DOE/EA-1310
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Environmental Assessment for Decontamination and Dismantlement of the Advanced Reactivity Measurement Facility and Coupled Fast Reactivity Measurements Facility at the Idaho National Engineering and Environmental Laboratory

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U.S. Department of Energy
Idaho Operations Office

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ACRONYMS

ALARA	as low as reasonably achievable
ANL-W	Argonne National Laboratory-West
ARMF	Advanced Reactivity Measurement Facility
BBWI	Bechtel BWXT Idaho, LLC
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFRMF	Coupled Fast Reactivity Measurement Facility
D&D	decontamination and dismantlement
DEQ	Division of Environmental Quality
DOE	Department of Energy
DOE-ID	Department of Energy, Idaho Operations Office
EA	Environmental Assessment
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EL	Emission Limits
EPA	Environmental Protection Agency
ESRF	Environmental and Science Research Foundation
ESRP	Eastern Snake River Plain
FR	Federal Register
HEPA	high-efficiency particulate air
HVAC	heating, ventilating and air conditioning
IDAPA	Idaho Administrative Procedures Act
INEEL	Idaho National Engineering and Environmental Laboratory

INTEC	Idaho Nuclear Technology and Engineering Center
KW	kilowatt
LLW	low-level waste
LMITCO	Lockheed Martin Idaho Technologies Company
LSDDP	Large-Scale Demonstration and Deployment Project
MEI	maximally exposed individual
MOA	memorandum of agreement
Mrem	millirem
mrem/yr	millirem per year
MWSF	Mixed Waste Storage Facility
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
NOD	Notice of Deficiency
OSHA	Occupational Safety and Health Administration
PCTS	pneumatic capsule transfer system
PTC	permit to construct
RAD	radiation absorbed dose
rem	roentgen equivalent man
R/hr	rem per hour
RCRA	Resource Conservation and Recovery Act
RRWAC	INEEL reusable property, recyclable materials, and waste acceptance criteria
RSAC	Radiological Safety Analysis Computer Code
RWMC	Radioactive Waste Management Complex
SHPO	State Historic Preservation Officer (Idaho)
SNF EIS	DOE Programmatic Spent Nuclear Fuel Management and Environmental Restoration and Waste Management Programs Final EIS
TAA	temporary accumulation area

TAN	Test Area North
TRA	Test Reactor Area
TSDF	Treatment, Storage and Disposal Facility
USFWS	U.S. Fish and Wildlife Service
WAC	waste acceptance criteria
WCF	Waste Calcining Facility

HELPFUL INFORMATION

GLOSSARY

As low as reasonably achievable (ALARA): An approach to radiation protection to control or manage exposures (both individual, and collective to the work force and the general public) and releases of radioactive material to the environment as far below applicable controlling limits as reasonably possible for social, technical, economic, practical, and public policy considerations.

Effective dose equivalent (EDE): The sum of the products of absorbed dose and appropriate factors to account for differences in biological effectiveness caused by the quality of radiation and its distribution in the body of a reference man. The unit of the effective dose equivalent is the roentgen equivalent man (rem).

High-efficiency particulate air (HEPA) filter: A disposable filter having a minimum removal efficiency of 99.97% for 0.3 micron or larger particles.

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 INEEL Site boundary nearest to the facility in question.

Radionuclide or radioisotope. An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

Roentgen equivalent man (rem): The dosage of ionizing radiation that would cause the same biological effect as one roentgen of x-ray or gamma-ray exposure.

> **millirem** is a unit equal to 1/1000th of a rem
>
> **person-rem** is a unit of collective radiological dose or the collective total dose to a population and is calculated by summing the individual doses to each member of the given population. For instance, if a population of 100 people receive 0.1 rem, then the collective dose would be 10 person-rem (100 persons x 0.1 rem).

Radiation absorbed dose (rad): The basic unit of absorbed dose equal to absorption of 0.01 joule per kilogram of absorbing material. For alpha emitting radionuclides 1 rad = 20 rem.

Scientific Notation

Scientists use scientific notation to express numbers that are very small or very large. This environmental assessment (EA) expresses a very small number with a negative exponent, such as 1.3×10^{-6}. To convert this number to the more commonly used form, move the decimal point left by the number of places equal to the exponent, in this case 6. The number thus becomes 0.0000013. For large numbers, those with a positive exponent, move the decimal point to the right by the number of places equal to the exponent. This EA writes the number 1,000,000 as 1.0×10^{6}.

Unit Prefixes

Prefix	Power	Value	Symbol
mega	10^{6}	1,000,000	M
kilo	10^{3}	1,000	K
centi	10^{-2}	0.01	C
milli	10^{-3}	0.001	M
micro	10^{-6}	0.000001	μ
nano	10^{-9}	0.000000001	N
pico	10^{-12}	0.000000000001	P
femto	10^{-15}	0.000000000000001	F

Environmental Assessment for Decontamination and Dismantlement of the Advanced Reactivity Measurement Facility and Coupled Fast Reactivity Measurements Facility at the Idaho National Engineering and Environmental Laboratory

1. INTRODUCTION

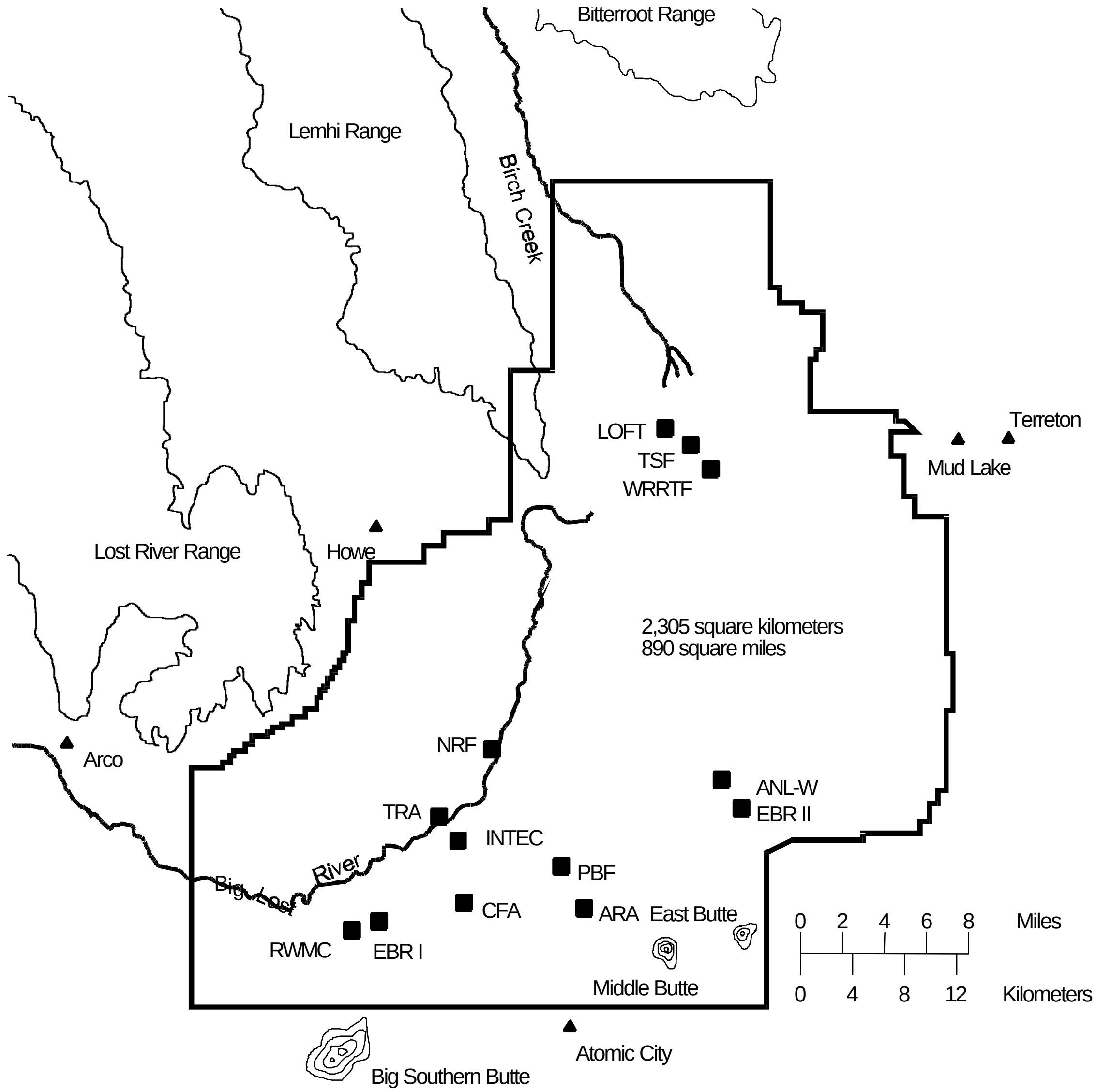
The United States Department of Energy (DOE) proposes to decontaminate and dismantle Building Number TRA-660 at the Idaho National Engineering and Environmental Laboratory (INEEL) Test Reactor Area (TRA). TRA-660 houses two water-cooled reactors, the Advanced Reactivity Measurement Facility (ARMF) and Coupled Fast Reactivity Measurement Facility (CFRMF). The location of the TRA facility at the INEEL is depicted in Figure 1. The purpose of this environmental assessment (EA) is to identify and analyze environmental impacts associated with decontaminating and dismantling TRA-660.

This EA has been prepared in accordance with Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) at Title 40, Code of Federal Regulations (CFR) 1500, and the DOE NEPA Implementing Regulations at 10 CFR 1021. This EA integrates the International Organization for Standardization 14000 standards, which require analysis of actions affecting the environment to determine the "significance" of potential impacts and ensure the appropriate NEPA review.

The DOE Idaho Operations Office (DOE-ID) approved an environmental assessment determination recommending an EA as the appropriate NEPA documentation for evaluating the environmental impacts of the proposed action and alternatives. Subsection D4, of Subpart D, of Appendix D, of DOE's NEPA Implementing Procedures (10 CFR 1021) states that the siting, construction, operation and decommissioning of power reactors, nuclear material production reactors, and test and research reactors normally requires the preparation of an environmental impact statement (EIS). The ARMF and CFRMF reactors are in the category of research reactors and the proposed action involves their removal and disposal, which could be included within the definition of decommissioning. Though the proposed action is to remove and dispose of nuclear research reactors, the reactors are small, fully contained units located in a building on the INEEL, within a water-filled canal where the environment is self-contained and controlled. The reactors can be removed from the canal and dismantled and disposed of on the INEEL. Because of these factors, the DOE has determined that an EA should be prepared first to determine whether there are any significant environmental impacts. Based on impacts addressed in this EA, and public review, the DOE-ID will either issue a Finding of No Significant Impact and proceed with the action, or if the EA identifies the potential for significant environmental impacts, an EIS will be prepared.

1.1 Purpose and Need for Agency Action

The purpose of the proposed project is to decontaminate and dismantle radiologically contaminated and hazardous components and equipment in TRA-660, to allow future use by other programs. Additionally, the need for the proposed action is to reduce the potential risk of radioactive exposure and release of hazardous constituents from the facility.



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ARA	Auxiliary Reactor Area
ANL-W	Argonne National Laboratory-West
CFA	Central Facilities Area
EBR-I	Experimental Breeder Reactor I
EBR-II	Experimental Breeder Reactor II
INETC	Idaho Nuclear Technology and Engineering Center
LOFT	Loss-of-Fluid Test Facility
NRF	Naval Reactor Facility
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Facility
TRA	Test Reactor Area
TSF	Test Support Facility
WRRTF	Water Reactor Research Test Facility

Figure 1.

deactivated or surplus facilities. These are facilities or sites (including equipment) that no longer have an identified programmatic use and may have radioactive or hazardous contamination levels requiring

from contaminants that may be present. This program is concerned with the safe caretaking of facilities until they have been decontaminated, entombed, dismantled and removed, or converted to another use.

using currently available technology. Following D&D of the TRA-660, management of the facility would be transferred to the TRA Landlord.

connection with routine operations in 1997. Defueling as part of routine operations is categorically excluded from review under DOE's NEPA Implementing Procedures.

History and Description of TRA-660

the building within the TRA is depicted in Figure 2. The building was designed to accommodate the reactors and related control systems, a sample preparation room, instrument repair area, and equipment

laboratory, an instrument repair area, and equipment storage, with offices on the second floor. A 15-ton

The ARMF and CFRMF are
apart in the canal. Pool reactors are reactors located in a canal or "pool" with water providing the

plating. A concrete sump, measuring 4 ft wide by 4 ft-2 in. long and 20 ft deep, is located on the
of the canal with a pump for draining water from the canal. The canal water provided cooling and

of the canal is a 4-ft by 8-ft storage pit extending the canal depth by an additional 5 ft. The reactor canal
belowgrade and open to the facility. The ARMF and CFRMF structures are shown in Figure 4.

criticality in 1960 and 1962, respectively. They were similar critical facilities used for precision

fuels and poisons, stability for reproducible reactivity measurements, and sensitive instrumentation for

and resonance integral cross sections of a variety of materials and nondestructive testing of reactor fuel

In 1969, the ARMF-II core was equipped with a unique fast neutron spectrum zone and has since

neutron fission product capture effects and developing fast reactor dosimetry. In 1978, a precision

using standard neutron radiograph techniques. A tapered collimator passed neutrons from the CFRMF

CFRMF allowing remote transfer of samples with short-lived isotopes to and from the core irradiation position to a neutron or gamma detector station. Initially, the CFRMF operated at a power level of 1.0 kW or less. In 1975, the CFRMF was modified to provide a heat exchanger and pump to remove 100 kW of heat from the CFRMF core. A plenum chamber beneath the reactor directed flow and contained the generated heat when the reactor power was increased above 80 kW.

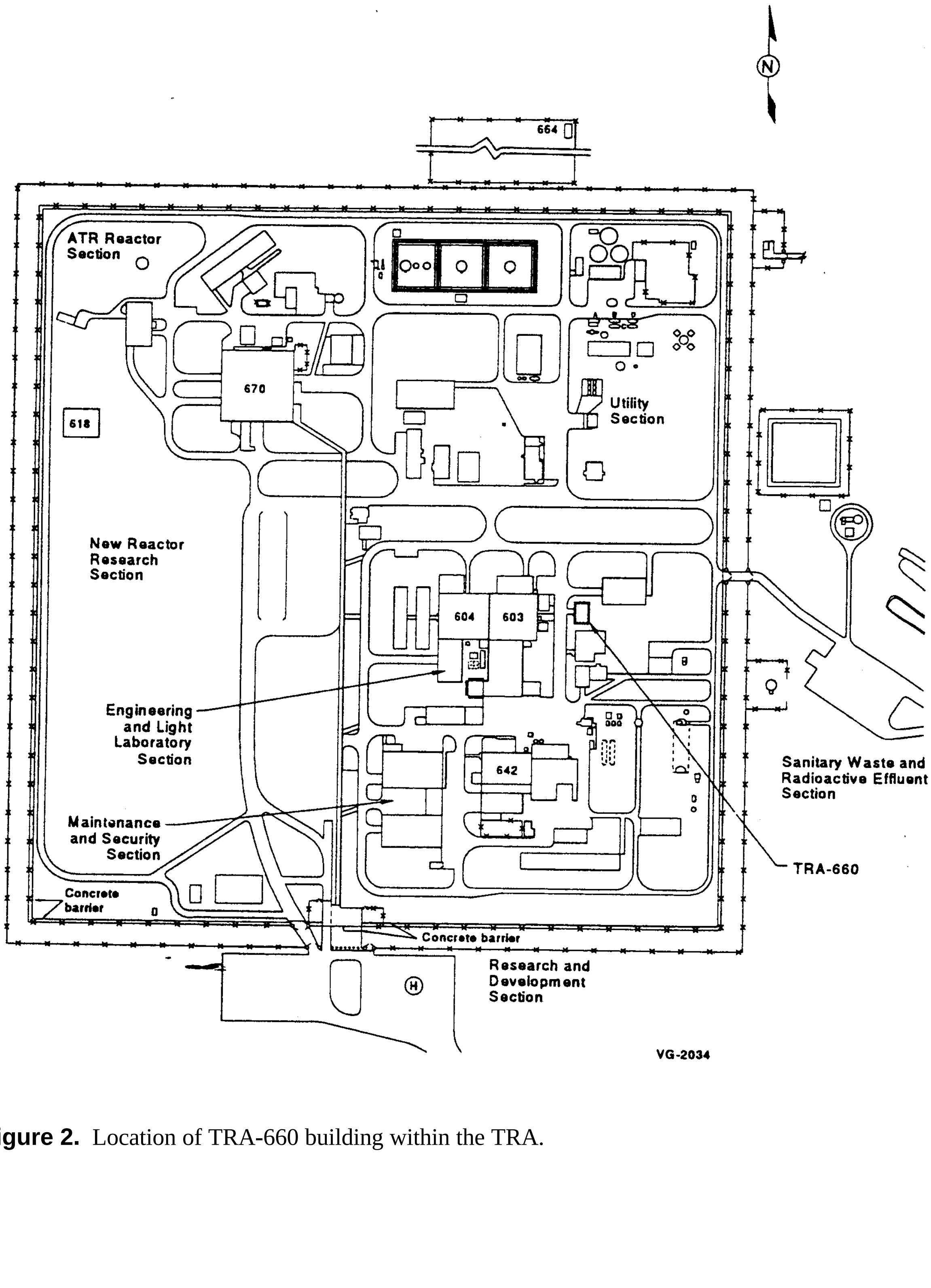

Figure 2. Location of TRA-660 building within the TRA.

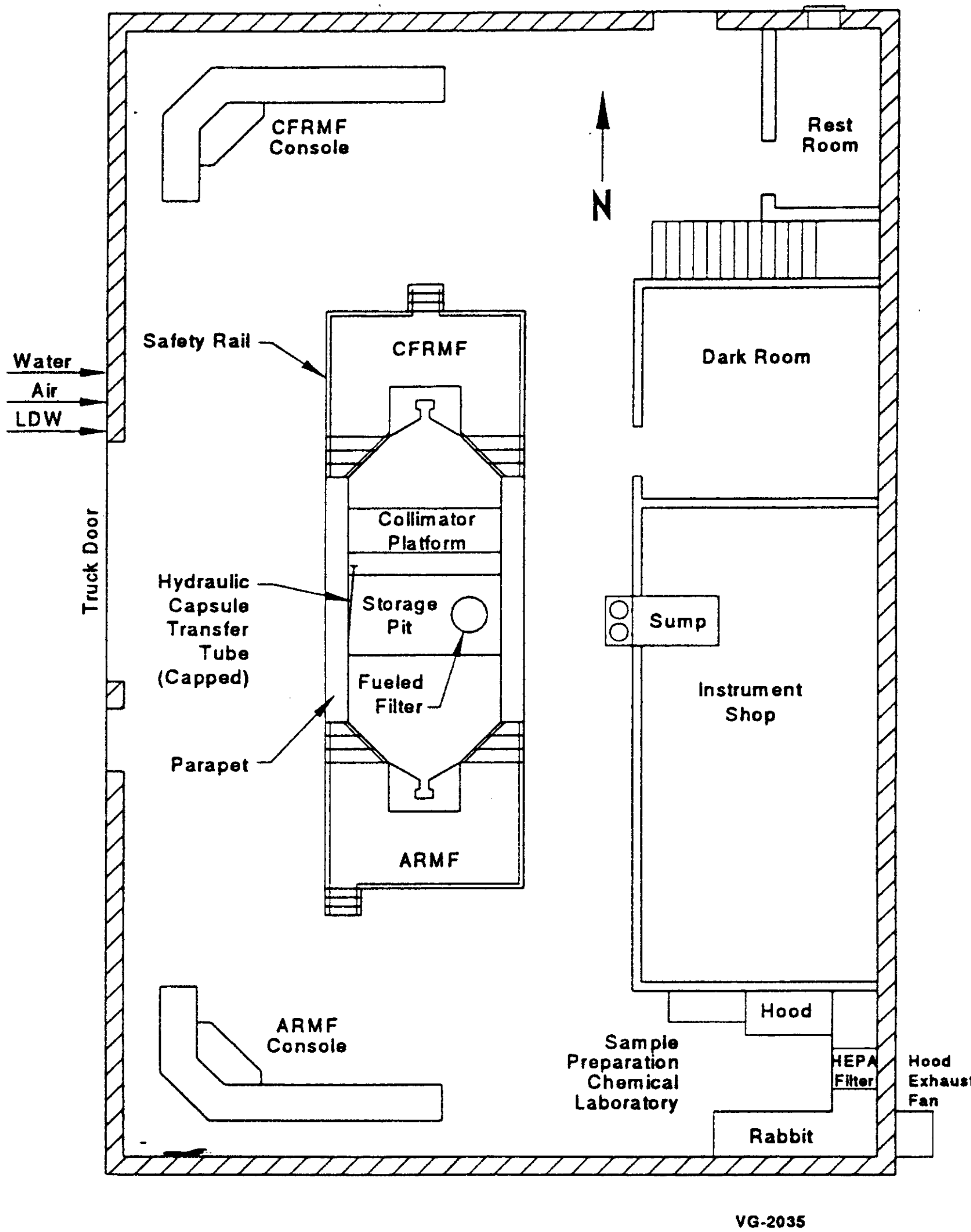

Figure 3. Plan view of TRA-660.

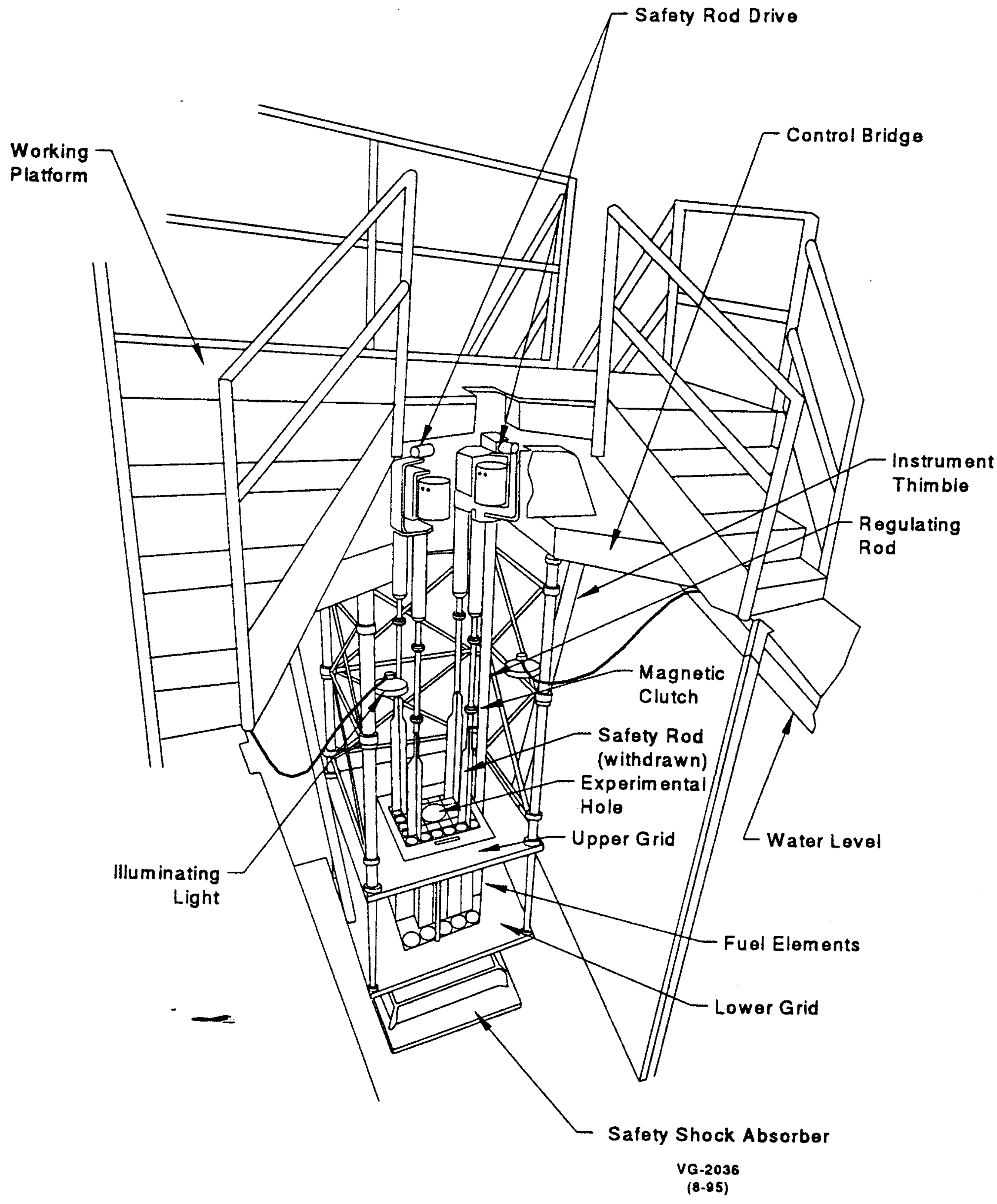

Figure 4. ARMF and CFRMF structures.

Beginning in 1995, actions were initiated to place the facility and the reactors in inactive or standby status. The fuel was removed in 1997, and transported to the Idaho Nuclear Technology and Engineering Center (INTEC) for storage. To gain access to the fuel elements, the four removable sections of the reactor upper grids were removed and placed on the bottom of the canal. All radioactive sources were removed and disposed of per applicable INEEL waste management requirements.

In addition to defueling, equipment and materials have been removed. The following components were removed and placed in storage in the INEEL Mixed Waste Storage Facility (MWSF), as mixed (radioactive and hazardous) low-level waste (LLW):

- Reactor components containing lead and cadmium not integral to the reactors
- The fuel rack containing cadmium, cadmium from the hydride measurement filter block, and cold coupon holder
- Radiologically contaminated lead bricks, lead shot, a lead pig, a lead gamma shield, and miscellaneous pieces, including lead bricks from the activated neutron filter assembly
- The prefilter from the sample preparation area hood exhaust system.

The following activities have also been completed or initiated as part of deactivation:

- The activated neutron filter assembly containing 24 lead bricks was removed from the canal and transported to Test Area North (TAN) for disassembly and characterization
- Samples were collected from facility systems, components, interior paint, tools, and upper grid assembly plates from both reactors
- The high-efficiency particulate air (HEPA) filter in the exhaust system was changed out in 1997, by defueling personnel, and is being left in the facility since it has not been used
- Two spare safety rod sections containing cadmium were crushed and excessed for recycling
- Security system personnel have removed the security system camera and motion detectors for reuse
- Clean electrical materials and equipment, such as spare parts and supplies in the instrument shop cabinets, have been excessed. Miscellaneous components from the ARMF and CFRMF reactor control consoles were transferred to TRA Advanced Test Reactor Operations.

Components remaining in the facility include the reactor and reactor housing, platforms, collimator, neutron radiography facility, reactor operating consoles, canal walls and steel liner, piping, metal tools, experiment tubes, internal office structure, and miscellaneous components.

1.3 Large Scale Demonstration and Deployment Project

The INEEL has the opportunity to use new and emerging technologies that may reduce exposures, reduce spread of contamination, and be more effective in characterizing the materials to be removed from buildings during D&D. Technologies would be demonstrated during small D&D projects such as the ARMF/CFRMF D&D, and if successful, used for the D&D of large facilities and structures where radiation and contamination hazards exist. The demonstration of new and innovative technologies for future deployment is referred to as the Large Scale Demonstration and Deployment Project (LSDDP). The intent of the LSDDP is to select technologies requiring less labor, thereby reducing costs, reducing worker exposure, and generating less secondary waste than traditional baseline technologies. Where available and applicable, LSDDP technologies will be demonstrated or tested during the ARMF/CFRMF D&D.

1.4 Related Actions

Several D&D activities were identified in the *DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (SNF EIS) (DOE 1995). The SNF EIS includes the D&D of two other reactors at the TRA, the Engineering Test Reactor and Materials Test Reactor. The SNF EIS also identified D&D of the Fuel Receiving and Storage Facility, Headend Processing Plant, Waste Calcining Facility (WCF) at the INTEC, and Central Liquid Waste Processing Facility at Argonne National Laboratory-West. While many D&D projects have not been initiated, the WCF closure/D&D was completed in July 1999. D&D projects in progress at the INEEL, not identified in the SNF EIS, include waste treatment and handling facilities such as the Certified and Segregated Building at the Radioactive Waste Management Complex (RWMC) and the Process Experimental Pilot Plant facility at the TAN. The *Draft Idaho High Level Waste and Facilities Disposition EIS*, issued January 21, 2000, addresses the D&D of INTEC facilities involved in the treatment of high level waste.

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The following sections describe the proposed action and alternatives:

- Alternative A, the proposed action, involves removing all contaminated equipment and materials, disposing canal water, and backfilling the canal with fill material for future use of the facility

- Alternative B involves decontamination and total dismantlement of TRA-660 and backfilling the area to grade with soil fill material

- No Action alternative, or continuing surveillance and maintenance on the TRA-660 facility.

2.1 Alternative A: Proposed Action - Decontaminate TRA-660 for Potential Future Use

This alternative involves removal and disposition of all radiologically contaminated equipment and hazardous materials from TRA-660. The canal would be decontaminated and backfilled. A possible reuse for the facility would be as a temporary accumulation area (TAA) for waste management activities at the TRA. A TAA is established and operated to provide safe, temporary, and controlled storage or treatment of hazardous waste. TAAs are 90-day waste accumulation areas managed according to the Resource Conservation and Recovery Act (RCRA) at 40 CFR 262.34. This alternative of decontaminating and reusing TRA-660 would cost about $2,400,000 and would reduce current surveillance and maintenance costs to about $5,000 annually.

The major steps for this alternative include removing internal structures, equipment and components, then removing the ARMF and CFRMF reactors, and draining and backfilling the canal.

First, electrical and instrument power to the reactor control consoles, canal area, and interior office structure would be isolated. The control consoles and office structure would be removed first, to provide space for waste containers for contaminated equipment associated with the reactors. Then, the following activities are anticipated to occur:

- Remove the pneumatic transfer capsule system and neutron detector station

- Place the paraffin blocks from the sample preparation area on pallets, then remove and either excess or transport to the INEEL Sanitary Landfill for disposal

- Remove the reactor working platforms and control bridges, neutron radiography facility and reactor assemblies, using the overhead bridge crane

- Remove all piping and wiring from the floor trenches.

A stainless-steel bucket located on the canal floor contains various-sized metal capsules, bolts, screws, tubing, wire, a small glass bottle, and metal shavings. Video taping and radiological surveys of the items were conducted during January 1999. Two of the capsules containing hafnium have been positively identified. Radiation readings on these two capsules were 10.0 and 75.0 rem (R)/hr, respectively. Radiation readings on the unidentified capsules and glass jar range from 0.5 to 25.0 R/hr. Administrative controls and shielding would be required for removing the materials in the bucket.

Because the canal water currently provides shielding, the bucket or materials in the bucket would require immediate shielding, such as a pig, upon removal from the canal.

The pump, heat exchanger, and piping in and around the canal and in the sump pit would be removed. The canal water would be pumped from the canal before removing the pump. The steel canal liner would then be decontaminated. If necessary, to reduce radiation levels, the canal liner would be removed and disposed of as LLW. The facility trenches and floors would be decontaminated as necessary, prior to release for reuse.

2.1.1 Dismantling the ARMF Reactor

Before removing the ARMF reactor, the steps from the reactor work platform and the work platform would be removed utilizing the overhead crane. The four safety rod drive motors, regulating and shim rod drive motors and associated drive mechanisms would then be removed. Finally, remaining electronics and mechanical equipment from the reactor control bridge assembly would be removed, to ensure complete isolation from the control bridge and reactor components and all wiring, piping and other components. The four safety rods, a regulating rod and a shim rod would be removed from the reactor. The 2-ft sections of the rods containing cadmium would be cut out of the rods and segregated for storage and disposal as mixed waste. Shielding could be required to handle and cut up the rods due to radiation levels.

Using the overhead bridge crane, the reactor control bridge with the reactor support structure and core structure attached, would be removed from the canal and placed on the floor for sizing and packaging, if radiation readings allowed. If it proved impossible to raise these structures as one piece, some cutting or shearing under water could be necessary. Because radiation readings in the ARMF core structure range from 1.5 to 2.0 R/hr, removal of the structure could require setting up temporary shielding. Temporary shielding could also be required during sizing. The higher radiation readings are primarily from Cobalt-60 activation of the stainless-steel fuel element adapters in the upper and lower grid assemblies. The remaining portions of the support structure and control bridge should have lower radiation levels and should not require shielding during sizing and packaging. The removed sections of the upper grid plate assembly would be removed from the canal floor when the water level decreased.

2.1.2 Dismantling the CFRMF Reactor

Large scale demonstration technologies could be utilized to dismantle the CFRMF reactor. Otherwise, the reactor would be removed and disassembled in the same manner as described for the ARMF reactor. The radiation readings for the core structure in this reactor range from 3 to 5 R/hr, which would possibly require additional temporary shielding or sizing the core structure under water. The collimator located between the CFRMF reactor and the neutron radiography facility would be removed from the canal. The collimator contains cadmium, and once removed, would be managed as mixed LLW. The plenum chamber, installed near this reactor to recirculate water for cooling, would be removed once the canal water level decreased.

2.1.3 Dismantling the Neutron Radiography Facility

The neutron radiography facility would be dismantled by first removing the carbon-steel shielding plates from the top of the assembly, utilizing the overhead bridge crane. Next, the upper and lower plate assemblies would be removed from the canal and sized as required to fit into waste containers. The small assemblies containing cadmium would be separated and disposed of as mixed LLW. The upper and lower plate assemblies also contain solid lead and lead shot, requiring segregation and disposal as mixed LLW.

2.1.4 Removing the Canal Water and Decontaminating the Canal

The canal water would be sampled once the major removal/disassembly activities in the canal were completed. If the water meets the emission limits defined in the TRA Evaporation Pond (TRA-715) permit to construct (PTC), the water would be pumped to the pond. If the water did not meet the PTC criteria, the water would be treated before release to the evaporation pond. The water would be pumped from the facility using the existing sump pit, via the existing warm waste drain lines.

Equipment and debris removed from the canal would include the safety rod shock absorbers from ends of the canal, underwater table assembly, debris from the bottom, piping, conduit, other metal components, and the sump pump components. After isolating the electrical components, the sump pump and associated piping would be removed from the sump pit. The piping going from the sump pit to the waste system would then be capped and the pit would be decontaminated. Drains and piping would be plugged or terminated as required.

If the liner were left in place, a radiological survey of the canal and pipe trenches would be conducted to identify areas requiring decontamination. The canal would be decontaminated to meet the specific release criteria established in the DOE Radiological Controls Manual and the DOE Order 5400.5, "Radiation Protection of the Public and the Environment." Decontamination techniques, such as chipping and scabbling, would be conducted as necessary to ensure removal of fixed contamination before backfillng the canal. The canal would be backfilled with clean fill material.

If the canal and liner were removed, the canal, sump, and trenches would be backfilled with clean fill material to ground level. Post decontamination radiological surveys and sampling would be conducted as necessary to demonstrate compliance with DOE Order 5400.5. To reuse the facility, a new program could require specific sampling or surveys to verify the facility sufficiently clean to reuse.

2.2 Alternative B - Decontamination and Total Dismantlement of TRA-660

Decontaminating and totally dismantling the ARMF to ground level would require performing the activities outlined in Section 2.1 for Alternative A. Additional activities required for total dismantlement include isolating and removing electrical feeds to the facility and rerouting some electrical feeds that currently run through TRA-660 to TRA-621. This alternative would cost approximately $2,700,000. The facility electrical equipment would be removed. The facility potable water, demineralized water, plant air, raw sewage, warm waste, voice paging, and telephone utilities would require isolation and termination.

A portion of the roof would be removed to allow access to the overhead bridge crane, which would be removed with a mobile crane. The overhead bridge crane and hoist would be excessed if reuse at another location were not identified.

The building structure and foundation would be demolished using heavy equipment such as excavators, front-end loaders, dump trucks, etc., and transported to the INEEL Sanitary Landfill. The steel liner from the canal would be removed, and disposed of as LLW or decontaminated to meet criteria established in DOE Order 5400.5 and the DOE Radiological Controls Manual. The upper five feet of the concrete canal walls would be demolished and used as fill material in the canal as well as sufficient material from the structure walls to complete backfilling the canal. Additional clean fill material would be placed over the foundation to allow contouring similar to the surrounding areas. Any residual contamination would be managed according to applicable DOE orders and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

2.3 No Action Alternative

The no action alternative would leave TRA-660 in its current status. Equipment or items requiring removal for compliance with Notice of Violations or the INEEL Voluntary Consent Order would be removed. The facility would not be decontaminated. Reusable equipment would be excessed to other facilities. The remaining facility would not be decontaminated, but maintenance and surveillance would continue. The roof would require some repairs; the heating and ventilating system, and the lighting (emergency and exit) would require annual preventative maintenance. Costs associated with maintaining the facility in the current condition, without decontamination, total approximately $60,000/yr.

Some equipment would remain in the canal for the life of the facility under the no action alternative. For example, cadmium-containing materials in 8 safety rods, 2 regulating rods, 2 shim rods, the collimator, and small assemblies in the neutron radiography facility (7.3 ft^3). Approximately 17.0 ft^3 of lead would remain in the facility. The no action alternative includes removing all items or equipment necessary to meet regulatory requirements.

3. AFFECTED ENVIRONMENT

The proposed action and alternatives would occur at the TRA, which is an existing, developed facility within the boundaries of the INEEL. The INEEL has been withdrawn from the public domain for the purpose of nuclear research and reactor testing. The INEEL occupies 890 square miles in southeastern Idaho on the Eastern Snake River Plain (ESRP). Public highways U.S. 20 and 26 and Idaho 22, 28 and 33 pass through the INEEL, but off-highway travel within the INEEL and access to INEEL facilities are controlled. The Experimental Breeder Reactor-I, a national historic landmark, is located on the INEEL and open to the public. The SNF EIS provides an extensive description of the INEEL's affected environment (DOE 1995). Since the SNF EIS was published in April 1995, the gray wolf has been listed by the U.S. Fish & Wildlife Service (USFWS) as endangered; experimental/nonessential (USFWS 1995). The gray wolf may range on or near the INEEL. Also, the King's bladderpod has been listed as other species of concern (USFWS 1997).

The surface of the ESRP is comprised of sediments and basaltic lava flows. The lava flows range in age from 2,100 to 1.2 million years in the vicinity of the INEEL. The youngest flows on the INEEL have been dated at about 13,400 years. The ESRP has historically experienced a few small earthquakes. Geologic evidence suggests that moderate earthquakes (magnitude 5.5 or less) at the INEEL may have resulted from volcanic activity that ended 13,400 years ago. Basin and range faulting adjacent to the ESRP have resulted in a higher rate of seismicity that can produce moderate to strong ground shaking at the INEEL. Seismic hazards at the INEEL include surface deformation (surface faulting, tilting) and ground shaking. Other potential seismic hazards (e.g., avalanches, landslides, mudslides, soil settlement, and soil liquefaction) are not likely to occur at the INEEL because the local geologic conditions are not conducive to them (DOE 1995). The magnitude and frequency of these potential seismic events and surface accelerations at the INEEL have been quantitatively described in deterministic and probabilistic seismic hazard assessments for some of the INEEL facilities.

There are no permanent residents on the INEEL. The TRA is located in the southwestern portion of the INEEL Site, covering 102 acres. The town nearest to the TRA is Atomic City, located approximately 15 mi to the southeast, with a population of 25. In June 1998, the total INEEL work force was 8,122 (includes Naval Reactors Facility, Argonne National Laboratory-W, and temporary employees); the number of employees at the TRA was 448.

Radiation in southeast Idaho in the vicinity of the INEEL consists of natural background radiation from cosmic, terrestrial, and internal body sources; manmade nuclear fallout; and radiation from consumer and industrial products. In 1997, INEEL activities added 0.03 millirem (mrem), 0.008% of background, to the total effective dose equivalent (EDE) to the maximally exposed individual. These sources result in an estimated total EDE of 362 millirem/year (mrem/yr) to an average member of the public residing in southeastern Idaho (DOE 1998).

Surface water flows on the INEEL consist of three intermittent streams (Big Lost River, Little Lost River, and Birch Creek) and localized run-off. The INEEL is located in a closed basin; no surface waters flow from the Site. The Snake River Plain Aquifer is the principal groundwater feature in southeastern Idaho, underlying nearly all of the Plain. The Snake River Plain Aquifer was designated a sole source aquifer by the Environmental Protection Agency (EPA). Aquifer depths within the INEEL range from 200 to 900 ft. The depth to the aquifer at the TRA is approximately 460 ft and perched water has been found in the unsaturated zone beneath the TRA at depths ranging from 50 to 200 ft.

4. ENVIRONMENTAL IMPACTS

This section describes the environmental impacts associated with the proposed action and alternatives. Section 4.1 describes the impacts for both Alternatives A and B. The impacts associated with Alternative B, total dismantlement of TRA-660, bound impacts associated with decontaminating and reusing the facility. Therefore, impacts such as air emissions are described for the bounding alternative and significant differences between the alternatives are noted. Section 4.2 describes impacts associated with the no action alternative.

4.1 Impacts Associated with Decontaminating and Dismantling

4.1.1 Air Emissions

This section discusses impacts from potential air emissions associated with decontaminating and dismantling TRA-660. Air emissions would include combustion emissions from operating heavy equipment during dismantling activities, and fugitive dust emissions from excavating and backfilling. Fugitive dust emissions would be controlled in accordance with the Idaho Administrative Procedures Act (IDAPA) 16.01.01.650, “Idaho Rules for Control of Fugitive Dust,” using common techniques such as spraying water and chemicals. For Alternative A, heavy equipment use would be less than for Alternative B, resulting in lower emissions from combustion.

Air emissions would also include radionuclide contaminants released during decontamination and dismantling of the reactors and the canal, and potential emissions from release of the canal water to the TRA Evaporation Pond.

4.1.1.1 Radionuclide emissions. Doses to workers and the public from the D&D of TRA-660 would be well below the established health-based regulatory levels. The doses to workers and the public were calculated based on the assumption that the facility was completely decontaminated and dismantled, with the canal water released to the TRA Evaporation Pond, as in Alternative B. Emissions associated with Alternative A (reuse) would be lower or bounded by Alternative B, because the canal and liner would be decontaminated and backfilled, rather than removed. Alternative A would not involve as much disturbance of the canal and liner, resulting in fewer airborne emissions and reduced risk worker exposure.

To estimate the concentrations of contaminants released during decontamination and dismantling, release factors (or resuspension factors) were assigned to the various components and areas of TRA-660, based on the anticipated decontamination processes and disposition of the materials (Staley 1998). Reactor components are activated metals and would not be expected to release radionuclides to the air. Tools and equipment have minor surface contamination and would not be decontaminated before disposal, and thus, were considered solid material. For both Alternatives A and B, the canal water would be discharged to the TRA Evaporation Pond. Therefore, the resuspension fraction applied to estimate airborne releases was the same as the factor used for calculating pond releases reported in the National Emission Standards for Hazardous Air Pollutants (NESHAPs) annual report. All resuspended radionuclides and metals are assumed released unabated at ground level. The emissions estimate assumed no HEPA filtration during dismantling activities.

The CAP-88 computer code was used for the radiological dose analysis. CAP-88 is approved for use by the EPA for demonstrating compliance with 40 CFR 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities*.

The maximally exposed worker is a hypothetical individual who works for one year at a location 328 ft from the TRA-660 facility where maximum air concentrations occur. The worker would be exposed via the inhalation and external exposure pathways only. The maximally exposed individual (MEI) is a hypothetical member of the public living at the location on the INEEL boundary where maximum air concentrations of radionuclides released from the TRA would occur. This location is determined by a screening run of the CAP-88 code (98° south southwest of the TRA).

Airborne contaminant emissions from this project would be extremely low because of the very low levels and nature of contamination in TRA-660. The dose to the MEI would be an estimated 1.4×10^{-08} mrem/yr, which is 6 orders of magnitude (1 million times) less than the 1998 dose from all INEEL operations of 2.8×10^{-02} mrem (DOE 1998). The dose to a worker 100 m from the facility, 1.8×10^{-05} mrem/yr, which is 7 orders of magnitude (10 million times) below the INEEL occupational dose limit of 500 mrem/yr (Staley 1998).

The dose to the population within a 50-mi radius of the project would be 5.2×10^{-08} person-rem. This is equivalent to an average dose of 5.1×10^{-10} mrem/person/yr. For perspective, an average individual in southeastern Idaho receives approximately 350 mrem/yr from all other radiation sources.

The increased lifetime risks of developing fatal cancers from radiological releases for the MEI, worker, and average member of the public within 80 km would be 7×10^{-15}(1 in 143,000,000,000,000), 7×10^{-12} (1 in 139,000,000,000), and 3×10^{-16} (1 in 3,330,000,000,000,000), respectively (Staley 1998). These risks can be compared to National Cancer Institute (NCI) data from Idaho of about 1 cancer death in 674 people annually, or an individual risk of 1 in 13 over a 50-year period, from all other sources of radiation (1987-1991 data, NCI, 1994).

4.1.1.1 Metals releases from the evaporation pond. Releases of metals, such as lead, barium and cadmiums from the evaporation pond due to the canal water would be below State of Idaho health-based emissions limits identified in the IDAPA. There is no emission limit for lead; instead, a maximum calculated concentration at the nearest ambient receptor location, 5,504 meters, distant, is compared to the concentration limit set by the State of Idaho. The concentration would be far below the concentration limit. Based on these data, the PTC limits for the TRA Evaporation Pond would not be exceeded (Staley 1998). To verify the water may be released to TRA-715, the water would be sampled after completing decontamination activities and removing the reactors from the canal.

4.1.2 Waste Generation and Disposition

The proposed project would generate hazardous and mixed (hazardous and radioactively contaminated) waste, and radioactive waste. Solid nonhazardous waste (sanitary) would be generated, characterized, and disposed of in the INEEL landfill complex according to the waste acceptance criteria (WAC). Prior to disposition, all waste would be evaluated against 40 CFR 262.11 (hazardous waste determination) criteria. Table 1 depicts the estimated volumes and waste types anticipated to be generated by Alternatives A and B.

For the alternative of total dismantlement, the volume of sanitary waste would be anticipated to be less than 9,450 ft^3, which is less than 3% of the existing INEEL landfill capacity. Wherever possible, recycling and waste minimization actions would be taken. Asbestos material would be disposed of in the INEEL landfill asbestos disposal section. The crane, steel, and other reusable materials would be excessed. For Alternative A, or reuse, the volume would be less than for total dismantlement, because the building would remain intact.

LLW or mixed waste generated during the deactivation of the ARMF facility would include the ARMF and CFRMF reactor structures and core components, canal liner, and reactor tools. The estimated volume of LLW totals about 1,825 ft^3. This waste would be dispositioned in accordance with the provision of the INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria (RRWAC) (DOE-ID 1998) and DOE Order 435.1, "Radioactive Waste Management." If sludge were encountered at the bottom of the canal, the material would be removed and containerized. The material would be sampled to prepare a hazardous waste determination for disposal. Any sludge would likely be LLW and would be disposed of at the RWMC. Some of the dismantled pieces may be excessed or reused. LLW would be disposed of at the RWMC according to the facility WAC.

It is likely the bucket containing capsules and other materials would be disposed of as LLW. However, future monitoring or inspection of the bucket could indicate whether the materials are special case LLW. If during the D&D, the materials are determined special case LLW, the materials would be stored or disposed of in the RWMC, in accordance with the RRWAC.

As mentioned in Section 2.2, it is possible, though unlikely, that residual low-level contamination would remain in the soils after demolition of the ARMF/CFRMF facility. Residual contamination would be managed in accordance with DOE Orders and the CERCLA.

Mixed waste would include radioactively contaminated components containing cadmium and lead, and other RCRA-regulated metals. Portions that could be considered mixed waste include, but are not limited to, the eight safety rods, two regulating rods and two shim rods. The sections of the safety, regulating, and shim rods containing cadmium would be cut out of the rods and segregated for disposal as mixed waste. The collimator also contains cadmium and would be managed as mixed waste. The center sections of the Neutron Radiography Facility platform contain lead and cadmium and would be removed from the platform. Mixed low-level waste would be managed in accordance with the RCRA regulations and DOE Order 435.1.

The canal water would be sampled and analyzed for radionuclide and metals concentrations after removing all materials in the canal. Characterization of the canal water is anticipated to result in levels of metals and radionuclides within the release criteria established in the TRA Evaporation Pond PTC (DOE-ID 1995). If the water could not be released to the TRA Evaporation Pond, the water would be treated through a water treatment system, such as an ion exchange system, to decrease metals and radionuclide concentrations. Waste generated from water treatment activities would be characterized and disposed of appropriately. The volume of the canal water is estimated at 4,010 ft^3 (30,000 gal). Before the canal was drained, TRA environmental support personnel would determine if the evaporation pond had sufficient capacity for the additional 30,000 gal and if the water met the PTC release criteria.

Table 1. Estimated volumes and types of waste generated by the proposed action and alternatives.

Waste type[a]	Estimated volume (ft³) Alternative A	Alternative B	No Action
Clean (Sanitary)[b]			
Building Systems:			
Concrete	93.6	93.6	
Around parapet			
Steel	50.0	50.0	
Around parapet	57.0	57.0	
Shielding	520.0	520.0	
Reactor consoles			
Office module	7.7	7.7	
Asbestos floor tile	435.2	435.2	
Wood/paper walls	13.4	13.4	
Steel			
Electrical	150.0	150.0	
Conduit, wiring, modules and boxes			
Building Structure:			
Concrete		8,390.0	
Floor, blocks, canal, restroom, footings			
Steel		1,241.6	
Ceiling/roof, structural, crane, shielding, overhead door			
Aluminum			
Floor plate		8.1	
Roofing		768.0	
Additional electrical		350.0	
Clean/Sanitary Total	1,326.9	12,084.6	
LLW			
Plastic capsule transfer tubing	45.0	45.0	
Reactor and core support assembly structures	1,350.0	1,350.0	
Neutron radiography structure and components	270.0	270.0	
Reactor tools	95.0	95.0	
Canal water	4,010.7	4,010.7	
Sump pump and associated piping	65.0	65.0	
Combustible LLW			
Personal protective equipment (PPE)	800.0	800.0	<7.35[c]
LLW Total	6,635.7	6,635.7	
Mixed			
Collimator	5.8	5.8	
Safety rods	1.0	1.0	
Regulating/shim rods	0.5	0.5	
Neutron radiography lead shielding	17.5	17.5	
Mixed Total	24.8	24.8	
Total	7,987.4	18,745.1	<7.35

a. Reference: *Characterization and Decision Analysis Report for the ARMF and CFRMF (TRA-660)*, INEEL/EXT-98-00855, March 1999

b. Includes materials that would be reused or recycled in addition to materials that would be disposed of in the INEEL landfill.

c. Less than one 55-gal drum/yr

4.1.3 Historical Resources

The D&D alternative would involve complete removal and/or destruction of a building considered to be eligible for nomination to the National Register of Historic Places. A 1997 inventory and historic significance assessment conducted by professional historians concluded the TRA-660 is eligible for nomination both individually and as a contributing element in an historic district (Stacy 1997). The report provides detailed mitigation recommendations for TRA-660, has been reviewed and accepted by the State Historic Preservation Officer (SHPO), and will eventually serve as the basis for a broad programmatic agreement between the DOE-ID and SHPO for the management of historic INEEL buildings. Due to the complete and irreversible nature of this alternative, all mitigation recommendations listed in the inventory and significance assessment report would be complied with.

In 1997, the SHPO was consulted as required by Section 106 of the National Historic Preservation Act, regarding potential adverse effects to TRA-660 resulting from D&D activities. On November 12, 1997, a Memorandum of Agreement (MOA) among the U.S. Department of Energy, Idaho Operations Office, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation was signed, detailing mitigation requirements established through the consultation process. The MOA identified substantive requirements that must be met prior to commencing with Alternatives A or B. All stipulations listed in this MOA must be complied with prior to the commencement of project activities. The resulting documentation must be submitted to the SHPO within one year of project completion. Also as required by the MOA, reference materials used to compile the documentation must be archived at the INEEL and made available to the SHPO upon request.

4.1.4 Land Use and Visual Resources

The D&D activities would not affect the current land uses or visual resources at the TRA facility or the INEEL. The INEEL Comprehensive Land Use Plan (DOE-ID 1997) identifies the TRA as "industrial" use for the 100-year scenario. The decontamination and eventual demolition of the ARMF facility is included in the planning activities through the next 25 years. The primary land use of the INEEL is to support facility and program operations. Aside from the facilities, the land is largely undeveloped. The TRA is expected to support programs and reactor research for at least another 50 years. Therefore, the D&D of the facility would have no adverse impact on the land use or visual resources in and around the TRA or the INEEL.

4.1.5 Worker Health and Safety

Workers would be subject to radiation exposure during decontamination and dismantling activities. The highest potential for exposure would occur during decontaminating and dismantling the reactors and canal, which would occur for both Alternatives A and B. Radiation exposure would be limited by administrative and engineering controls. Exposure would be managed under the as low as reasonably achievable (ALARA) principal, establishing minimum levels of exposure for radiation workers; the INEEL Radiological Control Manual (LMITCO 1996); and DOE Order 5480.11 "Radiation Protection for Occupational Workers," and Draft Orders G44.1.1-1 and G441.2-1 "Implementation Guidelines for Radiation Protection Program" and "Implementation Guidelines for the Occupation Radiation Protection ALARA Program," respectively. These orders establish an EDE of 5 rem per year, and calendar quarter EDE of 3 rem as the limiting doses from external and internal sources for occupation workers.

Activities would be performed following established safety procedures, based on applicable DOE orders and the ALARA principle. Safety analysis documentation and radiation work permits would be prepared before work began. Activities would be covered by a trained radiological control technician. Worker doses would be monitored by dosimeters and the dose to a worker would not be allowed to exceed the applicable regulatory limits. Limiting work times in the area and employing engineering controls would minimize occupational doses. Doses to individual D&D workers would be maintained within the ALARA goals established for either the project or the facility.

Workers would be exposed to industrial hazards and hazardous materials. Industrial hazards include working in excavations, entering confined spaces, and operating equipment such as backhoes, cranes, jackhammers, and other cutting tools. To minimize industrial hazards, all proposed activities would be planned and conducted in compliance with the INEEL Conduct of Operations Manual and Occupational Safety and Health Administration (OSHA) requirements at 40 CFR Parts 61, 1910 and 1926. The DOE Standard 101 "Integrated Work Control Process" for identifying hazards and safety requirements, would be the controlling work document for the project. Work items involving hazards would be reviewed and approved by appropriate safety, health physics, and industrial hygiene personnel, prior to the start of D&D activities. If an unsafe condition occurred during decontamination and dismantling activities, work would stop, the conditions would be evaluated, and the appropriate controls would be established before resuming D&D activities.

4.1.6 Noise

Noise levels could exceed 85 dB during decontamination and decommissioning activities. Safe work permits would be reviewed by qualified industrial hygienists to ensure adequate engineering controls were provided to protect workers from excessive exposure to hazardous noise levels. Personnel noise exposure is currently managed by adhering to 29 CFR 1910.95, 29 CFR 1926.52 and DOE orders. Noise exposure is considered to have an insignificant impact on the environment.

4.1.7 Biological Resources

The D&D of the TRA-660 building would not have any direct, negative, impacts on the flora, fauna, endangered species, or ecology of the TRA or the INEEL Site. The facility is located within an area that has been substantially disturbed by construction activities, paving, and industrial activities. Measurable impacts to flora and fauna, including threatened, endangered, or species of special concern are unlikely with Alternatives A and B. However, it is likely barn swallows build nests on the building. Activities that disturb nests or nestlings should not be conducted from late spring to midsummer. Actual nests are not to be physically disturbed (e.g. removed) if eggs or young swallows are present.[1]

4.2 Impacts Associated with the No Action Alternative

Impacts associated with the no action alternative would be associated with potential long-term radiation exposure resulting from leaving radioactively contaminated materials in the canal. Components containing cadmium and lead would be left in the canal indefinitely. Surveillance and maintenance costs associated with the facility are currently about $60,000 annually; these costs would not be reduced without decontamination and dismantling of the radiologically contaminated reactor components.

4.3 Accidents

Any accidents associated with the TRA-660 facility D&D would most likely be industrial-type accidents and could be essentially the same for either Alternative A (reuse) or B (demolition).

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[1] E-mail comm from T. D. Reynolds, Ph.D. and R. D. Blew, Ph.D. (Environmental Science and Research Foundation) to S. K. Evans (LMITCO), July 13, 1999.

Industrial/construction accidents could include those related to using heavy equipment such as the crane, cutting tools, and other heavy pieces of equipment. An industrial-type accident would not involve release of radionuclides to the facility, but could involve worker injury and loss-of-work days. Industrial accidents would be avoided through administrative controls, safe practices, and strict adherence to contractor conduct of operations procedures and DOE orders.

4.4 Cumulative Impacts

This section addresses potential cumulative impacts resulting from the proposed action and other past, present or foreseeable actions. The CEQ suggests that most environmental affects may result not from the direct effects of a particular action, but from the combination of individual minor effects of multiple actions over time (CEQ 1997).

The SNF EIS (DOE 1995) identifies the types and maximum volumes of waste generated from existing and proposed waste management and D&D activities. The maximum amount of sanitary waste and LLW generated from the ARMF/CFRMF D&D is projected to be less than 0.3% of the volumes generated by INEEL waste management and D&D activities addressed in the SNF EIS. The volume of mixed waste generated from the ARMF/CFRMF D&D is projected to be less than 0.004% of the maximum volumes generated identified in the SNF EIS. Storage and disposal facilities at the INEEL would not be impacted by the volumes of waste generated by the ARMF/CFRMF D&D when added to the cumulative volumes projected in the SNF EIS.

Seven decontamination and decommissioning projects were identified in the SNF EIS (DOE 1995). The D&D of the TRA-660 was not considered in the SNF EIS. However, the INEEL baseline 10-year cumulative dose and cancer risk can be reviewed with respect to the TRA-660 D&D activities (Table 2).

Based on the analysis in the SNF EIS, no reasonable foreseeable cumulative adverse impacts are expected to the surrounding populations. In addition, future Comprehensive Environmental Response, Compensation, and Liability Act analyses will address the cumulative impacts and risks associated with remediation of the operable units at the TRA and the entire INEEL.

Table 2. Dose and cancer risk compared with TRA-660 D&D dose and cancer risk.

	INEEL Baseline[a]		**TRA-660 Decontamination and Dismantlement**[b]	
	Dose	**Cancer Risk**	**Dose**	**Cancer Risk**
Worker	3.2×10^{0} mrem	1.3×10^{-6}mrem	1.8×10^{-05}	3×10^{-12} mrem
MEI	5.0×10^{-1} mrem	2.5×10^{-7}mrem	1.4×10^{-08} mrem	4×10^{-15} mrem
Population	3.0×10^{0} person-rem	1.5×10^{-3} person-rem	5.2×10^{-08}person-rem	3×10^{-16} person-rem

a. (DOE 1995) SNF EIS, Volume 2 Part A

b. Alternative B, representing the bounding impacts

5. PERMITS AND REGULATORY REQUIREMENTS

Following are the major laws, regulations and other requirements applicable to the proposed action analyzed in this EA. Detailed summaries of these laws can be found in Volume 1, Chapter 7 of the SNF EIS (DOE 1995b), which is incorporated by reference.

For Alternative B, total dismantlement of the TRA-660, a storm water pollution prevention plan would be required.

National Environmental Policy Act of 1969, as amended
[42 United States Code (USC) § 4321 et seq.]

Clean Air Act, as amended (42 USC § 7401 et seq.)

Safe Drinking Water Act, as amended (42 USC § 300{F} et seq.)

Clean Water Act, as amended (33 USC § 1251 et seq.)

Resource Conservation and Recovery Act, as amended (42 USC § 6901 et seq.)

Comprehensive Environmental Response, Compensation and Liability Act (42 U. S. C. § 9620) et seq.) as Amended by the Superfund Amendments and Reauthorization Act of 1986.

Occupational Safety and Health Act of 1970, as amended (29 USC § 651 et seq.) and implementing regulations at 29 CFR Part 1910

Executive Order 12892, 59 FR 7629, Federal Actions to Address the Environmental Justice in Minority Populations and Low Income Populations

CEQ Regulations for Implementing the National Environmental Policy Act, 40 CFR Part 1500

DOE NEPA Implementing Procedures at 10 CFR Part 1021

10 CFR Part 835, DOE "Occupational Radiation Protection"

“Rules for the Control of Air Pollution in Idaho” (IDAPA 16.01.01.210)

DOE Order 435.1 “Radioactive Waste Management,” July 9, 1999

DOE Order 5400.5 “Radiation Protection of the Public and the Environment,” January 7, 1993.

6. AGENCIES AND PERSONS CONSULTED

The DOE is required to review as guidance the most current USFWS list of threatened and endangered species. If, after reviewing the list, the DOE determines that the proposed action would not impact any threatened and endangered species, the DOE may determine that formal consultation with the USFWS is not required for an action. The environmental checklist and environmental assessment determination for this environmental assessment were reviewed by the DOE-ID and the Environmental Science and Research Foundation; a biological consultation with the USFWS is not required.

A consultation between the DOE-ID and SHPO resulted in an MOA signed November 1997. The MOA identified substantive requirements that must be met prior to decontamination and dismantlement activities. Requirements included completing an Idaho Historic Sites Inventory form and providing photographs of the facility to the SHPO.

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