)	16 Subs.	i (None / Ref.)	See Appendix F, Section 3
	Heavy Equip. Equip. used:	Trucks	a Effluents:	
	Trips:		i Type:	HW
	Acres Disturbed: New	0	o Quantity: (liters/yr)	8,000
	Previous	0.3	n Solid wastes:	
	Revegetated	0	o Type:	LLW Ind. HW
Information	Air Emissions:		o Quantity: (m3/yr)	20 170 2
	(None / Ref.)	See Belanger et al., 1994	r Haz./Toxic Chemicals:	
	Effluents:		o Storage/inventory	None
	Type:	Construction Water	m Pits/ponds used: Y/N (m2)	No
	Quantity: (liters)		a Water usage: (liters/yr)	
	Solid wastes:		t Energy requirements:	
	Type:	Industrial	i Electrical: (MWH/yr)	160
	Quantity: (m3)	75	o Fossil fuel: (liters/yr)	300kW diesel, 192 hr/yr (24.5 k l/yr)
	Haz./Toxic Chemicals:	None	n Nightlights used: Y/N	Yes
	Storage/inventory		o Generators: Night Y/N	No
		Day Y/N	No	

HEALTH PHYSICS INSTRUMENT LAB

PROJECT NAME: Health Physics Instrument Lab

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal, and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of the Health Physics Instrument Lab Project is to provide a technologically up-to-date facility that safely accommodates the programmatic and operational needs of the health physics program at the INEL.

PROJECT DESCRIPTION: The existing Health Physics Instrument Lab is located in Central Facilities Area Building 633, which was originally designed for the World War II naval gun testing program. The facility is 40 years old, has significant structural and mechanical deficiencies, and was constructed with asbestos wallboard. The final disposition of Building 633 would not be part of this project.

This project would provide the design, construction, and operation of a replacement facility to accommodate the Health Physics Instrument Lab at the INEL. The new facility would provide approximately 2,400 square meters (23,000 square feet) of space divided among four major areas: (a) shipping, receiving, and storage; (b) instrument control and repair; (c) laboratory operations; and (d) office and support areas.

The Health Physics Instrument Lab would provide portable health physics monitoring instrumentation and direct reading dosimetry procurement, calibration, and maintenance, along with research and development support services to the INEL and others. The existing Health Physics Instrument Lab maintains National Institute of Standards and Technology quality calibration services and provides support in specification and acceptance evaluation of new radiological instrumentation. These instruments are calibrated and maintained in compliance with standards of the American National Standards Institute and are used to accurately measure exposure of personnel from radiological sources and to ensure a safe and healthy workplace for INEL workers.

All instrumentation returned to the Health Physics Instrument Lab would be brought to the shipping and receiving area, surveyed for contamination, and decontaminated. Once the instrument is checked in, it would have an "as found" determination performed to check the condition of the instrument. Defective instruments would then be repaired per recommended repair procedures.

After repair, each instrument would have a reproducibility check performed before actual calibration adjustments are made. The actual calibration control adjustment procedure would depend on the type of readout for the instrument. Calibrations would be performed in the gamma well lab, gamma lab, beta lab, x-ray lab, low-level lab, or low-scatter lab as required. After calibration, the instrument would have a calibration sticker attached and placed in storage.

In addition to calibrations, the Health Physics Instrument Lab would provide technical support and standard irradiations for the Operational Dosimetry Unit. These irradiations would be performed in the panoramic lab, alpha/beta irradiation lab, low-level lab, or low-scatter lab as required. The dosimeter assembly room would be used for disassembly before irradiation and assembly after irradiation of the dosimeters.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

Project Data Sheet			Rev. 7 May 24, '96	
G e n e r a l c o n f o r m	Description/function:	Health Physics Instrument Lab	C Cultural resource effects:	None identified
	WAG	4	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	Infrastructure	s Energy requirements:	
	Action type:	New	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	54 k Diesel, 11 k Propane
	Size: (m2)	2,140	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	1,100 m3 concrete no utility upgrades needed	Generators: Night Y/N	No
			Day Y/N	Yes
			O Cost(\$): Operation:	\$1.3 Mil./yr
C o n s t r u c t i o n a l i n f o r m	Location:	Inside CFA Outside CFA-625	p Schedule Start /End:	2001 to 2030 - 2050
	Inside/outside of fence		e No. of workers: (new/exist)	2 Existing
	Inside/outside of bldg.		r Heavy Equip. Equip. used:	None
	Cost(\$): PreConst.	\$1 Mil.	t Trips:	
	Cost(\$): Const.	\$13.3 Mil.	i Air Emissions:	See Appendix F, Section 3
	Schedule Start /End: PreConst.	1991 - 1998	o (None / Ref.)	
	Schedule Start /End: Const.	1999 - 2000	n Effluents:	
	No. of workers: (new/exist)	20 Subs.	i Type:	LLW HW
	Heavy Equip. Equip. used:	Trucks	Quantity: (liters/yr)	< 600 No increase
	I n f o r m	Acres Disturbed: New	0	n Solid wastes:
Previous		1.3	i Type:	LLW Ind. HW
Revegetated		0	Quantity: (m3/yr)	< 0.5 25 16.4
Air Emissions:		See Belanger et al., 1994	o Haz./Toxic Chemicals:	<SARA/CERCLA reportable amounts
(None / Ref.)			r Storage/inventory	
Effluents:		Construction Water	m Pits/ponds used: Y/N (m2)	N
Type:			a Water usage: (liters/yr)	4.4 M liters/yr
Quantity: (liters)			t Energy requirements:	Electrical Heat
Solid wastes:		Industrial	i Electrical: (MWH/yr)	210
Type:		600	o Fossil fuel: (liters/yr)	None
o n f o r m	Quantity: (m3)		n Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	None	Generators: Night Y/N	No
	Storage/inventory		Day Y/N	No

RADIOLOGICAL AND ENVIRONMENTAL SCIENCES LABORATORY REPLACEMENT

PROJECT NAME: Radiological and Environmental Sciences Laboratory Replacement

This project is expected to be evaluated, approved, and in process as of June 1, 1995. It is included in EIS Alternatives A (No Action), B (Ten-Year Plan), C (Minimum Treatment, Storage, and Disposal), and D (Maximum Treatment, Storage, and Disposal).

GENERAL PROJECT OBJECTIVE: The proposed general objective of the Radiological and Environmental Sciences Laboratory Replacement Project is to provide updated analytical and support capabilities for the environmental, oversight, and standardization programs of DOE, the United States Geological Survey, and the INEL.

PROJECT DESCRIPTION: The Radiological and Environmental Sciences Laboratory currently includes buildings CFA-690, CFA-676, and CFA-638 located at the Central Facilities Area within the INEL site boundaries. CFA-690 includes the Director's Office, the Analytical Chemistry Branch, Environmental Sciences Branch, Laboratory Quality Branch, and Radiological Sciences Branch; and offices for the EG&G Idaho Operational Dosimetry Unit and the United States Geological Survey. CFA-638 is used for irradiation (beta, gamma, x-ray, and neutron) of dosimeters. CFA-690 was constructed in 1963, CFA-676 is a 1963 Butler storage building, and CFA-638 is a 1950 munitions bunker, all of which are inadequate for current operational requirements and have various code deficiencies. The potential decontamination and decommissioning of existing facilities would not be part of this action.

This project would provide for the design, construction, and operation of replacement test, office, and storage facilities with the capability to support environmental surveillance programs, oversee certain DOE contractor activities nationwide, and provide services as a DOE standardization laboratory.

This project would provide approximately 5,300 square meters of laboratory and office space to consolidate Radiological and Environmental Sciences Laboratory operations, correct existing facility deficiencies, and provide additional space to meet the demand of expanding Radiological

and Environmental Sciences Laboratory activities. The replacement facility would include the enhanced ability to conduct beta, gamma, x-ray, and neutron dosimetry irradiations and would streamline sample receipt and flow through the testing process. The facility would include controlled environment labs, chemical and biological labs, a central library, a secure sample and record storage area, a loading dock, a receiving room, a computer room and waiting room for whole body count clients, and sufficient office space to support the facility personnel.

REFERENCES:

Belanger, R., J. Raudsep, and D. A. Ryan, 1994, *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs*, (Draft unnumbered report), Science Applications International Corporation, Idaho Falls, ID, May 1994.

Project Data Sheet			Rev. 7 May 24, '96	
G • n • r l c l n f o .	Description/function:	RESL Replacement	C Cultural resource effects:	None identified
	WAG	4	o Pits/ponding created: (m2)	No
	EIS Alter. (A, B, C or D):	A, B, C, D	n Water usage: (liters)	
	SNF or Waste stream:	Infrastructure	s Energy requirements:	
	Action type:	New -- Replace	t Electrical: (MWH/yr)	
	Structure Type:	Building	. Fossil fuel: (liters)	85 k Diesel, 17 k Propane
	Size: (m2)	5,300	Nightlights used: Y/N	Yes
	Other features: (Pits, ponds, power /water/sewer lines)	Parking lot, road, power, water sewer lines	Generators: Night Y/N	No
			Day Y/N	Yes
	Location:		O Cost(\$): Operation:	\$200 k/yr
Inside/outside of fence	Inside CFA	p Schedule Start /End:	2001 - 2031	
Inside/outside of bldg.	Outside CFA-690	e No. of workers: (new/exist)	40 Existing	
C o n s t r u c t i o n a l f o r m a t i o n .	Cost(\$): PreConst.	\$1.1 Mil.	r Heavy Equip. Equip. used:	None
	Cost(\$): Const.	\$25 Mil.	a Trips:	
	Schedule Start /End: PreConst.	1995 - 1998	t Air Emissions:	
	Schedule Start /End: Const.	1999 - 2000	l (None / Ref.)	See Appendix F, Section 3
	No. of workers: (new/exist)	60 Subs.	o Effluents:	
	Heavy Equip. Equip. used:	Trucks	l Type:	LLW
			Quantity: (liters/yr)	100
	Acres Disturbed: New	0	l Solid wastes:	
	Previous	2.8	Type:	TRU LLW MLLW HW Ind.
	Revegetated	0	Quantity: (m3/yr)	0.1 1 0.1 0.1 600
o n l f o r m a t i o n .	Air Emissions:		o Haz./Toxic Chemicals:	
	(None / Ref.)	See Belanger et al., 1994	r Storage/inventory	
	Effluents:		m Pits/ponds used: Y/N (m2)	No
	Type:	Construction Water	a Water usage: (liters/yr)	174,000
	Quantity: (liters)		t Energy requirements:	
	Solid wastes:		l Electrical: (MWH/yr)	2000
	Type:	Industrial	Fossil fuel: (liters/yr)	290 k Propane
	Quantity: (m3)	1,500	o Nightlights used: Y/N	Yes
	Haz./Toxic Chemicals:	None	n Generators: Night Y/N	No
	Storage/inventory		Day Y/N	No

APPENDIX D ACRONYMS AND ABBREVIATIONS

A			
A1W	Large Ship Reactor Prototype	ARMF	Advanced Reactivity Measurement Facility
AAC	acceptable air concentration	ARN	Asbestos Removal Notification
AACC	acceptable air concentration of carcinogens	ARPA	Archeological Resources Protection Act
AAQS	Idaho Ambient Air Quality Standards	ARVFS	Army Reentry Vehicle Entry Site
ACGIH	American Conference of Government Industrial Hygienists	ASB	Air Support Building
AE	architectural engineering	ASWS	air support weather shield
AEA	Atomic Energy Act of 1954	ATR	Advanced Test Reactor
AIRFA	American Indian Religious Freedom Act	B	
ALARA	as low as reasonably achievable	BA	Bachelor of Arts Degree
ANL-W	Argonne National Laboratory-West	BACT	best available control technology
ANSI	American National Standards Institute	BEIR V	Biologic Effects of Ionizing Radiation (NAS-NRC committee)
APCE	air pollution control equipment	BLEVE	boiling liquid-expanding vapor explosion
App.	Appendix	BLM	U.S. Bureau of Land Management
APS	atmospheric protection system	BORAX	Boiling Water Reactor Experiment
ARA	Auxiliary Reactor Area	BS	Bachelor of Science Degree
ARAR	applicable or relevant appropriate requirement		

C		DCG	Derived Concentration Guide
CAA	Clean Air Act	DEIS	Draft Environmental Impact Statement
CEQ	Council on Environmental Quality	DEQ	Division of Environmental Quality (State of Idaho)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	DOE	U.S. Department of Energy
		DOE-CH	U.S. Department of Energy-Chicago Operations Office
CFA	Central Facilities Area	DOE-Chicago	U.S. Department of Energy-Chicago Operations Office
CFC	chlorofluorocarbons		
CFR	Code of Federal Regulations	DOE-ID	U.S. Department of Energy-Idaho Operations Office
CFRMF	Coupled Fast Reactivity Measurement Facility	DOI	U.S. Department of the Interior
CH-TRU	contact-handled transuranic waste	DOT	U.S. Department of Transportation
CHP	Certified Health Physicist	DRCT	Dry Rod Consolidation Technology
Ci	curies	DVF	Drum Venting Facility
cm	centimeters		
COCA	Consent Order and Compliance Agreement		
D		E	
COE	Corps of Engineers	EA	Environmental Assessment
CPP	Chemical Processing Plant	EBR-I	Experimental Breeder Reactor No. 1
CTF	Core Test Facility	EBR-II	Experimental Breeder Reactor No. 2
CWA	Clean Water Act	ECF	Expended Core Facility
		EDE	effective dose equivalent
		EDF	Engineering Design File
D&D	decontamination and decommissioning	EIS	Environmental Impact Statement
dBA	decibel A-weighted		
DBA	design basis accident		

EM	Environmental Restoration and Waste Management (DOE Headquarters)	FFCA	Federal Facilities Compliance Agreement
EMT	emergency medical technician	FMC	Food, Machinery, and Chemical Corporation
EO	Executive Order (U.S. President)	FONSI	Finding of No Significant Impact
EP	environmental program	FPR	fuel processing restoration
EPA	Environmental Protection Agency	FR	Federal Register
ER&WM	Environmental Restoration and Waste Management	FSA	Fuel Storage Area
ERPG	Emergency Response Planning Guide	FSV	Fort St. Vrain
ERPG3	Emergency Response Planning Guide Level 3	FTE	full-time employee
ES	Executive Summary	FWHA	Federal Highway Administration
ESF	engineered-safety features	FWS	U.S. Fish and Wildlife Service
exp.	exposure	FY	fiscal year

G H

F			
FAST	Fluorinel Dissolution Process and Fuel Storage	GPP	General Plant Project
FDM	frequency division multiplex	GTCC	greater-than-Class-C (waste)
FDM	Fugitive Dust Model	haz.	hazardous
FDP	fluorinel dissolution process	HEPA	high-efficiency particulate air (filter)
FECF	Fuel Element Cutting Facility	HFEF	Hot Fuel Examination Facility
FFA/CO	Federal Facility Agreement and Consent Order	HLLW	high-level liquid waste
FFC Act	Federal Facility Compliance Act	HLW	high-level waste
		HPIL	Health Physics Instrument Laboratory
		HTRE-3	Heat Transfer Reactor Experiment No. 3

HW	hazardous waste	ILTSF	Intermediate-Level Transuranic Storage Facility
HWMA	Hazardous Waste Management Act	ind.	industrial
HWSF	Hazardous Waste Storage Facility	INEL	Idaho National Engineering Laboratory
I		INPS	Idaho Natural Plant Society
		IPC	Idaho Power Company
IAEA	International Atomic Energy Agency	IRC	INEL Research Center
IAG	Interagency Agreement	ISC2	Industrial Source Complex 2
IAQB	Idaho Air Quality Bureau (now known as Division of Environmental Quality)	ISDE	Idaho State Department of Employment
IBO	Idaho Branch Office (of Pittsburgh Naval Reactors)	ISU	Idaho State University
IC	industrial/commercial waste	IWPF	Idaho Waste Processing Facility
ICPP	Idaho Chemical Processing Plant	J K L	
ICRP	International Commission on Radiation Protection	JD	Juris Doctor (Doctor of Law)
IDE	Idaho Department of Education	K	one thousand
IDHW	Idaho Department of Health and Welfare	kl	kiloliters
IDLH	immediate danger to life or health	km	kilometers
IDO	Department of Energy-Idaho Operations Office reports	kV	kilovolt
IDWR	Idaho Department of Water Resources	l	liters
IET	Initial Engine Test	LDR	Land Disposal Restrictions
IFSF	Irradiated Fuel Storage Facility	LLW	low-level waste
		M	
		m	meters
		MA	Master of Arts Degree

MACT	maximum achievable control technology	NCRP	National Council on Radiation Protection
MCL	maximum containment level	NDE/NDA	nondestructive examination/ nondestructive analysis
MCW	maximally exposed co-located worker	NEC	National Electrical Code/ Nuclear Energy Center
MEI	maximally exposed individual	NEPA	National Environmental Policy Act of 1969
mil.	millions		
MLLW	Mixed Low-Level Waste	NESHAP	National Emission Standard for Hazardous Air Pollutants
MLLWTF	Mixed Low-Level Waste Treatment Facility	NHPA	National Historic Preservation Act
MPA	Master's Degree in Public Affairs	NIOSH	National Institute for Occupational Safety and Health
mrem	millirem		
MRW	mixed radioactive waste	NOA	notice of availability
MS	Master of Science Degree	NOAA	National Oceanic and Atmospheric Association
MTHM	metric tons of heavy metal	NODA	Naval Ordnance Disposal Area
MTR	Materials Test Reactor		
MW	mixed waste	NOI	Notice of Intent
MWH	megawatt hours	NON	Notice of Noncompliance
		NOO	Notice of Opportunity
N			
NA, N/A	not applicable	NPDES	National Pollutant Elimination Discharge Systems
NAAQS	National Ambient Air Quality Standards	NPL	National Priority List
NAGPRA	Native American Graves Protection and Repatriation Act	NPR	New Production Reactor
		NPRD	New Production Reactor Department
NAS	National Association of Science	NPS	National Park Service
NCR	notification of change report		

NRC	U.S. Nuclear Regulatory Commission	PREPP	Process Experimental Pilot Plant
NRF	Naval Reactors Facility	PSAWT	private sector alpha low-level waste treatment
NSC	National Security Council	PSD	prevention of serious deterioration
NTIS	National Technical Information Service	PSD	plant safety document
NUREG	Nuclear Regulatory Guide	PTC	permit to construct
NWCF	New Waste Calcining Facility	PTI	Protection Technology Idaho
NWPA	Nuclear Waste Policy Act of 1982	PTO	permit to operate
NYSERDA	New York State Energy Research and Development Authority	Q R	
O P		R&D	Research and Development
OCRWM	Office of Civilian Radioactive Waste Management	RCRA	Resource Conservation and Recovery Act
OIP	operating internal pressure	RESL	Radiological and Environmental Sciences Laboratory
ops.	operations	RFP	Request for Proposal
ORR	Oak Ridge Reservation	RI/FS	Remedial Investigation/ Feasibility Study
OSHA	Occupational Safety and Health Administration	RLWTF	Radioactive Liquid Waste Treatment Facility
PBF	Power Burst Facility	RMWSF	Radioactive Mixed Waste Storage Facility
PCB	polychlorinated biphenyl	ROD	Record of Decision
pCi	picocuries	ROI	region of influence
PEW	process equipment waste	RSAC-5	Radiological Safety Analysis Computer Program
PhD	Doctor of Philosophy Degrec	RSWF	Radioactive Scrap and Waste Facility
PMF	probable maximum flood		
PNL	Pacific Northwest Laboratory		

RW	radioactive waste		Management Programs Environmental Impact Statement
RWMC	Radioactive Waste Management Complex		
RWMIS	Radioactive Waste Management Information System	SPERT	Special Power Excursion Reactor Test
		SPF	Sodium Process Facility
		spp.	species
S		SSC	species of special concern (State of Idaho)
S1W	Submarine Thermal Reactor		
S5G	Submarine Reactor	SWEPP	Solid Waste Examination Pilot Plant
SAA	Satellite Accumulation Area (process waste)	SWMU	solid waste management unit
SAJC	Science Applications International Corporation		T
SAR	Safety Assessment Report	TAN	Test Area North
SARA	Superfund Amendments and Reauthorization Act	TBD	to be determined
scfm	standard cubic feet per minute	TCE	tetrachloroethylene
SDA	Subsurface Disposal Area	TCLP	toxicity characterization leaching procedure
SDWA	Safe Drinking Water Act	TEDE	total effective dose equivalent
SF	support facilities	THEF	Thermal Hydraulic Experiment Facility
SL-1	Stationary Low-Power Reactor No. 1	TLD	thermoluminescent dosimeters
SMC	Specific Manufacturing Complex	TLV-TWA	threshold limit value/ time-weighted average
SNF	spent nuclear fuel	TMI	Three-Mile Island
SNF and INEL EIS	Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste	TPSP	TAN (Test Area North) Pool Stabilization Project
		TRA	Test Reactor Area
		TRANSAX	transportation accident exercise

TRD	Technical Resource Document	WCF	Waste Calcining Facility
TRU	transuranic waste	WEC	Westinghouse Electric Corporation
TRUPACT	transuranic packaging container	WEDF	Waste Experimental Development Facility
TSA	Technical Support Annex	WERF	Waste Experimental Reduction Facility
TSA	Transuranic Storage Area	WHF	Waste Handling Facility
TSCA	Toxic Substances Control Act	WIF	Waste Immobilization Facility
TSD	Treatment, Storage, or Disposal (Facility)	WINCO	Westinghouse Idaho Nuclear Company
TSD	Technical Support Document	WIPP	Waste Isolation Pilot Plant
TSF	Technical Support Facility	WM	waste management
U		WMO	World Meteorological Organization
UCRL	University of California Research Laboratory	WMO	Waste Management Office
UCW	utility cooling water	WNYNSC	Western New York Nuclear Service Center
USBC	U.S. Bureau of the Census	WRRTF	Water Reactor Research Test Facility
USC	United States Code	WTD	waste technology development
USGS	U.S. Geological Survey	WVDP	West Valley Demonstration Project
UTM	Universal Transverse Mercator	WWSB	Waste Experimental Reduction Facility Waste Storage Building
V W		X Y Z	
VOC	volatile organic compound	ZPPR	Zero Power Physics Reactor
VVE	vapor vacuum extraction		
WAG	Waste Area Group		
WCC	Warning Communication Center		

APPENDIX E

GLOSSARY

Terms in this glossary are defined based on the context in which they are used in this EIS.

100-year flood A flood event of such magnitude it occurs on average, every 100 years (equates to a 1 percent probability of occurring in any given year).

500-year flood A flood event of such magnitude it occurs on average, every 500 years (equates to a 0.2 percent probability of occurring in any given year).

absorbed dose The energy imparted by ionizing radiation per unit mass of irradiated material. The unit of absorbed dose is the rad.

accelerator produced radioactive material Radioactive material that was produced in a charged particle accelerator.

acceptable ambient concentration for a carcinogen (AACC) Ambient air quality standards based on the probability of developing excess cancers over a 70-year lifetime exposure to one microgram per cubic meter ($1\mu\text{g}/\text{m}^3$) of a given carcinogen and expressed in terms of a screening emission level or an acceptable ambient concentration for a carcinogenic toxic air pollutant.

acceptable ambient concentration for a non-carcinogen (AAC) Ambient air quality standards based on occupational exposure limits for airborne toxic chemicals expressed in terms of a screening emission level or an acceptable ambient concentration for a non-carcinogenic toxic air pollutant.

accident An unplanned sequence of events that results in undesirable consequences.

acute exposure The absorption of a relatively large amount of hazardous material (or intake of hazardous material) over a short period of time.

adsorption The attraction and adhesion of ions or molecules in a gaseous or aqueous state to a solid surface.

air pollutant Any substance, including but not limited to dust, fume, gas, mist, odor, smoke, vapor, pollen, soot, carbon, or particulate matter that is regulated.

air quality The specific measurement in the ambient air of a particular air pollutant at any given time.

air quality criteria The varying amounts of pollution and lengths of exposure at which specific adverse effects to health and welfare take place.

air quality standard The prescribed level of a pollutant in the outside air that cannot be exceeded during a specified time in a specified geographical area. Established by both Federal and State governments.

alluvium Sedimentary material deposited by flowing water, as in a riverbed or delta.

alpha-emitter A radioactive substance that decays by releasing an alpha particle.

alpha low-level waste Waste that was previously classified as transuranic waste but has a transuranic concentration lower than the currently established limit for transuranic waste. Alpha low-level waste requires additional controls and special handling. This waste stream cannot be accepted for onsite disposal under the current waste acceptance criteria; therefore, it is special-case waste.

alpha-particle A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2.

ambient air That portion of the atmosphere outside of buildings to which the general public has access.

applicable or relevant and appropriate requirements (ARARs) Requirements, including cleanup standards, standards of control, and other substantive environmental protection requirements and criteria for hazardous substances as specified under Federal and State law and regulations, that must be met when complying with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

aquifer A body of rock or sediment sufficiently permeable to conduct groundwater and to yield significant quantities of water to wells and springs.

as low as reasonably achievable (ALARA) A process by which a graded approach is applied to maintaining dose levels to workers and the public, and releases of radioactive materials to the environment as low as reasonably achievable.

attainment area Any area which is designated, pursuant to 42 U.S.C. Section 7407(d) of the Clean Air Act, as having ambient concentrations equal to or less than national primary or secondary ambient air quality standards for a particular air pollutant or air pollutants.

atomic number The number of positively charged protons in the nucleus of an atom and the number of electrons on an electrically neutral atom.

background level The value assigned to the quantity of particulate or gaseous material in ambient air which originates from natural sources uninfluenced by the activity of man.

background radiation Radiation from cosmic sources, naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices.

basalt A general term for dark-colored, fine-grained igneous rock. Commonly extrusive and composed primarily of calcic plagioclase and pyroxene minerals.

baseline For purposes of this EIS, the conditions projected to exist in June 1995, the scheduled date for the Record of Decision, against which the environmental consequences of the various alternatives are evaluated.

below regulatory concern A definable amount of low-level waste that is sufficiently small that it can be deregulated with minimal risk to the public.

best available control technology (BACT) An emission standard (including fuel cleaning or treatment or innovative fuel combination techniques) for control of such contaminants. BACT shall be determined on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, and shall be at least as stringent as any applicable Sections of 40 CFR Part 60 and 40 CFR Part 61. If an emissions standard is infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed as BACT.

beta-emitter A radioactive substance that decays by releasing a beta particle.

beta-particle A charged particle emitted from a nucleus during radioactive decay, with a mass equal to 1/1837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

beyond design basis accidents Accidents of the same type as a distinct design basis accident (fire, earthquake, and so forth) but defined by parameters that exceed in severity the parameters defined for the distinct design basis accident.

breeder reactor A type of nuclear reactor that creates more fissionable fuel than it uses.

buffer zone An area designed to separate. Specifically, the portion of a disposal site that is controlled by the licensee and that lies under and between the disposal units and the boundary of the site.

by-product material (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (b) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content [Atomic Energy Act 11(e)]. By-product material is exempt from regulation under the Resource Conservation and Recovery Act.

calcination The process of converting high-level waste to a unconsolidated granules or powder (also called calcining).

calcine The materials produced by a calcination.

canning The process of placing spent nuclear fuel in canisters to retard corrosion, contain radioactive releases, or control geometry.

certification plan See waste certification plan.

certified waste Waste that has been confirmed to comply with the waste acceptance criteria of the treatment, storage, or disposal facility for which it is intended under an approved waste certification program.

certifying authority or official An organization or person outside the waste generator line organization who is responsible for certifying that the waste being sent to a treatment, storage, or disposal facility meets the requirements of the receiving facility's waste acceptance criteria.

characterization The determination of waste composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done for the purpose of determining appropriate storage, treatment, handling, transportation, and disposal requirements.

chronic exposure The absorption of hazardous material (or intake of hazardous materials) over a long period of time (for example, over a lifetime).

cladding The outer jacket of fuel elements and targets usually made of aluminum, stainless steel, or zirconium-aluminum alloy, used to prevent fuel corrosion and retain fission products during reactor operation, or to prevent releases into the environment during storage.

Class I area Under the Clean Air Act, any Federal land that is classified or reclassified "Class I." The designation applies to pristine areas, such as national parks and wilderness areas, where substantial growth is effectively precluded in order to avoid any degradation of the air quality.

clean waste Waste products that are neither radioactive nor hazardous but require appropriate disposal in a solid waste landfill.

closure Deactivation, stabilization, and surveillance of a waste management unit, landfill, or other facility. Closure often refers to the process under the Resource Conservation and Recovery Act involving the preparation and signing of a Closure Plan.

cold nuclear fuel Nuclear reactor fuel which has not been exposed to a neutron flux in a nuclear reactor.

collective dose The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation. The units of collective dose are person-rem.

co-located workers Workers in a fixed population outside the day-to-day process safety management controls of a given facility area. In practice, this fixed population is normally the workers at an independent facility area located some distance from the reference facility area.

commercial waste management facility A facility located off DOE-controlled property that is not managed by DOE, to which DOE sends waste for treatment, storage, and/or disposal.

committed dose equivalent (H_{50}) The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake. The International Commission on Radiological Protection defines this as the committed equivalent dose.

committed effective dose See committed effective dose equivalent.

committed effective dose equivalent ($H_{E,50}$) The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues. The International Commission on Radiological Protection defines this as the committed effective dose.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) A Federal law (also known as "Superfund") that provides a comprehensive framework to deal with past or abandoned hazardous materials. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment that could endanger public health, welfare, or the environment, as well as the cleanup of inactive hazardous waste disposal sites. CERCLA has jurisdiction over any release or threatened release of any "hazardous substance" to the environment. Under CERCLA, the definition of "hazardous" is much broader than under the Resource Conservation and Recovery Act, and the hazardous substance need not be a waste. If a site meets the CERCLA requirements for designation, it is ranked along with other "Superfund" sites and listed on the National Priorities List. This ranking and listing is the U. S. Environmental Protection Agency's way of determining which sites have the highest priority for cleanup.

committed equivalent dose See committed dose equivalent.

confinement General control of contaminants through engineering design, such as heating and ventilation systems that use high-efficiency particulate air (HEPA) filters to remove contaminants before discharge to the atmosphere. Such systems may break down or experience a loss of electric power that would "lose confinement" temporarily. This may require evacuation of the structure but would not lead to significant consequences to workers or a significant release.

Consent Order and Compliance Agreement (COCA) A legally binding agreement signed in 1987 between the U.S. Department of Energy Idaho Field Office (DOE-ID), U.S. Environmental Protection Agency Region 10 (EPA Region 10), and the U.S. Geological Survey (USGS). This agreement addressed environmental restoration activities at the INEL. The COCA was superseded by the Federal Facilities Agreement/Consent Order, among DOE-ID, EPA Region 10, and the State of Idaho, signed in December 1991.

contact-handled waste Packaged waste whose external surface dose rate does not exceed 200 millirem per hour.

containerization The process of placing radioactive or other hazardous material in a confining receptacle for storage or shipment. For spent nuclear fuel this is called canning.

containment The provision of a gastight shell or other enclosure around a reactor to confine fission products that otherwise might be released into the atmosphere in the event of an accident.

contamination The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.

contingency plan A document setting out an organized, planned, and coordinated course of action to be followed in case of unanticipated events such as fire, explosion, or other events that may release toxic chemicals, hazardous wastes, or radioactive materials to threaten human health or the environment. The goal of the contingency plan is the containment or mitigation of the event.

continuity of operations Activities that include developing strategic and long-range waste management plans, surveillance and maintenance of facilities and equipment, waste certification, proper training programs for personnel, and record/information administration.

control equipment Any method, process or equipment which removes, reduces, or renders less noxious, air pollutants discharged into the atmosphere.

coolant A gas or liquid circulated through a nuclear reactor to remove or transfer heat.

core The central portion of a nuclear reactor containing the fuel elements, moderator, neutron poisons, and support structures.

criteria air pollutant Under the Clean Air Act, and the State of Idaho air quality regulations, any air pollutant for which there is a State or national ambient air quality standard.

cumulative impact The impact on the environment which results from incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impact can result from individually minor but collectively significant actions taking place over a period of time.

curie (Ci) The basic unit used to describe the intensity of radioactivity in a sample of material. The curie is equal to 37 billion disintegrations per second, which is approximately the rate of decay of 1 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 37 billion disintegrations per second.

decay, radioactive The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha or beta particles, often accompanied by gamma radiation. (See half-life; radioactive.)

decommissioning The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

decontamination The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive

contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

defense waste Radioactive waste from any activity performed in whole or in part in support of DOE atomic energy defense activities; excludes waste from DOE non-defense activities or waste under the purview of the U. S. Nuclear Regulatory Commission or generated by the commercial nuclear power industry.

delta E A parameter used to define color shift in visual impact modeling. It is the primary basis for determining perceptibility of plume visual impact in screening analyses.

design basis accident (DBA) Accidents that are postulated for the purpose of establishing functional requirements for safety significant structures, systems, components, and equipment.

diffusion The process by which a pollutant plume is diluted by turbulent eddies.

discharge Under principles of hydrogeology, the amount of water passing through (or leaving) a given cross-sectional area in a given period of time. Under the Clean Water Act, discharge of a pollutant, which includes any addition of any pollutant or combination of pollutants to waters of the United States from any point source. This definition includes additions of pollutants into waters of the United States from: surfaced runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

dispersion In air pollution, the process of transport and diffusion of airborne contaminants in the atmosphere.

disposal Emplacement of waste in a manner that ensures protection of human health and the environment within prescribed limits for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste.

disposal facility A facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

dissolution The ability of water to take a substance into solution.

DOE orders Requirements internal to the U.S. Department of Energy (DOE) that establish DOE policy and procedures, including those for compliance with applicable laws.

DOE site boundary A geographic boundary within which public access is controlled and activities are governed by the U.S. Department of Energy (DOE) and its contractors, not by local authorities. Based on the definition of exclusion zone, a public road traversing a DOE site is considered to be within the DOE site boundary if DOE or the site contractor has the capability to control the road at any time necessary.

dose (or radiation dose) A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined elsewhere in this glossary.

dose conversion factor Any factor that is used to change an environmental measurement to dose in the units of concern. Frequently used as the factor that expresses the committed effective dose equivalent to a person from the intake (inhalation or ingestion) of a unit activity of a given radionuclide.

dose equivalent The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The unit of dose equivalent is the rem. The International Commission on Radiation Protection defines this as the equivalent dose.

dose rate The radiation dose delivered per unit of time. Measured, for example, in *rem* per hour.

dry storage Storage of spent nuclear fuel in environments where the fuel is not immersed in liquid for purposes of cooling and/or shielding.

earthquake magnitude A measure of earthquake size, determined by taking the common logarithm (base 10) of the largest ground motion recorded during the arrival of a seismic wave type and applying a standard correction for distance to the epicenter. Three common types of magnitude are Richter (or local) (M_L), P body wave (m_b), and surface wave (M_s).

effective dose See effective dose equivalent.

effective dose equivalent (EDE) The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated. It includes the dose from radiation sources internal and/or external to the body and is expressed in units of rem. The International Commission on Radiation Protection defines this as the effective dose.

effluent The wastewater, treated or untreated, that flows out of a facility. Generally effluent is discharged into surface waters.

emission Any controlled or uncontrolled release or discharge into the outdoor atmosphere of any air pollutants or combination thereof. Emission also includes any release or discharge of any air pollutant from a stack, vent, or other means into the outdoor atmosphere that originates from an emission unit.

emission standard A permit or regulatory requirement established by the Idaho Department of Health and Welfare, or a requirement contained in 40 CFR Part 60, 40 CFR Part 61, or the Idaho State Implementation Plan (SIP), which limits the quantity, rate, or concentration of emissions on a continuous basis, including any requirements which limit opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures to assure continuous emission control.

engineered barriers Manmade components of a waste management system or facility designed to prevent or impede the release of radionuclides or other waste material into the biosphere. This includes the waste form, radioactive waste containers, and other materials placed over and around such containers, and physical features of the system or facility.

enriched uranium Uranium that has greater amounts of the fissionable isotope uranium-235 than occurs naturally. Naturally occurring uranium is 0.72 percent uranium-235.

environmental monitoring The process of sampling and analysis of environmental media in and around a facility being monitored for the purpose of (a) confirming compliance with performance objectives and (b) early detection of any contamination entering the environment to facilitate timely remedial action.

environmental restoration Cleanup and restoration of sites, and decontamination and decommissioning of facilities contaminated with radioactive and/or hazardous substances during past production, accidental releases, or disposal activities.

environmental restoration program A DOE subprogram concerned with all aspects of assessment and cleanup of both contaminated facilities in use and of sites that are no longer a part of active operations. Remedial actions, most often concerned with contaminated soil and groundwater, and decontamination and decommissioning are responsibilities of this program.

equivalent dose See dose equivalent.

existing facilities Facilities that are projected to exist as of the Record of Decision for this EIS, scheduled for June 1995.

exposure Being exposed to ionizing radiation or to hazardous material. Alternatively, a measure of the ionization produced in air by x or gamma radiation; the unit of exposure in air is the roentgen.

external accident Accidents initiated by manmade energy sources not associated with operation of a given facility. Examples include airplane crashes, induced fires, transportation accidents adjacent to a facility, and so forth.

external dose That portion of the dose equivalent received from radiation sources outside the body.

facility (a) Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft; or (b) any site or area where a hazardous substance has been deposited, stored, disposed of, placed, or otherwise come to be located.

facility area The area within the DOE site boundary immediately surrounding a facility or group of facilities that functions under process safety management programs and a common emergency response plan. This definition covers any building within such an area regardless of whether it is dedicated to production, waste handling, or administrative issues; for example, an office building, a cafeteria, a production facility, a machine shop, and a waste handling facility all contained within a common boundary. If programs such as radiation protection, training, auditing, and evaluation, are an integral part of safety management at each facility and emergency response plans cover the potential responses of individuals at all buildings, then the collection of buildings constitutes a facility area. All personnel in the area are facility workers, not co-located workers.

facility area boundary The geographic boundary of an area controlled on a daily basis by process safety management and a common emergency response plan.

facility security plan In the context of waste management, a security plan is one that provides the measures required by law, regulation, or good judgment for prevention of unknowing or unauthorized entry into a treatment, storage, or disposal facility; or operation of facility equipment and systems; or access to waste material or spent nuclear fuel.

facility worker Any worker whose day-to-day activities are controlled by process safety management programs and a common emergency response plan associated with a facility or facility area. This definition includes any individual within a facility/facility area or its 0.4-mile exclusion zone. This definition can also include those transient individuals or small populations outside the exclusion zone but inside the radius defined by the maximally exposed co-located worker if reasonable efforts to account for such people have been made in the facility or facility

area emergency plan. For facility accident analyses, the facility worker is defined as an individual located 100 meters (328 feet) downwind of the facility location where an accidental release occurs.

feasibility study (FS) A step in the environmental restoration process specified by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The objectives are to identify the alternatives for remediation and describe a remedial action that satisfies applicable or relevant appropriate requirements (ARARs) for mitigating confirmed environmental contamination. The FS presents a series of specific engineering or construction alternatives for cleaning up a site; for each alternative presented, there will be a detailed analysis of the costs, effects, engineering feasibility, and environmental impacts. The FS is based on information provided in the remedial investigation (RI). Successful completion of an FS should result in a decision (Record of Decision) selecting a remedial action alternative, and the subsequent development of a remedial design for implementation of the selected remedial action.

Federal Facilities Compliance Act (FFCA) Federal law signed in October 1992 amending the Resource Conservation and Recovery Act. The objective of the FFCA is to bring all Federal facilities into compliance with applicable Federal and State hazardous waste laws, to waive Federal sovereign immunity under those laws, and to allow the imposition of fines and penalties. The law also requires the U. S. Department of Energy to submit an inventory of all its mixed waste, and to develop a treatment plan for mixed wastes.

Federal Facility Agreement and Consent Order (FFA/CO) A binding agreement, negotiated pursuant to Section 120 of CERCLA, signed by DOE, the Environmental Protection Agency Region 10, and the State of Idaho, to coordinate cleanup activities at the INEL. The FFA/CO and its Action Plan outline the remedial action process that will encompass all investigation of hazardous substance release sites. The FFA/CO superseded the Consent Order and Compliance Agreement (COCA).

Federal land manager The Secretary of the Federal department with authority over any Federal lands in the United States.

field offices An administrative division of the DOE that operates facilities that are in its jurisdiction.

fiscal year (FY) The time frame specified by any public or private entity to separate one year's financial (fiscal) activities from the next year's. The 1994 Federal Fiscal Year (FY 1994) began on October 1, 1993, and will end September 30, 1994.

fissile material Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by thermal (slow) neutrons. The three primarily fissile materials are uranium-233, uranium-235, and plutonium-239.

fission The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

fission products The nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclides formed by the fission fragments' radioactive decay.

fissionable material Commonly used as a synonym for fissile material, the meaning of this term has been extended to include material that can be fissioned by fast neutrons, such as uranium-238.

fluorides Gaseous or solid compounds containing fluorine emitted into the air from a number of industrial processes.

free liquid Liquid that is not absorbed into host material such that it could readily separate from the solid portion of a waste under ambient temperature and pressure, and spill or drain from its container.

fugitive dust Dust that is stirred up and released into the atmosphere during construction activities. Fugitive emissions composed of particulate matter.

fugitive emissions Those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

gamma-emitter A radioactive substance that decays by releasing gamma radiation.

gamma ray (gamma radiation) High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.

generator (generation) Organizations of the DOE that produce waste.

geologic repository A system that is intended to be used for, or may be used for, the disposal of radioactive waste or spent nuclear fuel in excavated geologic media. A geologic repository includes (a) the geologic repository operations area, and (b) the portion of the geologic setting that provides isolation. A near-surface disposal area is not a geologic repository.

geothermal energy The energy available from natural sources of heat such as hot springs and near-surface heat sources in volcanically active areas.

graded approach A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with (a) the relative importance to safety, safeguards, and security; (b) the magnitude of any hazard involved; (c) the life-cycle stage of a facility; (d) the programmatic mission of a facility; (e) the particular characteristics of a facility; and (f) any other relevant factor.

graphite fuel Fuel that consists of small pellets of highly enriched uranium (HEU) -carbide fuel surrounded by protective layers of other carbide compounds. These pellets are dispersed in much larger graphite structures for handling and neutron moderation.

greater-than-Class-C waste (GTCC) Low-level radioactive waste that is generated by the commercial sector and that exceeds U. S. Nuclear Regulatory Commission concentration limits for Class-C low-level waste as specified in 10 CFR 61. DOE is responsible for the disposal of greater-than-Class-C wastes from DOE nondefense programs.

groundwater Generally, all water contained in the ground. Water held below the water table available to freely enter wells.

grouting Grouting is the process of immobilizing or fixing solid forms of waste so they can be more safely stored or disposed.

half-life The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from millionths of a second to billions of years. Also called physical half-life.

hazard classification A safety classification based on potential onsite consequences. Criteria for this classification are discussed in DOE Order 5480.23 (Nuclear Safety Analysis Reports).

hazardous air pollutant Any air pollutant subject to a standard promulgated under 42 U.S.C. Section 7412 or other requirements established under 42 U.S.C. Section 7412 of the Clean Air Act, including 42 U.S.C. Section 7412(g), (j), and (r) of the Clean Air Act.

hazardous substance Any substance that when released to the environment in an uncontrolled or unpermitted fashion becomes subject to the reporting and possible response provisions of the Clean Water Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

hazardous waste Under the Resource Conservation and Recovery Act, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Source, special nuclear material, and byproduct material, as defined by the Atomic Energy Act, are specifically excluded from the definition of solid waste.

hazardous waste landfill A disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, or a cave.

heavy metals Metallic elements with high atomic weights (for example, mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations and tend to accumulate in the food chain.

heterogeneous Pertaining to a substance having different characteristics in different locations. A synonym is nonuniform.

high-efficiency particulate air (HEPA) filter A filter with an efficiency of at least 99.95 percent used to separate particles from air exhaust streams prior to releasing that air to the atmosphere.

high-level waste The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High-level waste may include other highly radioactive material that the U. S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.

hot cell/hot cell facility A heavily shielded enclosure for handling and processing (by remote means or automatically), or storing highly radioactive materials.

hydraulic conductivity Capacity of a porous media to transport water.

hydraulic gradient The slope of the water table per unit of distance resulting in groundwater movement.

hydrogeochemistry The study of the chemical interactions between the earth's components, including rocks, minerals, and water.

hydrogeology The study of the geological factors relating to water.

hydrology The study of water, including groundwater, surface water, and rainfall.

Infiltrate Water passing from the land surface through the vadose zone into the aquifer.

Intermittent surface water A stream, creek, or river which does not contain water during part or all of the year.

Inadvertent intrusion The inadvertent disturbance of a disposal facility or its immediate environment by a potential future occupant that could result in loss of containment of the waste or exposure of personnel. Inadvertent intrusion is a significant consideration that shall be included either in the design requirements or waste acceptance criteria of a waste disposal facility.

Incineration The efficient burning of combustible solid and liquid wastes to destroy organic constituents and reduce the volume of the waste. Incinerators are designed to burn with an extremely high efficiency. The greater the burning efficiency, the cleaner the air emission. Incineration of radioactive materials does not destroy the radionuclides but does significantly reduce the volume of these wastes. High-efficiency particulate air (HEPA) filters are used to prevent radionuclides and heavy metals from going out of the stack and into the atmosphere.

Industrial commercial waste Material that is not subject to Resource Conservation and Recovery Act Subtitle C or Atomic Energy Act regulation. It is generated by manufacturing or industrial processes. Industrial commercial waste is also known as solid waste, and is regulated by Resource Conservation and Recovery Act, Subtitle D.

Institutional control The control of waste management facilities by human institutions.

Interagency Agreement (IAG) See Federal Facility Agreement/Consent Order.

Interim status facility See RCRA interim status facility.

Interim action (CERCLA) A remedial action undertaken to cleanup or contain a potential threat to human health and the environment that can or should be addressed within a short timeframe. The study associated with an interim action may be completed within an "umbrella" remedial investigation/feasibility study. Interim actions are completed on an accelerated schedule and generally deal with well-defined contamination problems that present a significant, although not immediate, threat to human health and the environment.

Interim action (NEPA) An action which may be undertaken while work on a required program EIS is in progress, and the action is not covered by an existing program statement. An interim action may not be undertaken unless such action: (a) is justified independently of the program; (b) is itself accompanied by an adequate EIS or has undergone other NEPA review; and (c) will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

Internal accidents Accidents that are initiated by man-made energy sources associated with the operation of a given facility. Examples include process explosions, fires, spills, criticalities, and so forth.

Inversion In the atmosphere, a condition in which air temperature warms with increasing altitude.

Isotope One of two or more atoms with the same number of protons, but different numbers of neutrons, in their nuclei. Thus, carbon-12, carbon-13, and carbon-14 are isotopes of the element carbon, the numbers denoting the approximate atomic weights. Isotopes have very nearly the same chemical properties, but often different physical properties (for example, carbon-12 and -13 are stable, carbon-14 is radioactive).

Kjeldahl nitrogen A method of nitrogen analysis designed to measure nitrogen present as part of organic compounds.

Land Disposal Restrictions A Resource Conservation and Recovery Act (RCRA) program that restricts land disposal of RCRA hazardous and RCRA mixed wastes and requires treatment to promulgated treatment standards. Land Disposal Restrictions identify hazardous wastes that are restricted from land disposal and define those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.

land-use planning A decision-making process to determine the future or end use of a parcel of land, considering such factors as current land use, public expectations, cultural considerations, local ecological factors, legal rights and obligations, technical capabilities, and costs.

lapse In the atmosphere, a condition in which air temperature cools with increasing altitude.

less-than-90-day storage The onsite accumulation and/or storage of hazardous waste for a period of less than 90-days by a generator subject to the requirements of 40 CFR 262.34(a).

life cycle The entire time period from generation to permanent disposal or elimination of waste.

liquid metal fast breeder reactor A reactor that operates using a type of fission known as fast fission where the neutrons that are used to split the atoms are not slowed down or moderated as is usually the case with normal fission. It creates more fissionable material than it consumes and uses liquid metal as a coolant. Liquid sodium is a common metal used to cool this type of reactor.

listed waste Under the Resource Conservation and Recovery Act, waste listed in 40 CFR 261, Subpart D, as hazardous. Listed hazardous wastes include wastes from specific sources, non-specific sources, and discarded commercial chemical products. These wastes have not been subjected to the toxicity characterization leaching procedure because the dangers they present are considered self-evident.

long-term storage The storage of hazardous waste (a) onsite (a generator site) for a period of 90-days or greater, other than in a satellite accumulation area, or (b) offsite in a properly managed treatment, storage, or disposal facility for any period of time.

low-level waste Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic elements is less than 100 nanocuries per gram.

major radionuclides The radioisotopes that together comprise 95 percent of the total curie content of a waste package by volume and have a half-life of at least 1 week. Radionuclides that are important to a facility's radiological performance assessment and/or a safety analysis and are listed in the facility's waste acceptance criteria are considered major radionuclides.

management (of spent nuclear fuel) Emplacing, operating, and administering facilities, transportation systems, and procedures in order to ensure safe and environmentally responsible handling and storage of spent nuclear fuel pending (and in anticipation of) a decision on ultimate disposition.

maximally exposed co-located worker (MCW) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for co-located workers. This individual is located at whichever is the greater of 0.4 miles from the facility area boundary (that is, the exclusion zone boundary) or 75 percent of the distance to the nearest independent facility area (that is, the low population zone boundary). The MCW is irrelevant if the DOE site boundary is closer than the MCW location.

maximally exposed individual (MEI) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed offsite individual (MOI).

maximally exposed offsite individual (MOI) A hypothetical individual defined to allow dose or dosage comparison with numerical criteria for the public. This individual is located at the point on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed individual (MEI).

maximum concentration level These are the maximum concentrations of radionuclides in water estimated to correspond to a lifetime cancer risk of 1/10,000, assuming a lifetime daily consumption of 2 liters of water. These concentrations assume radionuclides emit only one type of radiation. For nonradioactive, noncarcinogenic compounds, maximum concentration levels are based on no observable effect levels.

maximum contaminant level (MCL) Under the Safe Drinking Water Act, the maximum permissible concentrations of specific constituents in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set as maximum contaminant levels take into account the feasibility and cost of attaining the standard.

metric tons of heavy metal (MTHM) Quantities of unirradiated and spent nuclear fuel and targets are traditionally expressed in terms of metric tons of heavy metal (typically uranium), without the inclusion of other materials, such as cladding, alloy materials, and structural materials. A metric ton is 1,000 kilograms, which is equal to about 2,200 pounds.

millirem One thousandth of a rem (see rem).

mitigation Activities, feed stock, and/or design changes incorporated to control contaminant emissions.

mixed waste Waste that contains both hazardous waste under the Resource Conservation and Recovery Act and source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954.

mixing depth The height to which pollutants can freely disperse above which inversion conditions exist.

nanocurie One billionth of a curie (see curie).

National Environmental Policy Act of 1969 (NEPA) A law that requires Federal agencies to include in their decision-making processes appropriate and careful consideration of all potential environmental effects of proposed actions, analyses of their alternatives, and measures to avoid or minimize adverse effects of a proposed action which have the potential for significantly affecting the environment. These analyses are presented in either an environmental assessment (EA) or in an environmental impact statement (EIS).

National Oceanic and Atmospheric Administration (NOAA) A Federal agency that collects and analyzes information on the weather. NOAA has an office at INEL for collecting weather information. NOAA also is involved with the environmental monitoring programs at INEL.

National Priorities List (NPL) A formal listing of the nation's worst hazardous waste sites, as established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), that have been identified for remediation.

natural phenomena accidents Accidents that are initiated by phenomena such as earthquakes, tornadoes, floods, and so forth.

near-surface disposal Disposal in the uppermost portion of the earth, approximately 30 meters. Near-surface disposal includes disposal in engineered facilities that may be built totally or partially above-grade provided that such facilities have protective earthen covers. A near-surface disposal facility is not considered a geologic repository.

nearest public access For facility accident analyses, the location of the nearest public highway where members of the public could be present.

new facilities Any facility that is not an existing facility or an existing hazardous waste management facility.

nitrogen oxides (NO_x) Gases formed in great part from atmospheric nitrogen and oxygen when combustion takes place under conditions of high temperature and high pressure; considered a major air pollutant. Two major nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO₂) are important airborne contaminants. In the presence of sunlight, nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide, which in high enough concentrations can cause lung damage.

nonattainment area Any area which has been designated as not meeting (or contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.

non-certifiable waste Waste that is not able to meet the waste acceptance criteria for the intended treatment, storage, or disposal facility; transportation requirements; or waste that may be too difficult to characterize adequately to prove that it meets the applicable criteria.

nonreactor nuclear facility Those activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or to the general public. These activities or operations include producing, processing, or storing radioactive liquid or solid waste, fissionable materials, or tritium; conducting separation operations; conducting inspections of irradiated materials, fuel fabrication, decontamination, or recovery operations; conducting fuel enrichment operations; or performing environmental remediation or waste management activities involving radioactive materials.

nonhazardous Waste that does not pose risks to human health and the environment. Industrial/commercial waste is an example (see hazardous waste).

normal conditions All activities associated with a facility mission, whether operation, maintenance, storage, and so forth, which are carried out within a defined envelope. This envelope can be design process conditions, performance in accordance with procedure, and so forth.

normal operation All normal conditions and those abnormal conditions that frequency estimation techniques indicate occur with a frequency greater than 0.1 events per year.

NO_x A generic term used to describe the oxides of nitrogen (see nitrogen oxides).

nuclear criticality A self-sustaining chain reaction, which releases neutrons and energy, and generates radioactive byproduct material.

nuclear fuel Materials that are fissionable and can be used in nuclear reactors to make energy.

nuclide A general term referring to all known isotopes, both stable (279) and unstable (about 5,000), of the chemical elements.

off-link doses Doses to members of the public within 800 meters (2,625 feet) of a road or railway.

offsite facility A facility located at a different site or location than the shipper.

offsite population For facility accident analyses, the collective sum of individuals located within an 80-kilometer (50-mile) radius of the INEL facility and within the path of the plume with the wind blowing in the most populous direction.

on-link doses Doses to members of the public sharing a road or railway.

onsite The same or geographically contiguous property that may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing as opposed to going along the right-of-way. Non-contiguous properties owned by the same person but connected by a right-of-way that he/she controls and to which the public does not have access is also considered onsite property.

onsite facilities Buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed onsite.

operable unit A discrete portion of a Waste Area Group (WAG) consisting of one or many release sites considered together for assessment and cleanup activities. The primary criteria for placement of release sites into an operable unit include geographic proximity, similarity of waste characteristics and site types, and the possibilities for economy of scale.

operator The organization that operates a facility.

organic compounds Chemicals containing mainly carbon, hydrogen, and oxygen. Petroleum products, petroleum-based solvents, and pesticides are examples of organic compounds. Exposure to some organic compounds can produce toxic effects on body tissues and processes.

orphan wastes Wastes in a classification that currently has no long-term disposal scheduled or anticipated. An example of an orphan waste is low-level mixed waste. It is probably not radioactive enough to qualify for disposal at the Waste Isolation Pilot Plant and cannot be disposed of onsite because it has hazardous components.

orthophosphate The phosphate ions including H_2O_4 , HPO_4^{2-} , and PO_4^{3-} .

overpack A secondary container placed around a primary container to provide additional protection to or from the contents of a waste package, or enclose a damaged primary container.

package The packaging plus its contents.

packaging A receptacle and any other components or materials necessary for the receptacle to perform its required containment function.

particulate matter Any material, except water in uncombined form., that exists as a liquid or a solid at standard conditions.

perched water A discontinuous saturated water body above the water table with unsaturated conditions existing both above and below.

perennial surface water A stream, creek, lake, pond, or river which contains water year round.

performance assessment A systematic analysis of the potential risks posed by waste management systems to the public and environment, and a comparison of those risks to established performance objectives.

performance assessment limited waste Special case waste comparable to greater-than-Class-C waste but generated by the government. This is a low-level waste but has unique characteristics that make it unsuitable for shallow land burial.

performance-assessment-limited alpha waste Any alpha-contaminated waste, not meeting the definition of transuranic waste, that cannot be disposed of by shallow land burial, based on a documented site-specific performance assessment approved by the DOE Operations Office and Headquarters.

performance objectives Parameters within which a facility must perform to be considered acceptable.

permeability The degree of ease with which water can pass through a rock or soil.

playa The shallow central basin of a desert plain in which water gathers and then evaporates.

plume The three-dimensional area containing measurable concentrations of a compound or element which has migrated from its source point.

PM-10 All particulate matter in the ambient air with an aerodynamic diameter less than or equal to a nominal ten (10) micrometers.

pollutant migration The movement of a contaminant away from its initial source.

pollution prevention The use of any process, practice, or product that reduces or eliminates the generation and release of pollutants, hazardous substances, contaminants and wastes, including those that protect natural resources through conservation or more efficient utilization.

polychlorinated biphenyls (PCBs) A class of chemical substances formerly manufactured as an insulating fluid in electrical equipment that is highly toxic to aquatic life. In the environment, PCBs exhibit many of the characteristics of dichloro diphenyl trichloroethane (DDT); they persist in the environment for a long time and accumulate in animals.

population dose The overall dose to the offsite population.

porosity (n) Porosity is an index of the relative pore volume. It is the total unit volume of the soil or rock divided into the void volume.

preferential pathways Preferred pathways for fluid flow. They are dependent upon the moisture content of the porous media.

pressurized water reactor A nuclear power reactor that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.

primary ambient air quality standard That air quality which, allowing an adequate margin of safety, is requisite to protect the public health.

probable maximum flood The largest flood for which there is any reasonable expectancy in a specific area. The probable maximum flood is normally several times larger than the largest flood of record.

process knowledge The set of information that is used by trained and qualified individuals who are cognizant of the origin, use, and location of waste-generating materials and processes in sufficient detail so as to certify the identity of the waste.

processing (of spent nuclear fuel) Applying a chemical or physical process designed to alter the characteristics of a spent nuclear fuel matrix.

public Anyone outside the DOE site boundary at the time of an accident or during normal operation. With respect to accidents analyzed in this EIS, anyone outside the DOE site boundary at the time of an accident.

quality assurance All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or components will perform satisfactorily and safely in service. Quality assurance includes quality control, which is all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.

quality factor (Q) The modifying factor that is used to derive dose equivalent from absorbed dose.

rad The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram.

radiation (ionizing radiation) Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as it is used here, does not include non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

radiation worker A worker who is occupationally exposed to ionizing radiation and receives specialized training and radiation monitoring devices to work in such circumstances.

radioactive waste Waste that is managed for its radioactive content.

radioactivity The property or characteristic of material to spontaneously "disintegrate" with the emission of energy in the form of radiation. The unit of radioactivity is the curie (or becquerel).

radioisotope An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

radiological survey The evaluation of the radiation hazards accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from unexpected or possible changes in materials or equipment.

Radiological and Environmental Sciences Laboratory (RESL) A facility involved in environmental monitoring of INEL onsite and offsite radiation and research on its effects.

radionuclide See radioisotope.

RCRA See Resource Conservation and Recovery Act.

RCRA accumulation point There are two types of accumulation areas allowed under the Resource Conservation and Recovery Act (RCRA):

Satellite Accumulation Areas (SAAs): Locations where hazardous waste generators are allowed to accumulate waste at or near the point of generation. Generators may accumulate up to 55 gallons of hazardous waste or one quart of acutely hazardous waste at or near the point of generation. Upon reaching 55 gallons, the generator has 72 hours to move the hazardous waste to either a temporary accumulation area or a permitted facility.

Temporary Accumulation Areas (TAAs): Under RCRA, the location where hazardous waste may be stored by a generator without a RCRA permit, TAAs are limited by the amount of time they can store a hazardous waste. Generators may store hazardous wastes for up to 90 days without a permit if the generator complies with other safety and storage requirements, including a personnel training plan, a contingency plan, and an emergency preparedness and response plan.

RCRA Interim status facility Hazardous waste management facilities (that is, treatment, storage, or disposal facilities) subject to Resource Conservation and Recovery Act requirements that were in existence on the effective date of regulations are considered to have been issued a permit on an interim basis as long as they have met notification and permit application submission requirements. Such facilities are required to meet interim status standards until they have been issued a final permit or until their interim status is withdrawn.

RCRA storage A facility used to store Resource Conservation and Recovery Act (RCRA) hazardous waste for greater than 90 days. To be in compliance with the regulatory requirements of RCRA, the facility must meet both documentation requirements (for example, contingency and waste analysis plans) and physical requirements (for example, specific aisle widths and separation of incompatible wastes).

reclassified low-level waste See alpha low-level waste.

Record of Decision (ROD) A public document that records the final decision(s) concerning a proposed action. The Record of Decision is based in whole or in part on information and technical analysis generated either during the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process or the National Environmental Policy Act (NEPA) process, both of which take into consideration public comments and community concerns.

recycling Recycling techniques are characterized as use, reuse, and reclamation techniques (resource recovery). Use or reuse involves the return of a potential waste material either to the originating process as a substitute for an input material or to another process as an input material. Reclamation is the recovery of a useful or valuable material from a waste stream. Recycling allows potential waste materials to be put to a beneficial use rather than going to treatment, storage, or disposal.

regulated substances A general term used to refer to materials other than radionuclides that are regulated by Federal, State, (or possibly local) requirements.

release site A location at which a hazardous, radioactive, or mixed waste release has occurred or is suspected to have occurred. It is usually associated with an area where these wastes or substances contaminated with them have been used, treated, stored, and/or disposed of.

rem The dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray exposure.

remedial investigation (RI) The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations. The RI provides the site-specific information for the feasibility study (FS).

remediation Process of remedying a site where a hazardous substance release has occurred.

remote-handled waste Packaged waste whose external surface dose rate exceeds 200 millirem per hour.

remote handling The handling of wastes from a distance so as to protect human operators from unnecessary exposure.

repository A permanent deep geologic disposal facility for high-level or transuranic wastes and spent nuclear fuel.

representative sample A sample of a universe or whole (for example, waste pile, lagoon, ground water) that can be expected to exhibit the average properties of the universe or whole.

reprocessing (of spent nuclear fuel) Processing of reactor irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle such materials primarily for defense programs. Historically, reprocessing has involved aqueous chemical separations of elements (typically uranium or plutonium) from undesired elements in the fuel.

research reactor A nuclear reactor used for research and development.

Resource Conservation and Recovery Act (RCRA) A Federal law addressing the management of waste. Subtitle C of the law addresses hazardous waste under which a waste must either be "listed" on one of the U. S. Environmental Protection Agency's (EPA's) hazardous waste lists or meet one of EPA's four hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity, as measured using the toxicity characterization leaching procedure (TCLP). Cradle-to-grave management of wastes classified as RCRA hazardous wastes must meet stringent guidelines for environmental protection as required by the law. These guidelines include regulation of transportation, treatment, storage, and disposal of RCRA defined hazardous waste.

Subtitle D of the law addresses the management of nonhazardous, nonradioactive, solid waste such as municipal wastes.

retrieval The process of recovering wastes that have been stored or disposed of onsite so they may be appropriately characterized, treated, and disposed of.

rhyolite A very acid volcanic rock that is the lava form of granite.

risk Quantitative expression of possible loss that considers both the probability that a hazard causes harm and the consequences of that event.

roentgen A unit of exposure to ionizing radiation. It is that amount of gamma or X-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions.

safe and secure Storage with design and operational features that maintain the integrity of the fuel cladding, prevent criticalities, preclude diversion, and so forth. Safe and secure storage would generally meet the intent of DOE Orders, but waivers may be required and granted for some requirements on a case-by-case basis where warranted.

safety analysis report A report, prepared in accordance with DOE Orders 5481.1B and 5480.23, that summarizes the hazards associated with the operation of a particular facility and defines minimum safety requirements.

safety class structures, systems, and components Those systems, structures, or components whose functioning is necessary to keep maximally exposed offsite individual (MOI) exposure below a dose of 25 rem or an Emergency Response Planning Guideline-2 dosage for design basis accidents and evaluation basis accidents.

sanitary landfill A facility for the disposal of solid waste where there is no reasonable probability of adverse effects on health or the environment from disposal of the solid waste at the facility. This facility is not an open dump and is not for disposal of hazardous waste.

sanitary waste Liquid or solid wastes that are generated as a result of routine operations of a facility and are not considered hazardous or radioactive.

satellite accumulation See RCRA accumulation point.

saturated zone That part of the earth's crust in which all naturally occurring voids are filled with water.

scaling factor A multiplier that allows the inference of one radionuclide concentration from another that is more easily measured.

scrubber A device that uses a liquid spray to remove aerosol and gaseous pollutants from an airstream. The gases are removed either by absorption or chemical reaction. Solid and liquid particulates are removed through contact with the spray.

secondary ambient air quality standard That air quality which is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air.

secondary emissions Emissions which would occur as a result of the construction, modification, or operation of a stationary source or facility, but do not come from the stationary source or facility itself.

sedimentary interbeds Rock layers composed of materials such as sand or gravel which are derived from the breakdown of various rocks that are layered between other rock types.

segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

site inspection The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process to acquire the necessary data to confirm the existence of environmental contamination and to assess the associated potential risks to human health, welfare and the environment. The data collected must be sufficient to support the decision either for continuing with a remedial investigation/feasibility study (RI/FS) or for removing the site from further investigation through a decision document.

site waste management organization The functional organization at a DOE site whose responsibility it is to manage waste generated by that site's operations.

sizing The process of reducing the size of various types of solid wastes by compaction, melting, or mechanical reduction.

small quantity generator A generator who generates less than 1,000 kilograms of hazardous waste in a calendar month.

sodium-bearing waste Liquid radioactive waste generated from decontamination of process equipment and other miscellaneous activities at the Idaho Chemical Processing Plant.

sole source aquifer A designation granted by the U. S. Environmental Protection Agency when groundwater from a specific aquifer supplies more than 50 percent of the drinking water for the area overlying the aquifer. Sole source aquifers have no alternative source or combination of sources which could physically, legally, and economically supply all those who obtain their drinking water from the aquifer. Sole source aquifers are protected from federally financially assisted activities determined to be potentially unhealthy for the aquifer.

solid waste Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges, which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended, or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended [Public Law 94-580, 1004(27) (Resource Conservation and Recovery Act)].

solid waste management units (SWMU) Any site, excluding Land Disposal Units, that received or handled solid waste, whether or not hazardous constituents were involved.

solvents Liquid chemicals, usually organic compounds, that are capable of dissolving another substance. Exposure to some organic solvents can produce toxic effects on body tissues and processes.

source material (a) Uranium, thorium, or any other material that is determined by the Nuclear Regulatory Commission pursuant to the provisions of the Atomic Energy Act of 1954, Section 61, to be source material; or (b) ores containing one or more of the foregoing materials, in such concentration as the Nuclear Regulatory Commission may by regulation determine from time-to-time [Atomic Energy Act 11(z)]. Source material is exempt from regulation under the Resource Conservation and Recovery Act.

source term The type and quantity of pollutants emitted to air from a specific source or group of sources.

SO_x A generic term used to describe the oxides of sulfur. The combination of sulfur oxides with water vapor produces acid rain (see sulfur oxides).

special nuclear material (a) Plutonium or uranium enriched in the isotope 233, or in the isotope 235, and any other material that the U. S. Nuclear Regulatory Commission, pursuant to the provisions of the Atomic Energy Act of 1954, Section 51, determines to be special nuclear material; or (b) any material artificially enriched by any of the foregoing, but does not include

source material. Special nuclear material is exempt from regulation under the Resource Conservation and Recovery Act (RCRA).

special-case waste Radioactive waste that has limited or no planned disposal alternatives because it does not fit into the typical management plans developed for the major radioactive waste types or is limited by a facility's performance assessment.

spent nuclear fuel Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. For the purposes of this EIS, spent nuclear fuel also includes uranium/neptunium target materials, blanket subassemblies, pieces of fuel, and debris.

stable Low potential for vertical mixing.

stabilization (of spent nuclear fuel) Actions taken to further confine or reduce the hazards associated with spent nuclear fuel, as necessary for safe management and environmentally responsible storage for extended periods of time. Activities which may be necessary to stabilize spent nuclear fuel include canning, processing, and passivation.

stabilized waste (stability) Treatment or packaging of a waste stream that is intended to ensure that the waste does not structurally degrade and affect overall stability of the disposal site through slumping, collapse, or other types of failures that will lead to water infiltration into the waste. Stabilization is also a factor in limiting exposure to an inadvertent intruder since it provides a recognizable and nondispersible waste.

stakeholder Any person or organization with an interest in or affected by DOE activities. Stakeholders may include representatives from Federal agencies, State agencies, Congress, Native American Tribes, unions, educational groups, industry, environmental groups, other groups, and members of the general public.

stationary source Any building, structure, emissions unit, or installation which emits or may emit any air pollutant.

storage The collection and containment of waste or spent nuclear fuel in such a manner as not to constitute disposal of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity (that is, not short-term accumulation).

storativity Storativity of a saturated aquifer is defined as the volume of water that a unit volume of the aquifer releases from storage under a unit decline in hydraulic head.

sulfur oxides Pungent, colorless gases formed primarily by the combustion of fossil fuels; considered major air pollutants; sulfur oxides may damage the respiratory tract as well as vegetation (see SO_x).

subsurface The area below the land surface (including the vadose zone and aquifers).

superfund The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and its amendments.

superfund site Any site that has been listed on the National Priority List (NPL) because it has been identified by the EPA as having the potential to harm human health and the environment. Study and cleanup activities at these sites are regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). "Superfund" sites at Federal facilities must be cleaned up by the operating agency (lead agency) under the oversight of the U. S. Environmental Protection Agency and other parties to a Federal Facility Agreement.

surface dose The radiological dose emanating from a container of material (waste), usually expressed as a measurement at contact and at one meter.

tank A stationary device designed to contain an accumulation of waste, which is constructed primarily of non-earthen materials (for example, wood, concrete, steel, plastic) which provide structural support.

target A tube, rod, or other form containing material that, on being irradiated in a nuclear reactor would produce a designed end product (that is, uranium-238 produces plutonium-239 and neptunium-237 produces plutonium-238).

technical safety requirement Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and reduce the potential risk to the public and co-located workers from uncontrolled release of radioactive materials, radiation exposure due to inadvertent criticality, or uncontrolled release of non-radiological material or energy hazards.

tectonics Geological structural features as a whole, or a branch of geology concerned with the structure of the crust of a planet and especially with the formation of folds and faults in it.

thermal treatment The treatment of hazardous waste in a device which uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Examples of thermal treatment processes are incineration, molten salt, pyrolysis, calcination, wet air oxidation, and microwave discharge.

total effective dose equivalent The sum of the external dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

total suspended particulates All particulate matter in the ambient air as measured by the method described in Appendix B of 40 CFR Part 50.

toxic air pollutant Under the Idaho Air Quality Control Regulations, any air pollutant that is determined by the Idaho Department of Health and Welfare to be by its nature, toxic to human or animal life or vegetation.

toxic air pollutant reasonably available control technology (T-RACT) An emission standard based on the lowest emission of toxic air pollutants that a particular source is capable of meeting by the application of control technology that is reasonably available, as determined by the Idaho Department of Health and Welfare, considering technological and economic feasibility.

toxicological hazard Any material defined in 40 CFR 355 Appendix A as an extremely hazardous substance.

transient A change in the reactor coolant system temperature and/or pressure. Transients can be caused by adding or removing neutron poisons, by increasing or decreasing the electrical load on the turbine generator, or by accident conditions.

transmissivity The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is a function of properties of the liquid, the porous media, and the thickness of the porous media.

transuranic waste Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, per gram of waste, except for (a) high-level radioactive waste; (b) waste that the U. S. Department of Energy has determined, with the concurrence of the Administrator of the U. S. Environmental Protection Agency, do not need the degree of isolation required by 40 CFR 191; or (c) waste that the U. S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

transuranium radionuclide Any radionuclide having an atomic number greater than 92.

treatment Any method, technique, or process designed to change the physical or chemical character of the waste to render it less hazardous, safer to transport, store or dispose of, or reduced in volume.

treatment facility Land area, structures, and/or equipment used for the treatment of waste or spent nuclear fuel.

ultimate disposition The final step in which a material is either processed for some use or disposed of.

United States Geological Survey (USGS) A Federal agency that collects and analyzes information on geology and geological resources including ground and surface water.

vadose zone The zone between the land surface and the water table. Saturated bodies, such as perched groundwater, may exist in the vadose zone. Also called the zone of aeration and the unsaturated zone.

vapor vacuum extraction (VVE) A technology that applies a vacuum to a well field to remove volatile organic contamination from soils and permeable rock layers in that well field.

vitrification The process of immobilizing waste material that results in a glass-like solid.

volatile organic compound (VOC) Chemical containing mainly carbon, hydrogen, and oxygen that readily evaporates at ambient temperature. Exposure to some organic compounds can produce toxic effects on body tissue and processes.

waste Any waste defined as solid waste by 40 CFR 261.2. Solid waste excluded from regulation by the Resource Conservation and Recovery Act (RCRA) is still considered a waste. This includes wastes of all types (solid, liquid, gaseous, hazardous, radioactive, sanitary, and so forth).

waste acceptance criteria (WAC) The requirements specifying the characteristics of waste and waste packaging acceptable to a waste receiving facility; and, the documents and processes the generator needs to certify that waste meets applicable requirements.

waste acceptance specifications The functions to be performed and the technical requirements for a Waste Acceptance System for accepting spent nuclear fuel and high-level waste into the Civilian Radioactive Waste Management System according to the *Waste Acceptance System Requirements Document* (DOE/RW-0352P, January 1993, Office of Civilian Radioactive Waste Management).

waste analysis plan (WAP) A plan that specifies the parameters for which each waste will be analyzed. These include testing and sampling method(s), timing, and the rationale of the generator or the facility operator responsible for treatment, storage, or disposal. It ensures accurate waste type and composition determinations are made as required by law, regulation, or good judgment.

waste area group (WAG) Ten groupings of release sites under the INEL Federal Facility Agreement and Consent Order (FFA/CO). Groupings are for efficiency in managing the

assessment and cleanup process. Nine of these WAGs are associated with specific facilities and the tenth is associated with the remaining miscellaneous facilities. Each WAG may be broken down into individual operable units.

waste certification A process by which a waste generator certifies that a given waste or waste stream meets the waste acceptance criteria of the facility to which the generator intends to ship waste for treatment, storage, or disposal. Certification is accomplished by a combination of waste characterization, documentation, quality assurance, and periodic audits of the certification program.

waste certification plan A plan or collection of plans used by a generator to specify the means by which waste is prepared and certified to meet applicable waste acceptance and safety criteria; hazardous and radiological waste handling, treatment, transportation, and packaging regulations; and other local or site requirements. Certification plans result in developing the information that the receiving facility needs to confirm the suitability of waste for acceptance.

waste certification program A systematic approach to ensure that waste characterization is conducted in a manner to provide reasonable assurance that the receiving facility's waste acceptance criteria are met. A waste certification program consists of all the functional elements, organizations, and activities necessary to provide reasonable assurance that waste characterization is done with sufficient accuracy to ensure proper handling. These functions can be performed by various organizations.

waste characterization See characterization.

waste container A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal.

waste generation Any waste (after being declared a waste, see "waste") produced during a particular calendar year. This does not include waste produced in previous years that is being repacked, treated, or disposed of in the current calendar year. It does include any secondary waste (for example, clothing, gloves, waste from maintenance operations, and so forth) generated by treatment, storage, or disposal activities of previously generated wastes.

waste generator organization Any organization that is responsible for the individual generators of waste.

Waste Isolation Pilot Plant (WIPP) A facility near Carlsbad, New Mexico, authorized to demonstrate safe disposal of defense-generated transuranic waste in a deep geologic medium.

waste management The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

waste management facility All contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of waste or spent nuclear fuel. A facility may consist of several treatment, storage, or disposal operational units (for example, one or more landfills, surface impoundments, or combinations of them).

waste management program A systematic approach to organize, direct, document, and assess activities associated with waste generation, treatment, storage, or disposal. A waste management program consists of all the functional elements, organizations, and activities that comprise the system needed to properly manage waste. These functions and activities can be performed by various organizations.

waste management systems assessment A systems assessment of the entire low-level waste management (or all of waste management) structure/program at a given site that considers treatment, storage, and disposal, as well as on- and offsite points of generation with an emphasis on optimization of all aspects of the operations, including, but not limited to, protection of human health and the environment, regulatory compliance, and cost effectiveness.

waste minimization An action that economically avoids or reduces the generation of waste by source reduction, by reducing the toxicity of hazardous waste, by improving energy usage, or by recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

waste receiving facility A facility that formally accepts waste from a waste generator organization for treatment, storage, or disposal.

waste segregation The process of separating (or keeping separate) individual waste types and/or forms in order to facilitate their cost-effective treatment and storage or disposal.

waste stream A waste or group of wastes with similar physical form, radiological properties, U. S. Environmental Protection Agency waste codes or associated land disposal restriction treatment standards. It may be the result of one or more processes or operations.

waste type The waste types being considered in this EIS are high-level waste, transuranic waste, mixed low-level waste, low-level waste, hazardous waste, or nonhazardous waste.

water pool A type of facility usually used for the storage of irradiated nuclear materials and spent fuel. The water shields the material being stored while allowing it to be accessible for handling. Sometimes referred to as a water pit.

water table The surface below which is saturated with water (an aquifer), and above which is not saturated with water (the vadose zone).

weathering The process by which rocks are broken down and decomposed by the physical and chemical actions of wind, rain, temperature change, plant colonization, and bacterial activity.

weighing factor (W_T) For an organ or tissue, (T) is the proportion of the risk of health effects (cancer fatalities) resulting from irradiation of that organ or tissue to the total risk of health effects (cancer fatalities) when the whole body is irradiated uniformly.

wet storage Storage of spent nuclear fuel in a pool of water, generally for the purposes of cooling and/or shielding.

zone of aeration See vadose zone.

zone of saturation That part of the earth's crust in which all voids are filled with water.

APPENDIX F

TECHNICAL METHODOLOGIES AND KEY DATA

Appendix F provides information on the methodologies and key data used for six technical disciplines of Volume 2 of the Environmental Impact Statement. Analysts evaluated all disciplines addressed in this Environmental Impact Statement and determined the information necessary to substantiate the content and conclusions given in Chapter 5, Environmental Consequences, for the four alternatives evaluated.

The six disciplines are discussed in the following five sections:

- F-1, Socioeconomics
- F-2, Geology and Water
- F-3, Air Resources
- F-4, Health and Safety
- F-5, Facility Accidents.

Each section is paginated separately and has its own contents and reference section.

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F-1 SOCIOECONOMICS

The socioeconomic impact analysis conducted for this Environmental Impact Statement examines the potential effects of the proposed Idaho National Engineering Laboratory (INEL) alternatives on the social and economic resources of the region of influence, defined in terms of employment, income, population, housing, education, and community services. The changes in U.S. Department of Energy (DOE) expenditures, workforce, and payroll that would occur under each of the alternatives impact the community through their effects on regional business activity and employment. Changes in DOE expenditures for regional goods and services, as well as changes in household expenditures made by INEL employees, affect the level of local business activity generated within the region of influence, the demand for community services (such as health care and public education), and the ability of local government agencies to fund such services.

This analysis evaluates the effects of the proposed alternatives relative to the baseline socioeconomic conditions described in Section 4.3, Socioeconomics. The existing and projected economic conditions in the region of influence provide the framework for assessing the impacts of the socioeconomic effects that may result from implementation of each of the alternatives. The impact analysis, as described in the following methodology section, estimates the effects of the alternatives on regional employment (the number of direct and secondary jobs) and earnings (the sum of wages and salaries, proprietors' income, and other labor income). These employment and earnings effects then generate potential changes in regional population and demand for housing and community services.

In general, the results of the impact analysis indicate that each of the proposed alternatives would generate initial increases in employment within the region of influence, primarily due to planned construction activities. Alternatives A (No Action) and C (Minimum Treatment, Storage, and Disposal), which include phaseout of the Expanded Core Facility, would result in employment declines by 2004, while Alternatives B (Ten-Year Plan) and D (Maximum Treatment, Storage, and Disposal) would result in employment increases. However, the projected decreases in baseline expenditures and employment at INEL are of sufficient magnitude to offset any increases projected as a result of the proposed alternatives. As a consequence, the

cumulative socioeconomic impact of INEL activity over the forecast horizon would be a moderate decline in regional employment and economic activity.

F-1.1 Region of Influence

The analysis of socioeconomic impacts is limited to the seven-county area surrounding the INEL comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison counties. This region of influence was determined according to the following criteria:

- Counties that contain the residences of at least 85 percent of the current INEL operations and construction workforce.
- Counties in which the resident INEL workforce comprises 5 percent or greater of the county's civilian labor force.

F-1.2 Methodology and Key Assumptions

The analysis of socioeconomic impacts considers both impacts on economic activity, as measured by changes in employment and earnings, and the community, as measured by changes in population and the demand for housing and community services. The impact analysis conducted for Volume 2 of the Spent Nuclear Fuel and INEL Environmental Restoration and Waste Management Environmental Impact Statement estimates the potential social and economic impacts expected to occur within the region of influence as a result of implementation of any of the proposed INEL environmental restoration and waste management alternatives.

The socioeconomic impacts estimated in this analysis would be generated by the proposed changes in expenditures and employment at INEL, which includes employment at DOE and site-related contractors and subcontractors, and would consider both direct and secondary effects. Direct impacts are the estimated changes in INEL employment and earnings that occur during the construction and operations phases of each alternative over the period of analysis and the resultant effects on regional population, housing, and community services.

Secondary impacts include both indirect and induced impacts. Indirect impacts are the effects on regional economic activity that result from changes in DOE purchases of goods and services within the region expected to occur under any of the alternatives. Induced impacts are the additional changes in regional economic activity that result from changes in the household spending of employees whose jobs are affected by (a) the change in employment at INEL and (b) the change in employment at regional businesses resulting from the indirect impacts to regional economic activity.

F-1.2.1 Economic Activity

Analysis of socioeconomic effects utilized total output, employment, and earnings multipliers for the region of influence, obtained from the U.S. Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS II). Interindustry multipliers were prepared by the Bureau of Economic Analysis, using the United States input-output table in combination with the most recent region-specific information describing the relationship of the regional economy to the national economy. The Bureau of Economic Analysis's RIMS II model is based on research by Cartwright et al. (1981).

The direct economic impacts of each alternative were estimated based on project summary descriptions developed by DOE, INEL contractors, and their representatives. The project summary descriptions identify employment and expenditure requirements during the preconstruction, construction, and operations phases of each alternative. [For the purposes of this analysis, preconstruction and construction activities were combined.] Direct earnings were estimated based on average INEL wages and salaries. The direct employment impact under each alternative represents only the additional or new employment at INEL expected to occur under implementation of an alternative. The reassignment of existing employees at INEL would not represent a change in total INEL staffing; therefore is not included as part of the employment impact.

These direct effects were then multiplied, using RIMS II coefficients specific to the regional economy, to provide estimated total employment and earnings associated with the proposed alternatives. Input-output sectors were selected to appropriately reflect the activities associated with the proposed alternatives in order to capture the economic characteristics of each

scenario within the region of influence. For the purposes of this analysis, the construction activities under each alternative are represented by the New Construction Industry, and the operations phase activities are represented by the Chemicals and Petroleum Refining Industry.

The number of in-migrant or out-migrant workers associated with implementation of each alternative was estimated according to a set of proportional assumptions. Most INEL employees are in skilled positions, which increases the likelihood of migration from the area. Construction and related employees generally are employed under service contracts at the site, many of which are in lower-skilled positions, which decreases the likelihood of out-migration.

F-1.2.2 Population and Housing

Population changes associated with projected baseline conditions and the proposed alternatives are an important determinant of other socioeconomic and environmental impacts. These population changes have three key components: (a) baseline growth, (b) relocation of workers and their dependents, and (c) natural increase of population (births minus deaths) over the long term. The projected population trends for the region of influence, as presented in Section 4.3, assumed continuation of current operations at INEL. The forecasts were then adjusted to reflect the impacts of projected baseline decreases in INEL activity, as well as the potential effects of each of the alternatives.

The relocation of workers in response to the projected declines in baseline activity and implementation of each of the alternatives was determined by utilizing the methods and assumptions discussed in Section F-1.2.1. The number of dependents expected to relocate with these workers was estimated based on household size parameters derived from U.S. Census Bureau demographic data.

The population changes associated with the alternatives would result in further changes in housing demand. Housing demand impacts were estimated from migration projected for each scenario, assuming each in-migrating household would require one unit and each out-migrating household would relinquish one unit. The number of relocating households was determined assuming that each relocating worker represented a single household.

Expected housing availability was considered for the region of influence and key communities based on recent housing market conditions and vacancy trends. Projected demands associated with each alternative were then assessed in the context of recent housing construction trends and vacancies in key communities.

F-1.2.3 Community Services and Public Finance

Potential impacts to local community services due to changes in demand associated with the proposed alternatives were determined for the region's key public services. Impacts were determined for the jurisdictions that have the closest linkages to INEL personnel and their dependents, as well as jurisdictions likely to be most affected by the activities planned under the alternatives.

Projected changes in public school enrollments were estimated based on the results of the population analysis. The effects on public schools was based on the number of school-age children present in migrating households, current enrollment projections, and existing student/teacher ratios. Likewise, the effect on other public services was determined based on the current levels and service and the expected change in the size of the population to be served.

Local jurisdiction finances were evaluated based on changes in historic revenues and expenditure levels, changes in fund balances, and reserve bonding capacities. The effects of implementation of the alternatives and projected declines in baseline INEL activity were evaluated based on:

- Gains (or losses) of jobs in the region
- Population increases (or decreases) in each jurisdiction, including school districts
- Earnings and income gains (or losses)
- Potential changes in each jurisdiction's property tax base.

F-1.3 Key Assumptions

The following section documents the key assumptions used to establish baseline conditions and estimate economic and community impacts.

F-1.3.1 Idaho National Engineering Laboratory Employment and Earnings

- The Argonne National Laboratory-West (ANL-W) workforce was assumed to be constant from Fiscal Year 1999 to Fiscal Year 2004.
- Baseline workforce data for INEL assumes that the West Valley Demonstration Project is not included.
- All construction workers were assumed to be new personnel for the four alternatives. Based on information received from construction contractor, 85 percent of construction workers would be hired from existing labor force in the region of influence.
- Construction staffing was based on project descriptions. Where no staffing information was available, the construction staff was assumed to be one full-time employee for every \$2.35 million in expenditure. (The average expenditure per one full-time construction employee was derived from those projects that had construction staffing data).
- 97.45 percent of new operation and construction employees were expected to live in the region of influence.
- Preconstruction staffing levels were determined by assuming 1 full-time employee for each million dollars in construction expenditure (per K. Hendrickson, Science Applications International Corporation).
- Operations staff requirements were based on information provided by project descriptions and were assumed to be per year for the life of the project.

-
- Employees classified as existing were assumed to be transferred from existing duty stations at INEL. Existing employees were considered to be part of the baseline employment.
 - Operations staffing requirements that would be filled by reassignment of existing INEL personnel were not considered in the impact analysis. The impact analysis only includes new personnel.
 - An average annual wage of \$27,168 was assumed for construction employees. An average annual wage of \$43,304 was assumed for operation employees at INEL (Bureau of Economic Analysis, INEL Finance Office).
 - 19.7 percent of all non-payroll expenditures were assumed to be spent within the region of influence.

F-1.3.2 Idaho National Engineering Laboratory Funding

- Funding for environmental restoration and waste management does not include the West Valley Demonstration Project.
- Reasonably foreseeable projects identified by Science Applications International Corporation are assumed to be part of the baseline activities at INEL.
- Projects included under the alternatives were not included in baseline funding numbers. Funding data received from DOE was adjusted to take into account the exclusion of such projects.
- Effects of contractor consolidation were not incorporated in baseline funding.
- Duration of projects was rounded down to the nearest full year.
- For projects for which the funding period was not provided, funding was evenly distributed over the project period.

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- Funding for the Office of Civilian Radioactive Waste Management does not include the West Valley Demonstration Project.
 - Argonne National Laboratory-West was assumed to operate at projected levels until Fiscal Year 1999 and then hold constant through 2004.

F-1.3.3 Idaho National Engineering Laboratory Related Population

- One household per INEL employee is assumed.
- The average household size per INEL household is assumed to be 3.47 people.
- An 80-percent migration rate is assumed for population effects related to changes in direct employment. A 10-percent migration rate is assumed for population effects related to change in secondary employment.

F-1.3.4 Project Information

- Construction and Operations schedule, cost, and staffing data were obtained from the project summaries provided by K. Hendrickson, Science Applications International Corporation-Idaho Falls.
- Preconstruction and construction phases were combined for this analysis.
- Project schedules were based on project summaries. If not provided, the operations end date was assumed to be 2004 (last year in analysis timeframe).

F-1.4 Data Analysis

The following tables summarize the detailed economic data upon which the socioeconomic impact analysis was based. Table F-1-1 presents employment data derived from the project data sheets (see Appendix C). The employment data presented in the data sheets was categorized by existing, subcontract, and new workers for each project and then aggregated by alternative. Table

F-1-2 summarizes the new employment expected under each alternative and represents the direct employment impact. Table F-1-3 presents the results of the multiplier effects, summarizing direct, secondary, and total employment expected under implementation of each alternative. Table F-1-4 presents the direct, secondary, and total earnings expected under implementation of each alternative. Table F-1-5 presents the change in population in the region of influence that could occur under each alternative, including a breakdown of the direct-related and secondary-related effects. Finally, Table F-1-6 presents the population change expected in the region of influence due to the declines in baseline INEL activity and the cumulative effect of the alternatives.

Due to time constraints, the potential effects of the Spent Fuel Processing Project (PA-58) under Alternative D (Maximum Treatment, Storage, and Disposal) were not included in the quantitative socioeconomic analysis conducted for this Environmental Impact Statement. However, preliminary review of the PA-58 project data indicates that during Phase 2, construction activities associated with this facility could result in approximately 450 additional direct jobs in the region of influence. During Phases 1 and 3, however, the workforce required under this project would be filled primarily by existing personnel, resulting in minor impacts to direct or secondary employment (fewer than 50 jobs). The temporary employment increases expected during Phase 2 would likely generate additional secondary employment in the region, perhaps as many as 675 jobs, and would also result in temporary population increases. Because these construction-related effects would be temporary, long-term socioeconomic effects in the region of influence are expected to be negligible.

F-1.5 References

- Cartwright, J.V., R.M. Beemiller, R.D. Gustely, 1981, *RIMS II, Regional Input-Output Modeling System*, U.S. Department of Commerce, Bureau of Economic Analysis, Washington, D.C.
- U.S. Bureau of Economic Analysis, 1993, *Regional Input-Output Modeling System (RIMS II)*, Machine-readable regionalized input-output multipliers for the INEL region of influence, U.S. Department of Commerce, Washington, D.C.

Table F-1-1. Construction and operations employment (existing and new) at the Idaho National Engineering Laboratory under each alternative by category and by fiscal year.^{a,b,c}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Construction	553	567	376	117	186	76	0	0	0	0
Existing	79	79	63	39	39	0	0	0	0	0
Subcontractors	474	488	313	78	147	76	0	0	0	0
Operations	10	10	73	64	-90	-142	-380	-400	-400	-400
Existing	10	10	27	67	59	157	100	100	100	100
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-500	-500
Alternative B (Ten-Year Plan)										
Construction	780	998	936	1349	1584	1517	535	671	623	619
Existing	203	245	217	165	297	258	234	219	195	170
Subcontractors	578	753	718	1185	1287	1259	301	452	428	449
Operations	10	10	166	249	251	425	537	537	537	537
Existing	10	10	115	198	200	276	400	400	400	400
Subcontractors	0	0	6	6	6	6	67	67	67	67
New hires	0	0	46	46	46	143	70	70	70	70
Alternative C (Minimum Treatment, Storage, and Disposal)										
Construction	596	659	472	260	346	293	185	185	166	166
Existing	84	133	127	149	146	146	0	0	0	0
Subcontractors	512	526	346	111	200	147	185	185	166	166
Operations	10	10	95	95	-52	-104	-318	-337	-316	-316
Existing	10	10	49	97	97	195	196	196	174	174
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-490	-490
Alternative D (Maximum Treatment, Storage, and Disposal)										
Construction	829	1095	1035	1454	1689	1621	564	698	650	725
Existing	251	342	317	269	401	363	241	224	200	223
Subcontractors	578	753	718	1185	1287	1259	323	474	450	502
Operations	10	10	172	255	257	431	543	543	543	543
Existing	10	10	121	204	206	282	405	405	405	405
Subcontractors	0	0	6	6	6	6	67	67	67	67
New hires	0	0	46	46	46	143	70	70	70	70

a. Source: Project Data Sheets, see Appendix C.

b. See Section F-1.3 for assumptions regarding existing and new personnel.

c. Totals may not add due to rounding.

Table F-1-2. Direct construction and operations employment impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year.^{a,b,c}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Direct employment	474	488	358	75	-2	-223	-480	-500	-500	-500
Construction	474	488	313	78	147	76	0	0	0	0
Subcontractors	474	488	313	78	147	76	0	0	0	0
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-500	-500
Alternative B (Ten-Year Plan)										
Direct employment	578	753	770	1236	1339	1408	439	590	566	587
Construction	578	753	718	1185	1287	1259	301	452	428	449
Subcontractors	578	753	718	1185	1287	1259	301	452	428	449
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	52	52	52	149	138	138	138	138
Subcontractors	0	0	6	6	6	6	67	67	67	67
New hires	0	0	46	46	46	143	70	70	70	70
Alternative C (Minimum Treatment, Storage, and Disposal)										
Direct employment	512	526	392	108	50	-152	-295	-315	-324	-324
Construction	512	526	346	111	200	147	185	185	166	166
Subcontractors	512	526	346	111	200	147	185	185	166	166
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-490	-490
Subcontractors	0	0	0	0	0	0	0	0	0	0
New hires	0	0	46	-3	-149	-299	-480	-500	-490	-490
Alternative D (Maximum Treatment, Storage, and Disposal)										
Direct employment	578	753	770	1236	1339	1408	461	612	588	639
Construction	578	753	718	1185	1287	1259	323	474	450	502
Subcontractors	578	753	718	1185	1287	1259	323	474	450	502
New hires	0	0	0	0	0	0	0	0	0	0
Operations	0	0	52	52	52	149	138	138	138	138
Subcontractors	0	0	6	6	6	6	67	67	67	67
New hires	0	0	46	46	46	143	70	70	70	70

a. Source: Project Data Sheets, see Appendix C.

b. See Section F-1.3 for assumptions regarding existing and new personnel.

c. Totals may not add due to rounding.

Table F-1-3. Direct and secondary employment impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year.^{a,b,c}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Total employment	1142	1176	870	180	-28	-585	-1233	-1283	-1283	-1283
Direct	474	488	358	75	-2	-223	-480	-500	-500	-500
Construction	474	488	313	78	147	76	0	0	0	0
Operations	0	0	46	-3	-149	-299	-480	-500	-500	-500
Secondary	668	688	512	105	-26	-361	-752	-783	-783	-783
Construction-related	668	688	440	110	207	107	0	0	0	0
Operations-related	0	0	72	-5	-233	-468	-752	-783	-783	-783
Alternative B (Ten-Year Plan)										
Total employment	1391	1815	1862	2986	3233	3414	1079	1442	1385	1435
Direct	578	753	770	1236	1339	1408	439	590	566	587
Construction	578	753	718	1185	1287	1259	301	452	428	449
Operations	0	0	52	52	52	149	138	138	138	138
Secondary	814	1061	1092	1750	1894	2007	640	853	819	849
Construction-related	814	1061	1012	1669	1813	1773	1424	637	604	633
Operations-related	0	0	81	81	81	233	215	215	215	215
Alternative C (Minimum Treatment, Storage, and Disposal)										
Total employment	1233	1268	950	260	98	-413	-786	-836	-857	-857
Direct	512	526	392	108	50	-152	-295	-315	-324	-324
Construction	512	526	346	111	200	147	185	185	166	166
Operations	0	0	46	-3	-149	-299	-480	-500	-490	-490
Secondary	721	741	559	152	48	-261	-491	-522	-533	-533
Construction-related	721	741	587	157	281	207	261	261	234	234
Operations-related	0	0	72	-5	-233	-468	-752	-783	-768	-768
Alternative D (Maximum Treatment, Storage, and Disposal)										
Total employment	1391	1815	1862	2986	3233	3414	1131	1495	1438	1561
Direct	578	753	770	1236	1339	1408	461	612	588	639
Construction	578	753	718	1185	1287	1259	323	474	450	502
Operations	0	0	52	52	52	149	138	138	138	138
Secondary	814	1061	1092	1750	1894	2007	671	883	850	922
Construction-related	814	1061	1012	1669	1813	1773	455	668	634	707
Operations-related	0	0	81	81	81	233	215	215	215	215

a. Source: Project Data Sheets, see Appendix C; U.S. Bureau of Economic Analysis 1993.

b. See Section F-1.3 for assumptions regarding existing and new personnel.

c. Totals may not add due to rounding.

Table F-1-4. Direct and secondary earnings impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year (in thousands of dollars).^{a,b,c}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Total earnings	24,899	25,647	20,032	3,861	-4,035	-19,624	-37,924	-39,463	-39,463	-39,463
Direct	12,879	13,266	10,475	1,990	-2,456	-10,891	-20,804	-21,648	-21,648	-21,648
Construction	12,879	13,266	8,491	2,116	4,001	2,065	0	0	0	0
Operations	0	0	1,983	-127	-6,457	-12,955	-20,804	-21,648	-21,648	-21,648
Secondary	12,020	12,381	9,557	1,871	-1,579	-8,734	-17,120	-17,815	-17,815	-17,815
Construction-related	12,020	12,381	7,925	1,975	3,734	1,927	0	0	0	0
Operations-related	0	0	1,632	-104	-5,313	-10,661	17,120	-17,815	-17,815	-17,815
Alternative B (Ten-Year Plan)										
Total earnings	30,338	39,569	41,788	66,288	71,677	77,873	26,681	34,215	33,367	34,465
Direct	15,692	20,467	21,742	34,415	37,202	40,648	14,141	18,245	17,599	18,167
Construction	15,692	20,467	19,512	32,185	34,972	34,198	8,182	12,285	11,640	12,208
Operations	0	0	2,230	2,230	2,230	6,450	5,959	5,959	5,959	5,959
Secondary	14,646	19,102	20,046	31,873	34,475	37,225	12,540	16,370	15,768	16,298
Construction-related	14,646	19,102	18,211	30,038	32,640	31,917	7,636	11,466	10,864	11,394
Operations-related	0	0	1,835	1,835	1,835	5,308	4,904	4,904	4,904	4,904
Alternative C (Minimum Treatment, Storage, and Disposal)										
Total earnings	26,895	27,643	21,778	5,607	-1,291	-15,883	-28,194	-29,733	-29,962	-29,962
Direct	13,911	14,299	11,378	2,893	-1,037	-8,955	-15,772	-16,616	-16,710	-16,710
Construction	13,911	14,299	9,395	3,019	5,420	4,001	5,033	5,133	4,517	4,517
Operations	0	0	1,983	-127	-6,457	-12,955	-20,804	-21,648	-21,226	-21,226
Secondary	12,984	13,345	10,400	2,714	-255	-6,927	-12,423	-13,117	-13,252	-13,252
Construction-related	12,984	13,345	8,768	2,818	5,059	3,734	4,697	4,697	4,215	4,215
Operations-related	0	0	1,632	-104	-5,313	-10,661	-17,120	-17,815	-17,467	-17,467
Alternative D (Maximum Treatment, Storage, and Disposal)										
Total earnings	30,338	39,569	41,788	66,288	71,677	77,873	27,828	35,762	34,515	37,209
Direct	15,692	20,467	21,742	34,415	37,202	40,648	14,735	18,838	18,193	19,587
Construction	15,692	20,467	19,512	32,185	34,972	34,198	8,775	12,879	12,234	13,628
Operations	0	0	2,230	2,230	2,230	6,450	5,959	5,959	5,959	5,959
Secondary	14,646	19,102	20,046	31,873	34,475	37,225	13,094	16,924	16,322	17,622
Construction-related	14,646	19,102	18,211	30,038	32,640	31,917	8,190	12,020	11,418	12,719
Operations-related	0	0	1,835	1,835	1,835	5,308	4,904	4,904	4,904	4,904

a. Source: Project Data Sheets, see Appendix C. U.S. Bureau of Economic Analysis 1993.

b. See Section F-1.3 for assumptions regarding wages and salaries.

c. Totals may not add due to rounding.

Table F-1-5. Direct and secondary population impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year, not including baseline effects.^{a,b}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Alternative A (No Action)										
Population impact	478	493	471	69	-359	-942	-1636	-1703	-1703	-1703
Direct-related	247	254	293	32	-348	-813	-1369	-1424	-1424	-1424
Secondary-related	232	239	178	36	-11	-130	-268	-279	-279	-279
Alternative B (Ten-Year Plan)										
Population impact	583	760	900	1371	1474	1777	767	919	895	916
Direct-related	301	392	520	763	816	1079	544	622	610	621
Secondary-related	282	368	380	608	658	698	223	297	285	295
Alternative C (Minimum Treatment, Storage, and Disposal)										
Population impact	517	531	505	102	-306	-870	-1449	-1516	-1502	-1502
Direct-related	267	274	310	50	-321	-776	-1272	-1328	-1310	-1310
Secondary-related	250	257	195	53	14	-95	-177	-188	-192	-192
Alternative D (Maximum Treatment, Storage, and Disposal)										
Population impact	583	760	900	1371	1474	1777	789	941	917	969
Direct-related	301	392	520	763	816	1079	555	634	621	648
Secondary-related	282	368	380	608	658	698	234	308	296	321

a. See Section F-1.3 for assumptions regarding population migration.

b. Totals may not add due to rounding.

Table F-1-6. Direct and secondary population impacts in the Idaho National Engineering Laboratory region of influence by alternative and by fiscal year, including baseline effects.^{a,b}

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Baseline effects										
Change from 1995	0	-1617	-2251	-2831	-3240	-3306	-3333	-3333	-3333	-3333
Direct-related	0	-1352	-1882	-2368	-2709	-2765	-2787	-2787	-2787	-2787
Secondary-related	0	-265	-368	-463	-530	-541	-546	-546	-546	-546
Alternative A (No Action)										
Population impact	478	-1124	-1779	-2763	-3599	-4248	-4969	-5035	-5035	-5035
Direct-related	247	-1098	-1589	-2336	-3057	-3578	-4156	-4211	-4211	-4211
Secondary-related	232	-26	-190	-427	-541	-671	-813	-824	-824	-824
Alternative B (Ten-Year Plan)										
Population impact	583	-856	-1351	-1461	-1765	-1529	-2566	-2413	-2437	-2416
Direct-related	301	-960	-1362	-1605	-1893	-1686	-2243	-2165	-2177	-2166
Secondary-related	282	104	11	144	128	157	-323	-249	-260	-250
Alternative C (Minimum Treatment, Storage, and Disposal)										
Population impact	517	-1085	-1745	-2729	-3546	-4176	-4782	-4848	-4834	-4834
Direct-related	267	-1078	-1572	-2318	-3030	-3540	-4059	-4115	-4097	-4097
Secondary-related	250	-7	-174	-411	-516	-636	-723	-734	-738	-738
Alternative D (Maximum Treatment, Storage, and Disposal)										
Population impact	583	-856	-1351	-1461	-1765	-1529	-2544	-2391	-2415	-2363
Direct-related	301	-960	-1362	-1605	-1896	-1686	-2232	-2153	-2166	-2139
Secondary-related	282	104	11	144	128	157	-312	-238	-250	-225

a. See Section F-1.3 for assumptions regarding population migration.

b. Totals may not add due to rounding.

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F-2 GEOLOGY AND WATER

This section describes the methodology used to support the conclusions regarding the geologic hazards at the INEL site and local and regional water resource impacts for the four alternatives evaluated in Volume 2 of this Environmental Impact Statement. These conclusions resulted from an extensive review of existing documentation characterizing the geologic and hydrologic conditions at the INEL site and a compilation of this material into a concise description of the existing conditions and potential impacts. This portion of Appendix F directly supports the summaries provided in Sections 4.6 and 5.6 (Geology) and 4.8 and 5.8 (Water Resources).

F-2.1 Geology

The evaluation of geology at the INEL site focused on the geologic hazards that could potentially impact the environmental restoration, waste management, and spent nuclear fuel (SNF) management activities proposed under the four alternatives. The following sections discuss the methods used to determine the magnitude and likelihood of the hazards associated with seismicity and volcanism at the INEL site.

F-2.1.1 Seismicity

Since the early 1970s, seismic hazards assessments have been conducted at the INEL site to evaluate potential earthquake ground motions for establishing seismic design criteria. Since that time, ground motion seismology hazard assessment and Federal regulations evolved. To keep pace with these changes, deterministic evaluations were conducted for specific sites (Woodward-Clyde Consultants 1990), and deterministic and probabilistic seismic hazards assessments were conducted for the proposed New Production Reactor site at the INEL site (Woodward-Clyde Consultants 1992). Also, an INEL site probabilistic seismic hazard assessment is currently underway to assess the contributions from potential local and regional earthquake sources on the magnitude and frequency of ground motions and their estimated return periods (Wong 1993).

F-2.1.1.1 Current Deterministic and Probabilistic Evaluations. Both deterministic and probabilistic seismic hazards assessments were performed to estimate site-specific peak ground

accelerations for the proposed New Production Reactor site at the INEL site (Woodward-Clyde Consultants 1992). The deterministic evaluation computed the ground motion for seismic sources considered most significant to the New Production Reactor site in the south-central portion of INEL site. The probabilistic study evaluated the probability or likelihood that various levels of ground motion would be exceeded during a specified time period.

The probabilistic evaluations used the same geologic information as the 1990 INEL deterministic evaluation (Woodward-Clyde Consultants 1990) and additional information collected under the New Production Reactor Geologic/Seismological/Geotechnical Studies program, which was conducted during 1991–1992. Under this program, paleoseismic investigations were conducted on the Lemhi Fault to determine maximum magnitude and recurrence, and a deep hole [1.4 kilometers (4,700 feet)] was drilled at the proposed New Production Reactor site to determine the near-surface geology (core samples). Additional paleoseismology studies are currently being conducted to assess the seismogenic potential of the Arco Segment of the Big Lost River Fault.

In addition to an earthquake source along the Lemhi Fault, the Woodward-Clyde (1992) deterministic evaluation considered the level of ground motions that could be generated from an earthquake [moment magnitude (M_m) 5.5] randomly located within a 25-kilometer (15.5-mile) radius of the proposed New Production Reactor site and a volcanic earthquake (M_m 5.5) associated with Eastern Snake River Plain volcanic rift zones. Peak horizontal and vertical accelerations and response spectra were estimated for the 50th and 84th percentiles based on the range of uncertainties in geologic input and ground motion model. The predicted 50th percentile peak horizontal acceleration from the Lemhi fault at the New Production Reactor site was 0.21g and 0.18g from a volcanic earthquake. The vertical accelerations are approximately two-thirds of the horizontal accelerations.

The New Production Reactor site probabilistic evaluation considered ground motion contributions from the following earthquake sources: (a) Basin and Range faults, (b) Eastern Snake River Plain volcanic rift zones and the axial volcanic zone, (c) the "random" Eastern Snake River Plain earthquake, and (d) the Yellowstone Plateau and Idaho Batholith tectonic provinces (Woodward-Clyde Consultants 1992). Seismic wave transmission characteristics used empirically developed attenuation relationships based on INEL site seismography and a site-

specific model based on the interbedded basalt stratigraphy obtained from the deep hole. Sensitivity analyses indicated that the size and location of the random earthquake and seismicity rates in the Eastern Snake River Plain are important contributors to the uncertainty in the hazard at high peak acceleration levels.

Currently, a probabilistic evaluation is underway to estimate site-specific seismic hazard curves and response spectra for major INEL site facility areas. This evaluation will incorporate geologic data collected by the New Production Reactor geological, seismological, and geophysical studies. As with past studies, the results will undergo extensive peer review before being considered for use in INEL site seismic design criteria.

The INEL site is located adjacent to the Basin and Range province, which is characterized by extensional tectonics and associated normal faulting earthquakes. Limited empirical data on strong ground motion attenuation exist from the Basin and Range province necessitating the use of empirical data from other regions and direct modeling results of ground motions using numerical techniques. Although site-specific geologic and seismologic data would provide more accurate results, analyses indicate that empirical attenuation relationships developed to model strike-slip earthquake motions in California provide a reasonable estimate of the ground motions that may be experienced at the INEL site from predominantly normal-faulting earthquakes occurring in the region (Wong 1993). To model the effects of INEL site geology, a state-of-the-art stochastic ground motion modeling approach was used to develop site-specific attenuation relationships. The Band-Limited-White-Noise model, combined with random vibration theory, captures the features of strong ground motion with a minimum of free parameters.

The uncertainty in specifying attenuation relationships was considered in the Wong (1993) model. The empirical relationships and the site-specific stochastic relationships are assigned a weight based on the specific INEL site geology; that is, empirical relationships are given a higher weight for sites that have characteristics similar to the sites for which the empirical relationships were developed. The choice of attenuation relationship provides the greatest level of uncertainty for short-period motions (periods of 0.2 second and less).

F-2.1.1.2 Seismic Design Criteria. Following completion of the 1990 deterministic evaluation, the results were subjected to extensive peer review by the U.S. Geological Survey,

University of Utah, Risk Engineering, INEL subcontractors, the U.S. Department of Energy (DOE), and the Defense Nuclear Facilities Safety Board. The deterministic peak accelerations were adopted into the INEL architectural and engineering standards in 1991 (DOE-ID 1993a). The results of the New Production Reactor 1992 deterministic and probabilistic evaluations were extensively reviewed by a panel of experts. This panel included nationally recognized experts in the fields of seismology, tectonics, statistics, and structural engineering. They were convened by DOE through Lawrence Livermore National Laboratory to review and approve recommendations for New Production Reactor structural design criteria (including seismic design criteria). Ground motion results of the 1990 and 1992 studies indicate that INEL seismic design criteria are appropriate for the estimated seismic hazards. The Wong (1993) probabilistic seismic hazard assessment study is currently undergoing this review process.

F-2.1.2 Volcanism

Hazards associated with INEL-area volcanism, as well as distant volcanic sources, have been evaluated by several investigators. A Volcanism Working Group consisting of experts from the INEL, other national laboratories, the U.S. Geological Survey, and universities was convened in 1990 to assess the potential for volcanism on the INEL site (Volcanism Working Group 1990).

For volcanic areas such as the Eastern Snake River Plain with no historical volcanism and an incomplete chronologic record of prehistoric volcanism, assessments of potential volcanic hazards and volcanic risks are estimated based on interpretation of the long-term geologic record and on the documented effects of historical eruptions in analog regions such as Iceland and Hawaii. Volcanic hazards to the INEL site are related to future basaltic and rhyolitic eruptions along volcanic-rift zones and the axial volcanic zone. The most significant volcanic hazard to INEL site is the inundation or burning of facilities by basaltic lava flows from volcanic-rift zones. A significant related hazard is disruption of facilities due to ground deformation accompanying magma intrusion along volcanic-rift zones: opening of fissures, normal faulting, and broad-region tilting and uplift within several kilometers of vents. Other, less-significant basaltic hazards include volcanic-gas emission and disruption of groundwater.

Available geologic-map data, flow volume estimates, and geochronometry of INEL site basalt lava flows suggest maximum (most conservative) volcanic frequencies of 10^{-4} to 10^{-5} per

year for the axial volcanic zone, and the Arco and Lava Ridge-Hell's Half Acre volcanic-rift zones. The probabilistic risk of basalt-lava inundation or intrusion-related ground disturbance at a specific facility is therefore estimated to be less than 10^{-5} per year for facilities on the southern INEL site. Risk from these phenomena at northern-INEL site facilities is still lower because volcanism there has been less frequent and less recent. The probability of significant impact from all other volcanic phenomena, such as growth of new rhyolite domes on the Eastern Snake River Plain or thicker than 8-centimeter (3-inch) tephra fall from non-Eastern Snake River Plain vents, is estimated to be much less than 10^{-5} per year due to the combined effects of great distance, infrequency, low volume, and topographic or atmospheric barriers to the dispersal of tephra on the INEL site.

F-2.2 Water Resources

The evaluation of potential consequences to water resources at the INEL site focused on flooding potential and water quality and use. The following sections discuss the methods and references used to determine impacts resulting from the implementation of environmental restoration and waste management activities proposed under the alternatives.

F-2.2.1 Surface Water

Surface water studies and data were reviewed during a literature search performed for this Environmental Impact Statement (EIS). This section presents the methodology used for the analyses of potential impacts of the proposed alternatives to natural and artificial (manmade) surface waters on, and in the vicinity of, the INEL site. These methods were used to determine existing surface water quality and flood potential (which could conceivably cause surface contamination to enter surface water bodies). The U.S. Geological Survey has been compiling surface water quality data for many years. In addition, several U.S. Geological Survey and INEL studies have been conducted concerning flood potential at the INEL site.

F-2.2.1.1 Surface Water Quality. INEL site activities do not directly affect the quality of surface water outside the INEL site because the INEL site is located within a closed drainage basin and surface water does not flow directly offsite (Hoff et al. 1990). All major drainages within the INEL site terminate in the Big Lost River Playa in the northern portion of the INEL

site. However, water from the Big Lost River, as well as from seepage of evaporation basins and storm water injection wells, does infiltrate into the Snake River Plain Aquifer.

Physical, chemical, and radioactive water quality parameters have been measured along the Big Lost River, the Little Lost River, and Birch Creek. As a result of intermittent flow along these drainages and consequently limited sampling opportunities, insufficient information is available to make statistical comparisons. However, the water quality of these three intermittent streams is similar and appears to have varied relatively little over time (U.S. Geological Survey 1963–1993). Chemical and physical parameters measured in these three water tributaries do not exceed water quality standards (Lundahl et al. 1994), and water quality is adequate for all INEL site uses. However, surface water is not withdrawn from these tributaries for use at the INEL site.

The Big Lost River System (the Big Lost River, Little Lost River, Birch Creek, and their tributaries and playas) is defined as “waters of the United States” as specified by the Clean Water Act. Under the Clean Water Act, two National Pollutant Discharge Elimination System General Permits for Storm Water Discharges were issued for the INEL site, one for industrial activities and one for construction activities. The permit requirements for both of these activities specify the development of a site-wide Storm Water Pollution Prevention Plan. Any facility at the INEL site having the potential to discharge storm water to the Big Lost River System associated with industrial or construction activities is subject to the monitoring and reporting requirements of the INEL Storm Water Pollution Prevention Plans (FR 1992a, 1992b). The INEL Storm Water Pollution Prevention Plans (DOE-ID 1993b) were established to assess potential storm water pollution sources; select and implement appropriate management practices and controls to prevent contamination of storm water runoff; and implement monitoring, inspection, and notification programs. Periodic evaluations are performed to determine the effectiveness of the plans to prevent storm water pollution.

Many potential sources of surface water contamination are also identified in the Federal Facility Agreement/Consent Order. All potential contamination sources must be evaluated, including facility-specific activities, material inventory, past spills and leaks, nonwater discharge, and existing storm water monitoring data. Other activities required under the Federal Facility Agreement/Consent Order include identifying risk, summarizing potential pollutants, identifying

and implementing best management practices, developing water runoff maps, and identifying potential pollutants in the runoff.

F-2.2.1.2 Flood Analysis. Several studies have been performed to evaluate the potential for flooding to occur at the INEL site. A frequency analysis of local basin snowmelt for several facilities at the INEL site was conducted in 1986 using historical data (Koslow and Van Haaften 1986). Precipitation data from the Central Facilities Area weather station for 1956 to 1985 were used in the analysis. Precipitation data from the Central Facilities Area station were assumed to be representative of precipitation across the INEL site (Koslow and Van Haaften 1986).

In general, flood plains at the INEL site are poorly defined, primarily because detailed topographic and flood hydrographic data are not available for much of the INEL site. Studies are currently underway to determine the 100-year flood plain for the Big Lost River at the INEL site. These studies will lead to a rigorous assessment of the relationship between the Mackay Dam failure probable maximum flood (PMF) (discussed below in Section F-2.2.1.3) and the INEL site 100-year flood plain for the Big Lost River. A recent investigation by Sagendorf (1991) for a design analysis conducted by Zukauskas et al. (1992) used meteorological data from Central Facilities Area for 1950 through 1990 and, for the 25- and 100-year return periods, determined maximum 24-hour precipitation amounts and 25- and 100-year maximum snow depths at the Radioactive Waste Management Complex.

During the winter months, mid-November through mid-March, a rain-on-snow event could occur when the ground is frozen. The 25- and 100-year, 24-hour duration rainfall amounts for these months were determined to be 0.92 and 1.13 inches, respectively. Based on records for the full year, the 25- and 100-year, 24-hour duration amounts were found to be 1.36 and 1.64 inches, respectively. The expected 25-year maximum snow depth was determined to be 22.6 inches, and the 100-year maximum snow depth was found to be 30.6 inches. The peak discharges for the 25- and 100-year rainfall-on-snowmelt floods for the Radioactive Waste Management Complex watershed were estimated by Zukauskas et al. (1992) to be 643 and 704 cubic feet per second, respectively.

Zukauskas et al. (1992) conducted another flooding study at the Radioactive Waste Management Complex. The effects of natural topographic depressions, railroad embankments,

and culverts on peak discharges at the Radioactive Waste Management Complex were evaluated. The study was conducted in two parts. The first part was a hydrologic modeling study that evaluated the adequacy of the existing surface water drainage control system in preventing flooding of the Transuranic Storage Area during the 25- and 100-year return interval, 24-hour duration storm events. The second part of the study presented a grading and drainage plan for the area.

The Zukauskas et al. (1992) study computed reservoir stages and peak discharges at key locations using the U.S. Army Corps of Engineering HEC-1 flood hydrograph package. Precipitation and temperature inputs for modeling the 25- and 100-year return period events were derived from the National Weather Service records for the INEL site. Water surface profiles for the main channel flow system, and tailwater elevations for computing culvert flow at critical locations were computed with the HEC-2 water surface profiles program. The study concluded that, with some minor reconfigurations and grading in the main channel and the upgrading of two berms, the existing surface water drainage control system would prevent flooding resulting from the 25- and 100-year, 24-hour rainfall/snowmelt storm.

McKinney (1985) documents flooding events that have occurred at the INEL Diversion System on the Big Lost River. The report presents an evaluation of Big Lost River flow records, the INEL Diversion System, the 1983 Mount Borah Earthquake, record low temperatures in December 1983, and the resulting ice jam on the diversion system that forced the river to pond along and nearly overtop Dike 1.

Several flood routing studies have been conducted over smaller areas near specific INEL site facilities. One of these was conducted by Martineau et al. (1990) at the Subsurface Disposal Area within the Radioactive Waste Management Complex. The objective of this study was to determine if the current Subsurface Disposal Area berm is sufficient to prevent floodwater from entering the Subsurface Disposal Area if Dike 2 fails. The Martineau et al. (1990) investigation showed that the Subsurface Disposal Area berm could be in danger of being overtopped by a breach flood from Dike 2. For example, the breach flood from Dike 2 could be initiated by a large flood in the Big Lost River.

F-2.2.1.3 Probable Maximum Flood. Analysis of high-magnitude flooding caused by a dam failure relies on hydrodynamic theory to describe the dam-break wave and to propagate the wave downstream. Closed-form solutions do not exist for the partial differential equations of unsteady flow in open channels, so numerical techniques are employed to achieve solutions. Koslow and Van Haaften (1986) used the DAMBRK model developed by the National Weather Service to simulate four different postulated Mackay Dam failure scenarios: seismic dam failure, hydraulic (piping) failure of the dam with 100-year flood, hydraulic (piping) failure with 500-year flood, and overtopping failure. DAMBRK has been successfully tested against data from a number of actual dam failures, including the 1976 Teton Dam failure in eastern Idaho.

Three functional elements are involved in DAMBRK: description of the dam failure mode and initial conditions; computation of the time-varying flow and water surface elevations at the breach; and routing of the flood through the downstream valley. These functions are accomplished using a number of input elements, including breach description, reservoir inflow and storage characteristics, downstream frictional resistance, flow losses, and downstream channel geometry. The DAMBRK simulation routed the flood wave along the Big Lost River channel from Mackay Dam to Test Area North at the INEL site. Outflows from the river into the INEL site diversion channel were estimated by the broad-crested weir outflow model included in DAMBRK. Koslow and Van Haaften (1986) used a total of 259 channel cross-sections in the Mackay Dam flood analysis.

Peak flow rate, peak water surface elevation, flood wave arrival time, and maximum water velocity were presented for eight cross-sections along the Big Lost River. In the event of a Mackay Dam failure from any of the four scenarios, there would be flooding along the Big Lost River channel with low velocities and water depths on the INEL site. The water velocity on the INEL site would range from 0.18 to 1.04 meters per second (0.6 to 3.4 feet per second), with water depths outside the banks of the Big Lost River ranging from 0.61 to 1.22 meters (2 to 4 feet) (Koslow and Van Haaften 1986). No significant difference in flood inundation was formed for the seismically induced dam failure and the piping failures that occur during the 100- and 500-year floods. Significantly higher flow downstream and a greater extent of flooding result from the overtopping failure of the dam from a probable maximum flood.

The flat, open topography on the INEL site results in considerable spreading of floodwaters. The facilities subject to encroaching floodwaters are the Idaho Chemical Processing Plant, the Naval Reactors Facility, and the Loss-of-Fluid Testing Facility near Test Area North. As part of an overall evaluation by Koslow and Van Haaften (1986) of the flood potential at the INEL site facilities, Schreiber (1986) developed a probable maximum flood inflow hydrograph to the Mackay Reservoir.

The use of the probable maximum flood represents a conservative estimate of the Mackay Dam failure because the amount of water resulting as inflow into the reservoir would be far greater than either the 100-year or 500-year storm events. Inflow resulting from the probable maximum flood would be 82,100 cubic feet per second compared with 4,870 and 5,760 cubic feet per second for the 100-year or 500-year storm event, respectively (Koslow and Van Haaften 1986). Modeling of the probable maximum flood scenario was performed assuming the water levels rose above the dam and caused failure. This is likely because the spillways built into the dam would not be able to release the flow fast enough. Results predict that 306,700 cubic feet per second would be released immediately downstream of the dam. This peak flow attenuates to 71,850 cubic feet per second at the INEL Diversion Dam and to 34,810 cubic feet per second at the Test Area North. The flood wave reaches the INEL Diversion Dam in 10 hours with flow rates of 1 to 3 cubic feet per second on the INEL site. These flow rates would not be great enough to cause structural damage to the INEL site facilities.

F-2.2.2 Subsurface Water

Subsurface water quality and quantity, hydrologic properties, waste inputs, and other data were gathered through a literature search. This section contains a summary of the documentation and methods used to characterize subsurface water quality and use at the INEL site and to support conclusions on the impacts to water resources from the proposed alternatives. Section F-2.2.2.1 discusses data collection techniques, Section F-2.2.2.2 presents methodologies and references utilized to characterize subsurface water resources. Section F-2.2.2.3 discusses modeling methodologies, individual modeling studies used in this EIS, and the assumptions on which the models are based.

F-2.2.2.1 Data Collection Techniques. Hydrologic parameters at the INEL site, specifically hydraulic conductivity and transmissivity, are often determined by single-well pumping tests (Driscoll 1989, Ackerman 1991, Garabedian 1986). Storativity values must be determined from multi-well pumping tests. The standard method for determining transmissivity involves pumping water from a well at a rate which stresses the aquifer and creates drawdown in the well. The amount of drawdown is inversely related to the transmissivity of the aquifer. The drawdown in the well is recorded as a function of time. Time-well recovery techniques are also used and involve measuring the water level recovery as a function of time (Freeze and Cherry 1979). Curve matching techniques that compare the observed curves against type curves are used to determine aquifer parameters (Freeze and Cherry 1979, Driscoll 1989, Domenico and Schwartz 1990).

Finite-difference computer modeling as performed by Garabedian (1992) can also be used to assess the hydraulic parameters by matching observed water levels to simulated levels. The codes are based on finite-difference approximations of equations representing the hydrologic flow, which are dependent on the hydraulic conductivity, storativity, porosity, hydraulic gradient, and transmissivity. By iterative varying of parameters until a match between actual and modeled water levels occurs, the parameters can be estimated. Linear regression techniques have also been used to estimate transmissivity from specific capacity (Ackerman 1991).

Groundwater chemistry data are obtained by water sampling and chemical analysis. Monitoring wells sampled are purged until field parameters (that is, pH, temperature, conductivity) stabilize (Robertson et al. 1974). This ensures that the water sampled is formation water and not residual water that has been chemically altered in the well. The U.S. Geological Survey has been routinely monitoring wells at the INEL site since 1949 and uses these methods of sampling (Robertson et al. 1974, Barraclough et al. 1976, Pittman et al. 1988). Analytical techniques used to determine concentrations of solutes include liquid scintillation and alpha, beta, and gamma testing for radionuclides; atomic adsorption for metals and anions; and gas chromatography/mass spectrometry for volatile organic compounds (Mann 1990, Driscoll 1989). Recently, studies have used Inductively Coupled Plasma-Mass Spectrometry for chemical analysis of cations, which offers lower detection limits and an expanded analyte list (McCurry et al. 1994).

F-2.2.2.2 Water Resources Characterization. This section presents the methodologies and briefly summarizes sources of information used to characterize subsurface conditions. Specifically, sources describing aquifer properties, water quality, and contaminant distribution are identified and important elements are highlighted. Factors affecting background water chemistry and groundwater quality, and references for source term determination are also provided.

F-2.2.2.2.1 Description of Physical Properties and Flow

Characteristics—Determining the aquifer properties of the Snake River Plain Aquifer has been a long standing goal of the U.S. Geological Survey, INEL, and other investigators. Aquifer properties of interest include the hydraulic conductivity, transmissivity, specific capacity, flow rates and directions, and distribution of static head levels. Because of the significant heterogeneity of the aquifer, these parameters vary by several orders of magnitude within the Snake River Plain Aquifer (Ackerman 1991, Robertson et al. 1974). Several investigators attribute the heterogeneity to the complicated stratigraphy, which consists of numerous relatively thin basalt flows with rubble zones and intercalated sedimentary interbeds (Robertson et al. 1974, Ackerman 1991, Barraclough et al. 1976). Groundwater flow velocities within the aquifer are greatest along fractures, rubble zones, and boundaries between basalt flow lobes (McCurry et al. 1994). Locally, the variance can be important, but on a regional scale the properties are easier to model because the heterogeneities average out (Garabedian 1986, 1992). References that address hydrologic property testing, specific values of hydrologic parameters, and modeling of properties in the Snake River Plain Aquifer include Pittman et al. (1988), Ackerman (1991), Garabedian (1986, 1992), Robertson et al. (1974), and Barraclough et al. (1976).

Of these references, Ackerman (1991) and Garabedian (1986, 1992) are the most recent and provide details on transmissivity distributions at the INEL site. Ackerman (1991) utilized data from previous single-well pumping tests within the Snake River Plain Aquifer to determine the distribution of transmissivity values under the INEL site. Type-curve matching methods as discussed by Driscoll (1989) were used, as well as linear regression of specific capacity-transmissivity relationships. Conclusions showed that specific capacity values ranged from 0.6 to 70,000 liters per minute per meter (0.05 to 6000 gallons per minute per foot) and transmissivity values varied over six orders of magnitude from 0.09 to 90,000 square meters per day (1 to 1×10^6 square feet per day). Garabedian (1986) performed parameter estimation techniques to estimate

transmissivity and estimated values ranged from 400 to 3.5×10^5 square meters per day (4,300 to 3.8×10^6 square feet per day).

F-2.2.2.2.2 Subsurface Water Quality and Contaminant Distribution—The natural groundwater chemistry of the Snake River Plain Aquifer is determined by inputs from precipitation, recharge, anthropogenic inputs, and water-rock reactions (Wood and Low 1988). The background chemistry of the Snake River Plain Aquifer has been the subject of investigation and is important for determining locations where elevated contaminant levels may exist. Robertson et al. (1974) provides a detailed analysis of the recharge water quantity and quality entering the Snake River Plain Aquifer and presents reasons for the evolution of the natural groundwater chemistry. The study was a mass balance approach and considered inputs from the Mud Lake area, the Big Lost River System, and local precipitation.

Water-rock interactions taking place from the recharge to discharge zones of the aquifer impact the natural water chemistry of the aquifer. Robertson et al. (1974) and Wood and Low (1986, 1988) devised mass balance studies consisting of a series of equations to explain chemical changes from the northern to southern part of the INEL site. The equations consist of dissolution reactions for basaltic minerals such as anorthite, pyroxenes, and olivines, as well as precipitation reactions for calcite and quartz. Incongruent reactions, which are responsible for the formation of clays (Drever 1988), were also considered. Results of the calculations indicate that about 20 percent of the solutes in the groundwater can be attributed to dissolution reactions and that precipitation of quartz and calcite have an important impact on the buffering capabilities of the aquifer.

Knowledge of individual contaminant behavior is also necessary to understand contaminant transport and residence times below the surface. Properties affecting contaminant behavior include retardation, dispersion, and radioactive decay. These parameters are used in transport models; therefore, accurate values are required. Retardation factors are typically determined by laboratory column and batch experiments, which are performed considering site-specific conditions (for example, soil and rock type, porosities, pH) (Drever 1988, Domenico and Schwartz 1990). Retardation factors of 100-130, 1, and 1 for strontium-90, tritium, and iodine-129, respectively, have been used for modeling studies at the INEL site (Robertson et al. 1974, Arnett and Rohe 1993, Schafer-Perini 1993, Robertson 1977). Dispersivities used in contaminant transport models

range from 91 to 140 meters (298 to 459 feet) for the longitudinal and transverse directions, respectively (Robertson et al. 1974, Arnett and Rohe 1993). Radioactive decay is constant under all conditions, and the values used for the radionuclides are 26.6, 12.5, and 17,000,000 years for strontium-90, tritium, and iodine-129, respectively (Arnett and Rohe 1993, Schafer-Perini 1993, Robertson et al. 1974). References that address the determination of retardation factors and dispersion coefficients and discuss their use in transport equations include Freeze and Cherry (1979), Domenico and Swartz (1992), and Drever (1988).

Contaminants interact differently below the surface depending on whether they are in the vadose zone or the saturated zone. The vadose zone at the INEL site is very thick and acts as a buffer for contaminants between the surface and the saturated zone (EG&G 1993). As a result, several studies examine specific aspects of the vadose zone such as the infiltration rates of water in basalt and sediments, location and chemical quality of perched water zones, and location of contaminants sorbed to interbeds and the basalt matrix (Bishop et al. 1992, Marts and Barrash 1991, Ackerman 1992, Hubbell 1990, and Cecil et al. 1991). Kaminsky (1991), Bishop (1991), and Cecil et al. (1992) address infiltration rates of water in subsurface soils and basalts. Results indicate that the infiltration rates are highly dependent on the degree of saturation and matric suction. Under highly unsaturated conditions, rates can be as slow as 0.36 centimeter per year (0.4 inches per year). Bishop (1991) showed rates of water movement in a dry block of basalt to be approximately the same. Other investigators have shown rates to be higher under saturated conditions in the vadose zone (Hubbell 1990).

Water quality evaluation and determining distribution of contaminants in the Snake River Plain Aquifer beneath the INEL site is the primary goal of the U.S. Geological Survey monitoring program. The U.S. Geological Survey has conducted routine sampling of monitoring wells and maintains records of the chemical analyses in a database (Robertson et al. 1974). Typically, wells are sampled on a semiannual basis for major anions and cations, radionuclides, some trace metals, and field physical measurements (that is, temperature, conductivity, pH). Many wells constructed within the perched zones beneath the percolation ponds at the Test Reactor Area and Idaho Chemical Processing Plant are sampled quarterly for the same parameters but include an expanded list of radionuclides (Cecil et al. 1991, Marts and Barrash 1991, Ackerman 1992). In addition to the routine studies, special studies are conducted to define the distribution of specific contaminants. For example, several studies have been conducted to evaluate the distribution of

volatile organic compounds (Mann 1990, Liszewski and Mann 1992, Mann and Knobel 1987). Routine monitoring is required to maintain updated information characterizing the levels and distribution of contaminants. This is vital because subsurface distributions of contaminants are transient. Hubbell (1990) describes the fluctuation in water levels and perched water chemistry at the Radioactive Waste Management Complex as a function of recharge. Cecil et al. (1991) and Robertson (1977) discuss the relationship between waste inputs and perched zone chemistry at the Test Reactor Area. The distribution of contamination within the aquifer has also changed over time. Golder (1993) discusses the time relation of contaminant distribution and provides several maps of the plumes at various time intervals. Additional references addressing aquifer chemistry and distribution of contaminants include Robertson et al. (1974), Barraclough et al. (1976), Cecil et al. (1991, 1992), Pittman et al. (1988), Whitehead (1987), and Barraclough et al. (1981).

F-2.2.2.2.3 Source Terms—Many references provide information identifying and characterizing source terms of liquid effluents as well as discuss the processes that produced the wastes. This information is important for the overall characterization of the contaminant budget for the system. Records kept by INEL site facility operating personnel and from monitoring devices are used to determine these inputs. Input data from 1953 to 1970 are sparse compared to after 1970, because recordkeeping and sampling programs were not as comprehensive as they are today. References addressing source terms at the INEL site include Creed (1994), Lehto (1993), EG&G (1993), Arnett and Rohe (1993), Golder (1993), and Bobo (1993).

The report by Golder (1993), prepared for this EIS, describes the baseline contaminants in the subsurface. The history of contaminant plumes, background chemistry, concentrations of contaminants within the Snake River Plain Aquifer, and contaminants within the perched zones are summarized in this report from preexisting studies. Lehto (1993) was also prepared for this EIS and addresses the past history of waste injection. It summarizes the volumes and radionuclide concentrations disposed of at the Test Reactor Area, Idaho Chemical Processing Plant, Test Area North, and several inactive areas. Data in this report were obtained from the Radioactive Waste Management Information System and Non-Radioactive Waste Management Information System and was used as input for the modeling performed by Arnett and Rohe (1993). The draft report by EG&G (1993) addresses waste inputs at the Idaho Chemical Processing Plant and provides graphics of waste inputs over time to the percolation ponds and injection wells.

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Creed (1994) discusses source terms for a generic spent nuclear fuel storage facility based on water quality data from the Idaho Chemical Processing Plant Fluorinel and Storage Facility and a generic spent nuclear fuel storage facility design (Hale 1994) used to identify impacts to the water quality from an unintentional discharge of 18.9 liters per day (5 gallons per day) for 30 days consisting of the following radionuclide concentrations:

- Tritium - 10,000 picocuries per liter
- Strontium-90 - 810 picocuries per liter
- Antimony-125 - 100 picocuries per liter
- Cobalt-60 - 9,290 picocuries per liter
- Cobalt-58 - 148 picocuries per liter
- Cesium-137 - 101 picocuries per liter.

Creed (1994) also describes the scenario leading to the hypothetical leak, which consists of canal water leakage from secondary containment around the spent nuclear fuel storage pools.

Constant process monitoring, mass-balance, and facility design in accordance with current standards including double-walled confinement of all vessels and piping, would be used by DOE to limit potential operational releases from a new spent nuclear fuel processing facility to a goal of essentially zero. Any operational releases postulated would result from degraded equipment. Arnett (1994) addresses the affects that this leak will have on subsurface water resources. Results indicate that there will be no contaminants above maximum contaminant levels at the INEL site boundary resulting from a postulated operational leak.

F-2.2.2.2.4 Water Use—The amount of water consumed above the baseline differs for each alternative, with Alternative B (Ten-Year Plan) consuming the greatest quantity of water. Even under this alternative, the impacts to water quantity are expected to be minor compared to the volume of water flowing under the INEL site yearly [1.8×10^9 cubic meters (470

$\times 10^9$ gallons)] (Robertson et al. 1974). Moreover, 65 percent of the water consumed under current operations is returned to the aquifer by subsurface discharge and infiltration (Brennan and Medenna 1994). Similar returns to the aquifer are expected to occur regardless of the EIS alternative chosen. The amount of water to be consumed under each alternative is estimated based on an evaluation of project descriptions and conversations with project personnel.

F-2.2.2.2.5 Data Limitations—Groundwater samples used to characterize subsurface water quality are taken from dedicated pumps that access the most permeable parts of the aquifer, but the samples are homogenized by the pump and represent a composite of the entire well. Chemical constituents may vary depending on the particular interval being sampled, and some intervals may have higher concentrations than others (Robertson et al. 1974, McCurry et al. 1994). Hence, intervals with elevated concentrations of constituents may not be detected.

Retardation coefficients and dispersivity values used in contamination transport models for the INEL site are not well known and are initially estimated from previous investigations (Robertson et al. 1974, Robertson 1977, Arnett and Rohe 1993). The final values used are from calibration of the models where the retardation factor and dispersivity are varied until a match is obtained between the simulated and observed plume concentrations for some timeframe. Hence, they are treated as fitting parameters, rather than empirically derived coefficients. This is more important for the nonconservative contaminants because the values vary for specific elements. An assumed retardation factor of 1 for conservative contaminants (indicates no retardation) was used in all models for tritium, iodine-129, and volatile organic compounds (Domenico and Schwartz 1990, Arnett and Rohe 1993, Robertson et al. 1974, Robertson 1977). Laboratory experiments are difficult to extrapolate to the field because the tests are run under specific conditions that may or may not accurately reflect real conditions. Field-scale experiments are preferred because of the scaling towards a larger system. No empirical studies to date have been performed at the INEL site for determining field dispersivities or retardation coefficients for radionuclides. A large-scale aquifer infiltration test is planned for a site on the INEL to determine field-scale contaminant transport properties (Wood et al. 1994). Values for retardation and dispersion used in contaminant transport modeling for this EIS have been conservatively estimated to represent worst case conditions (Arnett and Rohe 1993).

Values for hydrologic parameters derived from pumping tests (for example, conductivity, transmissivity) are difficult to determine in the Snake River Plain Aquifer because the aquifer has a high transmissivity and is difficult to stress. Formations yielding large volumes of water require high pumping rates, but drawdowns of more than a few feet are difficult to obtain (Ackerman 1991, Robertson et al. 1974). Transmissivity values determined from pump tests are underestimated due to effects of partial penetration with the aquifer by the wells (Garabedian 1986, 1992). The effective portion of the aquifer is not well understood, especially beneath individual wells (Ackerman 1991, Garabedian 1986, 1992; Pittman et al. 1988). Garabedian (1992) compared modeled values to empirical values and determined that the empirical values represent smaller values, because the wells tested are only completed in the upper portion of the aquifer.

Porosity values are a limiting factor in transport modeling. Highest porosity zones in the Snake River Plain Aquifer are the rubble zones and fractures, although saturated vesicular basalts contain a large storage capacity. Porosity estimates range from near zero to 20 percent (Robertson et al. 1974), and porosity estimates of 5 to 10 percent are commonly used in modeling studies (Robertson et al. 1974, Arnett and Rohe 1993, and Schafer-Perini 1993). Because the Snake River Plain Aquifer is semiconfined, storativity is approximately equal to porosity, and values for storativity are also estimated.

The levels of contaminants in the vadose zone need further study because their distribution is only moderately characterized and concentrations change with time (Cecil et al. 1991, EG&G 1993, Marts and Barrash 1991). The lack of information is partially due to the lack of monitoring wells that access the vadose zone perched water zones. Several perched water zones are known and have been characterized for quantity and quality of water, but other perched zones may exist which have not been studied yet. Hubbell (1990), Marts and Barrash (1991), Cecil et al. (1991), and EG&G (1993) suggest the presence of possible perched zones other than the ones documented, located along deeper sedimentary interbeds. Known perched zones are being monitored and characterized at the Idaho Chemical Processing Plant and Test Reactor Area with sampling performed quarterly. Nonradiative metallic contaminants in unsaturated parts of the vadose zone are likely to exist locally but would probably be bound to sediments by sorption (EG&G 1993).

Infiltration rates in the vadose zone are one of the most poorly characterized but important parameters for modeling contaminant transport to the saturated zone. Two of the important studies on infiltration rates of water in the surface sediments near the Radioactive Waste Management Complex have been performed by Cecil et al. (1992) and Kaminski (1991). Arnett and Rohe (1993) use a rate of 47 meters per year (153 feet per year) as a conservative assumption in modeling the flow of liquids from the Idaho Chemical Processing Plant and Test Reactor Area surface ponds to the saturated zone. Additional vadose zone data will be obtained through the large-scale aquifer infiltration test currently scheduled for summer 1994 (Wood et al. 1994).

F-2.2.2.3 Modeling Contaminant Transport. For this EIS, computer modeling was performed to predict the fate and transport of contaminants in the vadose and saturated zones (Arnett and Rohe 1993, Schafer-Perini 1993, Dames and Moore 1993, Arnett 1994). The modeling characterizes contaminant behavior in the subsurface based on established theories of contaminant interaction, contaminant transport, and hydrologic flow. The models are capable of estimating contaminant migration for any timeframe specified by the user and results provide information on future impacts. This section describes the general approach to modeling, provides a discussion of the modeling studies used, and includes a description of limitations and assumptions on which the models are based. See Table F-2-1 for a summary of the contaminant transport models used to evaluate consequences to subsurface water resources. The table includes a brief model description, assumptions, calibration methods, modeling results, and predicted consequences to water resources.

F-2.2.2.3.1 Techniques in Contaminant Fate and Transport Modeling—Fate and transport modeling requires an understanding of the subsurface in addition to understanding how the models work. The steps involved in modeling include (a) data assembly and verification, (b) development of a conceptual model, (c) code selection, (d) model calibration, and (e) computer simulation.

Conceptual model development is one of the first steps in the modeling process and consists of taking a complicated system such as the aquifer located under the INEL site and making simplifying assumptions. This simplification process involves defining (a) the geometry, including

Table F-2-1. Matrix of contaminant transport models used to evaluate consequences to subsurface water resources at the Idaho National Engineering Laboratory site.

Reference	Model description	Assumptions ^a	Calibration	Results	Water resources consequences
Arnett and Rohe (1993)	Used a storage/drainage model coupled with the GFLUX code to determine the amount of strontium-90, iodine-129, and tritium expected to migrate through the vadose zone at the Test Reactor Area and Idaho Chemical Processing Plant. Considered inputs from past waste disposal to the percolation ponds and produced results of the amount of material migrating on a yearly basis.	Model assumed one-dimensional flow (1D) with travel times to the aquifer of three years.	Not applicable	Indicated tritium would migrate through the vadose zone to the aquifer in a relatively short period of time from both facilities. Strontium-90 is not expected to migrate through the vadose zone. Iodine-129 would migrate into the aquifer from the Idaho Chemical Processing Plant. Results were used as input into the MT3D code.	Tritium and iodine-129 would continue to migrate into the aquifer until at least 2010, but in concentrations decreasing with time. No new inputs of strontium-90 to the aquifer are expected. Overall the vadose zone would become "cleaner" with time as nonconservative contaminants decay in place, and conservative constituents flush out of the system.
Arnett and Rohe (1993)	Used the code MODFLOW for groundwater flow simulation coupled with the contaminant transport code MT3D to determine the fate and transport of strontium-90, iodine-129, and tritium plumes in the aquifer extending from the Idaho Chemical Processing Plant and Test Reactor Area. Modeling was from 1995-2035, or until contaminant levels dropped below the maximum contaminant level.	(a) Transient approach; (b) Two-dimensional (2D) flow of water; (c) model boundaries correlate with geographic boundaries on the west and far enough east that uncertainties in water flow would not effect water levels at the INEL; (d) No future discharge of liquids with concentrations above the maximum contaminant levels or derived concentration guides; (e) Precipitation has an insignificant effect on recharge; (f) Sources of waste can be lumped for convenience; (g) wastes are in the upper 100 m (328 ft) of the aquifer; and (h) no speciation of contaminants.	Calibrated using water level data and plume distributions for the years 1970-1990.	Results show that the tritium plume would decay significantly with time and maximum concentrations would be below the maximum contaminant level by the year 2000. Strontium-90 plume is not anticipated to migrate very far from the Idaho Chemical Processing Plant, but max. concentrations would not be below the maximum contaminant level until 2030. Iodine-129 plume would migrate southward towards the INEL boundary and max. concentrations would be above the maximum contaminant level beyond 2035, but within the INEL southern boundary.	The contaminant plumes currently have isolated adverse consequences because of concentrations above the maximum contaminant level. Over time concentrations would decrease and residual contamination would migrate southward. Contaminants would not pose a threat to offsite water quality because only tritium and iodine-129 would migrate off site, but at concentrations below their respective maximum contaminant levels.

Table F-2-1. (continued).

Reference	Model description	Assumptions ^a	Calibration	Results	Water resources consequences
Schafer-Perini (1993)	Used the code FLASH to simulate groundwater flow coupled with the code FLAME to simulate contaminant transport. Modeling was used to simulate the fate and transport of trichloroethylene, tetrachloroethylene, dichloroethylene, tritium, and strontium-90 plumes extending from Test Area North. Modeling was performed for the time period from 1994-2094.	Modeling was performed under two assumptions: (a) source was immobile and would act as a constant, infinite source; (b) source was limited in amount and free to migrate in the groundwater; (c) high strontium-90 retardation.	Hydrologic flow was calibrated using 1990 data and contaminant transport using 1991 data.	Results show that trichloroethylene and dichloroethylene plume migration depended on the choice of assumptions. Under the first, the plumes extended from Test Area North in concentration well above maximum contaminant levels. Under the second, the plumes migrated away from Test Area North in concentrations above maximum contaminant levels. Tetrachloroethylene would migrate away from the Test Area North at concentrations above the maximum contaminant level under either assumption. Tritium and strontium-90 migration did not depend on assumptions used. Tritium is at concentrations below the maximum contaminant level, and the plume would not migrate far. The strontium-90 plume would not migrate very far from Test Area North, but would exhibit concentrations well above the maximum contaminant level.	Test Area North represents one of the most significant contamination problems at the INEL. Modeling suggest organics would significantly affect an groundwater quality in the future as plumes spread. Plumes are not anticipated to migrate to the INEL boundary due to the remote location of Test Area North. Radionuclides do not pose a threat to offsite water quality because of low concentrations, short half-lives, and chemical retardation of constituents in the vadose zone. Remediation to extract organics and strontium-90 would start within the next year and is expected to reduce plumes to eliminate adverse impacts.
Dames and Moore (1993)	Used the code PORFLOW to model organic vapor transport through the vadose zone to the aquifer at the Radioactive Waste Management Complex. Contaminant migration in the aquifer to the INEL boundary was simulated by the code AT123D.	(a) Organics were assumed to travel in the vapor stage and advectively with vadose water towards the saturated zone; (b) complete mixing at saturated zone interface.	To be determined	Results indicate that a significant amount of organic material might enter the aquifer. Peak concentrations were predicted in the year 2070. Once chemicals enter the aquifer, material would migrate to the southern INEL boundary with some contaminant concentrations above the maximum contaminant level.	Volatile organic compounds at the Radioactive Waste Management Complex pose a potential threat to water quality. Most of the contamination is contained within the vadose zone [183 meters (600 feet) thick at the Radioactive Waste Management Complex]. A planned remediation project performing vapor extraction of organics should alleviate the potential of organic vapor migration into the aquifer, thus reducing impacts.

Table F-2-1. (continued).

Reference	Model description	Assumptions ^a	Calibration	Results	Water resources consequences
Robertson (1977)	Used a numerical model to determine the potential of tritium and strontium-90 migrating from the vadose zone into the aquifer at Test Reactor Area. The subsurface was divided into three sections representing the upper and lower perched zones and the migration pathway beneath the perched zones.	(a) 1D flow in Sections 1 and 3. (b) 2D flow in Section 2.	Simulated flow for 1.6 years from the percolation ponds to the perched zones to simulate observed contours.	Results indicate that tritium is expected to migrate from Test Reactor Area perched zones, but that strontium-90 would not breakthrough the vadose zone for the 35 year modeling time. Results are consistent with the vadose zone modeling by Arnett and Rohe (1993).	The only impact shown from this study is that tritium would migrate to the aquifer and act as a continued source of this contaminant. Concentrations were predicted to be low and would not significantly effect the current tritium plume. Strontium-90 would not migrate into the aquifer, hence no adverse impacts are expected due to this radionuclide.
Robertson (1974)	Modeled strontium-90, tritium and chlorine plume migration from the Idaho Chemical Processing Plant and the Test Reactor Area using a predecessor of the USGS code for groundwater flow contaminant transport. Modeling considered different source terms and slightly different effects, however, from recharge by the Big Lost River. The approach is very similar to the methods of Arnett and Rohe (1993) and was based on the same principles.	(a) no speciation of contaminants; (b) transient flow; (c) flow is in the upper 76 meters of the aquifer; (d) 2D flow; (e) porosity is 10 percent; (f) inputs from 1973-2000 are the same as for 1973; (g) recharge quantities along the Big Lost River; and (h) model boundaries correlate with geographic boundaries on the west and far enough east that uncertainties in water flow would not effect water levels at the INEL.	Calibrated the groundwater flow using data from 1964, strontium-90 plumes against 1964 and 1972 data, and tritium plumes against 1968.	Results of the model are similar to those produced by Arnett and Rohe (1993) for tritium and strontium-90 but slightly different due to differing source terms. Strontium-90 plume was not anticipated to migrate very far from sources and would have a restricted distribution, but maximum concentrations would be above the maximum contaminant level. Tritium plume was shown to migrate past the southern INEL boundary with concentrations below the maximum contaminant level.	Predictions from this study show that the plume contaminant concentrations would decrease eventually to levels below the maximum contaminant level, but that the plume front would continue to migrate towards the INEL boundary. No adverse impacts to areas outside the INEL are expected because contaminants would leave the site below maximum contaminant levels.
Arnett (1994) in prep.	Considered the affects of an unintentional discharge from a generic SNF storage facility on the environment.	(a) 5 gallons per day for one month; (b) radionuclide concentrations in the leak was equal to that in the storage pool water; (c) leakage from secondary containment.	To be determined.	Preliminary results indicate that the concentrations of strontium-90 above maximum contaminant level would not migrate to the southern INEL boundary.	Only localized impacts to the subsurface beneath the Idaho Chemical Processing Plant.

a. Input parameters for the equations are estimates based on the best available data.

boundaries of the aquifer; (b) flow input and output; (c) locations of important features such as sedimentary interbeds; and (d) locations of wastes and rates of discharge. Depending on the area being modeled, several different conceptual models were developed for the models addressed in this EIS (Arnett and Rohe 1993, Schafer-Perini 1993, Dames and Moore 1993, Robertson et al. 1974, Robertson 1977).

For the modeling conducted in this EIS, several codes are available to model contaminant transport in the Snake River Plain Aquifer. Arnett et al. (1992) provides a detailed discussion of the code selection and bases for selecting the codes used. The codes MODFLOW and MT3D were chosen because of their wide acceptance in the scientific community. GFLUX is a modification of a U.S. Nuclear Regulatory Commission code, GWSCREEN, which is widely used in the scientific community and is accepted for use at the INEL site. Schafer-Perini (1993) use the codes FLASH and FLAME for modeling organic plumes.

Calibration is an important step in the modeling process, because the validity of future predictions rely on the accuracy of the match between simulated groundwater flow patterns and contaminant plumes and observed data. Calibration of a flow model of the regional aquifer involved preparation of hydraulic head contours for multiple time periods. Time versus head plots (hydrographs) were also prepared for selected wells. Hydrologic parameters were varied until hydraulic heads resembled observed contours. This method required several iterations with manual parameter adjustment before a suitable match was obtained. Calibration of the contaminant transport model followed a similar approach. Errors in calibration are usually associated with areas where hydrologic parameters are uncertain because of the high degree of heterogeneity within the basalts. Contaminant transport modeling typically requires adjustment of the retardation and dispersion coefficient because field-scale values are not known (Arnett and Rohe 1993, Schafer-Perini 1993, Dames and Moore 1993, Robertson et al. 1974, Wood et al. 1994).

The general approach to groundwater modeling by computer simulation is to solve the groundwater flow equation to predict hydraulic heads and to use the head distribution in the transport model to calculate the advective flow (velocity). Hydrologic flow equations for transient conditions are a function of the changing hydraulic gradient in time and space (water input and output), storativity, porosity, fluid density and compressibility, and transmissivity. Contaminant

transport equations are a function of time, retardation factors, dispersion coefficients, decay constants, advective transport, and rates of waste input. Hydrologic flow equations must be solved first because results provide input into contaminant transport equations. The flow and transport equations used in this EIS are widely accepted and utilized in many types of computer codes (Arnett and Rohe 1993, Robertson 1974). Flow and contaminant transport theory are discussed in Freeze and Cherry (1979), Driscoll (1989), and Domenico and Schwartz (1990).

A primary step in performing computer simulation is to establish the model's spatial domain which is then divided into a set of similar units of specified dimensions which are assigned a computational node. Each node is assigned material properties. The edges of the domain are assigned boundary conditions from information external to the model (Arnett and Springer 1993, Arnett and Rohe 1993, Domenico and Schwartz 1990). In general, the finer the grid, the more accurate the predictions, but the longer the computational time. Grid patterns in Arnett and Springer (1993), Arnett and Rohe (1993), and Robertson et al. (1974) consisted of a rectangular pattern stretching from the northwestern mountain range and east about 16 kilometers (10 miles) past the INEL site boundary; the northern grid boundary was along the mountain front, and the southern boundary extended about 8 kilometers (5 miles) south of the INEL site. A submodel with a final grid was set up within the INEL site over the contaminant plumes for finer detail. The finite-element grid formed by Schafer-Perini (1993) was similar but contained more complicated triangular elements near sources of waste (for example, TSF-05 injection well).

The flow and contaminant transport equations are solved by finite-difference or finite-element techniques (approximations of the partial differential equations) for each node within the grid. Solutions predict hydraulic head and concentrations of contaminant distributions as a function of time. Fine grid patterns are needed around some waste sources to simulate steeper hydrologic and chemical gradients. Finite-element techniques have some advantages in these situations. Arnett and Rohe (1993) and Robertson et al. (1974) used the finite difference techniques, whereas Schafer-Perini (1993) used finite-element techniques. After completion of the simulation (that is, equations solved for each node at all time increments) the concentrations and hydraulic heads within the nodes are contoured, thus producing simulated plume maps and hydraulic head contours. The modeling grid used for this EIS was bounded by specified variable head and no-flow boundaries to the west. No-flow boundaries were assigned to the contacts between the mountains and Snake River Plain Aquifer, whereas variable head boundaries were

assigned to recharge areas such as mouths of the Big Lost River, Little Lost River, and Birch Creek. Schafer-Perini (1993) considered variable head boundaries for the Test Area North model. Eastern and southern boundaries were considered constant head and at sufficient distances from contaminant plumes such that reasonable errors in defining the boundary conditions had a negligible effect on the simulated groundwater velocity in the plume areas.

F-2.2.2.3.2 Modeling Studies—Table F-2-1 presents the different models used in the assessment of predicted consequences to water resources. Table F-2-1 describes the individual models used, results produced, potential impacts to the water resources, calibration of the models, and assumptions the models are based on. Modeling was performed by several investigators for the vadose zone, the saturated zone, for a bounding accident scenario, and for an unintentional release from a generic spent nuclear fuel storage facility. Iodine-129, tritium, and strontium-90 plumes extending from the Test Reactor Area and Idaho Chemical Processing Plant were modeled by Arnett and Rohe (1993). Organic contaminants at Test Area North and the Radioactive Waste Management Complex were modeled by Schafer-Perini (1993) and Dames and Moore (1993), respectively. In addition, an accident scenario for a high-level waste tank failure at the Idaho Chemical Processing Plant was modeled. The accident scenario model concluded that strontium-90 would not extend beyond the immediate vicinity of the Idaho Chemical Processing Plant above maximum contaminant levels throughout the implementation period (Arnett 1994). The results of the tank failure model were dependent on limited amount of liquid in the tank being the only hydraulic driver; it appears reasonable that prompt action would be taken by authorities to mitigate such an accident through capping, pumping, and other means. The source terms for unintentional discharges at a generic spent nuclear fuel storage facility are negligible compared with the strontium-90 source terms in the high-level waste tank and small compared to past strontium-90 discharges.

F-2.2.2.3.3 Modeling Assumptions and Limitations—Table F-2-1 lists the assumptions that provide the bases for the different models used to support the environmental consequences described in Section 5.8, Water Resources. The following briefly discusses the assumptions and limitations.

- **Transient versus steady-state modeling:** Garabedian (1986, 1992), Arnett and Springer (1993), and Robertson et al. (1974) concluded that the Snake River Plain

Aquifer system is best simulated by considering transient conditions and a transient hydraulic flow. Modeling can be conducted under transient (time-dependent) or steady-state conditions. Steady-state modeling is used when aquifer conditions (for example, water levels, recharge) can be considered constant for approximately the period of simulation. Mathematically, the change in hydraulic gradient with time is considered zero, and storativity terms are not needed when assuming steady-state conditions. The steady-state assumption cannot be made because water levels and recharge volumes change with time.

- **Aquifer anisotropy and two dimensional flow:** Garabedian (1992) concluded that on a regional scale the groundwater flow is predictable and can be simulated in two dimensions. Vertical flow was found to be several orders of magnitude less than horizontal flow. On local scales vertical flow may be significant, but on regional scales the assumption is valid.
- **No new discharge of radioactive wastes with concentrations above the maximum contaminant level or derived concentration guides:** One of the primary assumptions used for modeling and in the evaluation of impacts to the water resources is that no new intentional discharges of radioactive wastes with concentrations above the maximum contaminant levels or derived concentration guides will be discharged to the subsurface. Modeling performed for the fate and transport of contaminant plumes assumes this in evaluating baseline contaminant migration from the vadose zone to the saturated zone (Arnett and Rohe 1993). Review of individual project descriptions indicates that wastes will be disposed of in evaporation basins and liquid waste condensers. Sources of wastes are slowly declining due to improved management practices and engineering and institutional controls; therefore, under standard operating conditions no liquid wastes will have concentrations above maximum contaminant levels or derived concentration guides which would enter the subsurface. However, this assumes no accidental or unintentional releases will occur. Bounding conditions on possible effects from a series of accidental spills indicates that even under conservative estimates, spills will not likely affect water quality beyond the immediate facility area (Arnett 1994).

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- **Boundary conditions:** The boundary conditions imposed for the INEL site model grids consisted of constant head, no-flow, and variable head. Boundaries to the east were considered to have sufficient distances from contaminant plumes such that reasonable errors in defining the boundary conditions have negligible effects on the simulated groundwater velocity in the plume areas. These boundaries were assigned constant heads. The boundaries along the western border were considered to have no flow along the mountain fronts and variable head along the recharge zones. Variable head boundaries were used on the Schafer-Perini (1993) model among northern recharge zones. Model calibration indicates that these boundaries appear reasonable because a suitable match between simulated and observed flow patterns was made for the 1970-1990 time period (Arnett and Springer 1993).
 - **Precipitation is insignificant to recharge:** The amount of precipitation that accumulates in the vadose zone and migrates to the aquifer is negligible when compared to the amount from underflow. This is a good assumption considering the amount of precipitation (22 centimeters per year, 8.7 inches per year) and the evaporation rate (125 centimeters per year, 49.2 inches per year).
 - **Contaminant transport occurs in the upper 75-100 meters (243-325 feet) of the aquifer:** Several modelers assume that the contaminant transport occurs in the upper 100 meters (325 feet) of the aquifer since this is the portion with the highest hydraulic conductivity (Arnett and Rohe 1993, Schafer-Perini 1993, Dames and Moore 1993, Robertson 1977, Robertson et al. 1974). Vertical migration of wastes downward below this zone is considered insignificant. Several studies concluded this to be the effective portion of the aquifer (Robertson et al. 1974, Barraclough et al. 1976, Garabedian 1986, 1992), hence for regional scale modeling this is likely a valid assumption. On a local scale, downward vertical movement of contaminants may be significant.
 - **No speciation of the contaminant of interest:** The models that were used in this EIS do not consider speciation of contaminants (specifically strontium-90) with other anions in the water. The contaminants are assumed to be in their valence state and not bound to other constituents, thus preventing sorption. Equilibrium modeling

using the U.S. Environmental Protection Agency-developed code MINTEQA2 indicates that the contaminants of interest in the plume would be unspeci-ated and would be expected to sorb as discussed in the models.

The mathematics used in the models are founded on other assumptions that are not described here. For example, it is assumed that flow can be described by Darcy's Law and that the partial differential equations can be approximated for solution by numerical methods. For more detail, see Domenico and Schwartz (1990).

F-2.2.2.3.4 Potential Contaminant Migration from Solid Waste—Solid low-level radioactive and transuranic waste have been disposed of in several pits at the Subsurface Disposal Area within the Radioactive Waste Management Complex since 1952 and are projected to continue until 2020. Transuranic waste disposal at the complex was discontinued in 1970; however, disposal of low-level radioactive waste is projected to continue until 2020. A preliminary scoping risk assessment of radioactive waste disposal practices during the time period from 1952 to 1996 is currently being performed as part of a Comprehensive Environmental Response, Compensation, and Liability Act investigation. The investigation is being conducted under the Federal Facility Agreement/Consent Order which resulted from negotiations between DOE, the U.S. Environmental Protection Agency, and the State of Idaho. For the purposes of this EIS, impacts are being evaluated from 1995 to 2005. Results of the preliminary risk assessment indicate that contaminants would not reach the INEL site boundary exceeding Federal primary drinking water standards through 2005 (Loehr et al. 1994). For the next 100 years, the radionuclides with the highest 30-year average concentration in groundwater are predicted to be carbon-14 and tritium at 586 and 4,510 picocuries per liter, respectively. These levels are well below DOE's Derived Concentration Guide established for carbon-14 (70,000 picocuries per liter) and the U.S. Environmental Protection Agency's Maximum Contaminant Level established for tritium (20,000 picocuries per liter).

A radiological performance assessment was also conducted for low-level waste buried at the Radioactive Waste Management Complex from 1984 through present operations and projected to be disposed through 2020 (Maheras et al. 1994). The results of the assessment indicate that the maximum total pathway exposure occurring by the year 2060 at the INEL site boundary would be less than 0.60 millirem per year (Maheras et al. 1994). No significant impacts are expected to

occur within the implementation period of the EIS. However, further information is required before an accurate evaluation of the potential for contaminant transport from the Radioactive Waste Management Complex to the environment can be completed. Information is currently being compiled to characterize source terms, migration rates of vadose water, infiltration rates through soil coverings, sorptive characteristics of contaminants, and other information. A Remedial Investigation/Feasibility Study and a risk assessment is being prepared to evaluate the potential impacts of past, present, and future activities at the Radioactive Waste Management Complex, but is not available for this EIS.

New wastes resulting from sources outside the INEL site identified under the proposed alternatives would not be addressed by the Remedial Investigation/Feasibility Study or the risk assessment. Additionally, new wastes shipped to the INEL site under the alternatives would be addressed under separate National Environmental Policy Act documentation, and/or as specified under the Resource Conservation Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act.

Loehr et al. (1994) and Maheras et al. (1994) used computer models including GWSCREEN and PORFLOW to predict the levels of contaminants that would occur at the INEL site boundary. The models considered the leaching and migration of contaminants through the vadose zone and into the regional aquifer. For a detailed discussion of methods used in the modelling approach, refer to these reports.

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F-3 AIR RESOURCES

Section F-3 provides supplemental information on methodology and other technical support for the air resources sections of Volume 2 of the Spent Nuclear Fuel and INEL Environmental Restoration and Waste Management Environmental Impact Statement.

F-3.1 Overview

Activities proposed under the Environmental Restoration and Waste Management (ER&WM) Program at the Idaho National Engineering Laboratory (INEL) site may affect the quality of existing air resources in various ways. The alternative courses of action proposed under this Program have consequences that vary both in nature and magnitude. These consequences must be thoroughly characterized to provide information needed to support the selection of proper courses of action. Assessments have been performed to characterize the existing conditions of radiological and nonradiological air quality, as well as the consequences of alternative courses of action. Section F-3 presents background information related to these assessments, including descriptions of

- The regulatory framework under which air quality standards and criteria are established and administered
- Airborne emissions of radiological and nonradiological pollutants from existing INEL site facilities and proposed projects
- The data, methods, and computer models applied to estimate concentrations of pollutants at various locations as a result of airborne emissions.

The information presented herein supports the summary results presented in Sections 4.7 and 5.7 (Air Resources) of Volume 2 of the Spent Nuclear Fuel and Environmental Restoration and Waste Management Environmental Impact Statement, which respectively describe the affected environment and consequences of alternatives on air quality. In addition to establishing the technical basis for those summary results, this section presents detailed emissions estimates for specific proposed facilities. Additional details on the assessment results, including predicted

consequences for all combinations of alternative and waste management options and selected individual projects (including incineration at the Waste Experimental Reduction Facility), are presented in *Technical Support Document for Air Resources, INEL Environmental Restoration and Waste Management Programs* (Belanger et al. 1994).

F-3.1.1 Scope

The assessments described in Section F-3 consider both nonradiological and radiological air quality related to baseline conditions, foreseeable increases to the baseline, and the consequences of Environmental Restoration and Waste Management alternative courses of action. Specifically, the scope includes background information on air resources, air quality regulation, and assessments related to (a) existing conditions associated with actual emissions from INEL site facilities (termed the actual emissions baseline), (b) conditions that would be experienced if existing facilities operated to the maximum extent allowed by applicable permits or limits (termed the maximum emissions baseline), and (c) the estimated consequences of emissions from projects associated with each of the four Environmental Restoration and Waste Management alternatives.

The assessments focus on conditions or impacts that result at onsite and offsite locations from the release of contaminants from various categories of sources. The types of emissions assessed include radionuclides and the two major categories of nonradiological pollutants—the so-called criteria pollutants and toxic air pollutants. The categories of sources assessed include stationary sources (such as facility stacks and vents), mobile sources, and sources related to construction activities. The locations for which baseline conditions and impacts are assessed include major work areas within the INEL site, locations along the INEL site boundary and public roads, and Craters of the Moon Wilderness Area. Assessment results are summarized in Sections 4.7 and 5.7 (Air Resources) of the main text and are presented in additional detail in Belanger et al. (1994).

F-3.1.2 Supporting Documentation

Section F-3 summarizes the methods of independent analyses performed by several different specialists from contractor organizations. In some cases, those analyses are documented

in reports prepared for this Environmental Impact Statement. These documents are considered key references. Their contents and the manner in which they were used in the air resources assessments are summarized as follows:

- A report prepared by Science Applications International Corporation (Belanger et al. 1994), which provides additional detail on assessment methodology and results, including projected emissions and impacts for specific projects and waste management options.
- A report prepared by EG&G Idaho, Inc. (Leonard 1993), which presents estimated radiological doses resulting from airborne radionuclides released by facilities at the INEL site. This report was used as a basis for the existing radiological air quality conditions.
- A document prepared by Environment and Ecology, Inc. (Ecology and Environment 1994), describing the methods and results of the assessment of baseline conditions for toxic air pollutants. These results were used to establish the actual and maximum baseline levels of toxic air pollutants.
- An Engineering Design File prepared by EG&G Idaho, Inc. (Leonard 1994), which presents estimated radiation doses to the maximally exposed worker and offsite individual and population dose resulting from specific projects associated with Environmental Restoration and Waste Management alternative actions. These results were used as the basis for estimating radiological doses for radionuclide emissions associated with specific alternatives and waste stream management options.
- Engineering Design Files prepared by EG&G Idaho, Inc., describing the source terms estimated for no action projects (Staley 1993a) and proposed action projects (Staley 1993b). These source terms were used as input to the air quality assessments for foreseeable increases to the baseline and Environmental Restoration and Waste Management alternatives, which included no action and proposed action projects.

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- A document prepared by Ecology and Environment, Inc. (Ecology and Environment 1993), describing the methods and results of assessments to estimate impacts from mobile and construction source emissions. These results were used as a basis for estimating consequences of mobile sources and construction activities related to Environmental Restoration and Waste Management alternatives.

Section F-3 attempts to integrate the descriptions of methods, assumptions, and other key information from the analyses cited above into a single source.

F-3.1.3 Organization

The remainder of this section is organized as follows:

- Section F-3.2 presents the background environmental information on the INEL site, including background levels of radiation, radioactivity, and nonradiological pollutants
- Section F-3.3 contains a description of air quality regulations and guidelines and a discussion of how they apply to sources at the INEL site
- Section F-3.4 describes the methods and assumptions used to estimate emissions and assess conditions and impacts for releases of radiological and nonradiological pollutants and presents listings of these emissions for specific projects proposed for Environmental Restoration and Waste Management alternatives.

F-3.2 The Idaho National Engineering Laboratory Site Environment

This section describes background levels of radiation, airborne radioactivity, and nonradiological air quality in the environs of the INEL site.

F-3.2.1 Radiation and Airborne Radioactivity

The population of the Eastern Snake River Plain is exposed to environmental radiation from both natural and anthropogenic sources (that is, sources of human origin). This section describes background levels of radiation and airborne radioactivity in this geographical region and other sources of population exposure not related to INEL site emissions. Monitoring data for areas beyond the influence of INEL site emissions are also presented. Additional information related to radiological conditions (including monitoring results and airborne radioactivity associated with existing INEL site facilities) is presented in DOE-ID (1993a).

F-3.2.1.1 Sources of Radiation Exposure Not Related to Idaho National Engineering Laboratory Site Operations. The predominant source of radiation in the region is the natural radiation background, a term that refers to natural sources of radiation to which humans are continuously exposed. Background radiation includes sources such as cosmic rays; radioactivity naturally present in soil, rocks, and the human body; and airborne radionuclides of natural origin (such as radon). The dose from background radiation results from sources that can be either external (outside the body) or internal (within the body). External sources consist primarily of cosmic rays and radioactivity within soil and rocks. Internal sources include radioactivity naturally present within the human body and airborne radioactivity that can deposit in the lungs when inhaled. The natural background dose is increased by radioactivity still remaining in the environment as a result of atmospheric testing of nuclear weapons, although this increase is very minor (less than one percent).

Table F-3-1 presents a summary of the estimated background dose by various exposure categories for residents of the Eastern Snake River Plain. As can be seen from these results, the cumulative annual dose, 351 millirem, is due largely to the inhalation of airborne radioactivity. This radioactivity consists almost entirely of radioactive particles formed by the decay of naturally occurring radon.

In addition to natural background sources, residents of the Eastern Snake River Plain receive exposure from radiation sources of human origin (anthropogenic sources), including medical x-rays, nuclear medicine diagnostic procedures, consumer products (such as televisions, smoke detectors or self-luminous products), and radioactivity remaining in the environment as a

Table F-3-1. Summary of environmental radiation dose from natural background sources to residents of the Eastern Snake River Plain for 1991.^a

Source	Annual dose (millirem)
External sources^b	
Terrestrial radioactivity	73
Cosmic rays	39
Total external	112
Internal sources^c	
Airborne (inhaled) radioactivity	200
Radioactivity in the body	39
Total internal	239
Total dose	351

a. Dose is expected to vary by a small amount from year to year.

b. Source: DOE-ID (1992a).

c. Regional data are not available; internal dose values are effective doses for average member of the U.S. population but are likely to be representative of the Eastern Snake River Plain (NCRP 1987).

result of atmospheric testing of nuclear weapons. Collectively, these result in an annual dose of about 68 millirem to the average U.S. population member, with most of this dose (about 54 millirem per year) resulting from the medical use of radiation (NCRP 1987). This dose does not include the contribution from radioactivity in tobacco products, which results in a substantial radiation dose (several rem per year) to the lungs of smokers.

F-3.2.1.2 Radiological Environmental Monitoring. Over the years, radiological conditions in the INEL site environs have been characterized by various monitoring programs. Monitoring refers to a variety of activities (for example, sampling, analysis and direct measurements) performed to measure ambient radiation exposure rates and airborne radioactivity levels. The INEL Environmental Surveillance Program includes a comprehensive network of 23 continuous air samplers. Twelve of the sampling locations are located within the boundaries of the INEL site; 11 are located offsite, including seven stations near the INEL site boundary; and four distant stations are located within the communities of Blackfoot, Idaho Falls, and Rexburg, and in Craters of the Moon Wilderness Area. It is assumed that results from onsite and

boundary community locations include contributions from background conditions and INEL site emissions, while distant locations represent background conditions beyond the influence of INEL site emissions. A summary of gross alpha and beta activity measurement results for distant and INEL site boundary community locations, presented in Table F-3-2, indicates that there is no significant difference in airborne radioactivity levels among these locations. Additional details regarding this program are provided in DOE-ID (1992a).

The Environmental Surveillance Program also includes direct measurements of ambient (environmental) radiation levels using thermoluminescent dosimeters (TLDs). These devices measure ionizing radiation exposure rates due to the combined sources of natural radioactivity in the air and soil, cosmic rays, residual fallout from nuclear weapons tests, and radioactivity from INEL site operations. Dosimeters are placed at seven distant community locations and six boundary locations. The average annual exposure measured by the thermoluminescent dosimeters for 1991 was 123 milliroentgen (which corresponds to a dose of 130 millirem) for distant locations, and 121 milliroentgen (126 millirem) for boundary community locations (DOE-ID 1992a).

F-3.2.2 Background Nonradiological Air Quality

As used here, the term background air quality refers to the levels of nonradiological air pollutants in ambient air that are not attributable to INEL site activities. Limited information is available for characterization of background air quality levels, since only particulate matter has been monitored at locations beyond the influence of the INEL site. The INEL Environmental

Table F-3-2. Airborne radioactivity levels for Idaho National Engineering Laboratory onsite, site boundary communities, and distant locations for 1991.

Location	Average concentration ^a (10 ⁻¹⁵ microcuries per milliliter)	
	Alpha	Beta
Distant	2.0 ± 0.2	27 ± 1
Boundary	1.8 ± 0.1	28 ± 1
Onsite	1.7 ± 0.1	29 ± 1

a. Values are arithmetic means with 95 percent confidence interval.

b. Source: DOE-ID (1992a).

Surveillance Program, which is conducted by the Department of Energy (DOE) Idaho Operations Office Radiological and Environmental Sciences Laboratory (RESL), monitors airborne particulate matter concentrations at INEL site boundary communities and distant and onsite locations, as illustrated in Figure F-3-1. Onsite data are considered to include background levels plus contributions from INEL site activities. Results for airborne particulate monitoring at distant, INEL site boundary, and onsite locations for the period 1988 through 1992 are presented in Table F-3-3. Monitoring of other pollutant levels, including nitrogen dioxide and sulfur dioxide, is performed at onsite locations. Nitrogen dioxide is monitored at two locations onsite to fulfill one of the conditions in a Permit to Construct issued by the State of Idaho. Sulfur dioxide is also measured at one of these locations.

The State of Idaho has conducted particulate monitoring at Craters of the Moon Wilderness Area. Monitoring results for this activity, which was discontinued in 1990, are presented in Table F-3-4. Since this location is approximately 20 kilometers (12.4 miles) from the INEL site boundary (and much further from most major emissions sources), these levels can be considered representative of general background.

Table F-3-3. Environmental surveillance program particulate matter monitoring data at the Idaho National Engineering Laboratory for 1988 through 1992.^a

Year	Concentration ^b (micrograms per cubic meter)		
	Distant group	Boundary group	Onsite group
1988	50 ± 20	35 ± 9	32 ± 13
1989	40 ± 14	30 ± 7	17 ± 2
1990	36 ± 12	32 ± 8	20 ± 9
1991	30 ± 20	28 ± 12	18 ± 3
1992	26 ± 19	23 ± 10	13 ± 2

a. Source: DOE-ID (1993a).

b. Values are arithmetic group means of quarterly composites of weekly samples with 95 percent confidence level for the mean.

Figure F-3-1. The airborne radioactivity monitoring network operated by the Radiological and Environmental Sciences Laboratory at the Idaho National Engineering Laboratory.

Table F-3-4. Summary of total suspended particulate matter monitoring data for Craters of the Moon Wilderness Area.^a

Year	Concentration (micrograms per cubic meter)			
	24-hour maximum	Standard ^b	Annual average	Standard ^b
1984	41	260	6	75
1985	48	260	10	75
1986	41	260	10	75
1987	35	260	15	75
1988	43	260	14	75

a. Source: IDHW (1991). Data are for the last five years for which results are available.

b. These are primary State standards for total suspended particulates; secondary standards are 150 micrograms per cubic meter for 24-hour total suspended particulates and 60 micrograms per cubic meter for annual average.

F-3.3 Air Quality Standards and Regulations

To protect the public from potential harmful effects of air pollution, air quality regulations have been established by Federal and State agencies. 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
- Establishment of limits on emissions of air pollutants from vehicular and man-made sources
- Implementation of a permitting program to regulate (control) emissions from stationary (non-vehicular) sources of air pollution
- Issuance of prohibitory rules, such as rules prohibiting open burning.

At the INEL, 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 emission 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.

This section describes Federal and State air quality regulations that are applicable to the proposed actions and programs established by DOE to comply with environmental, safety, and health requirements in general and air quality requirements in particular.

F-3.3.1 Federal and State Air Quality Requirements

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. Facilities planned or currently operating at the INEL are subject to air quality regulations and standards established under the Clean Air Act and by the State Department of Health and Welfare (IDHW), Division of Environmental Quality, and to internal policies and requirements of DOE. Air quality standards and programs applicable to INEL operations are summarized in Figure 4.7-2 of Volume 2 of this Environmental Impact Statement and are described in further detail below.

F-3.3.1.1 Ambient Air Quality Standards. The Federal Clean Air Act establishes National Ambient Air Quality Standards (NAAQS) 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 on 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. In addition, the State of Idaho has

also established an additional State ambient air quality standard for total suspended particulates (all airborne particles regardless of size) and a standard for fluorides in vegetation.^a These pollutants have been termed criteria air pollutants. A listing of National Ambient Air Quality Standards is provided in Table F-3-5.

Table F-3-5. National Ambient Air Quality Standards and increment values for Prevention of Significant Deterioration (micrograms per cubic meter).

Pollutant	Averaging time	Standard		Increment	
		Primary	Secondary	Class II area	Class I area
Sulfur dioxide	3-hour	(a)	1300	512	25
	24-hour	365	(a)	91	5
	Annual	80	(a)	20	2
Particulate matter ^b	24-hour	150	150	30	8
	Annual	50	50	17	4
Nitrogen dioxide	Annual	100	100	25	2.5
Carbon monoxide	1-hour	40,000	(a)	(a)	(a)
	8-hour	10,000	(a)	(a)	(a)
Lead	Quarterly	1.5	1.5	(a)	(a)
Ozone	1-hour	235	235	(a)	(a)

a. No standard or increment for this pollutant or averaging time.

b. Refers to particulate matter less than 10 microns in size (PM-10). Includes recently promulgated increment for PM-10.

a. In the assessments performed for this Environmental Impact Statement, all particulate matter was assumed to be of respirable size (termed PM-10), with the exception of fugitive dust sources. Since the standard for PM-10 is more stringent than that for total particulates, the former standard was used as basis for comparison in these assessments. The assessment for fluorides in vegetation was omitted in favor of a more stringent comparative standard for levels of toxic air pollutants in air (see Section F-3.3.1.5). Therefore, discussions that follow do not include specific detail on total suspended particulates and fluorides.

The U.S. Environmental Protection Agency 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 standard. 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. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that encompasses the environs of the INEL has been classified as attainment for all ambient air quality standards, meaning that air pollution levels are below the ambient air quality standards and are considered healthful. The nearest nonattainment area lies some 50 miles south of the INEL site in Power and Bannock Counties. This area has been designated as nonattainment for the standards related to respirable particulate matter.

F-3.3.1.2 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 *Prevention of Significant Deterioration* (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, which is 1977. 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 INEL site are presented in Table F-3-5.

The State of Idaho Department of Health and Welfare, Division of Environmental Quality (DEQ), administers the Prevention of Significant Deterioration Program. Proposed new sources of emissions at the INEL site and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEL site is considered a major source, since facility-wide emissions of some air contaminants exceed 250 tons per year. As such, a Prevention of Significant Deterioration analysis must be performed for all significant emissions increases of specified pollutants and radionuclides. 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. 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 INEL site facility requires a Prevention of Significant Deterioration 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 control significant increases in 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 Prevention of Significant Deterioration Class I area
- Will not result in an exceedance of an ambient air quality standard.

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values—visibility, vegetation, and soils. Generally, all Prevention of Significant Deterioration projects must go through a public comment period with an opportunity for public review. The INEL has been granted a total of 23 Prevention of Significant Deterioration permits to construct by the Division of Environmental Quality; applications for an additional six permits have been submitted and are pending approval (DOE-ID 1992a).

F-3.3.1.3 National Emission Standards for Hazardous Air Pollutants. In addition to ambient air quality standards and Prevention of Significant Deterioration 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* (NESHAPs). This program was substantially amended in 1990 and has yet to be fully implemented. However, one section of the National Emission Standards for Hazardous Air Pollutants program that currently applies to INEL operations is contained in Title 40 of the Code of Federal Regulations (CFR) Part 61, Subpart H, *National Emissions Standards for Radionuclides from Department of Energy Facilities*. This regulation establishes a limit to the

dose that may be received by a member of the public due to operations at INEL. 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 INEL 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 U.S. Environmental Protection Agency. Proposed new sources of emissions at INEL 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 U.S. Environmental Protection Agency. New sources are also evaluated to determine emissions monitoring requirements. The INEL currently holds 27 National Emission Standards for Hazardous Air Pollutants Permits granted by the U.S. Environmental Protection Agency (DOE-ID 1992a).

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. The INEL complies with the requirements for evaluation, control, and permitting of nonradiological hazardous air pollutants through programs that are also administered by the U.S. Environmental Protection Agency. In accordance with 1990 Amendments to the Clean Air Act, maximum achievable control technology (MACT) will be specified by the U.S. Environmental Protection Agency for various sources. Those sources will have to implement programs or controls to achieve maximum achievable control technology by the scheduled implementation date and analyze residual risk. If the residual risk is above specified acceptable limits, additional controls will be required. To date, only a few maximum achievable control technology levels have been proposed, and the INEL is not yet directly affected. It is expected that future controls will be required as maximum achievable control technology levels are promulgated for source categories, including (but not limited to) solid waste treatment, storage and disposal facilities (scheduled for November 15, 1994), and industrial boilers, process heaters, stationary internal combustion engines, hazardous waste incinerators, and site remediation activities (all scheduled for November 15, 2000).

F-3.3.1.4 State of Idaho Permit Programs. The Idaho Air Pollution Control Program, administered by the Division of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt from permitting requirements, a *Permit to Construct* must be obtained before a source can be constructed. The list of exemptions is very specific and limited; most new INEL sources and modifications to existing sources would be subjected to a Permit to Construct. Under Title V of the 1990 Clean Air Act Amendments, the INEL would also be subjected to an Operating Permit, which must be renewed periodically. Permits are typically issued with 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.

In addition to the Prevention of Significant Deterioration permits cited in Section F-3.1.1.1, the State has also issued 29 Permits to Construct for sources at INEL. These sources do not exceed the threshold for Prevention of Significant Deterioration; the estimated emissions from these sources are less than 10 percent of levels deemed significant by the Division of Environmental Quality and Prevention of Significant Deterioration analysis is not required (DOE-ID 1992a).

F-3.3.1.5 State of Idaho Rules for Toxic Air Pollutants. The Idaho Division of Environmental Quality has recently 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. These rules are contained in Title I, Chapter 1, Section 210, of the Rules for the Control of Air Pollution in Idaho (IDHW 1994) and are implemented through the air quality permit program described above. Emission levels of significance have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected emissions above administrative screening levels must be evaluated using standard air dispersion modeling techniques (computerized programs to predict pollutant concentrations based on source emissions, release characteristics, and meteorological conditions) and risk assessment methodologies to assess potential impacts. A facility will not be granted a permit unless it can be shown that the emissions will comply with all applicable toxic air pollutant standards for carcinogenic (cancer-

causing) and noncarcinogenic substances (IDHW 1994). 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 and noncarcinogenic contaminants. For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen (AACC). 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.^a The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the U.S. Environmental Protection Agency. (The method used to assess cancer health risk associated with air emissions from current INEL site facilities and proposed actions is summarized in Section F-4, Health and Safety, of this Appendix.) 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, or BACT) is employed to limit emissions of carcinogenic substances.

Many air contaminants are not carcinogens 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 (AAC). The acceptable ambient concentration is 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 project emissions are expected to result in maximum concentrations (averaged over an eight-hour period) below the acceptable ambient concentration. However, if the acceptable

a. 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.

ambient concentration is 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.

The acceptable concentration levels specified in the regulation are increment (not cumulative) standards that apply to new and modified stationary sources. They are used as guidelines for comparison (called reference levels) with the results of the toxic air pollutant assessments presented in Section 5.7, Air Resources, of Volume 2 of this Environmental Impact Statement.

F-3.3.2 Department of Energy Orders and Guides

The 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 (ALARA). 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). Orders specifically designed for protection of environment, safety and health are:

- DOE Order 5400.1, "General Environmental Protection Program," establishes environmental protection program requirements pertaining to air and other environmental media, intended to ensure that operations comply with applicable Federal, State, and local laws and regulations, as well as DOE internal policies. This Order defines environmental protection requirements established in more general terms in DOE Order 5480.1B.
- DOE Order 5480.1B, "Environment, Safety, and Health Program for Department of Energy Operations," details overall requirements for environmental, safety, and health programs.

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- DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards," specifies and provides requirements for the application of mandatory standards applicable to DOE and contractor operations.
 - DOE Order 5400.5, "Radiation Protection of the Public and the Environment," prescribes exposure limits for exposure of the public to radiation from sitewide activities that are equivalent to the 40 CFR 61 limits described in Section F-3.3.1.3. This order is in the process of being codified as Title 10, Part 834, of the Code of Federal Regulations (that is, 10 CFR 834).
 - DOE policy further requires effluent and environmental air monitoring programs to determine whether the public and the environment are adequately protected and whether operations are in compliance with applicable regulations. The "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" (DOE 1991) has been issued to assist operating facilities in implementing this policy and specifies the required elements of a radiological air monitoring program.
 - DOE Order 5483.1A, "Occupational Safety and Health Program for DOE Contractor Employees at Government Owned, Contractor Operated Facilities," establishes requirements and procedures to ensure that worker protection is consistent with that afforded private industry employees by the Occupational Safety and Health Act of 1970.
 - DOE Order 5480.11, "Radiation Protection for Occupational Workers," establishes standards for protection of workers from occupational exposure to radiation. This Order has been codified as Title 10, Part 835, of the Code of Federal Regulations (that is, 10 CFR 835).

F-3.4 Air Quality Impact Assessment Methodology

Distinct types of assessments have been performed to assess air quality for existing conditions and future actions. These are:

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- Radiological air quality assessments, which are performed for radionuclide emissions from stationary sources
 - Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources and fugitive dust and combustion product emissions associated with construction equipment and some operational sources
 - Degradation of visibility assessments, which are performed for certain criteria emissions from stationary 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, as well as specific information on related assumptions, methods, and data used in the analyses.

F-3.4.1 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. This section summarizes methods used to estimate radiological and nonradiological source terms for current and projected INEL site facilities.

F-3.4.1.1 Source Terms for Existing Facilities. The source terms used for existing radiological conditions were obtained primarily from Engineering Design Files (EDFs) used to prepare the *1991 INEL National Emission Standard for Hazardous Air Pollutants, Annual Report* (DOE-ID 1992b) and *Supplement* (DOE-ID 1992c). Other source term-related data were obtained from the INEL Radioactive Waste Management Information System (RWMIS) (Litteer 1992, 1993) and from operating contractors of existing facilities. Radiological source terms for existing INEL site facilities are summarized in Table 4.7-1 of Volume 2 of this Environmental Impact Statement and are detailed in Leonard (1993).

The maximum hourly and annual average emission rates for criteria and toxic air pollutants from existing facilities and foreseeable projects are listed in Table 4.7-2 of Volume 2 of this Environmental Impact Statement. Criteria pollutant emission rates for existing facilities are based on data contained in the INEL Air Emissions Inventory for 1991 (DOE-ID 1992d). Toxic pollutant emission rates are from the INEL Toxic Air Pollutant Emissions Inventory for 1989 (DOE-ID 1993b). These are the two most recent years for which the required data are available. In order to characterize a maximum emissions baseline, actual emission rates were increased by appropriate scaling factors. In general, these scaling factors are based on maximum emission rates allowed by facility operating permits or on maximum throughput or capacity of the process producing the emissions. The rationale and method for this process is described in further detail in Ecology and Environment (1994) and Belanger et al. (1994).

Emission rates are estimated for all criteria pollutants. However, since there are so many toxic air pollutants (many of which are released in only trace quantities), analysts used a screening approach to reduce the number requiring assessment to only those toxic emissions that have the potential to result in concentrations approaching applicable standards or guidelines. For the baseline assessment, this was done by comparing current (1989) emission rates to the screening emission level proposed by the State of Idaho (IDHW 1994). Emission rates below this level are considered by the State as not likely to have significant impacts and therefore do not warrant further analysis. Notably, the proposed State regulations would apply only to new (and not existing) facilities; nevertheless, the screening emission levels are useful as indicators of potentially significant emissions.

Some projects that were originally considered part of Alternative A (No Action) are now considered as foreseeable increases to the baseline (that is, they will become operational prior to the implementation start date for the Environmental Restoration and Waste Management alternatives). Source terms for foreseeable projects were estimated as described below for Environmental Restoration and Waste Management alternative projects but are reported on Table 4.7-2.

F-3.4.1.2 Source Term Estimation for Environmental Restoration and Waste Management Alternatives. Emission rates were estimated for each project associated with one or more of the Environmental Restoration and Waste Management alternatives. Source terms for

specific projects associated with Environmental Restoration and Waste Management alternatives were estimated using conservative engineering calculations based on knowledge of the proposed facility or activity. Typically, these evaluations considered the processes to be incorporated, materials to be used, activities to be performed within the systems, and operating experience with similar systems. For some projects, emissions estimates had previously been made and documented as part of an Environmental Assessment, Permit to Construct, or other action. In such cases, the previously estimated source terms were either used directly or were revised to reflect updated project information. Where applicable, the analysis used emission factors from authoritative reference sources, such as EPA (1992a).

Source term estimates for Environmental Restoration and Waste Management projects include the following components:

- Radionuclide emissions from projected facility operation: as a minimum, all radionuclides that collectively contribute 95 percent or more of the projected dose are specified individually.
- Criteria pollutant emissions from facility operations: all criteria pollutants are included in the estimates.
- Toxic air pollutant emissions from facility operations: the toxic air pollutants that are assessed were those that were either (a) included in the baseline assessment and emitted by any proposed project or (b) emitted by proposed projects in a cumulative quantity that exceeds the screening level emission rate proposed by the State of Idaho (even if the toxic was not assessed in the baseline).
- Fugitive dust and criteria pollutant emissions from construction and demolition (that is, decontamination and decommissioning projects) activities.
- Fugitive dust and criteria pollutant emissions from mobile sources.

The radiological and nonradiological source terms for Environmental Restoration and Waste Management projects are documented in Staley (1993a, 1993b) for no action and proposed

action projects, respectively. However, since the time those documents were prepared, projects have been added, deleted, or changed in scope or definition. Emissions data have been revised to reflect updated project information. Revised emission rates for radionuclides, criteria pollutants, and toxic air pollutants are presented in Tables F-3-6, F-3-7, and F-3-8, respectively. These tables present emission rates for each project for which emissions are expected, as well as the Environmental Restoration and Waste Management alternative and waste stream or program with which each project is associated.

F-3.4.2 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 INEL site facilities.

F-3.4.2.1 Model Selection and Application. The computer program GENII (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 (ICRP), as contained in Publications 26 and 30 (ICRP 1977, 1979). This 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 NQA-1, Basic

Table F-3-6. Listing of projected Idaho National Engineering Laboratory site radionuclide emissions by project and alternative.

Project, location, and program or waste stream ^{a,b}	Associated alternative ^c	Radionuclide emission rates (Curies per year)											
		Hydrogen-3/ carbon-14	Cobalt-60	Krypton-85	Xenon-131m/ xenon-133	Strontium-90 ^d	Antimony-125	Iodine-129/ iodine-131	Cesium-134/ cesium-135	Uranium	Plutonium	Americium-241	Other
TAN Pool Fuel Transfer, TAN, spent nuclear fuel	A,B,D												
Drying operations		9.6×10^2	(e)	(e)	(e)	2.9×10^{-2}	(e)	3.4×10^{-2}	(e)	(e)	6.6×10^{-4}	2.2×10^{-4}	(e)
Storage operations		3.9×10^{-1}	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Pit 9 Retrieval, RWMC, remediation	A,B,C, D												
Retrieval of waste and soil		(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	4.1×10^{-4}	2.1×10^{-4}	(e)
Incineration		(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	8.1×10^{-3}	4.2×10^{-3}	(e)
Transuranic Storage Area Enclosure and Storage, RWMC, transuranic waste	A,B,C, D	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	1.7×10^{-8}	6.0×10^{-9}	(e)
Waste Characterization Facility, RWMC, transuranic waste	A,B,C, D	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	2.7×10^{-5}	9.3×10^{-6}	(e)
New Calcine Storage, ICPP, high-level waste	D	(e)	(e)	(e)	(e)	1.5×10^{-6}	2.0×10^{-6}	(e)	2.0×10^{-6}	(e)	2.2×10^{-7}	(e)	8.9×10^{-6}
Additional Increased Rack Capacity, ICPP, spent nuclear fuel	B,D	(e)	3.9×10^{-8}	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Dry Fuel Storage Facility, ICPP, spent nuclear fuel	B,C,D	1.8×10^{-2}	1.9×10^{-6}	(e)	(e)	1.8×10^{-5}	2.2×10^{-3}	4.2×10^{-3}	6.8×10^{-7}	(e)	2.6×10^{-7}	(e)	1.9×10^{-6}
Waste Immobilization Facility ^f , ICPP, high-level waste	B,C,D												
Separations		4.2×10^2	(e)	(e)	(e)	1.6×10^{-1}	(e)	1.5×10^{-1}	3.8×10^{-2}	(e)	$0.0 \times 10^{+0}$	(e)	3.0×10^{-1}
Direct vitrification		4.2×10^2	(e)	(e)	(e)	5.8×10^{-4}	(e)	1.5×10^{-1}	1.1×10^{-2}	(e)	$0.0 \times 10^{+0}$	(e)	1.0×10^{-3}
Mixed/Low-Level Waste Treatment Facility, east of RWMC ^g , low-level and mixed low-level waste	D												
Incineration		(e)	7.3×10^{-2}	(e)	(e)	1.2×10^{-2}	2.7×10^{-2}	(e)	3.1×10^{-1}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	4.7×10^{-1}
Sizing and compaction		(e)	7.0×10^{-2}	(e)	(e)	2.0×10^{-3}	2.7×10^{-2}	(e)	5.0×10^{-2}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	1.8×10^{-1}
Remote Mixed Waste Treatment Facility, ANL-W, mixed low-level waste	B,D	1.7×10^3	(e)	1.6×10^3	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Fort St. Vrain Spent Nuclear Fuel Shipment and Storage, ICPP, spent nuclear fuel	B,D	(e)	5.6×10^{-8}	(e)	(e)	1.8×10^{-6}	(e)	(e)	2.4×10^{-7}	(e)	5.6×10^{-7}	(e)	2.4×10^{-7}
Greater-Than-Class-C Dedicated Storage, TAN, greater-than-Class-C low-level waste	B,D	3.2×10^{-8}	(e)	(e)	(e)	1.4×10^{-5}	(e)	(e)	5.3×10^{-2}	8.6×10^{-8}	7.8×10^{-4}	5.1×10^{-5}	1.2×10^{-5}

Table F-3-6. (continued)

Project, location, and program or waste stream ^{a,b}	Associated alternative ^c	Radionuclide emission rates (Curies per year)											
		Hydrogen-3/ carbon-14	Cobalt-60	Krypton-85	Xenon-131m/ xenon-133	Strontium-90 ^d	Antimony-125	Iodine-129/ iodine-131	Cesium-134/ cesium-135	Uranium	Plutonium	Americium-241	Other
Idaho Waste Processing Facility ^h , east of RWMC ^g , low-level and mixed low-level waste	B,D	(e)	1.9×10^{-5}	(e)	(e)	4.0×10^{-4}	(e)	(e)	4.4×10^{-4}	1.9×10^{-4}	5.4×10^{-2}	1.8×10^{-2}	1.5×10^{-1}
Increased Rack Capacity, ICPP, spent nuclear fuel	B,D	2.0×10^{-1}	3.9×10^{-8}	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Waste Experimental Reduction Facility Incineration, ⁱ PBF, low-level and mixed low-level waste	B,D	$1.3 \times 10^{+0}$	7.3×10^{-2}	(e)	(e)	1.2×10^{-2}	2.7×10^{-2}	(e)	3.1×10^{-1}	2.5×10^{-3}	1.3×10^{-3}	1.5×10^{-4}	1.8×10^{-1}
Nonincinerable Mixed Waste Treatment, PBF, mixed low-level waste	B,D	(e)	4.7×10^{-7}	(e)	(e)	9.5×10^{-5}	(e)	(e)	7.3×10^{-5}	4.1×10^{-4}	(e)	(e)	(e)
EBR-II Blanket Processing, ANL-W, spent nuclear fuel	B,D	1.6×10^2	(e)	4.9×10^3	5.1×10^1	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Plasma Hearth Process, ANL-W, mixed low-level and hazardous waste	B,D	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	2.3×10^{-7}	1.6×10^{-7}	9.4×10^{-10}	7.6×10^{-10}
Actinide Recycle Demonstration, ANL-W, spent nuclear fuel	B,C,D	8.4×10^2	(e)	1.4×10^4	1.3×10^2	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Sodium Processing, ANL-W, mixed low-level waste	B,D	5.0×10^{-2}	(e)	(e)	(e)	(e)	(e)	(e)	1.0×10^{-3}	(e)	(e)	(e)	8.0×10^{-3}
New Calcine Storage, ICPP, high-level waste	B,D	(e)	(e)	(e)	(e)	3.2×10^{-4}	(e)	(e)	3.8×10^{-4}	(e)	(e)	(e)	3.0×10^{-7}
Fuel Processing Complex, ICPP, spent nuclear fuel	D	3.1×10^3	1.9×10^{-6}	5.0×10^5	(e)	5.8×10^{-2}	1.6×10^1	4.4×10^{-1}	1.8×10^{-1}	(e)	7.7×10^{-3}	(e)	2.1×10^{-1}
Total ^j													
With separations		7.2×10^3	2.3×10^{-1}	5.2×10^5	1.8×10^2	2.7×10^{-1}	1.6×10^1	7.8×10^{-1}	9.4×10^{-1}	8.1×10^{-3}	7.5×10^{-2}	2.3×10^{-2}	1.8×10^0
With direct vitrification		7.2×10^3	4.3×10^{-1}	1.0×10^6	3.6×10^2	1.1×10^{-1}	3.2×10^1	6.3×10^{-1}	9.1×10^{-1}	1.6×10^{-2}	7.5×10^{-2}	4.6×10^{-2}	1.5×10^0

a. TAN = Test Area North; RWMC = Radioactive Waste Management Complex; ICPP = Idaho Chemical Processing Plant; ANL-W = Argonne National Laboratory-West; EBR-II = Experimental Breeder Reactor-II; PBF = Power Burst facility.

b. All projects with projected radionuclide emissions are listed.

c. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).

d. An equal amount of yttrium-90 is assumed to accompany all strontium-90 emissions.

e. No emissions of radionuclides are expected from this project.

f. The Waste Immobilization Facility may operate in either of two modes—separations or direct vitrification.

g. The precise location for these facilities has not yet been determined; for purpose of analysis, the reference location is slightly east of RWMC.

h. Emissions listed are for Alternative D; emissions are estimated to be 15 percent higher than for the same facility operating under Alternative B; similar emissions would also be projected for the Private sector Treatment Facility, which is a competing project that would have a similar design and process the same type of waste.

i. This project includes incineration only; other waste processing is assessed as foreseeable increases to the baseline.

j. This total would apply only to Alternative D and only if all facilities were operating simultaneously; totals will vary, depending on whether the Waste Immobilization Facility operates in separations or direct vitrification mode.

Table F-3-7. Listing of projected Idaho National Engineering Laboratory site criteria air pollutant emissions by project and alternative.

Project, location, and program or waste stream ^a	Assoc- iated altern- ative ^b	Carbon monoxide		Nitrogen dioxide		Particulate matter		Sulfur dioxide		Volatile organic compounds		Lead	
		Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.Hr. (g/hr)	Annual (kg/yr)	Max.Hr. (g/hr)	Annual (kg/yr)
Radiological and Environmental Sciences Laboratory Replacement, CFA, infrastructure	A,B,C, D	14	118	66	580	3	29	7	60	3.5	130	(c)	(c)
BORAX-V D&D, EBR-I/BORAX-V area, D&D													
Emergency generator	A,B,C, D	200	176	940	814	67	58	63	55	75	65	(c)	(c)
Demolition (blasting)		(c)	292	(c)	52	(c)	(c)	(c)	6.5	(c)	(c)	(c)	(c)
Pit 9 Retrieval, RWMC, remediation	A,B,C, D												
Retrieval of waste and soil		(c)	(c)	(c)	(c)	0.67	1.3	(c)	(c)	(c)	(c)	0.0004	0.0007
Incineration		4,250	16,600	32,600	127,000	3.6	14	144	562	(c)	(c)	2.6	10.2
Transuranic Storage Area Enclosure and Storage, RWMC, transuranic waste	A,B,C, D	1,660	14,500	3,530	30,900	145	1,270	415	3,640	612	5,360	0.16	1.4
Waste Characterization Facility, RWMC, transuranic waste	A,B,C, D	1,700	3,450	6,800	13,600	0.25	0.49	0.0009	0.002	14	28	0.0003	0.0005
Waste Handling Facility, ANL-W, low-level waste	A,B,C, D	122	23	564	11	40	7.7	38	7.2	(c)	(c)	(c)	(c)
Waste Immobilization Facility, ^d ICPP, high-level waste	B,C,D												
With separations		1,300	420	190,000	1,650,000	530	4,600	6.5	57	7.8	68	0.000003	0.00002
With direct vitrification		0.04	0.4	190,000	1,630,000	420	3,700	130	1,100	84	740	0.000002	0.00001
Mixed/Low-Level Waste Treatment Facility, RWMC, ^e low-level and mixed low-level waste	D												
Incineration		24	137	232	133	0.003	0.02	68	390	24	137	4.9	28
Sizing, compaction, treatment		(c)	(c)	(c)	(c)	0.12	0.24	(c)	(c)	12,700	1,940	0.01	0.08
Emergency generator		4,060	211	18,800	978	1,340	70	1,250	65	1,500	78	(c)	(c)

Table F-3-7. (continued)

Project, location, and program or waste stream ^a	Assoc- iated altern- ative ^b	Carbon monoxide		Nitrogen dioxide		Particulate matter		Sulfur dioxide		Volatile organic compounds		Lead	
		Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.hr. (g/hr)	Annual (kg/yr)	Max.Hr. (g/hr)	Annual (kg/yr)	Max.Hr. (g/hr)	Annual (kg/yr)
Fort St. Vrain Spent Nuclear Fuel Shipment and Storage, ICPP, spent nuclear fuel	B,D	5.0	0.17	25	0.82	1.3	0.04	0.26	0.008	1.4	0.04	(c)	(c)
Idaho Waste Processing Facility, ^f RWMC, transuranic, low-level, and mixed low-level waste	B,D												
Incineration		7,810	20,300	21,200	8,290	0.32	0.73	756	595	31	7	2,780	198
Emergency generator		7,290	379	27,700	1,400	2,770	144	3,270	170	729	38	(c)	(c)
Heating boiler		386	1,270	4,250	14,000	541	1,780	9,830	32,300	87	287	0.6	2.0
Waste Experimental Reduction Facility Incineration, ^g PBF, low-level and mixed low-level waste	B,D	330	1,900	400	2,300	47	271	660	3,800	2.2	13	2.9	17
Plasma Hearth Process, ANL-W, mixed low-level and hazardous waste	B,D	82	257	2,200	6,850	0.001	0.005	18	57	(c)	(c)	0.14	0.42
Total ^h													
Separations		29,232	60,034	309,307	1,856,949	5,490	8,246	16,525	41,765	15,787	8,150	2,791	257
Direct vitrification		27,932	59,614	309,307	1,836,949	5,380	7,346	16,648	42,808	15,863	8,882	2,791	257

a. CFA = Central Facilities Area; BORAX-V = Boiling Water Reactor Experiment-V; EBR-I = Experimental Breeder Reactor-I; D&D = decontamination and decommissioning; RWMC = Radioactive Waste Management Complex; ICPP = Idaho Chemical Processing Plant; PBF = Power Burst Facility; ANL-W = Argonne National Laboratory-West.

b. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).

c. No emissions of this type are predicted for the project.

d. The Waste Immobilization Facility may operate in either of two modes: separations or direct vitrification.

e. The precise location for these facilities has not yet been determined; for purpose of analysis, the reference location is slightly east of RWMC.

f. Emissions listed are for Alternative D; emissions are estimated to be 15 percent higher than for the same facility operating under Alternative B; similar emissions would also be projected for the Private sector Treatment Facility, which is a competing project that would have a similar design and process the same type of waste.

g. This project includes incineration only; other waste processing is assessed as foreseeable increases to the baseline.

h. This total would apply only to Alternative D and only if all facilities were operating simultaneously; totals will vary, depending on whether the Waste Immobilization Facility operates in separations or direct vitrification mode.

Table F-3-8. Listing of projected Idaho National Engineering Laboratory site toxic air pollutant emission rate, by project and alternative.

Project name, location, and associated program or source group ^a	Associated alternative ^b	Compound	Emission rate			
			Maximum hourly		Annual average	
			(Grams per hour)	(Pounds per hour)	(Kilograms per year)	(Tons per year)
Radioactive and Environmental Science Laboratory Replacement, Central Facilities Area, infrastructure	A,B,C,D	Benzene	4.8×10^{-2}	1.1×10^{-4}	4.3×10^{-1}	4.7×10^{-4}
		Chromium	1.6×10^{-3}	3.5×10^{-6}	1.4×10^{-2}	1.5×10^{-5}
		Formaldehyde	5.3×10^{-1}	1.2×10^{-3}	4.7×10^0	5.2×10^{-3}
		Hydrochloric acid	1.5×10^1	3.2×10^{-2}	2.9×10^1	3.2×10^{-2}
		Nickel	1.8×10^{-2}	4.0×10^{-5}	1.6×10^{-1}	1.8×10^{-4}
		Nitric acid	7.0×10^0	1.5×10^{-2}	1.4×10^1	1.5×10^{-2}
		Sulfuric acid	2.0×10^1	4.4×10^{-2}	4.0×10^1	4.4×10^{-2}
Boiling Water Reactor Experiment-V (BORAX-V) Decontamination and Decommissioning, Experimental Breeder Reactor-I/BORAX-V area, decontamination and decommissioning	A,B,C,D	Ammonia	1.1×10^2	2.4×10^{-1}	1.6×10^0	1.8×10^{-3}
		Benzene	1.1×10^2	2.4×10^{-1}	1.4×10^1	1.5×10^{-2}
		Formaldehyde	3.0×10^0	6.6×10^{-3}	2.6×10^0	2.9×10^{-3}
Pit 9 Retrieval, Radioactive Waste Management Complex, remediation	A,B,C,D	Asbestos	1.1×10^{-1}	2.5×10^{-4}	4.4×10^{-1}	4.8×10^{-4}
		Beryllium	9.8×10^{-3}	2.2×10^{-5}	3.8×10^{-2}	4.2×10^{-5}
		Carbon tetrachloride	5.7×10^0	1.2×10^{-2}	9.4×10^0	1.0×10^{-2}
		Chloroform	1.3×10^0	2.8×10^{-3}	2.1×10^0	2.3×10^{-3}
		Hydrochloric acid	2.1×10^1	4.6×10^{-2}	8.1×10^1	8.9×10^{-2}
		Mercury	9.3×10^{-1}	2.1×10^{-3}	3.6×10^0	4.0×10^{-3}
		Perchloroethylene	1.3×10^0	2.9×10^{-3}	2.2×10^0	2.4×10^{-3}
		Trichloroethylene	1.9×10^0	4.1×10^{-3}	3.1×10^0	3.4×10^{-3}
Transuranic Storage Area Enclosure and Storage, Radioactive Waste Management Complex, transuranic waste	A,B,C,D	Asbestos	2.0×10^{-9}	4.4×10^{-12}	6.4×10^{-9}	7.0×10^{-12}
		Benzene	8.4×10^0	1.9×10^{-2}	7.4×10^1	8.1×10^{-2}
		Beryllium	3.0×10^{-13}	6.6×10^{-16}	9.6×10^{-13}	1.1×10^{-15}
		Cadmium	4.3×10^{-12}	9.5×10^{-15}	1.4×10^{-11}	1.5×10^{-14}
		Carbon tetrachloride	9.0×10^{-2}	2.0×10^{-4}	2.9×10^{-1}	3.2×10^{-4}
		Chromium	6.8×10^{-2}	1.5×10^{-4}	6.0×10^{-1}	6.6×10^{-4}
		Methylene chloride	5.8×10^{-3}	1.3×10^{-5}	1.9×10^{-2}	2.1×10^{-5}
		Nickel	7.8×10^{-1}	1.7×10^{-3}	6.8×10^0	7.5×10^{-3}
		Perchloroethylene	9.0×10^{-3}	2.0×10^{-5}	2.9×10^{-2}	3.2×10^{-5}
		Trichloro-trifluoroethane	5.4×10^{-2}	1.2×10^{-4}	1.7×10^{-1}	1.9×10^{-4}
		Trichloroethylene	5.8×10^{-2}	1.3×10^{-4}	1.9×10^{-1}	2.1×10^{-4}
Waste Characterization Facility, Radioactive Waste Management Complex, transuranic waste	A,B,C,D	Asbestos	2.9×10^{-9}	6.4×10^{-12}	5.8×10^{-9}	6.4×10^{-12}
		Benzene	1.9×10^{-1}	4.2×10^{-4}	3.9×10^{-1}	4.3×10^{-4}
		Beryllium	2.2×10^{-10}	4.8×10^{-13}	4.4×10^{-10}	4.8×10^{-13}
		Cadmium	3.2×10^{-12}	7.0×10^{-15}	6.4×10^{-12}	7.0×10^{-15}
		Carbon tetrachloride	4.5×10^{-1}	9.9×10^{-4}	9.0×10^{-1}	9.9×10^{-4}
		Chromium	1.2×10^{-4}	2.6×10^{-7}	2.3×10^{-4}	2.5×10^{-7}

Table F-3-8. (continued).

Project name, location, and associated program or source group ^a	Associated alternative ^b	Compound	Emission rate			
			Maximum hourly		Annual average	
			(Grams per hour)	(Pounds per hour)	(Kilograms per year)	(Tons per year)
Waste Immobilization Facility, ^c Idaho Chemical Processing Plant, high-level waste	B,C,D	Formaldehyde	2.1×10^0	4.6×10^{-3}	4.3×10^0	4.7×10^{-3}
		Mercury	1.5×10^{-9}	3.3×10^{-12}	3.0×10^{-9}	3.3×10^{-12}
		Methylene chloride	1.1×10^3	2.4×10^0	1.1×10^3	1.2×10^0
		Nickel	1.3×10^{-3}	2.9×10^{-6}	2.6×10^{-3}	2.9×10^{-6}
		Nitric acid	1.0×10^2	2.2×10^{-1}	1.8×10^2	2.0×10^{-1}
		Polychlorinated biphenyls	9.0×10^{-9}	2.0×10^{-11}	1.8×10^{-8}	2.0×10^{-11}
		Perchloroethylene	4.5×10^{-2}	9.9×10^{-5}	9.0×10^{-1}	9.9×10^{-4}
		Sulfuric acid	1.4×10^1	3.1×10^{-2}	2.5×10^1	2.8×10^{-2}
		Trichloro-trifluoroethane	2.8×10^{-1}	6.2×10^{-4}	5.6×10^{-1}	6.2×10^{-4}
		Trichloroethylene	1.6×10^{-1}	3.5×10^{-4}	3.2×10^{-1}	3.5×10^{-4}
		Cadmium	8.1×10^{-5}	1.8×10^{-7}	7.1×10^{-4}	7.8×10^{-7}
		Chromium	2.6×10^{-5}	5.7×10^{-8}	1.6×10^{-4}	1.8×10^{-7}
		Hydrofluoric acid	1.2×10^2	2.6×10^{-1}	1.2×10^3	1.3×10^0
		Mercury	2.7×10^1	5.9×10^{-2}	2.4×10^2	2.6×10^{-1}
		Nickel	9.1×10^{-6}	2.0×10^{-8}	8.0×10^{-5}	8.8×10^{-8}
Mixed/Low-Level Waste Treatment Facility, east of Radioactive Waste Management Complex, low-level and mixed low-level waste	D	Tributyl phosphate	1.1×10^2	2.4×10^{-1}	9.5×10^2	1.0×10^0
		Arsenic	1.4×10^{-1}	3.0×10^{-4}	8.0×10^{-1}	8.8×10^{-4}
		Benzene	6.0×10^1	1.3×10^{-1}	3.1×10^0	3.4×10^{-3}
		Cadmium	1.9×10^{-1}	4.2×10^{-4}	1.1×10^0	1.2×10^{-3}
		Chromium	5.6×10^{-1}	1.2×10^{-3}	3.2×10^0	3.5×10^{-3}
		Formaldehyde	1.2×10^2	2.6×10^{-1}	6.0×10^0	6.6×10^{-3}
		Mercury	1.5×10^1	3.3×10^{-2}	1.9×10^0	2.1×10^{-3}
Fort St. Vrain Spent Nuclear Fuel Shipment and Storage, Idaho Chemical Processing Plant, spent nuclear fuel	B,D	Polychlorinated biphenyls	4.8×10^{-3}	1.1×10^{-5}	4.8×10^{-6}	5.3×10^{-9}
		Benzene	5.6×10^{-2}	1.2×10^{-4}	1.8×10^{-3}	2.0×10^{-6}
		Formaldehyde	1.1×10^{-1}	2.4×10^{-4}	3.4×10^{-3}	3.7×10^{-6}
Idaho Waste Processing Facility, ^d site not determined (reference site is east of Radioactive Waste Management Complex); transuranic, low-level, and mixed low-level waste	B,D	Asbestos	2.1×10^{-1}	4.6×10^{-4}	6.6×10^{-3}	7.3×10^{-6}
		Benzene	3.4×10^1	7.5×10^{-2}	7.3×10^0	8.0×10^{-3}
		Beryllium	3.1×10^{-2}	6.8×10^{-5}	3.4×10^{-2}	3.7×10^{-5}
		Cadmium	4.6×10^{-2}	1.0×10^{-4}	7.2×10^{-2}	7.9×10^{-5}
		Carbon tetrachloride	3.9×10^0	8.5×10^{-3}	2.5×10^0	2.8×10^{-3}
		Chromium	2.5×10^{-1}	5.5×10^{-4}	8.4×10^{-1}	9.2×10^{-4}
		Formaldehyde	8.1×10^1	1.8×10^{-1}	6.5×10^1	7.2×10^{-2}
		Hydrochloric acid	3.1×10^3	6.7×10^0	6.6×10^3	7.2×10^0
		Hydrofluoric acid	1.5×10^1	3.4×10^{-2}	4.0×10^1	4.4×10^{-2}
		Lithium	9.3×10^2	2.0×10^0	4.3×10^1	4.7×10^{-2}
		Mercury	7.0×10^2	1.5×10^0	6.4×10^1	7.0×10^{-2}
		Methylene chloride	7.7×10^{-2}	1.7×10^{-4}	1.6×10^{-1}	1.8×10^{-4}
		Nickel	2.9×10^0	6.4×10^{-3}	9.5×10^0	1.0×10^{-2}
		Polychlorinated biphenyls	4.3×10^1	9.5×10^{-2}	3.4×10^0	3.8×10^{-3}

Table F-3-8. (continued).

Project name, location, and associated program or source group ^a	Associated alternative ^b	Compound	Emission rate			
			Maximum hourly		Annual average	
			(Grams per hour)	(Pounds per hour)	(Kilograms per year)	(Tons per year)
Nonincinerable Mixed Waste, Power Burst Facility, mixed low-level waste	B,D	Perchloroethylene	3.9×10^0	8.5×10^{-3}	2.5×10^{-1}	2.7×10^{-4}
		Trichloro-trifluoroethane	3.9×10^0	8.5×10^{-3}	1.5×10^0	1.6×10^{-3}
		Trichloroethylene	1.2×10^1	2.6×10^{-2}	1.6×10^0	1.7×10^{-3}
		Mercury	5.5×10^{-3}	1.2×10^{-5}	2.2×10^{-5}	2.4×10^{-8}
Waste Experimental Reduction Facility Incineration, ^c Power Burst Facility, low-level and mixed low-level waste	B,D	Arsenic	8.4×10^{-2}	1.9×10^{-4}	4.8×10^{-1}	5.3×10^{-4}
		Beryllium	1.9×10^{-2}	4.2×10^{-5}	1.1×10^{-1}	1.2×10^{-4}
		Cadmium	2.0×10^{-1}	4.4×10^{-4}	1.2×10^0	1.3×10^{-3}
		Chromium	3.8×10^{-3}	8.4×10^{-6}	2.2×10^{-2}	2.4×10^{-5}
		Hydrochloric acid	1.8×10^3	4.0×10^0	1.0×10^4	1.1×10^1
		Mercury	2.5×10^1	5.5×10^{-2}	1.4×10^2	1.6×10^{-1}
		Nickel	2.0×10^{-1}	4.4×10^{-4}	1.2×10^0	1.3×10^{-3}
		Trichloroethylene	1.4×10^0	3.1×10^{-3}	8.2×10^0	9.0×10^{-3}
Plasma Hearth Process, Argonne National Laboratory-West, mixed low-level and hazardous waste	B,D	Arsenic	4.5×10^{-3}	9.9×10^{-6}	1.4×10^{-2}	1.5×10^{-5}
		Beryllium	8.5×10^{-6}	1.9×10^{-8}	2.7×10^{-5}	3.0×10^{-8}
		Cadmium	9.1×10^{-3}	2.0×10^{-5}	2.8×10^{-2}	3.1×10^{-5}
		Chromium	2.0×10^{-3}	4.4×10^{-6}	6.1×10^{-3}	6.7×10^{-6}
		Hydrochloric acid	4.5×10^1	9.9×10^{-2}	1.4×10^2	1.6×10^{-1}
		Mercury	2.3×10^{-2}	5.1×10^{-5}	7.1×10^{-2}	7.8×10^{-5}
		Nickel	1.4×10^{-1}	3.1×10^{-4}	4.2×10^{-1}	4.6×10^{-4}
Spent Fuel Processing, Idaho Chemical Processing Plant, spent nuclear fuel	D	Ammonia	1.8×10^4	4.0×10^3	1.6×10^3	1.8×10^0
		Hydrofluoric acid	3.8×10^0	8.4×10^{-1}	1.6×10^1	1.8×10^{-2}
		Methyl isobutyl ketone	2.7×10^3	5.9×10^0	2.3×10^4	2.5×10^1
		Tributyl phosphate	8.6×10^0	1.9×10^{-2}	5.5×10^1	6.1×10^{-2}
Total ^f			2.9×10^4	6.5×10^1	4.6×10^4	5.1×10^1

a. Only those emissions that meet assessment criteria are listed (see text for explanation).

b. A = Alternative A (No Action); B = Alternative B (Ten-Year Plan); C = Alternative C (Minimum Treatment, Storage, and Disposal); D = Alternative D (Maximum Treatment, Storage, and Disposal).

c. Emissions listed are for separations process; toxic emissions from direct vitrification are very similar.

d. Emissions listed are for Alternative D; hourly and annual emissions are estimated to be 15 percent higher than for the same facility operating under Alternative B; similar emissions would also be projected for the Private Sector Treatment Facility, which is a competing project that would have a similar design and process the same type of waste.

e. Includes incineration only; other waste processing is assessed as foreseeable increases to the baseline.

f. Total would apply only to Alternative D and only if all facilities were operating simultaneously; totals would vary depending on whether the Waste Immobilization Facility operates in the separations or direct vitrification mode.

Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control), which includes requirements for verification and validation of computer codes.

An additional dose model, CAP-88 (Clean Air Act Assessment Package), is routinely used at the INEL for the specific purpose of evaluating compliance with National Emission Standards for Hazardous Air Pollutants standard 40 CFR 61. As prescribed by that standard, CAP-88 is used to calculate the highest offsite dose to any member of the public resulting from annual airborne radionuclide emissions from cumulative INEL site operations. The result must be below 10 millirem to demonstrate compliance with the standard. The CAP-88 model was used in the prescribed manner to support the 1991 and 1992 INEL National Emission Standards for Hazardous Air Pollutants Reports (DOE-ID 1992b, 1992c, 1993c). As part of that effort, detailed comparisons between results obtained with GENII and CAP-88 were made and documented (Maheras 1992, Ritter 1992). A comparison of GENII and CAP-88 dose results for the maximally exposed individual is presented in Table F-3-9. In both cases, the dose results represent a summation of the external effective dose equivalent (EDE) from the ground deposition and air immersion pathways and the 50-year committed effective dose equivalent (CEDE) from the inhalation and ingestion pathways. These results are not directly comparable in that there were minor differences in the source terms used. Nevertheless, this comparison verifies that for each source category, GENII results in a higher estimation of dose and serves to illustrate that the methods employed and resultant baseline radiological doses used in this Environmental Impact Statement are not likely to underestimate actual baseline or future doses.

F-3.4.2.1.1 Release Modeling—Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this Environmental Impact Statement, the decision whether to model a given emission point as a stack or ground-level release was based on guidelines issued by the U.S. Environmental Protection Agency (EPA 1993b) and the National Council on Radiation Protection and Measurements (NCRP 1989). In essence, 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 were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For

Table F-3-9. Comparison of doses to maximally exposed individual due to Idaho National Engineering Laboratory site emissions as calculated by the GENII and CAP-88 computer codes.

Source category	Dose to maximally exposed individual (millirem)		
	GENII 1991 ^a	CAP-88 1991 ^b	CAP-88 1992 ^c
Monitored	9.8×10^{-3}	4.1×10^{-3}	1.4×10^{-3}
Diffuse	3.0×10^{-3}	2.4×10^{-5}	3.1×10^{-5}
Unmonitored	3.0×10^{-4}	1.2×10^{-4}	1.0×10^{-4}
Total	1.3×10^{-2}	4.2×10^{-3}	1.5×10^{-3}

a. Source: Leonard (1993); calculation for monitored source emissions from Idaho Chemical Processing Plant has been revised (Leonard, unpublished data).

b. Source: 1991 INEL National Emission Standards for Hazardous Air Pollutants Report and Supplement (DOE-ID 1992b, 1992c).

c. Source: 1992 INEL Annual National Emission Standards for Hazardous Air Pollutants Report (DOE-ID 1993c).

example, 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 manner in which specific sources were modeled is described in Leonard (1993, 1994).

F-3.4.2.1.2 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 INEL site. In particular, the data files prepared for these assessments were derived from observations at INEL site weather stations over the period 1987 through 1991. The method used for incorporating these data into wind files that can be used by the GENII program is documented in Leonard (1992).

F-3.4.2.1.3 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. In each case, the dose was assessed for baseline conditions, foreseeable increases to the baseline, and Environmental Restoration and Waste Management alternatives.

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 (MEI). 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. For each INEL site area, radionuclide concentrations were calculated for the minimum distance to the INEL site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the INEL site areas, the maximally exposed individual receptor locations are merely points on the INEL site boundary and do not correspond to any actual residences or quarters. These maximum impacts were conservatively summed to derive cumulative impacts, although they occur at spatially distant locations. (The actual maximally exposed individual locations for five of the major INEL site facilities are all located along a segment of the southern boundary, southwest of the facilities in question.) Although unrealistic, this cumulative maximally exposed individual assessment process serves to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained are low; and further resolution of the actual maximally exposed individual location and dose is not necessary. The same general method for dose determination to the maximally exposed individual is used in the annual National Emission Standards for Hazardous Air Pollutants compliance evaluation.

Population Dose. Dose was assessed for the collective population residing in a circular area defined by a radius of 80 kilometers (50 miles) extending out from each major INEL site facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with Environmental Restoration and Waste Management alternatives and for projects expected to become operational before June 1, 1995, growth projections for the counties surrounding INEL were applied. These growth estimates are approximately 10 percent per decade. Since the period of analysis for this Environmental Impact Statement extends to the year 2005, the population doses reported in Section 5.7, Air Resources, of Volume 2 of this Environmental Impact Statement are the highest obtained for any year throughout this period.

INEL Site Worker. INEL site workers may be exposed to radiation attributable to INEL 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 INEL site). Onsite

concentrations of radionuclides due to incidental exposure were assessed as described in this section. (Direct, job-related occupational exposure is discussed in Section 4.12, Health and Safety, of Volume 2 of this Environmental Impact Statement.) An individual who would receive the highest dose due to incidental exposures is termed the maximally exposed worker. The dose to the maximally exposed worker was assessed for all major INEL site work areas as a result of radionuclide emissions from all current and projected sources. The dose was calculated using the general methodology described in previous sections. One major difference is the fact that the worker dose calculations did not include the food ingestion pathway, since workers do not consume food products grown onsite.

F-3.4.3 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 U.S. Environmental Protection Agency (EPA 1993b) and the State of Idaho (DOE-ID 1991) 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) will be noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison (a) to applicable standards or guidelines and (b) between alternative courses of action.

The types of pollutants assessed include the criteria pollutants and certain types of 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 are assessed for offsite locations and public roads traversing the INEL site. The nonradiological assessment did not specifically address impacts related to ozone formation because (a) volatile organic compound emission levels are below the significance level designated by the State of Idaho; (b) no simple, well-defined method exists to assess ozone

formation potential (Wilson 1993); and (c) ozone is not recognized as a problem in the region (Johnson 1993).

Offsite levels of noncarcinogenic toxic air pollutants were calculated using maximum hourly emission rates and were compared to eight-hour standards for these substances recently promulgated by the State of Idaho. Offsite levels of carcinogens were evaluated on the basis of annual average emission rates and compared to proposed annual average standards. Toxic air pollutants were also assessed for onsite locations because of potential exposure of workers to these hazardous substances. Onsite levels of specific toxics 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 (OSHA) or the American Conference of Governmental Industrial Hygienists (the lower of the two limits being used).

F-3.4.3.1 Atmospheric Dispersion Models for Criteria and Toxic Air Pollutant Evaluations. Atmospheric dispersion models used to estimate upper-bound levels of toxic and criteria impacts, as well as impacts to visibility and highway hot spots, are described below.

F-3.4.3.1.1 Model Description and Application—The modeling effort employed two levels of sophistication—screening-level and refined. Screening-level modeling was used in many cases where a source's contribution to air quality levels was expected to be minimal (that is, well below acceptable standards). This method is less rigorous mathematically than refined modeling and results in an overestimation of pollutant concentrations (greater than that of refined modeling).

The short-term version of the U.S. Environmental Protection Agency Industrial Source Complex-2 (ISC-2) computer code (EPA 1992a) is a refined model that was used to estimate concentrations resulting from routine operational emissions of criteria pollutants. The ISC-2 model incorporates site-specific data (such as meteorological observations from INEL site weather stations). This model takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. Account was taken for building wake effects in the baseline assessments of criteria pollutant emissions. However, it was not feasible to include wake effect calculations into the proposed action assessments, since building dimensions and distances have not been defined. This is not expected to show appreciable differences in results other than

in locations in very close proximity of sources. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations can be calculated over a range of durations, from one-hour maximum values to annual averages. Dispersion modeling using ISC-2 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for use in the Environmental Impact Statement process.

The SCREEN model (EPA 1992b) was used to estimate toxic air pollutant concentrations. SCREEN is a relatively simple model that incorporates conservative data and methods. SCREEN is limited to the calculation of only one-hour maximum concentrations from a single source for various user-specified or predefined distances and performs iterations to determine the distance and concentration at the point of maximum impact. Persistence factors (averaging time adjustment factors) recommended by the U.S. Environmental Protection Agency or the Idaho Division of Environmental Quality were used to scale one-hour SCREEN results to other required averaging times. A factor of 0.7 was used to scale one-hour results to eight-hour estimates and a factor of 0.125 was used to scale one-hour results to annual average estimates, as recommended by IDHW (1994). Since SCREEN can only accommodate a single source, most cases required multiple sources within an area to be grouped and treated as a single source. This model incorporates building wake algorithms; however, in the manner employed herein (that is, combining impacts from multiple stacks and simulating as a single source), this feature was not used. Wind direction is not taken into account; therefore, impact levels were assumed equal in all directions from the source. SCREEN was used in these assessments only to estimate baseline concentrations of toxic air pollutants and to identify which of these pollutants warranted further refined modeling. For cases where the SCREEN model predicted that toxic air pollutant concentrations were close to (within 50 percent or so) an acceptable level, remodeling with ISC-2 was performed to provide a more realistic estimate.

Those operations that would result in the generation of fugitive dust, including construction activities and equipment, travel on paved or unpaved roads, the concrete batch plant, mixing and pouring, and gravel pit and landfarming operations, were assessed using the U.S. Environmental Protection Agency-recommended Fugitive Dust Model (FDM) (Winges 1992). The Fugitive Dust Model was designed specifically for computing concentration and deposition impacts from fugitive dust sources through improved algorithms for deposition. Sources may be either point, area, or line. Model execution may include up to 20 particle size classes, with

calculation of gravitational settling and deposition velocity for each hour. Similar to ISC-2, concentrations may be calculated over a range of durations, from one-hour maximum values to annual averages; 24-hour and annual average assessments were conducted. Modeling of fugitive dust sources with the Fugitive Dust Model has been shown to be superior to ISC-2 for area ground-level ambient temperature releases (Winges 1992).

F-3.4.3.1.2 Model Input Data—The use of air dispersion models requires emission parameters, such as stack height and diameter and exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. For the most part, emission parameter data were obtained from the INEL site air emissions inventories discussed above. In some cases, data were observed to be missing or in error. The missing data were replaced by substituting parameter values from similar sources at the INEL site. (For example, data for emergency generator combustion engines were obtained from other generators of the same capacity.)

The estimation of impacts from fugitive dust sources was dependent on the type of source. For construction sources, the size of the disturbed area was assumed to be two times the construction project footprint. For example, construction of a 100-by-100-meter building is expected to disturb a 200-by-200-meter area during construction. Use of watering was assumed, providing a 50 percent reduction in fugitive emissions and preferentially removing larger-diameter particles. The resultant distribution was estimated to contain 64 percent dust of respirable size. [This follows methods developed by EPA (1993a)]. Construction-related emissions were averaged over the expected hours of construction activity—12 hours per day, six days per week, for 26 weeks per year. Fugitive dust emissions were similarly calculated for demolition projects. Emissions related to the use of unpaved roads were divided equally across INEL site areas. Emissions of dust from paved roads were assumed to be generated primarily by the INEL bus fleet. These emissions include tire wear and road dust but exclude exhaust particulates, which were calculated separately in the evaluation of mobile source emissions. Paved road use within the INEL site is heaviest along State Route 33 and U.S. Route 20/26. All emissions, therefore, were assumed to occur along these routes. Because approximately 11.4 percent of the buses travel to Test Area North, 11.4 percent of the total paved road emissions was assigned to State Route 33, the primary route to the Test Area North facility, and 88.6 percent to U.S. Route 20/26. The estimation of

emissions from employees vehicles assumed 1.5 persons per vehicle, 100 mile round trip, and 250 trips per year in light-duty (pickup) trucks.

F-3.4.3.1.3 Meteorological Data—The modeling effort made use of two types of meteorological data: (a) ISC-2 and the Fugitive Dust Model modeling incorporated data from measurements of meteorological conditions (temperature, wind speed and direction, atmospheric stability, and so forth) made at the INEL site by the National Atmospheric and Oceanic Administration (NOAA); and (b) SCREEN modeling used a standard (not specific to INEL) set of meteorological data, which are incorporated into the model to derive a worst-case approximation of pollutant concentrations. The following description pertains only to the site-specific data used by ISC-2 and the Fugitive Dust Model.

Meteorological data collected by the National Atmospheric and Oceanic Administration meteorological monitoring towers located at Grid 3 (lower, north of Central Facilities Area), Test Area North, and Argonne National Laboratory-West were used in the assessment of source impacts. Conditions at these three locations are representative of the three major wind flow regimes at the INEL site (Clausen et al. 1989). Sources at Test Area North and Argonne National Laboratory-West were modeled with meteorological data from those respective locations. All other sources were modeled using data from the Grid 3 Station. The locations of these and other meteorological monitoring stations on and around the INEL are shown in Figure F-3-2. The meteorological data used contained hourly observations of wind speed, direction, temperature, stability class, and mixing height for the years 1991 and 1992. Each case was assessed separately using data from these years, and the highest of the predicted concentrations was selected.

F-3.4.3.1.4 Receptor Locations—The ISC-2 and Fugitive Dust Model are capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. For ambient air impacts, 87 discrete receptor locations were used. These locations were specified as Universal Transverse Mercator (UTM) coordinates and included 50 points along the INEL site boundary, 27 points along public roads, and 10 points at Craters of the Moon Wilderness Area. Preliminary analysis indicated that the location of highest predicted offsite concentration would be at INEL site boundary locations; therefore, it was not necessary to develop a receptor grid that extended beyond the INEL site boundary.

Figure F-3-2. Locations of meteorological monitoring stations at the Idaho National Engineering Laboratory site and surrounding communities.

Concentrations of air pollutants at onsite facility areas were assessed to indicate potential levels to which workers may be subjected. For the onsite assessments, 11 separate receptor grids were developed. In general, these were 2-by-2-kilometer grids with fine (100-meter) spacing centered on the major source groups at each facility. The grids for Test Area North, Power Burst Facility, and Central Facilities Area were made larger to accommodate the distribution of sources within those areas. These grids are described in detail in Belanger et al. (1994) and were used to determine maximum impacts as a result of emissions from sources where low release elevations or building effects are prevalent. In addition to a fine grid, the assessments for each facility area also included discrete receptor locations of other facilities. For example, assessments for sources at the Central Facilities Area included discrete receptor points at the Idaho Chemical Processing Plant, Power Burst Facility, and other facilities. In this way, it was ensured that contributions of sources at locations other than the facility being assessed were represented in the total concentration.

F-3.4.3.2 Summation of Results. An important function of the modeling effort is to identify the location of highest predicted impact and the magnitude of the impact. This is complicated by the fact that there are numerous sources in widely dispersed locations at the INEL site, and determination of the highest concentration must consider the contributions from each of these sources. Also, in some cases, sources at different facility areas required different meteorological input data. These factors precluded the execution of a single modeling run in which all sources and receptor arrays could be included and necessitated the application of computer-aided data consolidation techniques. Since a common receptor array was used for all ambient air assessments, a summation of concentrations at each receptor point as a result of emissions from each source was possible. The value and location of highest impact were identified by entering the results from individual modeling runs for a specific type of assessment (for example, maximum one-hour carbon monoxide concentrations) into a spreadsheet program, summing the values for each receptor point, and identifying the maximum value and corresponding location. The same process was used to sum the contributions from baseline sources, foreseeable increases to the baseline, and proposed action sources.

The onsite assessments used separate grids, and the results had to be processed differently. This involved summing the contribution from each area to each area-specific discrete receptor point. This discrete receptor summation was then added to the maximum value calculated with

use of the fine-grid network for the area under review. For example, maximum impacts at the Central Facilities Area consist of the maximum-predicted impact from sources within the Central Facilities Area and the sum of contributions from all other areas. In this way, it was ensured that contributions of sources at locations other than the facility being assessed were represented in the total concentration.

F-3.4.3.3 Impacts on Visibility. Atmospheric visibility has been specifically designated as an air quality-related value under the 1977 Prevention of Significant Deterioration Amendments to the Clean Air Act. Therefore, in the assessment of proposed projects that invoke Prevention of Significant Deterioration review (see Section F-3.1.1.2), 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 20 kilometers (12.4 miles) southwest of the INEL site, is the only Class I area in the Eastern Snake River Plain.

The U.S. Environmental Protection Agency has designed methodologies to estimate potential plume visual impacts due to emissions of proposed 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. 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 more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. The U.S. Environmental Protection Agency has developed computer codes to implement the calculations associated with each level of visual impact modeling. The VISCREEN model is designed to implement the methodology of the Level-1 analysis (EPA 1992c).

The VISCREEN model was used to evaluate the potential visual impact of the cumulative emissions of proposed sources at the INEL site on Craters of the Moon Wilderness Area. As stated above, Level-1 screening is designed to provide a conservative estimate of plume visual impacts, that is, to estimate impacts that would be 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) stability coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind that would transport the

plume directly adjacent to a hypothetical observer in the Class I area. Maximum short-term (hourly) emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area are used. The U.S. Environmental Protection Agency recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration, for which a site-specific value of 0.06 parts per million was used. Use of this value has been agreed to by the Idaho Division of Environmental Quality (DOE-ID 1991) and the National Park Service (NPS) (Notar 1993a). The annual average background visual range as measured by the National Park Service at Craters of the Moon is estimated to be 140 kilometers (Notar 1993b); however, as suggested by the National Park Service, the maximum seasonal average of 158 kilometers was used in this assessment (Notar 1993a, 1993b).

The objective of the VISCREEN analysis was to calculate the potential visual impact of a plume of specified emissions for specific 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 1992c). The VISCREEN model determines whether a plume is visible by calculating contrast. If a viewed object, such as a snow-covered peak, is brighter than its background, it will have a positive contrast; alternatively, if an object is darker than its background, its contrast is negative. In VISCREEN, contrasts at three visual wavelengths are calculated 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. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background. With a range of wavelengths, a measure of contrast must recognize both overall intensity and perceived color; perceptibility is a function of changes in both brightness and color. To address the dimension of color, a parameter called delta E is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. In order to ascertain whether the plume from a facility has the potential to be perceptible to untrained 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. 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. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

For this assessment, the potential impact of incremental emissions of particulate matter and oxides of nitrogen associated with each project was evaluated. Cumulative impacts were estimated for each alternative as the sum of the impacts from specific projects associated with those alternatives and waste stream options. Current operations were considered in the baseline (that is, the impact of current emission levels is monitored at Craters of the Moon, resulting in a 158-kilometer value for maximum seasonal visual range); however, reasonably foreseeable increases to the baseline were evaluated and added to the cumulative assessment for each alternative. All emission sources were included, except construction emissions and emergency diesel generators, which are not evaluated in a Prevention of Significant Deterioration assessment.

F-3.4.3.4 Mobile Source Assessment Methodology. Ambient air quality impacts at offsite receptor locations due to INEL bus fleet operations, INEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEL site facilities were quantitatively predicted using emission factors and screening-level methodologies developed by the U.S. Environmental Protection Agency. The methodology included the use of a computerized mathematical model, CALINE-3 (Benson 1979), recommended for analysis of highways characterized by uninterrupted traffic flows (EPA 1993b). CALINE-3 is designed to simulate traffic flow conditions and pollutant dispersion from traffic and was used to predict maximum one-hour ambient air concentrations of carbon monoxide and inhalable 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 U.S. Environmental Protection Agency guidance.

Receptor locations were selected in accordance with DOE guidance for air permit modeling (DOE-ID 1991), including locations in the City of Idaho Falls near the central bus garage, along streets that are heavily travelled by INEL buses, and at selected ambient air locations along major routes to the INEL site. The receptor locations on the INEL site are accessible to the public and where INEL traffic is heaviest. These locations include the INEL site

main entrances on U.S. Highway 20, the northern access point to Test Area North from State Highway 33, and other points where public highways carrying INEL site traffic cross site boundaries.

Modeling was conducted for the year 1993 to quantify the current impact due to INEL buses and traffic and projected impact of projects that would be constructed before 1995, together with the projected impacts of alternatives. Additional details on the methodology used for mobile sources are presented in Ecology and Environment (1993).

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F-4 HEALTH AND SAFETY

Potential health impacts to the public and workers can arise from a variety of sources under several distinct circumstances. The appropriate methods for evaluating health impacts are somewhat different under each of these conditions. This Appendix describes the methods used and presents the key data required for evaluating the health effect impacts reported in the EIS.

The methods presented here are organized under three broad categories: (a) health impacts from effluent releases, (b) normal workplace hazards, and (c) chemical releases under accident conditions. The first category includes effluent releases of radioactivity, carcinogenic chemicals, and chemical toxins to air and water and addresses health effects to both the public and workers. The second category includes radiological and nonradiological hazards to INEL workers in the normal conduct of their jobs. The final category of methods addresses the special case of toxic chemicals released under accident conditions.

F-4.1 Background Information

This section provides essential background information on health effects to INEL workers and the public surrounding the INEL. The information provides a historical perspective on health and safety concerns, and a basis for projecting future impacts to workers from normal occupational hazards.

F-4.1.1 Public Health and Safety

The primary public health and safety concern at the INEL is the potential for exposure of the surrounding public to radioactivity. The principal pathway by which the public may be exposed to radioactivity is through releases to the atmosphere. Radiation doses to members of the public from airborne releases at the INEL are calculated annually by the Radioactive and Environmental Sciences Laboratory using information from the Radioactive Waste Management Information System database (DOE-ID 1988, 1989, 1990, 1991a, and 1992). Table F-4-1 presents the results of these calculations for the five years of site operation from 1987 through 1991. The table indicates that offsite radiation doses to any individual member of the public from normal operations have been substantially less than 1 millirem per year over the five-year period

Table F-4-1. Estimated doses to members of the public, from Idaho National Engineering Laboratory airborne releases 1987-1991.

Year	Maximally exposed individual (millirem)	Principal radionuclides	Percent of dose	Population dose (person-rem)
1987	0.54	Sb-125	96.0	4.5
		I-129	1.1	
		Ar-41	1.0	
1988	0.13	Sb-125	68.0	1.7
		I-129	19.6	
		Ar-41	6.1	
1989	<0.01	Ar-41	59.9	0.04
		Kr-88	12.3	
		Xe-138	11.6	
1990	<0.01	Ar-41	82.2	0.04
		Kr-88	6.3	
		I-129	3.4	
1991	0.02	Ar-41	45.1	0.06
		I-129	40.3	
		Cs-137	4.8	

examined. Current regulations limit releases of airborne radioactivity from DOE facilities to that which will produce no more than 10 millirem per year to any member of the public.

The principal radionuclides contributing to offsite doses reflect the operation of different site facilities. During 1987 and 1988, for example, the fuel dissolution facility at the Idaho Chemical Processing Plant was operating and the antimony-125 releases characteristic of that facility were the largest contributors to offsite dose. The fuel dissolution facility at the Idaho Chemical Processing Plant did not operate during 1989 or 1990. Consequently, offsite doses were smaller and were dominated by releases of argon-41 and other noble gases from the Advanced Test Reactor. In 1991, the New Waste Calcining Facility operated for part of the year and contributed a small amount of other radionuclides such as iodine-129 and cesium-137.

Collective doses to the population residing in the vicinity of the INEL are also estimated annually by the Radioactive and Environmental Sciences Laboratory (DOE-ID 1988, 1989, 1990, 1991a, and 1992). These calculations sum the potential radiation doses to the population of

approximately 121,000 people living within 80 kilometers (50 miles) of INEL facilities. As indicated in Table F-4-1, current site operations have resulted in an offsite collective dose of 6.3 person-rem for a five-year period. The average over the period 1987 through 1991 was about 1.3 person-rem.

Past activities at the INEL have resulted in larger doses to the public than current operations. Estimates of these doses have been made for all years of INEL operation before 1989 (DOE-ID 1991b). The largest doses were during the late 1950s and mid-1960s and ranged between 1 and 10 millirem. The organ receiving the largest dose has been the thyroid during years when large quantities of radioactive iodine were released, or the skin during years when releases were dominated by radioactive noble gases. Since the early 1970s, there has been a steady decline in offsite doses as controls on emissions have improved and various reactor programs at the INEL have been completed.

To put the offsite doses from the INEL into perspective, it is useful to compare them to the levels of natural background radiation in the vicinity of the INEL. Table F-4-2 summarizes the estimated annual dose equivalent from natural sources for an individual living on the Snake River Plain (DOE-ID 1991b).

Doses from airborne releases over the operating history of the INEL site have been small compared to doses from sources of natural background radiation, a maximum of 3 percent of the natural background effective dose equivalent in 1956. Since the early 1970s, doses from airborne releases have been small even when compared to the variability in natural background.

F-4.1.2 Occupational Health and Safety

F-4.1.2.1 Radiological Hazards. Because of the nature of the work done at the INEL site, occupational radiation exposures above background levels will inevitably occur for some workers. The radiation protection programs required by regulations and DOE orders are designed to ensure that no worker receives doses larger than the applicable limits and that worker doses are kept as low as reasonably achievable. In addition, Federal regulations and DOE orders require that records of occupational exposure are maintained. Reports of radiation doses are

Table F-4-2. Estimated natural background radiation dose for the Snake River Plain^a

Source	Annual effective dose equivalent (millirem)
External	
Terrestrial	75
Cosmic	39
Subtotal	114
Internal	
K-40 and others	40
Inhaled nuclides ^b	200
Subtotal	240
Total	354

a. From: Idaho National Engineering Laboratory Historical Dose Evaluation, Volume 1, DOE/ID-12119 (DOE-ID 1991b).

b. The dose from inhaled radionuclides is due primarily to short-lived decay products from radon and varies widely with geographic location. The value shown represents the United States population average.

provided annually to each worker. Summary reports are also provided to DOE and published periodically.

Workers at the INEL site may be exposed either internally or externally to radiation. Internal exposures arise when radioactive materials are deposited in the body through inhalation, ingestion, or absorption through intact skin or wounds in the skin. External exposures in the workplace are those received from radiation-emitting sources outside the body.

All workers in areas with a potential for airborne or surface contamination are monitored routinely for internal radioactivity using bioassay techniques. Whole body counting is used to detect internally deposited gamma emitters. Urinalysis and fecal analysis are used to detect beta and alpha emitters that cannot be measured adequately using whole body counting, for instance, monitoring for uranium and plutonium uptakes. Radiation workers participate in the bioassay program if there is a potential that they could receive intakes resulting in a dose of 100 millirem

or more in the 50-year period following an intake. If routine bioassay results indicate measurable intakes, workers participate in follow-up bioassay programs to determine the date and source of the intake and to estimate the radiation dose received. Internal radiation doses constitute a small fraction of the occupational dose at the INEL site. All cases of measurable internal radioactivity are investigated thoroughly to determine the cause and to assess the potential for additional internal dose to the workforce.

External radiation dose is the largest fraction of the occupational dose received at the INEL site. There are many more facilities at the INEL site with a potential for external exposure to workers than there are with a potential for internal exposure. Facilities with a potential for external radiation exposure are those containing large quantities of gamma-emitting radioactive materials. Certain devices, such as accelerators, x-ray machines, and nuclear reactors, can produce external radiation exposure while operating, whether or not radioactive materials are present. In addition, there is a potential for external radiation dose during any maintenance, construction, environmental remediation, or decontamination activities at facilities where gamma-emitting radioactive materials have been used in the past.

Personnel that could potentially receive annual external radiation exposures greater than 100 millirem are assigned a thermoluminescent dosimeter that must be worn at all times during work on the INEL site. The dosimeter measures the amount and type of external radiation dose the worker receives.

All INEL site facilities are required to keep records of the individual exposure of each employee. For normal INEL site operations, the summary establishes a baseline for comparing the potential impacts of alternatives considered in the EIS. Reported doses resulting from normal INEL site operations for a recent five-year period of site operation are representative of current INEL site operations, and are used here as a baseline for routine operational activities. Table F-4-3 shows the collective dose equivalent measured on personnel dosimeters for each of the last five years of data. The number of individuals monitored for radiation exposure over the last five years has averaged about 6,000. Of these, an average of about 31 percent receive measurable radiation doses. The average dose equivalent of those individuals with measurable exposure ranges from about 130 to 180 millirem. The average dose equivalent of all monitored individuals ranges from 27 to 60 millirem.

Table F-4-3. Total collective dose equivalent for Idaho National Engineering Laboratory site workers from normal operations.

Year	Number of individuals monitored	Number of individuals with measurable exposure	Collective dose equivalent ^a (person-rem)	Average dose equivalent ^b per individual for all monitored individuals (millirem)	Average dose equivalent ^b per individual with measurable exposure (millirem)
1987	5,588	1,831	290	52	158
1988	5,799	2,201	288	50	131
1989	5,883	2,118	351	60	166
1990	6,381	2,138	381	60	178
1991	6,646	1,224	182	27	149
Five-year average	6,060	1,902	298	49	156

a. Collective Dose Equivalent: The sum of the dose equivalents to all members of a group of interest. For example, if 100 workers each received a dose equivalent of 0.1 rem, the collective dose equivalent would be 10 person-rem (100 persons $\times$ 0.1 rem).

b. Average Dose Equivalent: The average dose to members of a group of interest. For example, if the collective dose equivalent for a group of 100 workers was 1 person-rem, then the average dose equivalent for each member of the group would be 0.01 rem (1 person-rem $\div$ 100 persons).

The average radiation dose rate to all INEL site workers over this five-year period was 27 millirem per year. This is the dose rate that is used to project doses to workers at the INEL site under each of the alternatives of this EIS.

F-4.1.2.2 Workplace Hazards Other Than Radiation. There is widespread diversity of the types and quantities of chemicals used at the various INEL facilities. Consequently, industrial hygiene monitoring and sampling programs are designed to ensure that personal and/or area monitoring strategy is directed toward the chemicals that pose the greater risks and hazards. All aspects of the toxic chemical control program are designed to reduce risks and maintain potential exposures to hazards as low as reasonably achievable. The sampling and monitoring programs at the INEL provide data to enable assessments for characterizing the more common materials and toxic chemicals, such as asbestos, lead, cadmium, beryllium, formaldehyde, benzene, hydrogen chloride, nitric acid, sulfuric acid, hydrogen fluoride, sulfur dioxide, welding by-products, coal dust from coal-fired generation plants, solvents, NO_x, and other potentially hazardous substances. The

more common physical agents encountered include noise, heat stress, nonionizing radiation sources, and ergonomic factors. Use of chemical carcinogens at the INEL is extremely limited and occurs only when absolutely required for a specific activity, and no other practical substitute can be found. When used, every effort is made to minimize the potential of exposure to as low as reasonably achievable levels and to limit the size of and access to the work area.

The primary source of information on nonradioactive hazards to the workers at the INEL are reports of occupational injuries. Data for DOE contractors was obtained from the EG&G Safety Performance Measurements System to provide comparative statistics for total recordable injury and illness cases, lost workday cases, and lost workdays for 1987 to 1991 (EG&G Idaho 1993a,b). There were 1,337 total recordable injury/illness cases experienced at the INEL from 1987 to 1991 by an average of 8,385 employees that worked a total of 79,654,000 hours (EG&G Idaho 1993d). The total recordable injury/illness cases rate of 3.4 for the INEL was slightly above the DOE-wide rate of 2.9, but less than half the Bureau of Labor Statistics rate of 8.5.

Of the 1,337 total recordable injury/illness cases at the INEL from 1987 to 1991, 668 (50 percent) of the cases resulted in lost workdays or lost workdays restricted (EG&G Idaho 1993c). The INEL lost workdays rate of 1.7 was slightly higher than the DOE-wide rate of 1.4, but less than half the Bureau of Labor Statistics rate of 4.0. A total of 8,497 lost workdays resulted from the 668 lost workdays cases. The INEL lost workdays rate of 21.3 is nearly half that of the DOE-wide rate of 36.0, and almost four times better than the Bureau of Labor Statistics rate of 79.1.

Of the 1,337 total recordable injury/illness cases at the INEL, 114 cases were classified as occupational illnesses falling into the following six categories: (a) 34 cases were skin diseases or disorders, (b) 55 cases were repeated trauma disorders, (c) 13 cases were respiratory condition because of toxic agents, (d) 4 cases were disorders caused from physical agents, (e) 2 cases were dust diseases of the lungs, and (f) 6 cases were from all other illnesses (EG&G Idaho 1993a).

Other measures of occupational hazards include motor vehicle accidents and property loss due to fire and other causes. The average number of government vehicles driven at the INEL was 805 for the five-year period of 1987 to 1991 (EGG 1993d). The INEL experienced 90 recordable motor vehicle accidents (over \$500 loss) during 64,711,000 miles of travel (EG&G

Idaho 1993d). The resultant accident rate of 1.4 compares very favorably with the DOE-wide rates for the same five-year period of 2.4, and is nearly nine times better than the National Safety Council five-year rate.

The INEL Motor Vehicle accident loss was a total of \$202,000 for the 1987 to 1991 period (EG&G Idaho 1993d). An average loss rate of \$3.11 per 1,000 miles traveled is only 65 percent of the DOE-wide average loss of \$4.76 per 1,000 miles of travel (EG&G Idaho 1993d) and four times less than the National Safety Council rate of \$12.47 for the same five-year period. The INEL loss rate for each of the five years is considerably below the DOE-wide average loss.

The INEL fire loss experience for the five-year period from 1987 to 1991 shows only two reportable losses over \$1,000. A loss in 1989 resulted in \$25,000 damage and one in 1991 totaled \$63,000 in damage loss. The INEL experienced a total of 20 reportable non-fire property damage losses (over \$1,000) from 1987 to 1991. The total value of the loss from these 20 cases was \$1,292,000. In 1988, seven cases accounted for a loss of \$1,026,000, and represents 80 percent of the five-year total.

F-4.2 Health Effects Methodology

This section describes the methods used to evaluate (a) potential adverse health effects to workers and members of the public from releases of radioactive and nonradioactive effluents to the environment under routine operating conditions, and (b) hazards to workers from normal workplace conditions. The scope of the health effects evaluation in the EIS follows the recommendations specified by the DOE Office of National Environmental Policy Act Oversight in their *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DOE 1993a).

F-4.2.1 Health Effects from Effluent Releases to the Environment

In general, health impacts are estimated for releases of radioactive and nonradioactive contaminants to air and groundwater. However, the "sliding scale" concept has been applied to the evaluation of health effects by considering the relative importance of specific contaminants and exposure pathways. For example, there are no permanent surface waters on the INEL site

and no surface drainage from the INEL to offsite locations. Therefore, the INEL ER&WM EIS does not include a detailed analysis of this exposure pathway.

For routine or accidental releases from facilities, the following three categories of exposed individuals are addressed as a minimum: (a) maximally exposed individual located at the INEL site boundary, (b) population within 80 kilometers (50 miles) of the operating facilities, and (c) nearby workers. For routine releases, the population within a 80-kilometer (50-mile) radius was evaluated. For releases from accidents, the most populous section of a 16-point compass section was evaluated. In special circumstances, a fourth receptor location may be appropriate for evaluating accidental releases at individual sites. For example, at the INEL, where the site is traversed by public highways, it is possible that a member of the public on or near the highway could be affected by some potential accidents.

For offsite transportation accidents, four categories of exposed individuals are addressed: (a) maximally exposed individual located 100 meters downwind of the accident scene, (b) urban population density (3,861 persons per square kilometer), (c) suburban population density (719 persons per square kilometer), and (d) rural population density (6 persons per square kilometer). Onsite transportation accidents are treated similar to facility accidents. However, onsite transportation accidents may be treated using the methods described for offsite transportation accidents where deemed appropriate on a case-by-case basis. Impacts from transportation are presented in Section 5.11.

Health effects from radioactive and nonradioactive contaminants are reported separately and are not summed. Adding these impacts can be misleading because of the differences in environmental modeling methodology, health effect end-point, and basis for the risk factors used. Similarly, where distinctly different types of effects are reported for chemical exposures (that is, carcinogenic and noncarcinogenic) they are reported separately and not summed.

F-4.2.1.1 Radiological Health Effects from Effluent Releases. Estimation of health effects from radionuclides are based on the *1990 Recommendations of the International Commission on Radiological Protection*, (ICRP 1991). The risk factors from Table F-4-4 were used.

Table F-4-4. Risk of fatal cancers and other health effects from exposure to radiation.^a

	Fatal cancer	Nonfatal cancer	Genetic effects	Total detriment
Workers	4.0×10^{-4}	8.0×10^{-5}	8.0×10^{-5}	5.6×10^{-4}
General public	5.0×10^{-4}	1.0×10^{-4}	1.3×10^{-4}	7.3×10^{-4}

a. Units when applied to an individual are "lifetime probability of cancer per rem of radiation dose". Units when applied to a population of individuals are "excess number of cancers per person-rem of radiation dose". Genetic effects apply to populations, not individuals.

In the interests of clear and consistent presentation, the measure of impact used for evaluation of potential radiation exposures in the EIS is risk of fatal cancers. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of fatal cancer. Estimates of health effects from routine and accidental radiation exposures are based on the *1990 Recommendations of the International Commission on Radiological Protection*, (ICRP 1991). The risk factors to be used in the EIS are consistent with those recommended by the DOE Office of National Environmental Policy Act Oversight and contained in the *Preamble to Standards for Protection Against Radiation* (FR 1991) .

The risk factors in Table F-4-4 are applicable for all cases involving low individual doses (<20 rem) and low individual dose rates (<10 rem/hour). At higher doses, near-term effects other than cancer are the primary concern. Those unusual accident situations that may result in high radiation doses to individuals are considered as special cases.

As indicated in Table F-4-4, the risk per unit of radiation exposure is slightly smaller for workers than for the general public. This is because the working population is made up of a narrow age group that excludes infants, children, and the elderly.

Other health impacts could result from exposure to radiation. Risk factors for these effects have been provided so that anyone desiring to estimate them will have the necessary information. Additional health effects that could be considered as measures of impact for radiation exposures include nonfatal cancers in the exposed population and genetic effects in subsequent generations. When these are added to fatal cancers, the combined incidence of

adverse health effects is called "total detriment". In all cases, risks expressed as total detriment are only slightly larger than the fatal cancer risk. The risk factors for these other health effects are included in Table F-4-4 for reference.

For the calculation of health effects from exposure to airborne radionuclides, the actual or modeled exposure (in either rem for individuals or person-rem for populations) provided in Sections 4.7 and 5.7 of the EIS is multiplied by the appropriate risk factor from Table F-4-4. The measure of impact used for evaluation of potential radiation exposures in the EIS is risk of fatal cancers. Population effects are reported as collective radiation dose (in person-rem) and the estimated number of fatal cancers in the affected population. The maximum individual effects are reported as individual radiation dose (in rem) and the estimated lifetime probability of fatal cancer.

The concentration of radionuclides in water is reported in Sections 4.8 and 5.8 of the EIS. To calculate health effects from radionuclide concentrations in water, the total quantity of radionuclide ingested must be converted to an effective dose equivalent and then the appropriate risk factor applied. This is accomplished by multiplying the concentration of radionuclide in the drinking water (microcurie per liter) by the consumption rate (liter per day) and by the consumption period (days) to obtain the quantity of radionuclide ingested. This ingested quantity (microcurie) is then multiplied by the appropriate exposure to dose conversion factor (millirem per microcurie) to obtain the dose which is then multiplied by the appropriate risk factor.

Exposure to dose conversion factors were obtained from Federal Guidance Report No.11 *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (EPA 1988). These dose conversion factors were used to convert a quantity of intake to an effective dose equivalent for the subsequent application of the appropriate risk factor obtained in ICRP (1991). The dose to conversion factors used in the EIS have been provided in Table F-4-5.

F-4.2.1.2 Nonradiological Health Effects from Effluent Releases. For public exposures data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose-response values approved by the Environmental Protection Agency. These values include slope factors and unit risks for evaluating cancer risks, reference doses and

Table F-4-5. Exposure to dose conversion factors.

Isotope	Exposure to dose conversion factor (millirem per microcurie)
Tritium	6.4×10^{-2}
Iodine-129	2.76×10^2
Strontium-90	1.42×10^2

reference concentrations for evaluating exposure to noncarcinogens, and primary National Ambient Air Quality Standards (CFR 1977) for evaluating criteria pollutants. When possible all values were taken from the Integrated Risk Information System database (EPA 1994). If the information was not available in the Integrated Risk Information System database, other sources were used, primarily the Environmental Protection Agency's Health Effects Assessment Summary Tables (EPA 1993) and the National Ambient Air Quality Standards (CFR 1977).

For occupational exposures, data were obtained from occupational standards. These include 8-hour time-weighted averages established by either the American Conference of Governmental Industrial Hygienists (ACGIH 1993) or Occupational Safety and Health Agency and proposed standards for carcinogens from new sources under State of Idaho Rules for the Control of Air Pollution in the State of Idaho (IDHW 1994).

Per Environmental Protection Agency's guidance, each contaminant was categorized as carcinogenic or noncarcinogenic. Exposures to contaminants were then evaluated for potential health effects. The method used was dependent on whether the exposure was to the public or to a worker and whether the contaminant was classified as a carcinogen or a noncarcinogen. Health effects were reported separately and were not summed where distinctly different types of effects were reported for chemical exposures (that is, carcinogenic and noncarcinogenic).

The organization of the following sections is based on the difference in evaluation methods used for nonradiological health effects to the public and to workers.

F-4.2.1.2.1 Nonradiological Health Effects to the Public—For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a

lifetime as a result of exposure to the potential carcinogen (that is, incremental or excess individual lifetime cancer risk).

Values for slope factors and unit risk were taken from the Integrated Risk Information System database (EPA 1994). If the information was not available in the Integrated Risk Information System database, other sources were used, primarily the Health Effects Assessment Summary Tables (EPA 1993).

For carcinogenicity, the probability of an individual developing cancer over a lifetime is estimated by multiplying the slope factor (milligram per kilogram-day) for the substance by the chronic 70-year average) daily intake. Hence, the slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. This risk is considered a conservative estimate because the upper bound estimate for the slope factor is used with the "true" risk likely being less.

The unit risk that is calculated from the slope factor is an estimate in terms of either risk per microgram per liter drinking water, or risk per microgram per cubic meter air concentration. In assessing the carcinogenic potential of a chemical, the Human Health Assessment Group of the Environmental Protection Agency classifies the chemical into one of the following groups, according to the weight of evidence from epidemiologic and animal studies:

- Group A—Human Carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B—Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
- Group C—Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)
- Group D—Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

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- Group E—Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

Quantitative carcinogenic risk assessment are performed for chemicals in Groups A and B, and on a case-by-case basis for chemicals in Group C. Cancer slope factors [formerly called cancer potency factors in the Superfund Public Health Evaluation Manual (EPA 1989)] are estimated through the use of mathematical extrapolation models, most commonly the linearized multistage model, for estimating the largest possible linear slope (within the 95 percent confidence limit) at a low extrapolated dose that is consistent with the data. The slope factor or risk is characterized as an upperbound estimate, that is, the true risk humans, while not identifiable, is not likely to exceed the upper-bound estimate and in fact may be lower.

Unit risk estimates for inhalation and oral exposure can be calculated by dividing the appropriate slope factor by 70 kilogram and multiplying by the inhalation rate (20 cubic meters per day) or the water consumption rate (2 liters per day), respectively, for risk associated with unit concentration in air or water. Hence,

$$\text{risk per } \mu\text{g}/\text{m}^3 \text{ (air)} = (\text{risk per mg/kg/day}) \times 1/70 \text{ kg} \times 20 \text{ m}^3/\text{day} \times 10^{-3} \text{ (mg}/\mu\text{g)}$$

$$\text{risk per } \mu\text{g}/\text{L} \text{ (water)} = (\text{risk per mg/kg/day}) \times 1/70 \text{ kg} \times 2 \text{ L/day} \times 10^{-3} \text{ (mg}/\mu\text{g)}.$$

Ingestion and inhalation slope factors are best estimates (that is, median or 50th percentile values) of the age-averaged, lifetime excess cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk per picocurie or risk per becquerel.

In the interest of simplicity, and to assure a bounding assessment, all Environmental Protection Agency weight-of-evidence classes were pooled and Class C (those with equivocal evidence of carcinogenicity) were included with Classes A and B.

Noncarcinogenic and criteria pollutant health effects are presented using the method described in the *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (EPA 1989). This approach presents noncarcinogenic effects in terms of a hazard quotient, which is the ratio between the calculated concentrations in air or drinking water

and the reference dose or reference concentration, respectively. Doses or concentrations for each chemical and exposure pathway are compared with the route-specific reference dose or reference concentration. If the hazard index (the summed hazard quotients) for all chemicals and pathways exceeds one, the potential may exist for noncarcinogenic health risks. If the hazard quotient is less than one, then no adverse health effects are expected. In situations where simultaneous exposure to maximum baseline chemical concentrations is not feasible, the hazard quotients are reported separately and are not summed.

For criteria pollutants (ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead) that are regulated through the National Ambient Air Quality Standards, the potential for health effects was based on a hazard quotient given by the ratio of calculated air concentration to the appropriate regulatory limit. Because the primary National Ambient Air Quality Standards (CFR 1977) and the inhalation reference concentration serve essentially the same function, and the primary National Ambient Air Quality Standards have extensive databases rigorously reviewed, the primary National Ambient Air Quality Standards with annual averaging times was used *in lieu* of an inhalation reference concentration. Primary standards are designed to protect public welfare.

The measures used to describe the potential for noncarcinogenic toxicity to occur in an individual are not expressed as the probability of an individual suffering an adverse effect. Instead, the potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (for example, lifetime) with a reference dose derived from a similar exposure period. This ratio is called a hazard quotient and is described below.

$$\text{Noncancer Hazard Quotient} = E/RfC$$

where:

E = exposure level (or intake)

RfC = reference concentration

E and RfC are expressed in the same units and represent the same exposure period (that is, chronic, subchronic, or shorter term).

The noncancer hazard quotient assumes that there is a level of exposure (that is, reference concentration) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) exceeds this threshold (that is, if E/RfC exceeds unity), there may be concern for potential noncancer effects. As a rule, the greater the value of E/RfC above unity, the greater the level of concern. Be sure, however, not to interpret ratios of E/RfC as statistical probabilities; a ratio of 0.001 does not mean that there is a one in 1,000 chance of the effect occurring. Further, it is important to emphasize that the level of concern does not increase linearly as the reference dose is approached or exceeded because reference concentrations do not have equal accuracy or precision and are not based on the same severity of toxic effects. Thus, the slopes of the dose-response curve in excess of the reference concentration can range widely depending on the substance.

Where appropriate, to assess the overall potential for offsite (public) noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach was used Environmental Protection Agency's *Guidelines for Health Risk Assessment of Chemical Mixtures* (FR 1986). This approach assumes that simultaneous subthreshold exposure to several chemicals could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to acceptable exposures. The hazard index is equal to the sum of the hazard quotients, as described in the box below, where exposure level and the reference concentration represent the same exposure period (for example, subchronic, chronic, or shorter-term). When the hazard index exceeds unity, there may be concern for potential health effects. While any single chemical with an exposure level greater than the toxicity value will cause the hazard index to exceed unity, for multiple chemical exposures, the hazard index can also exceed unity even if no single chemical exposure exceeds its reference concentration.

$$\text{Noncancer Hazard Index} = E_1/\text{RfC}_1 + E_2/\text{RfC}_2 + \dots + E_i/\text{RfC}_i$$

where:

E_i = exposure level (or intake) for the i^{th} toxicant

RfC_i = reference concentration for the i^{th} toxicant

E and RfC are expressed in the same units and represent the same exposure period (that is, chronic, subchronic, or shorter-term).

F-4.2.1.2.2 Nonradiological Health Effects to Workers—The primary difference between health effects evaluation of nonradiological exposures to workers and to the public is due to exposure duration. For the public, exposure is assumed to occur, at the given concentration, for the individual's lifetime (70 years). For the worker, exposure occurs only in the workplace and is, therefore, of a limited duration.

The potential for occupational health effects from exposure to all chemical contaminants is evaluated using the method outlined for public exposures to noncarcinogens, with the exception that all occupational concentrations were compared with the applicable occupational standards. The hazard quotient for occupational exposure then becomes the ratio of the chemical concentration to the occupational standard.

Table F-4-6 provides the appropriate reference concentrations, unit risk factors, National Ambient Air Quality Standards, and occupational standards for evaluating exposure to chemicals in air. To estimate the potential for health effects, these values were applied to the air emission concentrations given in Sections 4.7 and 5.7. Note that all values presented in this table were obtained from the current published reference as of January 1, 1994.

F-4.2.1.3 Additional Assumptions. In addition to the values reported in Tables F-4-4 through F-4-6, the following assumptions were made. Where modeled plume concentrations are predicted to impact site drinking water, the following assumptions were made:

- The facility worker consumes 1 liter of water (one-half of the total daily consumption) from a contaminated onsite well.
- Consumption of the contaminated water is assumed to occur for a sample interval (a sample interval is the time between samples plus two weeks). The additional two weeks is used to allow sufficient time for the sample to be analyzed and the results of the analysis returned to the appropriate water control personnel.

Table F-4-6. Chemical contaminant risk evaluation factors (airborne)^a.

Occupational exposure			Occupational exposure		
Carcinogens	limit ($\mu\text{g}/\text{m}^3$) ^b	Unit risk ($\mu\text{g}/\text{m}^3$)	Noncarcinogens	limit ($\mu\text{g}/\text{m}^3$) ^b	Chronic reference concentration ($\mu\text{g}/\text{m}^3$)
Arsenic	1.0×10^1	4.3×10^{-3}	Ammonia	1.7×10^4	1.0×10^2 (subchronic)
Asbestos	3.0×10^{0c}	2.3×10^{-1} (fiber/mL)	Freon	7.6×10^6	3.0×10^4
Benzene	3.0×10^3	8.3×10^{-6}	Hydrochloric acid	7.0×10^3	7.0
Beryllium	2.0×10^0	2.4×10^{-3}	Hydrofluoric acid	2.6×10^3	2.6×10^3
Cadmium	5.0×10^0	1.8×10^{-3}	Lithium	2.5×10^1	None Available
Carbon tetrachloride	1.3×10^4	1.5×10^{-5}	Mercury	5.0×10^1	3.0×10^{-1}
Chloroform	9.8×10^3	2.3×10^{-5}	Methyl isobutyl ketone (Hexone)	2.1×10^5	80
Formaldehyde	3.7×10^2	1.3×10^{-5}	Nitric acid	5.0×10^3	50 (AAC)
Hexavalent chromium	5.0×10^1	1.2×10^{-2}	Sulfuric acid	1.0×10^3	70 (AAC)
Methylene chloride	1.7×10^5	4.7×10^{-7}	Tributyl phosphate	2.2×10^3	2.2×10^3
Nickel	1.0×10^2	2.4×10^{-4}	Trivalent chromium	5.0×10^2	5 (AAC) ^d
Perchloroethylene	1.7×10^5	4.8×10^{-7}	Criteria pollutants ^e	Primary standards	Average time
Trichloroethylene	2.7×10^5	1.7×10^{-6}	Carbon monoxide	10 mg/m ³	8-hours ^f
			Lead	1.5 $\mu\text{g}/\text{m}^3$	quarterly
			Nitrogen dioxide	100 $\mu\text{g}/\text{m}^3$	annual
			Particulate matter	50 $\mu\text{g}/\text{m}^3$	annual ^g
			Sulfur dioxide	80 $\mu\text{g}/\text{m}^3$	annual

a. All values presented in this table were obtained from the most recent data as of January 1, 1994.

b. Occupational exposure limits are 8-hour, time-weighted averages established by either the American Conference of Government Industrial Hygienists (ACGIH) or Occupational Safety and Health Administration (OSHA); the lower of the two is used.

c. Value reported for asbestos standard is mass equivalent of most restrictive National Institute of Occupational Health and Safety standard of 0.1 fibers per cubic centimeter.

d. AAC = Acceptable Air Concentration.

e. Criteria pollutant, from the National Ambient Air Quality Standards (NAAQS); EPA HEAST Table A-V-1.

f. Not to be exceed more than one per year.

g. The standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 $\mu\text{g}/\text{m}^3$.

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- All workers at the facility are assumed to obtain water from the same water supply.
 - The level of drinking water contamination is equal to the modeled groundwater plume concentration (no allowance is made for treatment).
 - The water supply is assumed to be isolated from human consumption at the time sample results are obtained.

Where actual facility drinking water data is used, the following assumptions are made:

- The facility worker consumes 1 liter of water (one-half of the total daily consumption) from the contaminated drinking water distribution system.
- Consumption of the contaminated water occurs five days per week for 50 years.

Offsite health effects were calculated assuming:

- The individual would have access to the highest modeled or measured offsite contaminant concentration.
- The individuals entire water consumption would be from the contaminated water supply.
- The consumption would occur for 70 years.

F-4.2.2 Hazards to Workers from Normal Workplace Conditions

The primary impacts to workers at the INEL are not a result of effluent releases, but arise from occupational exposure to radioactivity and other workplace hazards. This section describes the methods used to evaluate these occupational hazards.

F-4.2.2.1 Radiological Exposure and Health Effects. The activities to be performed by workers under each of the alternatives are similar to those currently performed at each site.

Therefore, the potential hazards encountered in the workplace will be similar to those that currently exist. Further, these hazards will be controlled by occupational and radiological safety programs operating under the same regulatory standards and limits that currently apply at DOE facilities. For these reasons, the average collective radiation dose to the INEL workforce is anticipated to be proportional to the number of workers employed under each alternative.

The average annual dose rate for INEL workers was derived from the measured doses reported over the period 1987 to 1991, as presented in Table F-4-3. The value used for projecting doses to the INEL workforce is 27 millirem per worker per year. The number of workers under each alternative is based on the values reported in Section F-1, Socioeconomics.

F-4.2.2.2 Workplace Hazards Other than Radiation. The measures of impact for workplace hazards used in this EIS are (a) total reportable injuries and illness, and (b) fatalities in the workforce. Injury and fatality rates for construction workers are considered separately because of the relatively more hazardous nature of construction work. Table F-4-7 gives the rates for reportable injury and illness and for workplace fatalities for DOE and its contractors. The rates for DOE construction workers include both categories reported by DOE, that is, direct DOE contractors (cost contractors) and their subcontractors (lump contractors). These rates are applied to the estimated workforce under each alternative to evaluate potential occupational health effects. The number of workers under each alternative is based on the values reported in Section F-1, Socioeconomics.

The average rates for private industry in the United States are also provided for perspective. While the reporting practices of the DOE and the National Safety Council are not identical, they are similar enough to provide a good basis of comparison between DOE and private industry.

F-4.2.3 Accidents

For evaluation of accident scenarios, health effects from exposure to radiation are evaluated using the methodology outlined in Section 4.2.1.1. However, due to acute exposure conditions under accident scenarios, it is inappropriate to apply either occupational or public

Table F-4-7. Average occupational injury/illness and fatality rates at the Idaho National Engineering Laboratory^a

	All labor categories		Construction workers	
	Total injury/illness	Fatalities	Total injury/illness	Fatalities
DOE and contractors ^b	3.2	0.0032	6.2	0.011
Private industry ^c	8.4	0.0097	13	0.034

a. All incidence rates are given per 100 worker-years.

b. 1988-1992 averages (DOE 1993b).

c. 1983-1992 averages (NSC 1993).

standards to chemical releases. Therefore, the following methods have been used to evaluate chemical concentrations under accident scenarios.

F-4.2.3.1 Nonradioactive Releases from Accidents. For accident conditions, possible impacts to human health are assessed by comparing the airborne concentrations of each substance at specified downwind locations to standard accident exposure guidelines for chemical toxicity.

Where available, Emergency Response Planning Guideline values are used for this comparison (Homann 1988). The Emergency Response Planning Guideline values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects. The Emergency Response Planning Guideline values are specific for each substance, and are derived for each of three general severity levels:

- Exposure to concentrations greater than Emergency Response Planning Guideline-1 values result in an unacceptable likelihood that one would experience mild transient adverse health effects, or perception of a clearly defined objectionable odor.
- Exposure to concentrations greater than Emergency Response Planning Guideline-2 values result in an unacceptable likelihood that one would experience or develop irreversible or other serious health effects, or symptoms that could impair one's ability to take protective action.

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- Exposure to concentrations greater than Emergency Response Planning Guideline-3 values result in an unacceptable likelihood that one would experience or develop life-threatening health effects.

Where Emergency Response Planning Guideline values have not been derived for a toxic substance, other chemical toxicity values are substituted, as follows:

- For Emergency Response Planning Guideline-1, Threshold Limit Value, Time-Weighted Average values (ACGIH 1993) are substituted: The Time-Weighted Average is the time-weighted average concentration for a normal eight-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effects.
- For Emergency Response Planning Guideline-2, Level of Concern values (equal to 0.1 of Immediately Dangerous to Life or Health) are substituted: Level of Concern is defined as the concentration of a hazardous substance in air, above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (EPA 1987).
- For Emergency Response Planning Guideline-3, Immediately Dangerous to Life or Health values are substituted: Immediately Dangerous to Life or Health is defined as the maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any effects which would impair the ability to escape or irreversible side effects (NIOSH 1990).

Possible health effects associated with exceeding an Emergency Response Planning Guideline-2 or -3 are specific for each substance of concern, and must be characterized in that context. When concentrations are found to exceed an Emergency Response Planning Guideline or substitute value, the specific toxicological effects for the chemicals of concern are considered in describing possible health effects associated with exceeding a threshold value.

Emergency Response Planning Guideline values are based upon a one-hour exposure of a member of the general population. In this EIS, exposures resulting from the release of toxic

chemicals during an accident condition were postulated to occur over a period of 1 hour or less to allow for a direct comparison to the Emergency Response Planning Guideline values. This approach provides an additional element of conservatism in the evaluation of accidents with releases that last much less than one hour.

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F-5 FACILITY ACCIDENTS

F-5.1 Introduction

Section F-5 provides background information for Volume 2, Section 5.14 (facility accidents at the INEL associated with environmental restoration and waste management operations as well as the receipt, storage and handling of spent nuclear fuel). For this EIS, the likelihood of accidents has been categorized into events that are abnormal (for example, minor spills), design basis (accidents a facility was designed to withstand), and beyond design basis (accidents a facility is not designed to withstand but may mitigate). This section presents analyzed consequences of facility accidents in these categories for a member of the public at the nearest INEL site boundary, for the collective population within 80 kilometers (50 miles), and for workers.

An accident is an unplanned sequence of events that results in undesirable consequences. Initiating events for accidents were defined in three broad categories: external initiators, internal initiators, and natural phenomena initiators. All types of initiators were defined in terms of those events that cause or may lead to a release of materials and energy by failure or bypass of confinement.

To obtain a perspective on potential accidents involving spent nuclear fuel and waste management and environmental restoration operations at the INEL, the approach was as follows:

- Summarize historical accidents at the INEL.
- Review previous accident analyses for spent nuclear fuel, waste management, and environmental restoration activities.
- Perform an independent analysis of the accidents with the greatest potential consequences.

This section describes the selection of locations or operations for analysis, the process used to identify maximum reasonably foreseeable accident scenarios, the basis for evaluating selected scenarios, and the selection of computer codes and modeling assumptions used to

estimate health effects consequences. The analyses of accidents are intended to be conservative in the sense that where uncertainties exist, assumptions that bound the potential for credible environmental consequences are used.

F-5.2 Methodology

F-5.2.1 Accidents with Potential Release of Radioactive Material

Radioactive materials are involved in a wide variety of operations at the INEL, including scientific research and engineering development for both domestic and national defense purposes. In the past four decades, the INEL has been the world's most notable research and development center for testing of nuclear power reactor concepts, their fuels, their stability, and their behavior in accidents, as well as a center for the reprocessing of spent nuclear fuel. Radioactive materials encompass potentially valuable resources, such as spent nuclear fuels and various isotopes, but also include waste products ranging in form from contaminated laboratory equipment and metal filings to contaminated trash and liquids. These resources and wastes present a potential for releases of radioactive materials caused by human error, equipment failure, or severe natural phenomena such as earthquakes.

This section describes the selection of facilities and operations for analysis and discusses the computer codes used in the analysis. The assumptions concerning atmospheric dispersion, scenarios, and generic data used to calculate consequences is presented in Section F-5.3.

F-5.2.1.1 Selection of Facilities and Operations for Radiological Accident Scenarios.

Radiological accident scenarios were selected and classified.

F-5.2.1.1.1 Selection Process—The accident analysis considered all INEL nonreactor nuclear facilities (accidents at the Naval Reactors Facility are considered in Appendix D of Volume 1). U.S. Department of Energy (DOE) Order 5480.23 (DOE 1992a) defines nonreactor nuclear facilities as those with activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to

the employees or the general public. Excluded from the definition are facilities with generation of radioactive emissions (for example, x-ray machines, industrial lasers, radiography sources, or electron microscopes).

After excluding offices and facilities without radioactive materials (that is, considering only nonreactor nuclear facilities), facilities were screened using preexisting "hazard classifications." Contractors operating nonreactor nuclear facilities are required by DOE Order 5480.23 (DOE 1992a) and DOE guidance (DOE 1992b) to perform a hazard classification of a facility to assess the consequences of an unmitigated release of radioactive and/or hazardous material in one of the following categories:

- *Category 1.* The hazard analysis shows the potential for significant offsite consequences.
- *Category 2.* The hazard analysis shows the potential for significant onsite consequences.
- *Category 3.* The hazard analysis shows the potential for only significant localized consequences.

These categories (or the equivalent classifications performed under the previous DOE order) were used as a screening threshold. Category 3 (low) hazard facilities were excluded since accidents in these facilities would be bounded by those in Category 2 (moderate) or Category 1 (high) hazard facilities. Those facilities with a hazard classification of Category 2 or greater were evaluated further. They were ranked on the basis of their total quantities of radioisotopes, their potential and likelihood of an accident occurring, and their relationship with surrounding facilities. Changes in projected inventories by alternative at the various facilities were considered.

F-5.2.1.1.2 Determination of Qualitative Likelihood of "Reasonably Foreseeable" Accidents—The estimated frequency of each postulated accident was based on an identification of the physical basis for the accident and estimates of the frequency or probability of independent events combined with the conditional probability of the dependent events required for the accident to occur. Once the frequency was estimated for each accident, they were classified by a frequency range. Descriptions of the accidents and data obtained from a variety of sources were used to estimate accident frequency. Once an accident frequency was estimated, it

was categorized into one of the likelihood ranges described below. In addition, a brief description was developed on the basis of the frequency determination for each accident.

The three frequency ranges chosen, based on the frequency of an accident per facility year, are as follows:

Category	Frequency range (accidents per year)
Abnormal events	frequency $> 1 \times 10^{-3}$
Design basis events	$1 \times 10^{-3} > \text{frequency} \geq 1 \times 10^{-6}$
Beyond design basis events	$1 \times 10^{-6} > \text{frequency} \geq 1 \times 10^{-7}$

Results of the screening process are given in Section F-5.4.

F-5.2.1.2 Computer Modeling to Estimate Radiation Doses. To determine dose from radioactive material releases using computer codes, factors such as receptor locations and biological uptake parameters, material transport mechanisms, and radionuclide inventory are required as input variables. This section explains these input parameters, notes the degree of conservatism, and describes computer models used to perform dose estimates. Generic input parameters used in the accident analyses are summarized in Section 3.

The Radiological Safety Analysis Computer Program (RSAC-5) (Wenzel 1993) was the computer code chosen for estimating radiation doses resulting from the accidental airborne release of radionuclides. Two other computer codes, ORIGEN2.1 (Croff 1983, RSIC 1991), and Microshield 3.13 (Grove 1988) are used for some accident scenarios to calculate radionuclide inventories as input to RSAC-5.

F-5.2.1.2.1 RSAC-5 Code—The computer code RSAC-5 was developed for the DOE Idaho Operations Office by Westinghouse Idaho Nuclear Co., Inc. (Wenzel 1993) and is in the public domain.

RSAC-5 simulates potential radiation doses to maximally exposed individuals or population groups from accidental airborne releases of radionuclides to the environment. From a specified or RSAC-calculated source term users can calculate the environmental transfer, uptake, and

human exposure. Individual doses are determined at specific distances onsite, at the site boundaries, and away from the site via airborne plume immersion, ground surface contamination (shine), inhalation, and ingestion. (The ingestion pathway applies only where food is raised locally and potentially consumed there.) Population doses are the product of individual dose and the number of people in the affected population.

Source Term Calculation. For most accident scenarios, the radioactive source term is calculated separately by the analyst for input to RSAC-5. Alternatively, for accident scenarios involving reactor fuel, the source term can be calculated by RSAC-5 directly. The latter option is useful for calculating fission product inventories. However, activation products and actinide inventories (for example, uranium and plutonium) must be calculated separately and input by the analyst. RSAC-5 includes an option to calculate radioactive decay of the entire radionuclide inventory or selected specific nuclides.

Atmospheric Dispersion Calculations. Because this analysis addresses accidents, doses are calculated for discrete releases of specific quantities of radioactive material.

The RSAC-5 code uses a two-dimensional Gaussian atmospheric-dispersion model to estimate the dispersion of the radioactive-material plume at various distances downwind from the point of release. INEL-specific values of these dispersion coefficients are built into RSAC-5 for calculation of dispersion factors (χ/Qs).

The user has the option of directly entering χ/Q or having the χ/Qs calculated by the code. Other code options for calculating atmospheric transport include plume depletion by wet or dry deposition and building wake effects.

Dose Calculations. As recommended by the International Commission on Radiological Protection (ICRP 1977, 1979), RSAC-5 uses weighting factors for various body organs to calculate a "committed effective dose equivalent" (CEDE) from radioactivity deposited inside the body by inhalation or ingestion.

RSAC-5 calculates an effective dose equivalent (EDE) for the external exposure pathways (immersion in plume, from ground surface contamination) and a 50-year CEDE for the internal

exposure pathways (inhalation, ingestion). The sum of the EDE from external pathways and the CEDE from internal pathways is called the "total effective dose equivalent" (TEDE). The TEDE summation is performed external to RSAC-5.

Doses may be calculated for an individual at a specified receptor location out to 100 kilometers (62 miles) or for a population within a 80-kilometer (50-mile) radius of the point of release. Population doses are determined by calculating an average individual TEDE at 16-kilometer (10-mile) radial intervals of a compass sector and then multiplying by the number of people to whom that average TEDE applies.

F-5.2.1.2.2 ORIGEN2.1: Isotope Generation and Depletion Code—ORIGEN (Croff 1983, RSIC 1991) is a computer code system for calculating the buildup, decay, and processing of radioactive materials (fission products, actinides, and activation products). It is one of two computer codes recommended by the NRC (1977a) for calculating the radioactivity initially present and later produced in an inadvertent nuclear chain reaction in a fuel reprocessing plant.

ORIGEN2.1 was used in accident analyses involving significant contribution of actinides and activation products to the radioactive source term associated with spent fuel and inadvertent nuclear chain reaction accidents. The radioactivity of each such radionuclide (in curies) in the material damaged by the accident, as calculated by ORIGEN2.1, was multiplied by the appropriate release fraction and supplied as input to subsequent RSAC-5 calculations.

F-5.2.1.2.3 Microshield 3.13—Microshield (Grove 1988) is a radiation shielding code developed for analysis of shielding design, container design, and selection of temporary shielding. Another use of Microshield, employed in some of the accident analyses performed for this EIS, is the calculation of source strength on the basis of radiation measurements from a shielded source of known material and dimensions. This calculation is an iterative process of estimating values of the source strength until the measured radiation values are matched by the calculation.

Microshield has solution algorithms for 14 different geometries, including sources configured as points, lines, spheres, disks, cylinders, slabs, and rectangular solids. Microshield 3.13 contains a library of approximately 500 radionuclides. The user selects the nuclides appropriate

for the application and enters the activity in curies for each. A later version of Microshield (Version 4) has been issued. The changes from Microshield 3.13 do not affect the validity of the calculations presented in the EIS.

F-5.2.2 Accidents With Potential Release of Hazardous Material

Like radioactive materials, hazardous materials are involved in a variety of operations at the INEL. As a result of these operations, a potential exists for releases of hazardous materials due to human error, failure or malfunctioning of equipment, and severe natural phenomena such as earthquakes.

This section describes the selection of facilities and operations for analysis and discusses the computer codes used in the analysis. The assumptions about weather conditions, atmospheric dispersion, scenarios, and generic data utilized to calculate consequences are presented in Section F-5.3.2.1.

F-5.2.2.1 Selection of Facilities and Operations for Hazardous Material Accident Scenarios.

F-5.2.2.1.1 Selection of Hazardous Material Accident Scenarios—Starting with a compilation of INEL hazardous chemicals (Priestley 1992) used in the preparation of the Superfund Amendments and Reauthorization Act of 1986 (SARA) 112 Report for 1992 (CFR 1993a), a search was made for those chemical quantities that were (a) in excess of 227 kilograms (500 pounds), or (b) in excess of reportable quantities (usually one pound) on the U.S. Environmental Protection Agency (EPA) Title III List of Lists (EPA 1990), which includes hazardous chemicals defined in the following lists:

- SARA Section 302 Extremely Hazardous Substances (CFR 1993a)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hazardous Substances (CFR 1993b)
- SARA Section 313 Hazardous Chemicals (CFR 1993c)

-
- Resource Conservation and Recovery Act (RCRA) Hazardous Wastes (CFR 1993d)
 - Environmental Protection Agency (EPA) list of 100 extremely hazardous chemicals (EPA 1990).
 - EPA, 40 CFR Part 9 and 68 (FR 1994) list of regulated substances.

As part of the initial screening, facilities were assigned classifications on the basis of the chemical inventories provided in the SARA list of Extremely Hazardous Substances. Final hazard classifications were based on the reportable chemical quantities within the facilities, Environmental Protection Act (FR 1994) classifications of chemicals stored at the facilities, and the potential consequences of mixing chemicals during an accident. Reviews of existing safety analysis documentation and discussions with plant personnel confirmed that accidents in the resulting facilities would have the potential of producing bounding consequences.

F-5.2.2.1.2 Determination of Qualitative Likelihood of "Reasonably Foreseeable" Accidents—The method of estimating qualitative likelihoods is the same as that described in Section F-5.2.1.1.2 for radiological accidents.

F-5.2.2.2 EPIcode™. Like RSAC-5, EPIcode™ (Homann 1988) uses the well-established Gaussian Plume Model to calculate the dispersion of airborne hazardous chemicals usually at the same receptor locations as used for RSAC-5; that is, facility worker, nearest public access, nearest site boundary, and nearby communities. The EPIcode™ library contains information on over 600 hazardous substances listed in ACGIH (1988); all substances analyzed for the INEL were contained in the library.

The continuous release models require specifying the source term as an ambient concentration and a release rate. For term releases, the user specifies the release duration and the total quantity of material released.

By specifying a release quantity, release duration and release area, the user effectively proposes a release rate per unit spill area. EPIcode™ confirms that the volatility of the spilled

substance can support such a release rate. If the proposed release rate exceeds the saturation conditions at the release temperature, the EPIcode™ calculates a more realistic release rate and a corresponding longer release time based on the properties of the spilled materials.

In calculating effective release height, the actual plume height may not be the physical release height, for example, the stack height. Plume rise can occur because of the velocity of a stack emission and the temperature differential between the stack effluent and the surrounding air. EPIcode™ calculates both the momentum plume rise and the buoyant plume rise and chooses the greater of the two results. In this application, the standard terrain calculation of EPIcode™ is always used. Except as otherwise noted, the established 95 percent meteorological (stability class and wind speed) conditions for INEL are input into EPIcode™. The receptor height is always ground level (0 meters) and, as in RSAC-5, the mixing layer height is always 400 meters (1,300 feet). The deposition velocities listed in Table F-5-2 in the next section are used.

F-5.3. Generic Input Parameters

F-5.3.1 Accidents with Potential Release of Radioactive Material

Calculation of doses rely upon numerous input parameters. Generic input requirements and parameters are discussed below.

F-5.3.1.1 Source Term. The source term is expressed as the fraction of the radioactive material at risk that is released into the immediate environment. The material at risk is specific to a given process in the facility of interest. It is the material the scenario postulates to be potentially available for release, and is not necessarily the total quantity of material present. The release fraction is a multiplier applied to material at risk to estimate initial source term.

For airborne releases, the overall release fraction is the product of the damage ratio, the airborne and respirable fractions, and the leak path factor. The source term (Q) for each scenario is therefore developed as follows:

$$Q = \text{material at risk} \times \text{damage ratio} \times \text{airborne release fraction} \times \text{respirable fraction} \\ \times \text{leak path factor.}$$

F-5.3.1.1.1 Damage Ratio—The damage ratio is the fraction of material exposed to the effects of the energy/force/stress generated by the postulated event. A damage ratio of one is applied for accidents involving 100 percent of the material at risk.

F-5.3.1.1.2 Airborne Release Fraction—The airborne release fraction is the fraction of the material that is made airborne due to the accident. Values from generic DOE guidance are used for the analyses unless more specific information is provided in source documents applicable to a particular accident scenario. These generic values are summarized in Table F-5-1.

Table F-5-1. Release fractions for various release mechanisms for accidents at the Idaho National Engineering Laboratory.^a

Material	Release mechanisms				Inadvertent nuclear chain reaction
	Failed fuel gap	Fire	Explosion		
Gas					1.00
Noble gas	0.10	1.00	1.00		— ^b
Krypton	0.30	—	—		—
Halogens	0.10	1.00	1.00		0.25 ^c
Iodine-129	0.30	—	—		—
Solids					(d)
Volatile	0.01	0.01	(e)		—
Nonvolatile	0.01 ^f	0.01	0.01		—
Fly ash	—	0.01	0.01		—

a. Source: Elder et al. (1986).

b. — indicates no recommendation or not applicable.

c. Includes release and plateout.

d. Use Regulatory Guide values (NRC 1977a, 1979a,b).

e. 100 mg/m³ for particulate airborne material.

f. Actually semivolatile (cesium, rubidium, ruthenium, antimony, selenium, technetium, and tellurium); review on a case-by-case basis.

F-5.3.1.1.3 Respirable Fraction—The respirable fraction is the fraction of the material with particle sizes less than 10 microns (DOE 1993) that could be retained in the respiratory system following inhalation. It is applied only to the source term for the inhalation pathway.

F-5.3.1.1.4 Leak Path Factor—The leak path factor accounts for the action of removal mechanisms, such as containment systems, filtration, deposition, etc., to reduce the amount of airborne radioactivity that is ultimately released to occupied spaces of the facility or to the environment. A leak path factor of one is assigned for a major failure of confinement barriers.

F-5.3.1.2 Meteorological/Dispersion Parameters. For accidents initiated within the INEL site, radiological doses are calculated not only for the general population, but also usually at three locations: (a) for facility workers within the originating facility area (for example, Idaho Chemical Processing Plant), at 100 meters (328 feet) from the source, (b) at the nearest public access to the accident location, and (c) at the nearest INEL site boundary. A qualitative assessment of representative accidents for workers less than 100 meters (328 feet) from the source is given in DOE-ID (1994).

Except for releases through operable discharge systems such as the main stack at the Idaho Chemical Processing Plant, most releases of radioactive material are assumed to be at ground level. The ground-level release assumption is conservative because the slower dispersion compared to elevated releases results in higher ground-level concentrations and, therefore, higher estimates of radiation exposures. Credit is taken for plume rise where applicable, such as that due to thermal buoyancy of combustion products from a fire. Release of a plume either from a height above ground level or with an elevated temperature could cause the plume to partially or completely miss nearby receptors.

The assumed mixing height puts a limit on vertical dispersion of the plume. The selected value of the mixing height of the plume is 400 meters (1,300 feet), considered to be conservative (Clawson et al. 1989). Both conservative and average meteorological conditions were assessed. For the conservative assessment, meteorological conditions were selected that would be favorable to dispersion 95 percent of the time. Applicable parameters are listed in Table F-5-2.

Table F-5-2. Meteorological/dispersion parameters used in dosimetry calculations.^a

Parameter	Facility worker	Nearest public access	Nearest site boundary ^b
Receptor distance (m)	100	Specific ^c	Specific ^c
Wind velocity ^d (m/s)			
95 percent	0.5	0.5/2.0	2.0
50 percent	0.5	0.5/4.0	4.0
Release elevation ^e (m)	0	0	0
Wind stability class ^f			
95 percent	F	F	F
50 percent	D	D	D
Dry deposition velocity ^g (m/s)			
Solids	0.001	0.001	0.001
Halogens	0.01	0.01	0.01
Noble gases	0	0	0
Cesium	0.001	0.001	0.001
Ruthenium	0.001	0.001	0.001
Release duration ^c	Specific	Specific	Specific
Release coefficient ^c	Linear	Linear	Linear
Diffusion coefficients ^c	Markee	Markee	Markee

a. To convert meters to feet, multiply by 3.28.

b. Nearest site boundary values also used in population dose calculations.

c. Specific to accident scenario.

d. 0.5 meters per second for less than 2 kilometers from source; 2.0 meters per second for greater than 2 kilometers with 95% meteorological conditions and 4.0 meters per second for 50% meteorological conditions. For cases with plume rise, fumigation is employed.

e. Applies to most accident scenarios; deviations identified in specific accident descriptions (Markee 1067).

f. 50% meteorology is used only for the population dose calculations.

g. Applies to materials (element and physical state) included in specific source terms.

Dry deposition, as modeled in RSAC-5, is assumed so no washout factor is specified. Plume depletion by dry deposition means that ground surfaces are contaminated during plume migration as particles fall to ground surfaces by gravitational settling. Dry deposition is conservative for the ground surface and biological uptake pathways because radionuclides are made available for uptake. It is slightly nonconservative for inhalation and immersion pathways due to the fractional loss of activity within the plume.

To model the atmospheric transport of released radioactive materials from the INEL, site-specific meteorological data were reviewed to determine the prevailing meteorological conditions. Accidents were evaluated for both average and conservative meteorological conditions. For results that represent the upper bound on consequences, stable meteorological conditions that give rise to minimal dispersion are assumed.

Workers within the facility area and individuals at the nearest public access and nearest site boundary are assumed directly downwind from the accident location. For population doses the wind direction is constrained to the directions with the highest consequences for the general population.

F-5.3.1.3 Biological Parameters. Inhalation and ingestion pathway parameters are discussed below.

F-5.3.1.3.1 Inhalation Pathway Parameters—Inhalation parameters are the same for all radiological scenarios. Breathing rates are assumed to be 3.33×10^{-4} cubic meters per second (worker average) for exposures at controlled areas like the Idaho Chemical Processing Plant facility area (DOE Order 5480.11 (DOE 1992c)) and 2.66×10^{-4} cubic meters per second (member of public average) for uncontrolled areas like public highways inside the INEL site and at the nearest INEL site boundary.

RSAC-5 provides options for specifying pulmonary clearance classes for each isotope in the inventory, or for using code-selected default clearance classes. Clearance classes are selected on the basis of conservatism, unless otherwise supported by available data on the chemical form of isotopes. For INEL facility accidents, the RSAC-5 default selections are used except for the alternate classes of weekly for plutonium and yearly for strontium.

Another conservatism in RSAC-5 involves tritium as a radioactivity source, that is, the source terms for H-3 (tritium) are assumed to be 100 percent tritiated water (HTO).

F-5.3.1.3.2 Ingestion Pathway Parameters—Constants used for calculation of internal dose from ingestion of agricultural products such as leafy vegetables, stored vegetables, meat and milk are default parameters in the RSAC-5 code. They are based on the most current available guidance from the NRC and DOE (NRC 1977b, Moore et al. 1979, DOE 1988). The fraction of the food consumed that is grown locally is assumed to be 10 percent, and this assumption is implemented by multiplying the calculated ingestion dose by 0.1. Consumption rates for the average population are lower than the maximum individual values from the above references. They are based on Rupp (1980). Concentration ratios and transfer coefficients are based on the data of Baes et al. (1984).

F-5.3.1.4 Dose Estimates for Individuals. Underlying assumptions for exposure times, for purposes of dose estimates are discussed below. The following assumptions apply to workers within the facility area:

- Workers are exposed unprotected to the plume for a limited time (a maximum of five minutes). An alarm and/or a "Take Cover Alert" is assumed to sound shortly after accident initiation. Workers, as they are trained to do, would immediately take cover inside the nearest building or, particularly in case of an earthquake, evacuate upwind or crosswind from the release location.
- After the accident is over and the airborne release is terminated, workers are evacuated to buses in a nearby parking lot. During transit from buildings to the buses, workers are exposed to radioactivity deposited on the ground surface for a limited time (a maximum of 15 minutes).
- Workers are exposed to radioactivity via the inhalation, air immersion, and ground surface pathways only. Ingestion of food plants or animals grown onsite at INEL is not expected for facility workers.

The following assumptions apply to the maximally exposed individual at the nearest public access:

- The nearest public access to the location of an accident is usually a public highway (for example, for the Idaho Chemical Processing Plant, U.S. Highway 20/26 near the Experimental Breeder Reactor I National Historic Monument is approximately 5.9 kilometers (3.7 miles) from the Chemical Processing Plant area). This location is within the INEL site boundaries and is patrolled by the INEL Security force. In the event of an accident with potential impacts outside the complex boundary, public access to the highway was assumed to be controlled by INEL Security and State Highway Patrol. It is conservatively assumed that a motorist could be on such a highway for up to two hours before being evacuated by INEL Security personnel.
- A member of the public on such a public highway directly downwind of an accident location would be exposed to radioactivity via the inhalation, air immersion, and ground surface pathways only. Consumption of food plants or animals grown onsite is not expected for a member of the public temporarily on INEL site. For the inhalation and air immersion pathways, exposure time to the plume would be for the entire release duration up to a maximum of two hours. Exposure time to radioactivity deposited on the ground surface would be a maximum of two hours.

The following assumptions apply to the maximally exposed individual at the nearest site boundary:

- A hypothetical member of the public resides at the INEL nearest site boundary (for example, for Idaho Chemical Processing Plant, approximately 14 kilometers or 22.5 miles). This individual grows crops and raises animals for personal food consumption. The wind is assumed to blow directly toward this person and this person's land when the accident occurs, and this person is assumed to receive no warning of the accident.

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- This hypothetical member of the public at the nearest site boundary directly downwind of the accident would be exposed to radioactivity via the inhalation, air immersion, ingestion, and ground surface pathways. For the inhalation and air immersion pathways, exposure time to the plume would be for the entire release duration. Crops and grazing land are exposed for the entire duration of plume passage.
 - Food contaminated by the accidental release of radioactivity is assumed to be ten percent of the hypothetical individual's diet during the ensuing year. This percentage is considered consistent with normal practices that would reduce contamination, such as sprinkler irrigation and washing of vegetables. It does not take credit for interdictive measures, such as enforced limits on consumption unless exposures reach values where protective action guidelines are exceeded.
 - Exposure time to radioactivity deposited on the ground surface would be a maximum of 70 percent of the year following the accident, because the individual could reasonably be expected to spend, on the average, at least 30 percent of each day indoors and shielded from ground surface radioactivity.

F-5.3.1.5 Population Dose Estimates. The RSAC-5 option for calculating population doses (in person-rem) involves determining a total effective dose equivalent (TEDE), in rem, for an average individual at several locations within a 80-kilometer (50-mile) radius and multiplying that TEDE by the number of persons for whom it applies. The TEDE calculation is similar to that for the maximum exposed individual at the nearest site boundary, with some limitations and exceptions:

- For the population option, RSAC-5 limits the radionuclide inventory to 100 entries. For scenarios with more than 100 nuclides, such as those for inadvertent nuclear chain reactions, a screening step is performed. Only those nuclides that produce an EDE or CEDE greater than one millirem for any one of the four pathways at any of the three locations are included.

- In the ingestion pathway, the consumption rates are reduced as described in Section F-5.3.1.3.2.
- The adjustment for respirable fraction in the inhalation pathway is done outside RSAC-5.

The method for calculating population dose effectively assumes that the plume travels at a constant velocity (under both 95 percent and 50 percent meteorological conditions) in a straight line out to 80 kilometers (50 miles) over the sector with the maximum population. This method is conservative because changes in actual wind directions and speeds that vary with time and distance from the accident would cause greater diffusion of the plume and result in lower doses.

F-5.3.1.6 Health Effects. Health effects expected from the estimated doses are discussed in the following sections. The risk factors used for calculation of these health effects are taken from ICRP Publication 60 (ICRP 1991), NCRP Report No. 80 (NCRP 1985), and NUREG/CR-4214 (Abrahamson et al. 1989) and are presented in Table F-5-3.

Table F-5-3. Risk estimators for health effects from exposure to ionizing radiation from accidents at the Idaho National Engineering Laboratory.

Effect	Nuclide	Risk factor (probability per rem)	
		Facility worker	General population
Fatal cancer (all organs)	All	4.0E-04	5.0E-04
Fatal, nonfatal, and severe genetic effects (all organs)	All	5.6E-04	7.3E-04
Cancer and severe genetic effects (thyroid)	Iodine-131	1.05E-05	1.05E-05
	Iodine 132	3.15E-05	3.15E-05
Lifetime risk of hypothyroidism	Iodine-131	1.7E-05	1.7E-05
	Iodine-132	1.7E-05	1.7E-05

F-5.3.2 Accidents with Potential Chemical Exposures

Input parameters for the analyses and the potential health effects of accidents with potential chemical exposures are discussed below.

F-5.3.2.1 Input Parameters. Factors such as receptor locations, terrain, meteorological conditions, release conditions, and characteristics of the chemical inventory are required as input parameters for hand calculations or computer codes to determine human exposure from airborne releases of hazardous chemicals. This section discusses these input parameters, notes the degrees of conservatism, and describes the computer models used to perform exposure estimates. Generic input parameters used in the accident analyses are given in Table F-5-4.

Table F-5-4. Release and dispersion parameters used for calculating hazardous chemical concentrations resulting from accident scenarios at the Idaho National Engineering Laboratory.^a

Meteorological/dispersion parameter	Facility worker	Co-located facilities and nearest public access	Nearest site boundary
Receptor distance (m)	100	Specific ^b	Specific ^b
Wind velocity (m/s)	0.5 ^{c,d}	0.5/2.0 ^{c,d,e}	2.0 ^{c,d}
Release elevation ^c (m)	0	0	0
Wind stability class ^{c,d}	F	F	F
Deposition velocity ^f (m/s)			
Solids	0.01	0.01	0.01
Gases/vapors/liquids	0.001	0.001	0.001
Unspecified	0.001	0.001	0.001
Release duration ^b	Specific	Specific	Specific
Release area ^g	Point	Point	Point

a. To convert from meters to feet, multiply by 3.28.

b. Specific to accident scenario.

c. Applies to most accident scenarios; deviations identified in specific accident descriptions

d. Worst-case meteorological conditions are calculated for some scenarios by optional routine.

e. 0.5 meters per second for less than or equal to 2 kilometers from source; 2.0 meters per second for greater than 2 kilometers.

f. Applies to materials (element and physical state) included in specific source terms.

g. Unless area-release calculational option is used.

F-5.3.2.2 Health Effects. Hazardous constituents dispersed during an accident could induce adverse health effects among exposed individuals. This possible impact is assessed by comparing the airborne concentrations of each substance at specified downwind receptor locations to standard exposure guidelines for chemical toxicity.

Where available, Emergency Response Planning Guideline (ERPG) values are used for this comparison. ERPG values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects (Rusch 1993). ERPG values are specific for each substance, and are derived for each of three general severity levels:

- Exposure to concentrations greater than ERPG-1 values result in an unacceptable likelihood that one would experience mild transient adverse health effects, or perception of a clearly defined objectionable odor.
- Exposure to concentrations greater than ERPG-2 values result in an unacceptable likelihood that one would experience or develop irreversible or other serious health effects, or symptoms that could impair one's ability to take protective action.
- Exposure to concentrations greater than ERPG-3 values result in an unacceptable likelihood that one would experience or develop life-threatening health effects.

Where ERPG values have not been derived for a toxic substance (Weitzman 1992), other chemical toxicity values are substituted, as follows:

- For ERPG-1, threshold limit value/time-weighted average (TLV-TWA) values (ACGIH 1988) are substituted: The TWA is the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
- For ERPG-2, level-of-concern values (equal to 0.1 of the immediately dangerous to life or health value—see below) are substituted: level-of-concern value is defined as the concentration of a hazardous substance in air, above which there may be

serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (EPA/FEMA/DOT 1987).

- For ERPG-3, immediately dangerous to life or health (IDLH) values are substituted: IDLH is defined as the maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any escape impairing or irreversible side effects (NIOSH 1990).

Possible health effects associated with exceeding an ERPG-2 or -3 are specific for each substance of concern and must be characterized in that context. ERPG values are based upon a one-hour exposure of a member of the general population. In this EIS, ERPG values are applied only to time-averaged exposures of one hour or less in duration. This approach provides an additional element of conservatism in the evaluation of accidents with releases that are significantly less than one hour.

F-5.4 Accident Screening Methodology

F-5.4.1 Screening and Selection Process

There are many types of postulated events that may lead to accidental release of radioactive and/or hazardous material of which only some have the potential to cause consequences away from the facility or immediate local area. These events could generate consequences to the environment, workers, and the public at the nearest site boundaries. The screening and selection process focused on events with potential to generate consequences to the public at the nearest site boundary locations. This screening may not identify maximum consequences to the worker within the facility or within 100 meters (328 feet) of the accident location. These consequences are addressed qualitatively and by analysis of accident consequences in terms of worker injuries, deaths, or exposures from a historical perspective.

F-5.4.2 Screening of Locations, Spent Nuclear Fuel, Waste and Activity Types

Sufficient quantities of each material type to cause a potential impact if released are defined in accordance with DOE-STD-1027-92, "Hazard Categorization and Accident Analysis

Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports" (DOE 1992b) for a Category 2 hazard. Results by waste stream or material type for the nine major areas are given in Volume 2, Section 5.14.

F-5.4.3 Screening of Accident Initiating Event Types

Each INEL facility area was screened for initiating events with the potential to cause nonnegligible consequences to the worker, environment, or public at the nearest site boundary.

F-5.4.4 Estimation of Accident Event Release Frequency Ranges

Most types of accident events considered in this screening have never occurred at the INEL. They are defined as rare events in that the frequency with which these events are expected to occur is very small. The estimation of the frequency of occurrence is based on analytical analysis and statistics of the occurrence of conditions and contributing events leading to an accident. Frequencies are defined in terms of annual frequency of occurrence.

Annual frequency range estimates are derived from three sources: (a) existing safety analysis documentation, (b) other accident safety analysis documentation with similar frequency of occurrence information, or (c) best engineering judgment if no other reference or similar information is available.

F-5.4.5 Summary of Accident Event Selection and Categorization

The selected accident events are categorized in Table F-5-5 according to the expected annual frequency of occurrence range of the event. Table F-5-5 also summarizes these accidents by frequency of occurrence, source term, dose at the nearest site boundary, and dose to populations.

Table F-5-5. Accident screening process: Summary of events selected for consequence analysis and summary information for consequence assessment.^a

Accident	Frequency	Approximate total source term ^b	Largest source contributor ^c	Total EDE at site boundary (rem) ^d	Maximum dose to sector population ^e (person-rem)
Spent Nuclear Fuel—Abnormal Events and Design Basis Accidents					
Idaho Chemical Processing Plant (ICPP)/ Spent Fuel Storage Facility inadvertent nuclear chain reaction (1×10^{19} fissions, 8-h release)	1E-03	4.2E+03 Ci	Xe-138	1E-03	5.9E-01
Argonne National Laboratory-West (ANL-W)/Hot Fuel Examination Facility (HFEF) earthquake-induced breach and fuel melt	1E-05	1.7E+05 Ci	Xe-133	5E+00	1.4E+04
ANL-W/Fuel Cycle Facility (FCF) earthquake-induced breach and fuel fire	1E-05	8.5E+03 Ci	Cs-137	5E+00	6.1E+03
ANL-W/HFEF fuel handling accident, fuel pin breach, noble gas venting	1E-02	(f)	(f)	2E-03	(f)
ICPP dissolver hydrogen explosion	1E-05	(f)	(f)	6.3E-04	8.1E-01
ICPP inadvertent dissolution of 30-day cooled fuel	1E-06	(f)	(f)	3.0E-02	2.9E+01
Spent Nuclear Fuel—Beyond Design Basis Accidents					
Test Area North (TAN) Hot Cell Complex inadvertent nuclear chain reaction in spent fuel (3×10^{19} fission, 1-h release)	5E-07	3.1E+06 Ci	Kr-85	1.6E+01	4.0E+03
TAN Hot Cell Complex inadvertent nuclear chain reaction in spent fuel (1×10^{19} fissions, 8-h release)	5E-07	3.0E+06 Ci	Kr-85	2.9E-01	3.4E+02
ANL-W/HFEF aircraft crash (radiological)	1E-07	1.8E+05 Ci	Xe-133	5E+00	2.0E+03
ANL-W/FCF aircraft crash (radiological)	1E-07	1.1E+04 Ci	Cs-137	1.8E+00	2.6E+03
ICPP/Spent Fuel Storage Facility seismic pool drain and nuclear chain reaction at CPP 603 (3×10^{19} fission, 1-h release)	1E-07	8.5E+03 Ci	Xe-138	2.8E-02	5.6E+00

Table F-5-5. (continued)

Accident	Frequency	Approximate total source term ^b	Largest source contributor ^c	Total EDE at site boundary (rem) ^d	Maximum dose to sector population ^e (person-rem)
High-Level Waste—Abnormal Events and Design Basis Accidents					
ICPP filter bank fire	3E-05	1.3E-02 Ci	Sb-125	1.2E-05	1.3E-01
ICPP main stack earthquake-induced collapse	3E-04	1.5E+01 Ci	Sb-125	9.1E-02	1.7E+01
ICPP/Calcined Solids Storage Facility earthquake-induced structural collapse	1E-05	9.5E+01 Ci	Cs-137	7.6E-02	4.3E+02
ICPP/New Waste Calcining Facility explosion	3E-06	(f)	(f)	2E-01	(f)
ICPP earthquake-induced high-level waste (HLW) tank failure	1E-05	3E+06 Ci	Cs-137	NA	NA
High-Level Waste—Beyond Design Basis Accidents					
ICPP/CSSF aircraft crash (radiological)	2E-07	2.9E+04 Ci	Cs-137	1.1E+00	1.0E+04
Transuranic Waste—Abnormal Events and Design Basis Accidents					
Radioactive Waste Management Complex (RWMC) lava flow (radiological)	2E-05	4.3E+00 Ci	Pu-241	9.4E-02	9.6E+01
RWMC/Transuranic Storage Area (TSA) fire	4E-06	(f)	(f)	1E-06	(f)
RWMC/TSA explosion	2E-04	(f)	(f)	2.0E-07	(f)
Transuranic Waste—Beyond Design Basis Accident					
RWMC/TSA aircraft crash	1E-07	(f)	(f)	6E-04	(f)
Mixed Low-Level Waste—Abnormal Events and Design Basis Accidents					
RWMC/Subsurface Disposal Area (SDA) fire	1E-03	(f)	(f)	4E-04	(f)
Waste Experimental Reduction Facility (WERF) design basis fire	1E-03	(f)	(f)	2.8E-03	(f)

Table F-5-5. (continued).

Accident	Frequency	Approximate total source term ^b	Largest source contributor ^c	Total EDE at site boundary (rem) ^d	Maximum dose to sector population ^e (person-rem)
Mixed Low-Level Waste—Beyond Design Basis Accidents					
WERF Waste Storage Building beyond design basis fire	1E-07	(f)	(f)	1.4E-02	(f)
Hazardous Materials—Abnormal Events and Design Basis Accidents					
ANL-W chlorine and sodium hydroxide release	1E-05	300 lb 6E+05 lb	chlorine ^g sodium	35% of ERPG 3	NA
RWMC lava flow (hazardous material)	2E-05	1.4E+04 kg	mercury	30% of ERPG 3	NA
Central Facilities Area (CFA): Hazardous Waste Storage Facility fire	1E-04	660 gal 150 lb	nitric acid chlorine	4% of ERPG 3 10% of ERPG 3	NA NA
Sewage Treatment Plant chlorine release					
ICPP chlorine release	5E-06	270 lb	chlorine	7% of ERPG 3	NA
ICPP earthquake-induced HLW tank failure (hazardous material)	1E-05	300,000 gal	nitrates	4% of MCL	NA
INEL Research Center hazardous material release	1E-04	68 kg	sulfur dioxide	33% of ERPG 3	NA
ICPP hydrofluoric acid spill	1E-05	3,000 gal	hydrofluoric acid	0.2% of ERPG 3	NA
ICPP nitric acid spill	1E-05	300 gal	nitric acid	0.05% of ERPG 3	NA
ICPP anhydrous ammonia release	1E-06	36,000 gal	anhydrous ammonia	12% of ERPG 3	NA
Hazardous Materials—Beyond Design Basis Accidents					
ICPP/CSSF aircraft crash (hazardous material)	2E-07	30 kg	ZrO ₂	<ERPG 1	NA
ANL-W/HFEF aircraft crash (hazardous material)	1E-07	9.7E+04 g	TCE mercury	<ERPG 1 0.2% of ERPG 3	NA
ANL-W/FCF aircraft crash (hazardous material)	1E-07	5.6E+03 g	cadmium	<ERPG 1	NA
Test Area North depleted uranium fire	1E-07	1.3E+03 kg	depleted uranium	<ERPG 1	NA

Table F-5-5. (continued).

Accident	Frequency	Approximate total source term ^b	Largest source contributor ^c	Total EDE at site boundary (rem) ^d	Maximum dose to sector population ^e (person-rem)
Environmental Remediation and Decontamination and Decommissioning Waste—Abnormal Events and Design Basis Accidents ^h					
RWMC/Pit 9 vent release	2E-03	(f)	(f)	5.1E-02	(f)
RWMC/Pit 9 design basis fire	9E-05	(f)	(f)	8E-01	(f)
RWMC/Pit 9 beyond design basis fire	1E-05	(f)	(f)	3.3E-01	(f)

Definition of acronyms:

EDE - effective dose equivalent
 ERPG - Emergency Response Planning Guideline
 MCL - maximum contaminant level
 NA - not applicable
 TCE - 1,1,1 trichloroethane

- a. All analyses use RSAC-5 (Wenzel 1993) for radiological consequences and EPIcode (Homann 1988) for hazardous material consequences.
- b. Sum of the individual source terms.
- c. Largest source by magnitude (activity or mass).
- d. For hazardous material, exposures are given in terms of percentage of ERPG 3 values (immediately dangerous to life or health) or less than ERPG 1 values (mild transient health effects or objectionable odor).
- e. 95% meteorology.
- f. The safety analysis report used for this accident does not provide this information because it was developed before the DOE orders specifically required this information.
- g. An estimated 20 lb of chlorine were released in an accident on April 15, 1994.
- h. No beyond design basis accidents were identified for environmental remediation and decontamination and decommissioning activities.

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