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Revision D
January 2004

Risk-Based End State Vision for the Idaho National Engineering and Environmental Laboratory Site (Draft)

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Prepared for the
U.S. Department of Energy
Idaho Operations Office

EXECUTIVE SUMMARY

Over the past 50 years, the Idaho National Engineering and Environmental Laboratory (INEEL) has played a key role supporting defense and nuclear energy programs for the United States. Past practices at the INEEL and other U. S. Department of Energy (DOE) facilities have resulted in a legacy of waste generation and contaminants released to the environment. The DOE Environmental Management (EM) Program has been tasked with the complex challenge of cleaning up environmental releases, disposing of legacy waste, and closing no longer needed facilities (reducing the footprint) in a timely and cost-effective manner.

In an effort to accelerate legacy cleanup, the Secretary of Energy directed that a review of the EM Program be conducted with the goal of quickly and markedly improving program performance. In February 2002, DOE published the *Top-to-Bottom Review for the Environmental Management Program* (DOE 2002a). The report concluded that the department's cleanup efforts across the United States need to be refocused on reducing or eliminating environmental risk as quickly as possible without compromising protection of the public. This review also found that cleanup of sites is often further complicated by a lack of realistic future land-use assumptions and by overly conservative scenarios that assume contaminated areas will be subject to farming, drilling of drinking water wells, or residential use (DOE 2002a, p. V-10).

To address this particular impediment to cleanup progress, DOE issued a policy on "Use of Risk-Based End States" (DOE P 455.1, 2003). The policy was issued in July 2003 and is based on the premise that effectiveness of cleanup programs can be improved by focusing efforts on cleanup that is aimed at, and achieves, clearly defined risk-based end states. Risk-based end states are representations of site conditions that are based on the planned future land use of the property and are protective of human health and the environment consistent with that use.

The policy requires that each DOE site undergoing cleanup prepare a risk-based end state vision (RBESV) document that describes anticipated conditions at the site at the end of the EM cleanup mission. The RBESV is not a decisional document but rather serves as a means to communicate that vision and initiate dialog with stakeholders, regulatory agencies, and the public.

Long after EM cleanup is completed, the INEEL Site is expected to have a long-term future mission in nuclear energy research and development. In July 2002, Secretary of Energy Spencer Abraham announced a major mission realignment for the lab, establishing the Site as the nation's lead laboratory for nuclear energy, research, and development. Management of the laboratory was reassigned to the Nuclear Energy, Science, and Technology Office of DOE.

Acreage within the INEEL is classified as industrial and mixed use by the U.S. Department of the Interior Bureau of Land Management (DOE-ID 2002b, p. 30). Most of the work at the INEEL is performed within the Site's discrete primary facility areas. The great majority of the Site is undeveloped. The RBESV is based on the fact that the INEEL Site, as it currently exists, will remain intact for the foreseeable future. Restricted access to INEEL land provides protection of important ecological and cultural resources. No change to the present INEEL boundaries or ownership is anticipated, and most of the developed areas of the Site will remain industrial use for the foreseeable future. Likewise, the undeveloped areas will continue to be used as a buffer area around the Site's developed facility areas and will be available for use for ecological and cultural preservation, environmental research, and controlled grazing and hunting.

Most of the previous Comprehensive Environmental Response, Compensation, and Liability Act risk-based cleanup decisions for the INEEL have been based on a scenario of 100 years of federal institutional control followed by possible residential use. A more realistic vision for the INEEL Site is continued federal control with restricted access mixed land use very similar to the way the land is currently used. Future risk assessments and remedial action decisions will be based on more realistic future land-use scenarios that do not include residential use, unless cleanup to such levels proves to be appropriate.

Once the RBESV is developed, DOE Policy 455.1 (2003) requires that sites evaluate existing cleanup activities and strategies to determine if they are consistent with the end state vision. Some potential variances between the risk-based end states depicted in this document and current cleanup plans and requirements have been identified in Section 5 of this document. At this time, no decisions have been made regarding the variances; they are simply cleanup activities that the DOE believes merit further evaluation to determine if they are necessary and a wise expenditure of taxpayer dollars. Cost-benefit analyses and risk assessments will be needed to evaluate whether the variances are worth pursuing and to ensure that the proposed alternatives are protective of human health and the environment.

If the DOE determines that it is appropriate to propose changes to current cleanup plans and agreements, such changes would have to be approved through the appropriate legal and regulatory channels with input from stakeholders. DOE is committed to full compliance with all applicable regulatory and legal requirements.

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FIGURES

TABLES

ACRONYMS

ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ATR	Advanced Test Reactor
bgs	below ground surface
BLM	U.S. Department of the Interior Bureau of Land Management
BORAX	Boiling-Water Reactor Experiment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
COC	contaminant of concern
DD&D	deactivation, decontamination, and decommissioning
DOE	U.S. Department of Energy
EM	Environmental Management
EPA	U.S. Environmental Protection Agency
ETR	Engineering Test Reactor
FFA/CO	Federal Facility Agreement and Consent Order
HWMA	Hazardous Waste Management Act
ICDF	INEEL CERCLA Disposal Facility
IDEQ	Idaho Department of Environmental Quality
IET	Initial Engine Test
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LLW	low-level waste
LPSO	lead program secretarial office
LTS	long-term stewardship
MCL	maximum contaminant level
mg/L	milligrams per liter

MTR	Materials Test Reactor
nCi/g	nanocuries per gram
NE	Nuclear Energy, Science, and Technology Office of DOE
NRF	Naval Reactors Facility
OU	operable unit
PBF	Power Burst Facility
pCi/g	picocuries per gram
pCi/L	picocuries per liter
ppm	parts per million
RAO	remedial action objective
RBESV	risk-based end state vision
RCRA	Resource Conservation and Recovery Act
RDX	royal demolition explosive
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SPERT	Special Power Excursion Reactor Test
SVOC	semivolatile organic compound
TAN	Test Area North
TCE	trichloroethene
TNT	trinitrotoluene
TRA	Test Reactor Area
TSA	Transuranic Storage Area
TSF	Technical Support Facility
UXO	unexploded ordnance
VCO	Voluntary Consent Order

VOC	volatile organic compound
WAG	waste area group
WCF	Waste Calcining Facility
WROC	Waste Reduction Operations Complex
WRRTF	Water Reactor Research Test Facility
μg/L	micrograms per liter

DEFINITIONS

agencies	The U.S. Department of Energy, the U.S. Environmental Protection Agency, and the State of Idaho—the three agencies responsible for the scope and schedule of remedial investigations and cleanup activities at the Idaho National Engineering and Environmental Laboratory (INEEL).
ancillary equipment	Any device including, but not limited to, piping, fittings, flanges, valves, and pumps used to distribute, meter, or control the flow from its point of generation to: (1) an underground storage tank, an aboveground storage tank, or treatment tank(s), (2) between hazardous waste storage and treatment tanks to a point of disposal onsite, or (3) a point of shipment for disposal offsite.
aquifer	Layer of water-saturated rock or soil through which water flows in a quantity useful to people. The rate of flow depends upon porosity, permeability, and slope of the water table.
area of contamination	A continuous extent of generally dispersed contamination at a superfund site.
CERCLA	(Comprehensive Environmental Response, Compensation, and Liability Act). Federal law that establishes a program to identify, evaluate, and remediate sites where hazardous substances may have been released (leaked, spilled, or dumped) to the environment.
cultural resources	Include but are not limited to (1) prehistoric, historic, and ethnohistoric archaeological materials (artifacts) and sites on the ground surface or buried beneath it, (2) standing structures and associated components more than 50 years old or of importance because they represent a major historical theme or era, (3) cultural and natural places, select natural resources, and sacred objects important to Native Americans and other ethnic groups, and (4) American folk life traditions and arts.
deactivation	The process of placing a facility in a stable condition to minimize existing risks and the related life-cycle cost of a surveillance and maintenance program that is protective of workers, the public, and the environment.
decommissioning	A phase where the facility is taken to its ultimate end state through decontamination or dismantlement to demolition or entombment.
decontamination	The process of removing contamination at U.S. Department of Energy facilities. "Contamination" refers to both radioactive contamination and to hazardous substance contamination.
end state	Physical condition when cleanup actions are complete.

FFA/CO	(Federal Facility Agreement and Consent Order). Agreement among the U.S. Department of Energy, U.S. Environmental Protection Agency, and State of Idaho that establishes a process and schedule to evaluate potentially contaminated sites at the INEEL, to determine if remediation is warranted, and then to select and implement a remedy.
groundwater	Water below the land surface in a zone of saturation.
hazard index	A ratio between the contaminant intake concentrations and the concentrations that are not likely to cause adverse health effects, even to sensitive populations such as pregnant women or children.
hazardous waste	A solid waste identified as hazardous in federal regulations (Resource Conservation and Recovery Act).
high-level waste	The highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.
historic building or structure	A building or structure, including Goodale's Cutoff, WWII canals, reactors, reactor control panels, WWII concussion walls, and shielded locomotive, that is eligible to the National Register of Historic Places.
INEEL	The 890-square-mile Idaho National Engineering and Environmental Laboratory Site, including DOE operations at the Site and supporting operations in Idaho Falls.
injection well	A well into which fluids are injected.
institutional controls	Generally includes all nonengineered restrictions on activities or on access or exposure to land, groundwater, surface water, waste and waste disposal areas, and other areas or media. Some common examples of tools to implement institutional controls include restrictions on use or access, zoning, governmental permitting, public advisories, and installation master plans. Institutional control commitments are necessary at sites where contamination levels prevent unrestricted and unlimited use.
long-term stewardship	All activities necessary to protect human health and the environment after remediation, disposal, or stabilization of a site or part of a site. The INEEL expanded the scope of long-term stewardship to include conservation of ecological and cultural resources and awareness of technology changes in addition to surveillance and maintenance of remedies.

low-level waste	Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or Atomic Energy Act Section 11 (e)(2) by-product material (e.g., uranium or thorium mill tailings) by U.S. Department of Energy Order 435.1 (2001). 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 isotopes are less than or equal to 100 nCi/g.
mg/L	milligrams per liter. A milligram is one-thousandth of a gram (10^{-3}).
mixed low-level waste	Low-level waste that also contains hazardous waste subject to the Resource Conservation and Recovery Act.
mixed waste	Waste containing both radioactive and hazardous waste.
nCi/g	nanocuries per gram. A nanocurie is one-billionth of a curie (10^{-9}).
off-Site	Off the INEEL Site.
pCi/g	picocuries per gram. A picocurie is one-trillionth of a curie (10^{-12}).
pCi/L	picocuries per liter. A picocurie is one-trillionth of a curie (10^{-12}).
perched water	Water that collects above a layer of relatively impermeable material, such as clay, and then slowly moves downward to the aquifer; perched water zones are often present beneath reservoirs and industrial facilities but disappear when the surface water source is eliminated.
radioactive waste	Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and that is of negligible economic value considering recovery costs.
radionuclide	Alternate forms or isotopes of an element that are unstable and decay by giving off energy in the form of radioactivity.
RCRA	(Resource Conservation and Recovery Act). Federal waste management law. Its regulations govern the management (transportation, treatment, storage, and disposal) of solid waste and the generation, accumulation, recycling, and handling of hazardous waste. RCRA waste includes material listed on one of the U.S. Environmental Protection Agency's hazardous waste lists or material that meets one or more of the U.S. Environmental Protection Agency's four characteristics: ignitability, corrosivity, reactivity, or toxicity.
record of decision	An agreement among the agencies that explains which remedies will be used at a site and why. The responsiveness summary contains public comments on proposed actions and the agencies' responses.

remedial action objectives	Objectives for the cleanup remedy that specify contaminants and media of concern, potential exposure pathways, and remediation goals.
remediation	Process of cleaning up, to an acceptable level of risk, a site where a hazardous or radioactive substance has been released.
residual contamination	Amount of a hazardous or radioactive pollutant remaining in the environment after a natural or technological remediation process.
RI/FS	(remedial investigation/feasibility study). Identifies contaminants in an area, assesses the risk they pose to human health and the environment, and evaluates remedial options.
risk assessment	The process of estimating the current and future adverse health impacts to humans and the environment.
secondary containment system	An impervious system that will contain all of the contents of a tank and has residual space adequate to contain any other material that could be expected to accumulate before the secondary containment is emptied.
spent nuclear fuel	Fuel that has been withdrawn from a nuclear reactor following irradiation.
transuranic waste	Radioactive waste containing more than 100 nCi/g of alpha-emitting transuranic isotopes, with half-lives greater than 20 years.
unexploded ordnance	Military munitions that have been primed, armed, or fused and fired; dropped; or launched but through malfunction or design have failed to explode. Unexploded ordnance poses a physical risk to human safety through the danger of explosion when it is handled or contacted, especially by machinery.
vadose zone	Unsaturated layers of rock and soil extending from the ground surface down to the water table, or aquifer. Contaminants move at different rates through the vadose zone depending on how they react with the rock and sedimentary material.
vapor vacuum extraction	Technology that extracts vapor from beneath the ground by inducing a vacuum in wells located at specific depths. The vacuum forces underground vapors to flow toward the well and up into an aboveground treatment system.

wetland	A wetland is any geographic area that exhibits three characteristics indicating that the area is wet, at least periodically. Wetlands do not necessarily appear to have freestanding water. The wetland determination is based on soil moisture content, type of plant life, and type of soil.
μg/L	micrograms per liter. A microgram is one-millionth of a gram (10^{-6}).

Risk-Based End State Vision for the Idaho National Engineering and Environmental Laboratory Site (Draft)

1. INTRODUCTION

The Secretary of Energy's *Top-to-Bottom Review for the Environmental Management Program* (DOE 2002a) examined the Environmental Management (EM) cleanup program and concluded that "the EM Program's major emphasis has been on managing risk, rather than actually reducing risk to workers, the public, and the environment." The recommendations in the report focused on accelerating risk reduction and cleanup at EM sites. In July 2002, U.S. Department of Energy Idaho Operations Office followed the report with the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (hereinafter referred to as the *Performance Management Plan*) (DOE-ID 2002a). The plan described a strategy for significantly accelerating cleanup at the Idaho National Engineering and Environmental Laboratory (INEEL) Site. Accelerating cleanup at the INEEL will reduce the risk of contamination of the Snake River Plain Aquifer from radioactive and hazardous waste. It also will reduce the risk to workers, the environment, and the public by cleaning up, stabilizing, and disposing of waste decades sooner than previously planned.

To address concerns identified in the *Top-to-Bottom Review for the Environmental Management Program* (DOE 2002a), the U.S. Department of Energy (DOE) issued a policy on "Use of Risk-Based End States" (DOE P 455.1, 2003). The policy is based on the premise that effectiveness of cleanup programs can be improved by focusing efforts on cleanup that is aimed at, and achieves, clearly defined, risk-based end states. Risk-based end states are representations of site conditions that are based on the planned future land use of the property and are protective of human health and the environment consistent with that use.

The policy requires that each DOE site undergoing cleanup prepare a risk-based end state vision (RBESV) in cooperation with regulators and in consultation with affected governments, tribal nations, and stakeholders. Once the RBESV is finalized, sites are expected to evaluate their cleanup activities and strategies to determine if it is appropriate to change site baseline documents and renegotiate agreements. The RBESV is not a decisional document. It describes a vision for the INEEL at the end of the EM cleanup mission and serves as a means to initiate dialog with stakeholders, regulatory agencies, and the public on that vision.

The final version of this document will present the RBESV for the INEEL Site at the completion of the EM cleanup program based on future land-use projections developed through public meetings and consultation with regulators (i.e., the state of Idaho and EPA), regional government entities (e.g., Shoshone-Bannock tribes and city and county representatives), INEEL Citizens Advisory Board, and special interest groups. The end state vision is based on the premise that access to the INEEL will remain under federal U.S. government control. Cleanup objectives will be based on this premise along with other factors, such as protectiveness, cost, and technical feasibility. When all active EM cleanup activities have been completed, which is expected to take place by 2035 or sooner, responsibility for operation and long-term stewardship of the Site will be transferred to DOE's lead program secretarial office (LPSO) for the INEEL or to other appropriate DOE programs. The current LPSO for the INEEL Site is the Nuclear Energy, Science, and Technology Office of DOE (NE).

There is one exception to the 2035 timeframe for the end state vision. At some facility areas, groundwater monitoring and groundwater remediation are expected to continue beyond 2035. The goal for DOE's selected Snake River Plain Aquifer remedial actions has been to be below maximum contaminant levels (MCLs) in the aquifer by 2095. Therefore, 2095 is considered the end state timeframe for discussions related to groundwater remediation. The DOE LPSO will assume responsibility for those activities as well as for future cleanup activities upon completion of the EM mission. In addition, there are some areas where institutional controls will be required beyond 2035. The DOE LPSO will assume responsibility for this scope as well.

It is important to recognize that the RBESV does not describe the Site at the end of the DOE mission but rather at the end of the EM cleanup mission. The INEEL Site is expected to have a long-term future mission as a nuclear energy research and development site. The document does not contain projections about the nuclear energy development activities or work force, as non-EM operations at the INEEL are outside the defined scope of this document.

Once the RBESV has been developed, previously established cleanup strategies will be evaluated to ensure that they are consistent with the end state vision and the future, intended use of the Site. Some potential variances between the risk-based end states depicted in this document and current cleanup plans and requirements have been identified in Section 5 of this document. At this time, no decisions have been made regarding the variances; they are simply cleanup activities that the DOE believes merit further evaluation to determine if they are necessary and a wise expenditure of taxpayer dollars. Cost-benefit analyses and risk assessments will be needed to evaluate whether the variances are worth pursuing and to ensure that the proposed alternatives are protective of human health and the environment.

In cases where DOE determines that current cleanup plans are not consistent with the future land-use vision, DOE will work with the appropriate regulatory agencies to negotiate modifications, as needed, to cleanup strategies, agreements, and baselines. The DOE will continue to comply with applicable legal and regulatory requirements. The land-use vision in this document also will be used for future risk assessments, selecting remedial actions, and determining cleanup levels required to protect human health and the environment.

Several compliance agreements, amendments, and consent orders executed between 1991 and 2000 govern the EM cleanup work at the INEEL. The primary agreements are summarized below:

- Federal Facility Agreement and Consent Order (FFA/CO)—In November 1989, the U.S. Environmental Protection Agency (EPA) listed the INEEL on the National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan. As a result, the INEEL became subject to the cleanup requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991a) between the DOE, EPA, and Idaho Department of Environmental Quality (IDEQ) established a strategy and plan for cleanup at the INEEL in accordance with CERCLA. The INEEL was divided into 10 waste area groups (WAGs) based on similar characteristics or geographic boundaries. Nine groups generally correspond to the Site's major facility areas. The tenth group assesses overall risk to the aquifer beneath the Site, addresses sites outside the boundaries of INEEL's primary facility areas, and allows for inclusion of newly identified release sites. These WAGs are further divided into operable units (OUs). Under the FFA/CO, the DOE conducts an environmental investigation at each site that may be contaminated. At the end of each investigation, if it is determined the area needs cleanup, a proposed plan that documents the results of the investigation and proposes alternative cleanup actions is presented for public comment. After reviewing and addressing any comments, the DOE, EPA, and State of Idaho reach a final decision, which is documented in a record of decision (ROD). Cleanup design and construction can then begin.

- Notice of Noncompliance Consent Order—*The Notice of Noncompliance Consent Order* (IDEQ 1992) is an agreement between the DOE, IDEQ, and EPA that establishes actions and milestones to resolve 1989 EPA Resource Conservation and Recovery Act (RCRA) inspection issues, including configuration of stored transuranic waste and high-level waste in the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm.

- Settlement Agreement—The *Settlement Agreement* (DOE 1995) between the DOE, State of Idaho, and U.S. Navy resolved a lawsuit regarding the receipt of spent nuclear fuel at the INEEL. The agreement specifies milestones toward the removal of all spent nuclear fuel and certain radioactive waste from INEEL by 2035.

- Site Treatment Plan—In fulfillment of the 1992 Federal Facilities Compliance Act, the INEEL prepared *Idaho National Engineering Laboratory Site Treatment Plan* (DOE-ID 1995b) to address the long-term storage of waste that contains both chemical and radioactive materials. This enforceable plan was approved by the State of Idaho and is updated annually.

- Voluntary Consent Order (VCO)—The *Consent Order* (IDEQ 2000) is an enforceable agreement with IDEQ that governs resolution of self-disclosed RCRA issues, most of which were related to the closure of 912 tanks and tank systems.

Public documents that contain additional detailed information on planned land use, environmental impacts, and remediation plans and strategies include the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE-ID 1996), the *Performance Management Plan* (DOE-ID 2002a), *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* (hereinafter referred to as *Final Environmental Impact Statement*) (DOE 2002b), and *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE-ID 1995c). Other information sources include RCRA closure plans and a number of CERCLA documents.

1.1 Organization of the Report

Section 1 of this report provides general, introductory information related to this document; a summary of the INEEL's past, current, and future missions; and a brief discussion of the types of hazards and contamination at the Site. Section 1 also provides an overview of the Site cleanup strategy, priorities, and remaining cleanup work.

Section 2 provides information on the region surrounding the INEEL. Maps and narratives describe physical characteristics and human and ecological land use for the region surrounding the INEEL.

Section 3 provides information on physical characteristics, human and ecological land use, legal ownership, and population of the INEEL Site and areas next to the Site. Maps and narrative for Sections 2 and 3 depict both the current state and the risk-based end state.

Section 4 provides information on eight separate "hazard areas" at the Site. A hazard area is a portion of the Site that contains hazards that present risks to human health or the environment (e.g., contaminated soil, entombed facilities, contaminated groundwater plumes, or buried waste). In general, the hazard areas correspond to WAGs established in the FFA/CO; however, information on other planned closure activities, such as RCRA closures; VCO activities; and deactivation, decontamination, and decommissioning (DD&D), is also provided. Each of the eight hazard area subsections in this document contains a brief narrative description followed by a map and a conceptual site model depicting the current hazards. These are followed by a map and conceptual site model that reflect anticipated conditions at the end state. Differences between current state and risk-based end state are discussed in the narrative.

Conceptual site models provide, in block diagram form, information regarding the hazards, pathways, receptors, and barriers (current and planned) between the hazards and receptors. The conceptual site models, which were prepared during baseline risk assessments and published in approved CERCLA documents, have been updated to reflect current (2003) conditions and modified to show anticipated conditions at the end state.

In some cases, potential variances between the RBESV and current cleanup decisions for the INEEL have been identified. These variances are discussed in Section 5.

Section 6 contains a list of references used in this document.

1.2 Site Mission

The INEEL Site began its mission during World War II when the U.S. Navy withdrew 270 square miles in Southeast Idaho from the public domain for use as a gunnery range. In 1950, the U.S. Atomic Energy Commission (the predecessor to the DOE) obtained the Navy's gunnery range and established the site as the National Reactor Testing Station.

Lands were added later for use in developing and testing nuclear reactors and support facilities. Over the years, personnel at the Site have designed and tested 52 reactors, the world's largest concentration. Most of them were first-of-a-kind reactors, and many made significant contributions to what were then the newly developing fields of reactor safety and design. For example, the Experimental Breeder Reactor I, which is now a National Historic Landmark, was the first reactor in the world to generate electricity. Three nuclear reactors are still operable today. The Advanced Test Reactor (ATR) at the INEEL's Test Reactor Area (TRA) is used for materials testing and the production of medical and industrial isotopes. The other two operable reactors are the ATR Criticality Facility at TRA, which is a full-scale, low-power version of the ATR designed to provide physics data, and the Neutron Radiography Reactor at Argonne National Laboratory-West (ANL-W).

The INEEL received its first shipments of DOE-owned spent nuclear fuel from nuclear weapons production reactors at the Hanford Site in Richland, Washington, in 1952. In 1957, the Navy began shipping spent nuclear fuel from nuclear-powered submarines and warships to the INEEL. Spent nuclear fuel was reprocessed to recover highly enriched uranium for reuse in the nation's weapons program from 1953 to 1992.

From 1954 through 1970, over 67,000 m^3 of transuranic waste, mostly from the Rocky Flats Plant in Colorado, were disposed of in the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC).

In 1974, the National Reactor Testing Station was renamed the Idaho National Engineering Laboratory to reflect an expanded mission, including waste management, environmental engineering and restoration, and development of advanced technologies and methods related to energy efficiency, renewable energy, national security and defense, and nuclear materials. In 1997, the Site was renamed the Idaho National Engineering and Environmental Laboratory to reflect its increased mission focus on environmental cleanup and research and development of related technologies.

In July 2002, Secretary of Energy Spencer Abraham announced a major mission realignment for the lab, establishing the Site as the nation's lead laboratory for nuclear energy research and development. Management of the laboratory was reassigned to NE.

Since 1991, the INEEL EM Program has been managing a significant cleanup legacy, including contaminated groundwater, contaminated buildings and soil, and significant volumes of radioactive and hazardous waste.

The INEEL EM Program is responsible for treating, storing, and disposing of waste streams; removing or deactivating facilities that are no longer needed; and cleaning up contamination from past releases that presents a risk to human health or the environment. The INEEL EM Program is scheduled to complete all active cleanup by 2035, at which time operation and maintenance of all INEEL facilities will be transferred to the LPSO for the Site.

1.3 Status of Cleanup Program

In February 2002, the DOE published the *Top-to-Bottom Review of the EM Program* (DOE 2002a). The report concluded that the department should restructure its cleanup efforts to focus on reducing or eliminating environmental risk as quickly as possible. In response to this report, DOE-EM challenged DOE sites to develop plans to change their cleanup strategies from a focus on risk management to an approach that accelerates risk reduction and closure.

In May 2002, DOE, IDEQ, and EPA signed a letter of intent formalizing an agreement to pursue accelerated risk reduction and cleanup at the INEEL. This letter of intent identified seven priorities for accelerating cleanup. The seven priorities are (DOE-ID 2002a):

- Continued cleanup and protection of the Snake River Plain Aquifer
- Consolidation of EM activities to INTEC, reducing the actively managed EM footprint by over 51%
- Removal and stabilization of sodium-bearing liquid waste from the INTEC tank farm and RCRA closure of the high-level waste tanks
- Placement of all DOE spent nuclear fuel managed by EM into dry storage
- Transfer of all special nuclear material managed by EM to other sites
- Completion of shipments of stored transuranic waste required by the *Settlement Agreement* (DOE 1995)
- Making significant progress in remediation of the buried waste in accordance with the comprehensive remedial investigation/feasibility study (RI/FS) and ROD for the SDA.

In July 2002, the *Performance Management Plan* (DOE-ID 2002a) was published. This document defines the INEEL EM Program vision as "By 2012, the INEEL will have achieved significant risk reduction and will have placed materials in safe storage ready for disposal. By 2020, the INEEL will have completed all active cleanup work with potential to further accelerate cleanup to 2016."

In mid-2003, the INEEL was restructured into two distinct business units—one for cleanup activities and one for laboratory missions. This was done to allow each organization to focus on its distinct mission. The laboratory (to be renamed the Idaho National Laboratory in February 2005) will focus on nuclear technology development, and the INEEL EM Program will focus on cleaning up historic contamination at the Site as quickly and efficiently as possible.

Funding for the INEEL EM Program will be prioritized to expedite those activities that significantly reduce risk at the INEEL. Risk analyses based on realistic future land-use scenarios will be used to evaluate the extent of cleanup needed to protect human health and the environment and to establish cleanup requirements. This approach may require reevaluating and negotiating revisions to some previous cleanup decisions that are not consistent with future land use of the Site.

Over the past decade, the following considerable progress has been made toward addressing legacy waste and contamination at the INEEL:

- Of the 596 CERCLA sites identified as being potentially contaminated, 75% have been cleaned up or determined not to pose any risk.
- Over 2 million gallons of high-level liquid waste have been calcined, reducing the volume of liquid waste to approximately 1 million gallons and emptying six of 11 tanks to the heel.
- Stored transuranic waste is being sent for permanent disposal on a routine basis to the Waste Isolation Pilot Plant in New Mexico (more than 3,100 m^3 have been shipped).
- Over 29,000 m^3 of legacy low-level waste (LLW) have been disposed of, reducing the backlog by 99%, and 3,780 m^3 of legacy mixed LLW have been disposed of. The goal is to eliminate the legacy LLW and mixed LLW backlog by the end of 2004.
- 92% of INEEL EM-owned spent nuclear fuel, by weight, has been consolidated into dry storage.
- Substantial masses of volatile organic compounds (VOCs) have been extracted and destroyed from the vadose zone beneath the RWMC.

The following is a summary of the major cleanup activities still remaining at the INEEL Site:

- Treatment of remaining sodium-bearing-waste liquids in the INTEC tank farm and closure of 11 high-level waste tanks and ancillary equipment
- Retrieval, packaging, and preparation of 4,386 m^3 of calcine for shipment to an off-Site repository
- Shipment of all DOE-owned legacy spent nuclear fuel to an off-Site repository by January 1, 2035
- Deactivation, decontamination, and demolition of surplus inactive facilities
- Remediation of remaining contaminated sites at the RWMC, INTEC, and Test Area North (TAN).

As cleanup is completed and risk is reduced, further consolidation and footprint reduction will be possible. This will result in lower mortgage costs, which will free up funding for additional cleanup acceleration.

The *Performance Management Plan* (DOE-ID 2002a) states that some activities will continue after 2020: shipment of spent nuclear fuel to a repository; retrieval, treatment, packaging, and shipment of high-level waste calcine to a repository; and final dismantlement of remaining EM buildings. In addition, the Site will continue with ongoing activities, such as groundwater monitoring, well beyond 2020. These activities should be complete by 2035 with the exception of continued remediation of groundwater through monitored natural attenuation and some activities leading to long-term stewardship. Responsibility for groundwater remediation and environmental monitoring will be transferred to the DOE LPSO upon completion of the EM cleanup mission.

More specific information on cleanup strategies, priorities, and milestones is available in the *Performance Management Plan* (DOE-ID 2002a).

2. RISK-BASED END STATE VISION: REGIONAL CONTEXT

Section 2 provides information on physical features and land use for the five-county region in which the INEEL Site is located. Maps showing current conditions and anticipated conditions in 2035 follow each section of narrative.

2.1 Physical and Surface Interface

The INEEL is located in southeast Idaho, near the northeast end of Idaho's Snake River Plain, which extends in a broad arc from the Idaho-Oregon border on the west to the Yellowstone Plateau on the east. The Snake River Plain is a broad, fairly flat basin with a floor of basalt lava flows and sediments and is characterized by a semiarid environment (see Figure 2-1).

The plain transects and sharply contrasts with the adjacent mountainous country. Surface elevations on the plain decrease gradually from about 6,500 ft above sea level near Yellowstone National Park to about 2,100 ft above sea level near the Idaho-Oregon border. The summits of mountains surrounding the plain reach more than 12,000 ft in elevation.

There are a number of rivers on the Snake River Plain. The Snake River is located about 50 miles east of the INEEL Site. The Big Lost River originates west of the Site and drains an area of about 1,400 square miles. It enters the INEEL Site on the southwest end, flows east, then flows northward, and terminates in a playa called the Big Lost River Sinks in the northwest portion of the INEEL Site, where the water evaporates or infiltrates into the ground.

The Snake River Plain Aquifer, consisting primarily of basalts and sediments and the groundwater stored in these materials, is among the nation's largest aquifers. It extends about 200 miles through eastern Idaho, encompasses about 9,600 square miles, and stores 1–2 billion acre-feet of water, roughly the same volume contained in Lake Erie. In 1991, the EPA designated the Snake River Plain Aquifer a sole-source aquifer. A sole-source aquifer is one that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. About 9% of the aquifer lies beneath the INEEL Site at depths ranging from 200 to 1,000 ft below ground surface.

A map showing the location of the INEEL Site in relation to major physical features in the region is provided as Figure 2-1a. There is no difference between the current state and end state, as no changes in the Site's boundaries or regional physical features are anticipated.

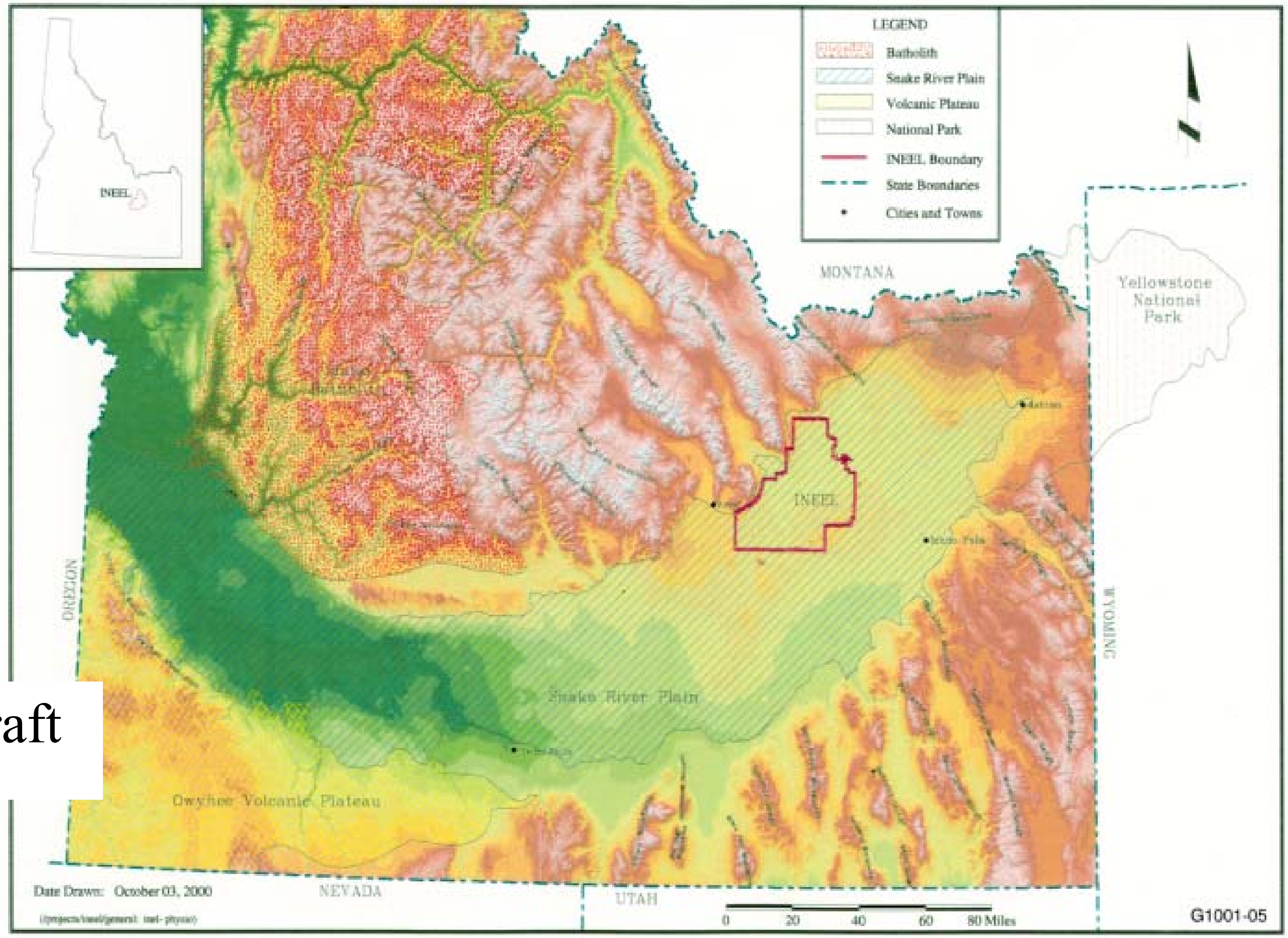

Figure 2-1. The Snake River Plain.

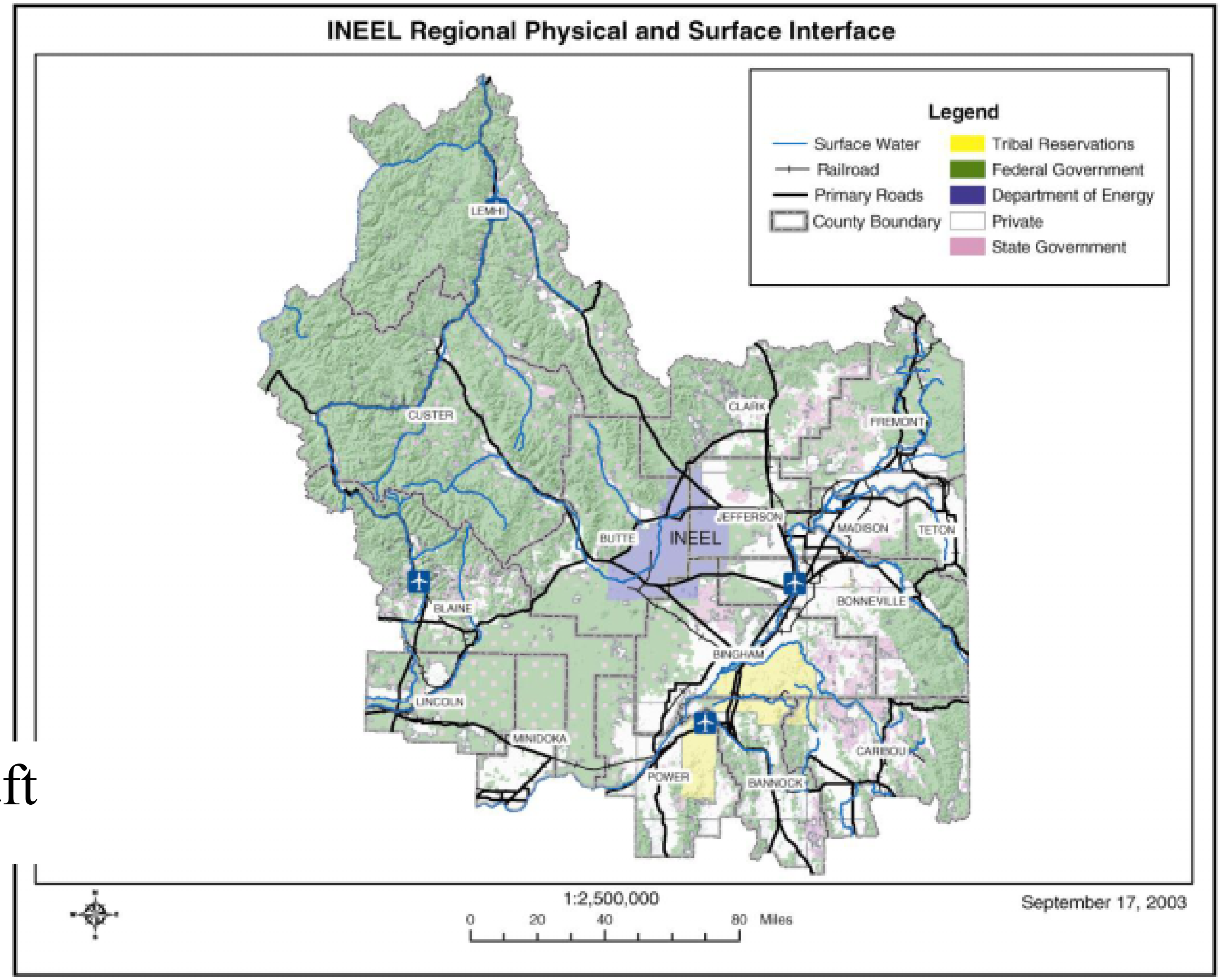

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Figure 2-1a. Regional physical and surface interface—current state.

2.2 Human and Ecological Land Use

Lands immediately surrounding the INEEL Site are owned by the federal government, the State of Idaho, and private parties. Land uses on federally owned land next to the INEEL consist of grazing, wildlife management, mineral and energy production, and recreation. State-owned lands are used for grazing, wildlife management, and recreation. Private lands near the INEEL are used primarily for grazing and farming. Irrigated farmlands make up about 25% of the land bordering the INEEL.

Several small rural communities are scattered around the borders of the INEEL: Howe, Mud Lake, Atomic City, Butte City, and Arco. The larger communities of Rexburg, Idaho Falls, Blackfoot, and Pocatello are located to the east and southeast of the INEEL Site. The Fort Hall Indian Reservation is located approximately 30 miles southeast of the INEEL Site.

Recreational activities in the five-county region around the INEEL include hunting, fishing, boating, hiking, cross-country skiing, and camping. Major recreational and tourist attractions in the general region surrounding the INEEL Site include the Craters of the Moon National Monument, Sawtooth National Recreation Area, Yellowstone National Park, Grand Teton National Park, and the Snake River.

Agricultural and open lands are the dominant types of land in the five counties surrounding the INEEL Site. When combined, these two land types account for 90% of the area. About 1.2 million acres in the five-county region are used for cropland. This region also produces about 105,000 head of livestock annually.

The Snake River Plain Aquifer is a major component of the region's agricultural industry. Groundwater use on the Snake River Plain includes irrigation, food processing, aquaculture, and domestic, rural, public, and livestock water supplies.

Maps showing regional land use for the current and end state are provided as Figures 2-2a and 2-2b. The maps are identical, with the exception of anticipated population growth in some communities. No significant changes in the regional land use are expected.

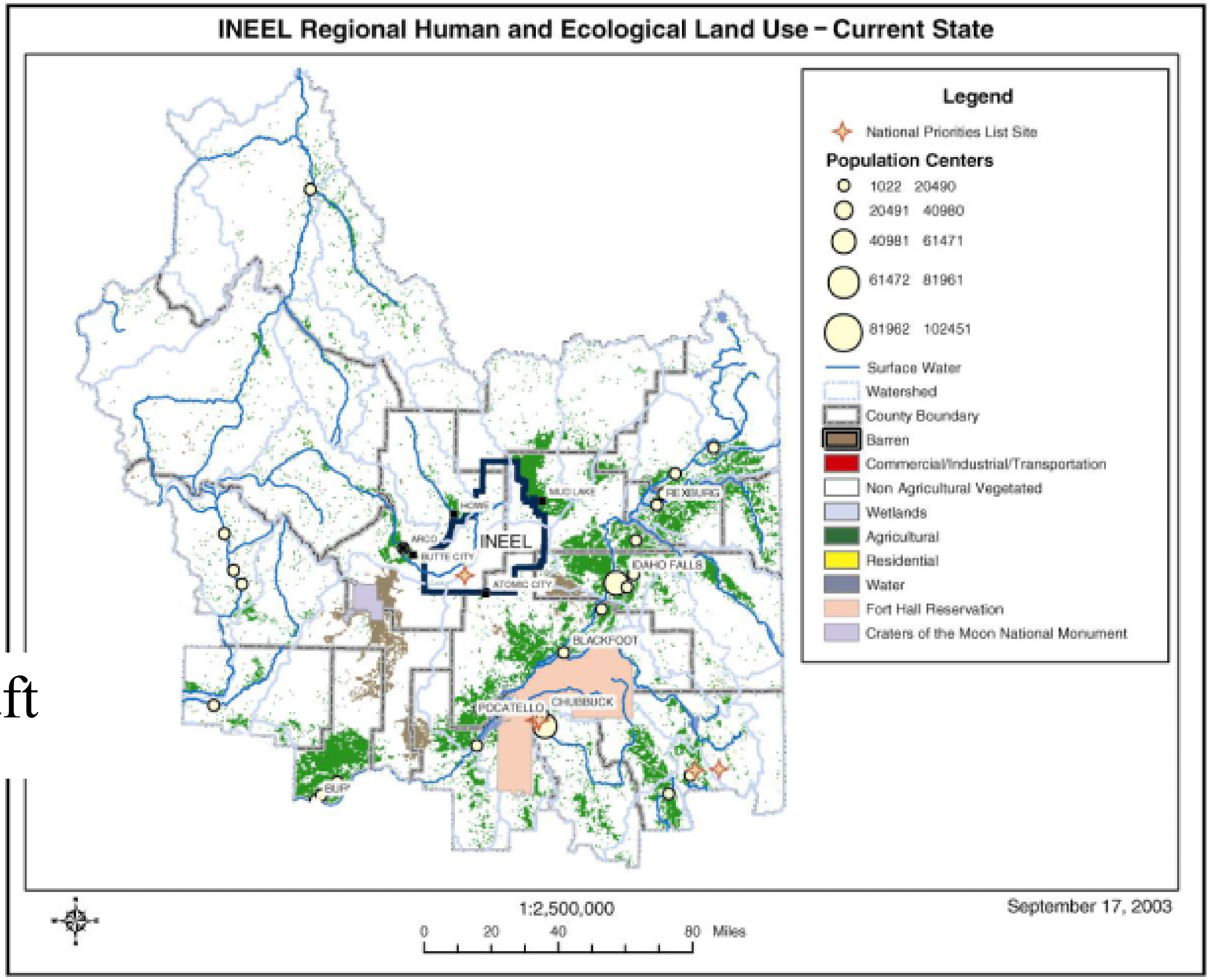

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Figure 2-2a. Regional human and ecological land use—current state.

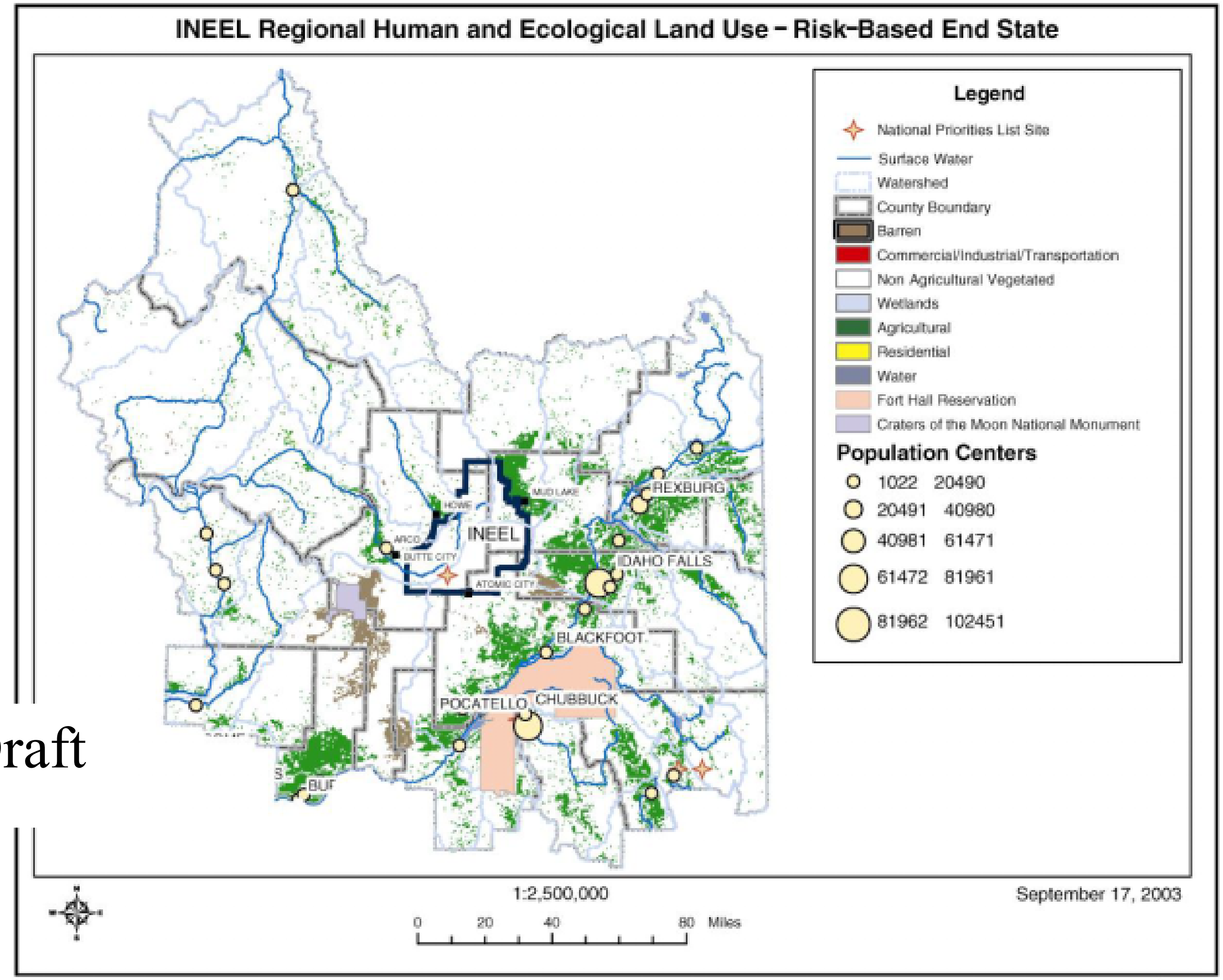

Figure 2-2b. Regional human and ecological land use—risk-based end state.

3. SITE-SPECIFIC RISK-BASED END STATE DESCRIPTION

Section 3 provides information on physical characteristics, human and ecological land use, legal ownership, and population of the INEEL Site and adjacent lands. Maps showing current conditions and anticipated conditions at the end state follow each section of narrative.

3.1 Physical and Surface Interface

A map showing the physical configuration of the INEEL Site is provided as Figure 3-1a.

INEEL land consists of flat-to-gently-rolling, high-desert terrain that lies about 5,000 ft above sea level. Isolated buttes on INEEL land reach 6,572 ft. Vast sagebrush flats with outcroppings of basalt rock dominate the INEEL landscape.

Surface water at the INEEL Site is generally scarce. Intermittently flowing waters in the Big Lost River and Birch Creek flow to the Big Lost River Sinks in the northwest portion of the INEEL Site, where the water evaporates or infiltrates into the aquifer. Typically, however, irrigation demands drain these streams before they reach the Site. Water from Birch Creek is diverted during the nonirrigation season to produce hydropower before reaching the INEEL Site. Excess water from the hydropower plant flows onto the Site through a canal. Surface water occurs in channels and playas across the Site during spring run-off and provides an important water source for the local fauna and migratory species. No surface water flows off the INEEL Site.

Although surface water is scarce at the INEEL Site, subsurface water is plentiful. The Site lies over part of the Snake River Plain Aquifer, the largest aquifer in Idaho and one of the most productive in the nation. The aquifer is the source of water used at the INEEL Site. Protection of the aquifer is one of the primary environmental concerns governing INEEL operations. The Site has an extensive network of wells used for monitoring perched groundwater and the aquifer.

The INEEL Site is crossed by several highways, a rail system, and a high-voltage power distribution loop. Public access is restricted by fences, signs, and a number of manned guard gates. Although the total INEEL land mass is 890 square miles, most of the work at the INEEL is performed within the Site's primary facility areas, which are summarized below:

- TAN—TAN was originally built to develop and test designs for nuclear-powered aircraft engines. Other subsequent missions included reactor safety testing and behavior studies and storage of material from the 1979 Three-Mile Island reactor accident. Now, the major project at TAN is the Specific Manufacturing Capability, which develops and manufactures armor for U.S. Army military vehicles. Many historic buildings remain from the facilities' rich history.

- INTEC—Facilities at INTEC are used to store spent nuclear fuel, hazardous waste, mixed waste, and radioactive waste; treat radioactive waste; and develop waste management technologies. Current work at INTEC includes treating and disposing of radioactive liquid waste in the tank farm, identifying a disposal path for the calcine, and consolidating spent nuclear fuel into dry storage.

- RWMC—RWMC provides a disposal facility for LLW at the SDA and interim storage and management for approximately 62,000 m^3 of transuranic waste in the Transuranic Storage Area (TSA). The stored waste will be shipped to the Waste Isolation Pilot Plant in New

Mexico. Mixed transuranic waste in storage will be prepared for shipment at the newly constructed Advanced Mixed Waste Treatment Facility.

- Central Facilities Area (CFA)—CFA is the main service and support center for the INEEL Site's programs and facilities. Support services include environmental monitoring and calibration laboratories, communication systems, security, fire protection, medical services, warehouses, a cafeteria, vehicle and equipment pools, power distribution, bus operations, and vehicle maintenance. CERCLA cleanup activities at this area are nearly complete.

- Waste Reduction Operations Complex (WROC), Power Burst Facility (PBF), and Auxiliary Reactor Area (ARA)—This area originally supported two reactor facilities: PBF and ARA. DD&D of the PBF reactor and supporting facilities is in progress. WROC includes waste storage facilities and a mixed waste incinerator. RCRA closure of the incinerator was completed, and the certification was approved by the State of Idaho on October 7, 2003.

- TRA—The primary mission at TRA is researching the effect of radiation of materials and producing radioisotopes for medical industry and research applications through operation of the ATR. Spent nuclear fuel is stored under water in the ATR canal. CERCLA cleanup activities at TRA are nearly complete.

- ANL-W—For the past 50 years, ANL-W has been the prime center in the United States for research on advanced reactor systems and their associated technologies. The mission of the laboratory is to conduct basic and applied research that supports these systems, with a current emphasis on development of new ways to deal with spent nuclear fuel.

- Naval Reactors Facility (NRF)—Bechtel Bettis, Inc., operates NRF for the DOE Office of Naval Reactors. NRF is located on the INEEL Site, 6.7 miles from the nearest INEEL boundary. The developed portion within the security fence covers approximately 84 of the 4,400 acres of NRF. NRF is not accessible to the general public.

  NRF examines developmental nuclear fuel material samples, naval spent fuel, and irradiated reactor plant components and materials. The knowledge gained from these examinations is used to evaluate the performance of existing reactors and to improve reactor core designs. The examination of spent fuel at NRF has led to the design of longer-lived cores, which improves ship operations, reduces lifetime costs, and results in the creation of less spent fuel requiring disposition. NRF is also preparing spent nuclear fuel for dry storage. Historically, NRF operated prototype reactors for training naval students.

  NRF will remain in operation for many years. No change in land use is planned. Current cleanup activities were completed on June 3, 2003, in accordance with CERCLA risk-based cleanup standards, and caps will be installed in three areas over the next 2 years. Any required future decontamination and decommissioning activities will be performed in accordance with applicable regulatory agreements and requirements to ensure that human health and environment are protected. No further action is required at this time with respect to developing risk-based end states for NRF. NRF is not discussed further in this document.

Figure 3-1a represents the end state as well as the current state of the INEEL Site. Although physical features will change significantly in certain developed portions of the Site, they are not visible on Figure 3-1a because of the scale of this map. Changes to specific developed areas of the Site are more thoroughly described in Section 4 of this report.

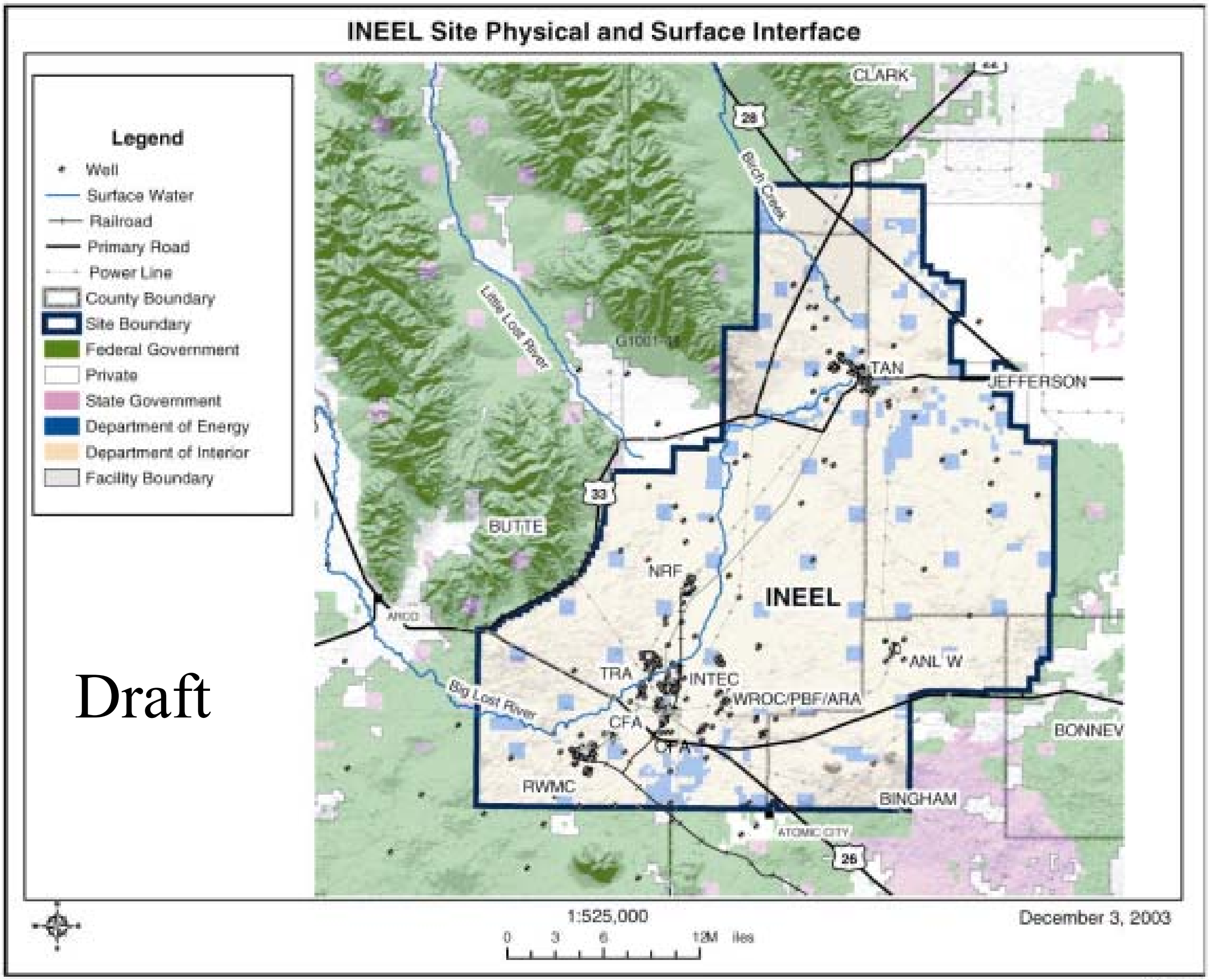

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Figure 3-1a. Site physical and surface interface—current state.

3.2 Human and Ecological Land Use

Acreage within the INEEL is classified as industrial and mixed use by the U.S. Department of the Interior Bureau of Land Management (BLM). Most of the work at the INEEL is performed within the Site's discrete primary facility areas. The great majority of the Site is undeveloped. Restricted access to INEEL land provides protection of important ecological and cultural resources. A map showing current and end state land use is provided as Figure 3-2a. There are no differences between the current and end states, as the current land uses described below are expected to remain the same at the end of the EM cleanup mission.

3.2.1 Ecological Resources Preservation

The INEEL Site is located at the mouth of several mountain valleys through which large numbers of migratory birds of prey and mammals are funneled onto the Site. During some years, hundreds of birds of prey and thousands of pronghorn antelope and sage grouse live year round or winter on the INEEL Site. About 30% of Idaho's pronghorn antelope population uses the INEEL Site as a winter range. Mule deer and elk also reside on the Site. Predators observed on the Site include bobcats, mountain lions, badgers, and coyotes. In all, over 270 vertebrate species have been observed, including 43 mammal, 210 bird, 11 reptile, nine fish, and two amphibian species. Currently, no threatened or endangered species are found at the Site (DOE-ID 2003a).

Aquatic communities on the INEEL depend largely on the flow of the Big Lost River. The river flows intermittently across about 30 miles of the INEEL from southwest to north before it terminates in the Big Lost River Sinks. No water reaches the INEEL section of the Big Lost River during drought years or during periods when water is diverted upstream of the INEEL for agricultural and flood prevention purposes.

The INEEL Site contains one of the largest areas of undeveloped and ungrazed sagebrush steppe outside of national park lands in the Intermountain West. In 1999, a portion of the INEEL was designated a Sagebrush-Steppe Ecosystem Reserve. This designation supports continued protection of ecological resources at the INEEL.

A management plan for the INEEL Sagebrush-Steppe Ecosystem Reserve has been drafted by the BLM and DOE with input from the Idaho Department of Fish and Game, U.S. Fish and Wildlife Service, and the Shoshone-Bannock tribes. The draft management plan discusses wildfire suppression, livestock grazing, road management, weed control, and protection of cultural resources.

3.2.2 Cultural Resources Preservation

Many INEEL cultural resources are eligible for nomination to the National Register of Historic Places and include artifacts, sites, structures, and properties that represent several periods of Southern Idaho prehistory and history. Cultural resource management activities at the INEEL have been ongoing for more than 40 years.[a] In that time, approximately 7.5% (43,145 acres) of the undeveloped portion of the 890-square-mile facility has been systematically surveyed, the buildings have been evaluated for their historical significance, and local tribal people whose aboriginal homelands included the INEEL (Shoshone-Bannock) have become active participants in cultural resource management. Inventories of

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a. DOE-ID, 2002b, "INEEL Cultural Resource Management Plan (Draft)," DOE/ID-10997, Rev. A, U.S. Department of Energy Idaho Operations Office, September 2003.

other INEEL property types (such as historic objects, structures, and records and Native American sacred sites) are ongoing.

Archaeological sites reflecting thousands of years of use by hunting and gathering cultures and several centuries of farming, ranching, and other emigrant activities number nearly 2,000 in the inventories that have been completed. Ongoing communication and cooperation between DOE and the Shoshone-Bannock tribes under the *Agreement-in-Principle between the Shoshone-Bannock Tribes and the United States Department of Energy* (DOE 2002c) have shown that many archaeological sites in the region are regarded as ancestral and important to tribal culture. Natural landforms and native plants and animals of the INEEL region are also of sacred and traditional importance, and although rare, human burials are of special concern. In recognition of these unique tribal values, DOE provides tribal members with unrestricted access to certain areas of the INEEL for activities related to the maintenance of tribal heritage, education of tribal members, and exercise of traditional cultural activities (DOE 2002c). Communication and interaction are ongoing, and the tribes actively participate in the preservation of these important resources.

In addition to archaeological sites and artifacts, many more recent historic architectural properties exist on the INEEL. Of the more than 500 buildings surveyed, 215 are historical and one, the Experimental Breeder Reactor I, is a National Historic Landmark. It is open daily for public tours from Memorial Day through Labor Day.

Strategies for the effective management of INEEL cultural resources have been developed in conjunction with pertinent INEEL programs and are detailed in the "INEEL Cultural Resource Management Plan (Draft)" (see footnote a) and the *INEEL Historic Architectural Properties Management Plan* (Braun 2003).

3.2.3 Environmental Research

As the shutdown of INEEL facilities and environmental restoration of INEEL land play greater roles, environmental studies are becoming increasingly important elements of land-use planning. These studies provide INEEL scientists, engineers, and planners with information about how nuclear reactor research has affected the environment and the extent of remediation necessary to restore the land. In addition, INEEL scientists and engineers are researching and developing technologies to mitigate the effects of environmental contamination and to preserve the environment during current and future INEEL operations. An extensive environmental surveillance program is in place for air, soil, surface and subsurface water, big game animals, and local produce (e.g., potatoes, wheat, lettuce, and dairy milk) for the INEEL Site and surrounding areas.

The INEEL Site was designated a National Environmental Research Park in 1975. The DOE has established seven such parks within the DOE laboratory complex. The parks are field laboratories set aside for ecological research and the study of environmental impacts from nuclear energy development. National Environmental Research Parks also help fulfill the DOE's policy for good stewardship of its land by supplying research and data needed for proper land management. Research results are published in reports, peer-review journals, and conference proceedings. These publications provide data necessary to support ecological risk assessments and National Environmental Policy Act documentation.

3.2.4 Grazing

The amount of INEEL land used for grazing varies from year to year, but between 300,000 and 341,000 of the site's nearly 569,600 acres are generally used for cattle and sheep grazing. A 900-acre portion of this land, located at the junction of Idaho State Highways 28 and 33, is used by the U.S. Sheep

Experiment Station as a winter feedlot for about 6,500 sheep. No grazing occurs within 1/2 mile of any primary facility area boundaries.

Rights of way and grazing permits for INEEL lands are granted and administered by the BLM. Thirty-four ranchers currently hold grazing permits on INEEL land.

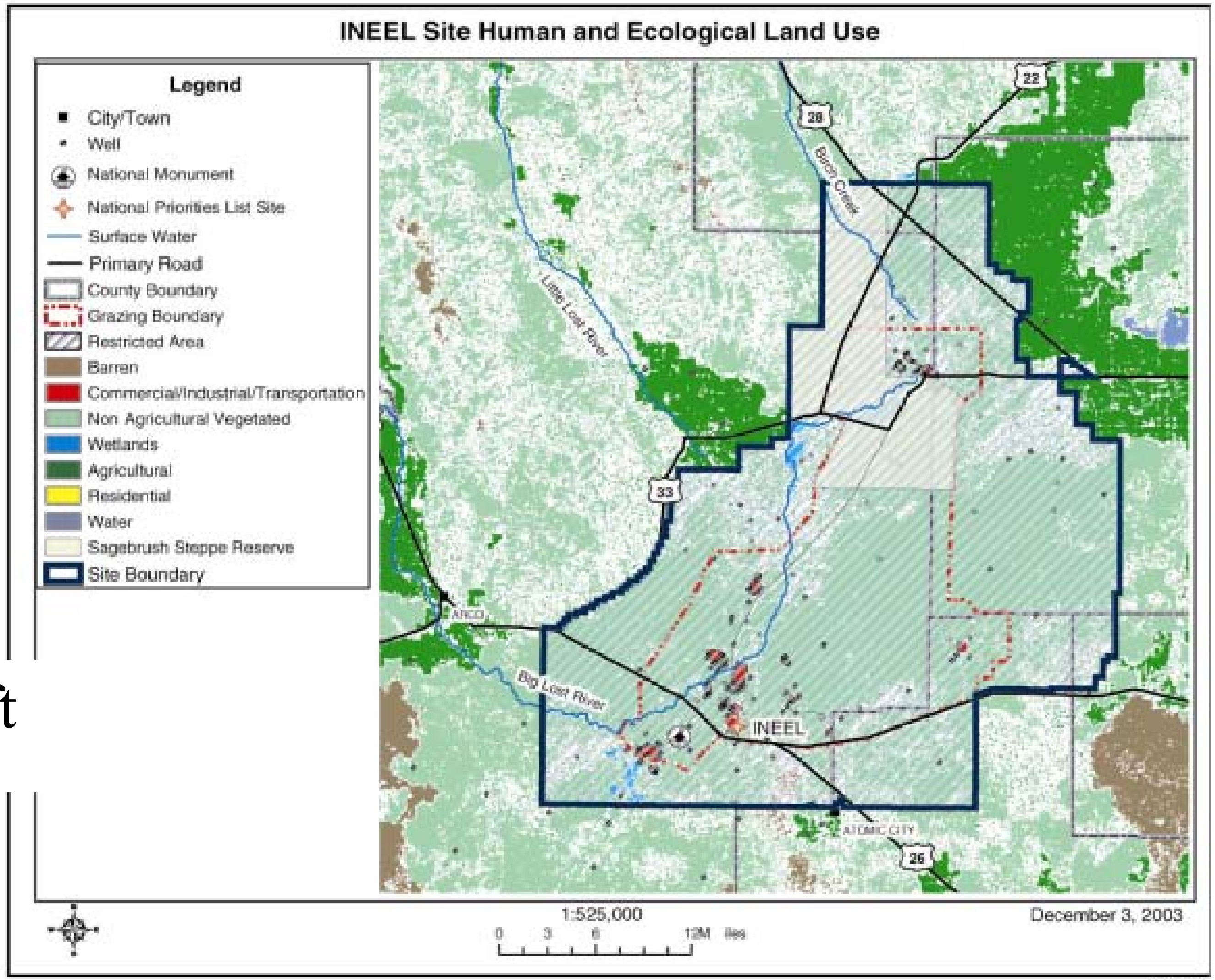

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Figure 3-2a. Site human and ecological land-use map—current state.

3.2.5 Hunting

Controlled hunting also is permitted on INEEL land but is restricted to 1/2 mile inside the boundary. Each year, the Idaho Department of Fish and Game and the DOE determine whether to allow controlled hunts of wild game populations on INEEL land. The purpose of these hunts is to reduce potential movement of animals off INEEL property and onto private lands where crops may be damaged. Hunts have so far been restricted to pronghorn antelope, elk, and coyotes.

3.3 Site Context Legal Ownership

In November 1947, the Atomic Energy Commission (now the DOE) began examining the pros and cons of developing a site where nuclear research reactors could be constructed to augment those at Hanford, Washington. The Commission found the Idaho site attractive for reasons that included its remote location, soil that afforded good drainage without rapid run-off, and the fact that it was already the site of the Arco Naval Proving Ground.

The Commission approved the Idaho site as its new research reservation on March 1, 1949. The acquisition proceedings lasted several more months, culminating in a presidential directive that transferred the Arco Naval Proving Ground to the jurisdiction of the Atomic Energy Commission. In subsequent years, this land was augmented through a series of withdrawals from the public domain and purchases of state and private lands.

Between 1946 and 1958, a total of 505,832 acres (89% of the current-day INEEL Site) were withdrawn from the public domain through a series of decrees called public land orders. Even though withdrawn lands were transferred to the INEEL, the public land orders provide for certain responsibilities to remain with the BLM, including the administration of grazing permits on the INEEL Site, granting utility rights of way across INEEL land, extracting materials, and controlling wildfires, weeds, insects, and predators. However, the public land orders also require that the DOE be consulted before final decisions are made about these actions.

Several parcels of state-owned land that amounted to 21,308 acres and 43,275 acres of land acquired from private parties were interspersed with land that was withdrawn from the public domain to form the INEEL Site. The Commission obtained these parcels to form a totally intact land area for the INEEL Site.

The land area for the INEEL Site totaled 570,415 acres at the culmination of land acquisitions and resulted in a unified site area. Subsequently, however, a transfer in January 1994 of 1,120 acres and a transfer in 1997 of 160 acres were made to the BLM, which in turn sold the land to Jefferson County to enable them to establish a multicounty landfill. The current-day INEEL land area consists of 569,135 acres (889 square miles).

INEEL land purchased by DOE from the State of Idaho and from private parties is owned by DOE. INEEL land obtained though land withdrawals is owned by the BLM. DOE has the right to conduct its missions on BLM land within the INEEL boundary until such time as the land is no longer needed by DOE. DOE currently has no end date projection for use of INEEL land within the current Site boundary. Accordingly, INEEL land ownership as it exists today is forecasted to be the same in 2035 and beyond. Legal ownership of the INEEL Site is shown in Figure 3-3a.

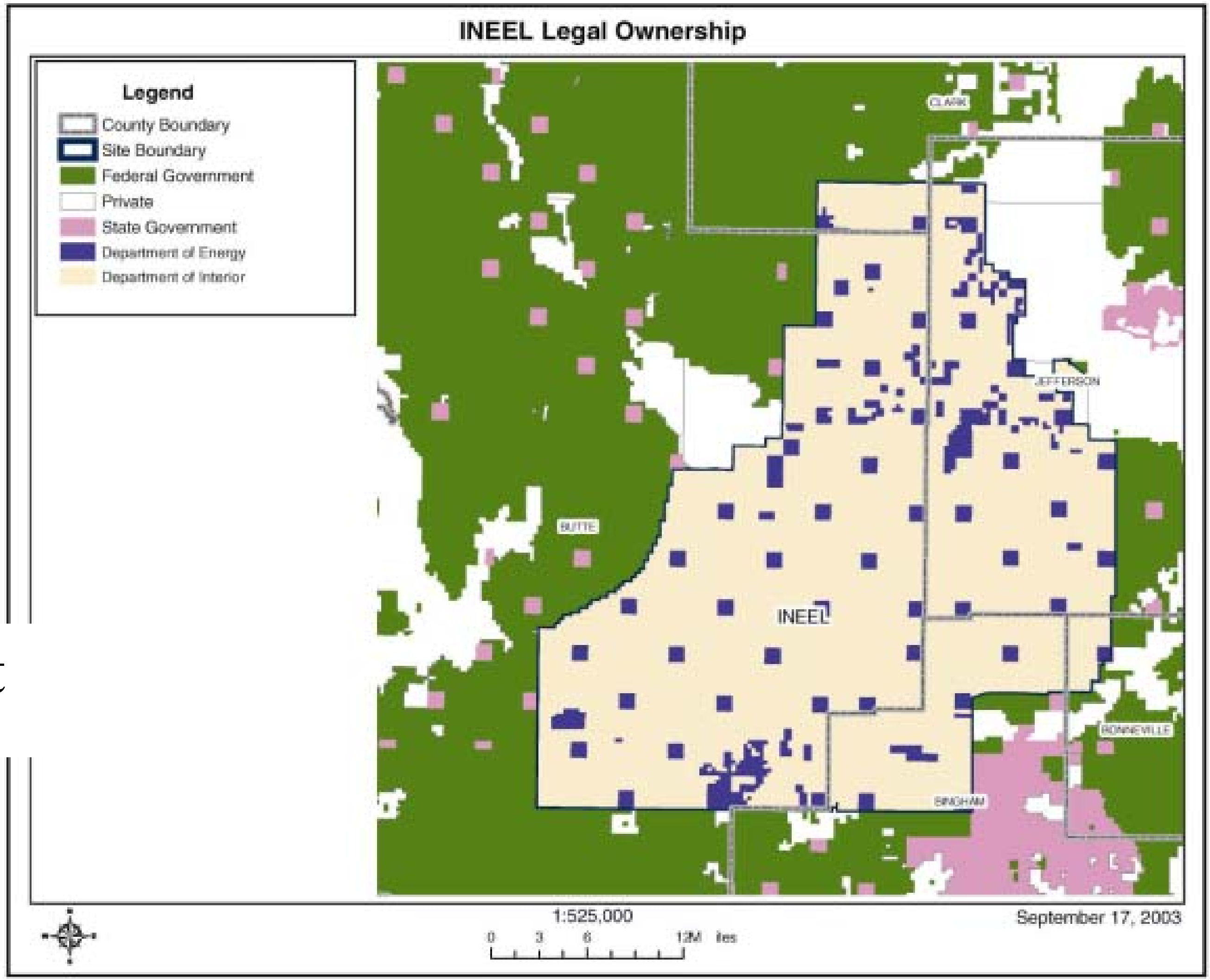

Figure 3-3a. Site legal ownership—current state.

3.4 Site Context Demographics

A map showing the population in the immediate vicinity of the INEEL Site (based on the U.S. Census data for 2000) is provided as Figure 3-4a. Current population centers in the region are shown on Figure 2-2a.

The rural population immediately surrounding the Site is sparse, with most counties ranging from 15 to 62 individuals per square mile. Butte County has the lowest population density at 1.3 individuals per square mile. Bonneville County, with the City of Idaho Falls as its population center, has 44.2 individuals per square mile. Most of the land next to the Site is open land owned by the BLM and therefore not available for residential use. Private land next to the Site is primarily used for single-family farms, ranches, and residences. Several small, agricultural towns, with populations less than 1,000, flank the Site boundary. The towns of Arco, Butte City, Moore, and Howe are located to the west of the Site in Butte County, while the towns of Monteview, Mud Lake, and Terreton are located east of the Site in Jefferson County. Atomic City is located south of the Site in Bingham County. Detailed statistical information on Idaho is available from the U.S. Census website, http://www.census.gov/, or the State of Idaho homepage, http://www.state.id.us/.

The INEEL work force peaked at 11,961 employees in 1995 but has steadily decreased since then. Approximately 8,000 people currently work at the INEEL. Approximately 65%, or 5,300 individuals, commute to the desert Site on weekdays, returning home each evening. During the weekends, the INEEL maintains a skeleton crew; however, there are no permanent residents living within the boundaries of the INEEL. The INEEL work force resides primarily in Bonneville County to the east of the Site, with Bingham, Bannock, Butte, Jefferson, and Madison Counties and the Shoshone-Bannock Reservation also contributing to the worker population.

Figure 2-2b shows the anticipated population in the vicinity of the INEEL Site at the end of the EM cleanup mission. In order to make projections on population density in the 2035 timeframe, several sources of information were used. Some population forecasts for 2010 are available from the U.S. Census website. Two population forecast reports prepared by Intermountain Demographics of Boise, Idaho, provide information on anticipated population growth through 2015 for Bonneville County and through 2020 for Bannock County (Intermountain Demographics 1996; Intermountain Demographics 2000). Information also was gathered from discussions with county planning and zoning commissioners for Fremont, Jefferson, Butte, Bannock, Bonneville, and Madison Counties and with planning and zoning departments for the cities of Idaho Falls, Pocatello, Blackfoot, and Rexburg.

It is not expected that significant population growth will occur in rural areas in Butte, Jefferson, Clark, and Bingham Counties. Most of the arable land surrounding the Site has been or is in production, and it is anticipated that no new arable land will go into production by 2035. Agriculture in the area is constrained by lava flows, temperature extremes that characterize high desert plateaus, and availability of surface and aquifer water for irrigation. Southeast Idaho has endured severe droughts in the past, and the current drought has affected areas next to the INEEL. The U.S. Census website predicts a 0.05% decrease in the Butte County population by 2010. If severe drought continues, some informal estimates by county planning and zoning commissioners predict a regional population decline of 2% by 2035. If moisture returns, the forecast is for stable population densities in most counties next to the INEEL. Therefore, Figure 3-4a also represents the anticipated end state population in the vicinity of the Site.

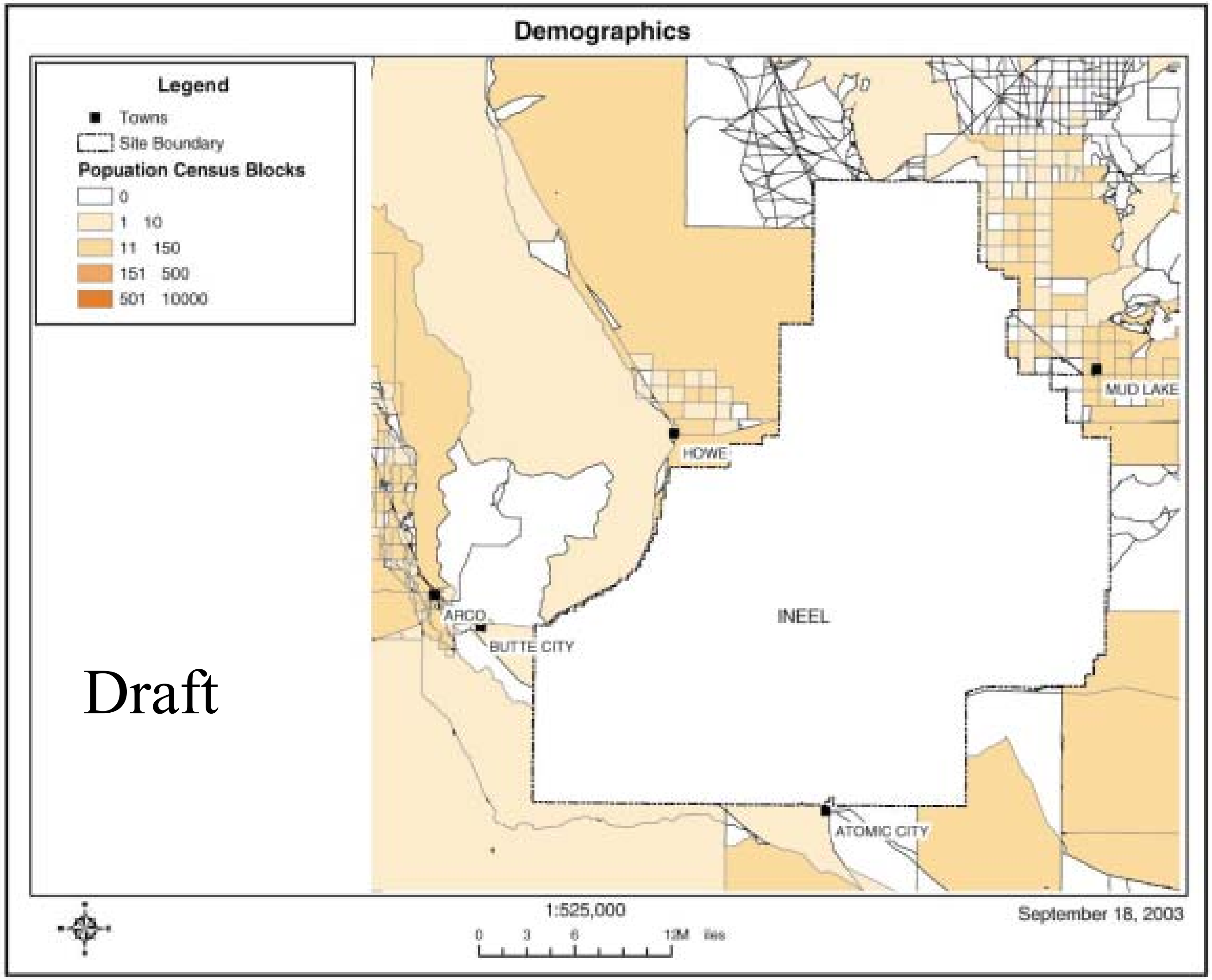

Figure 3-4a. Site demographics—current state.

As the EM cleanup work scope is completed, it is anticipated that reductions in the EM work force will continue. Employment reductions also are expected to occur in response to increased outsourcing of employees. In September 2000, the subcontractor number was 14, in comparison to 209 individuals for 2003, indicating an increase in outsourcing. It is not possible to predict the size of the work force that will be needed to support the NE mission in 2035, as the NE 10-year plan for the INEEL is just being developed and projections as far out as 2035 are not available.

Changes to the INEEL work force were predicted in the *2000, 2005, 2010, and 2015 Employment, Population, and Household Forecasts for Bonneville Metropolitan Planning Organization* (Intermountain Demographics 1996). "In this analysis, it was assumed that Bonneville County INEEL employment would decrease 4 percent annually, a rate slightly lower than the 1990 to 1995 annual rate." In the 2000 employment forecast, it was assumed that all of that employment reduction would occur in Bonneville County. Reductions in INEEL employment were forecast to cause additional employment reductions in the service, retail trade, and government employment sectors. Every basic job was estimated to support 2.59 additional jobs. Conversely, for every basic job reduction, 2.59 jobs were withdrawn from the employment forecast. For instance, in Fiscal Year 2002, the INEEL reduced its work force by 433 employees. The impact of that reduction is estimated at an additional 1,148 employees.

Nevertheless, because of continued economic diversification, some growth is anticipated in Bonneville County, Bannock County, and Madison County. In 2000, Bonneville County had 87,261 residents, and the forecast for 2015 is 108,455, a 7.1% increase (Intermountain Demographics 1996). Local planning and zoning representatives estimated that by 2035, the population of Bonneville County could reach 130,000. In 2000, Bannock County had a population of 70,100. The forecast population for 2020 is 89,900 (Intermountain Demographics 2002). Local planning and zoning representatives indicated that the population in Bannock County would probably reach 94,000 by 2035. Half of the projected population growth is expected to occur in Pocatello. Madison County had a count of 27,467 individuals in 2000, a 16% increase from the 1990 census figures. It is expected that Madison County will continue to grow at that rate during the forecast period, because of the addition of the 4-year college (BYU Idaho), the professionals the college will attract, and the increase in housing at the north end of the county by retirees attracted to recreational activities. These population increases are shown on Figure 2-2b.

4. HAZARD-SPECIFIC DISCUSSION

This section of the report discusses the hazards that are present at the INEEL Site as a result of historic operations. Eight hazard areas at the INEEL Site are described in the following sections. A hazard area is a portion of the Site that contains hazards that present risks to human health or the environment (e.g., contaminated soil, entombed facilities, contaminated groundwater plumes, or buried waste). Each section contains general narrative, maps, and conceptual site models that provide additional information about the hazards. The hazards are described as they currently exist (in 2003) and as they are anticipated to exist at the end of the EM cleanup mission. The timeframe for active cleanup is currently anticipated to be 2035, while the timeframe for completion of existing groundwater remediation is 2095. Current mitigation, planned actions, and institutional controls are discussed for each hazard area. In general, the hazard areas correspond to WAGs established in the FFA/CO; however, information on other planned closure activities, such as RCRA closures; VCO activities; and DD&D, is also provided.

Cleanup activities at the hazard areas include removal of radioactive waste and other nuclear materials from the INEEL Site, DD&D of facilities that are no longer needed, RCRA closures of hazardous waste facilities, actions required by the VCO, and CERCLA remedial actions. These activities are discussed in more detail in each of the following hazard area narratives. An overview of VCO and RCRA closure activities is provided below.

The VCO required resolution of a number of self-disclosed RCRA compliance issues, most of which were related to tanks and tank systems. Work to resolve the VCO issues has been in progress for about 3 years. There are still open VCO actions at four INEEL facilities: INTEC, TAN, TRA, and PBF. The open actions include characterization of several tank systems and RCRA closure of those systems where the characterization data confirm that the systems were used to store hazardous waste. The open actions at PBF are expected to be complete by the end of 2004. Actions at TAN will be completed by the end of 2005. Actions at TRA and INTEC will be completed by 2012.

RCRA closures of hazardous waste facilities will be required at INTEC, TAN, TRA, RWMC, and WROC. The RCRA closures at TRA are all related to the VCO actions described above. The RCRA closures at WROC will be complete by the end of 2004. The RCRA closures at TAN are scheduled to be complete by the end of 2006. INTEC will require numerous RCRA closures, the last of which (calcine storage bins) will not be complete until 2035. The Advanced Mixed Waste Treatment Facility at RWMC will require RCRA closure after operations have been completed. Specifics on these activities are detailed in RCRA closure plans, which require approval from the State of Idaho.

The RBESV is based on an assumption of government control of the INEEL. Future land-use assumptions include the following:

- The INEEL will remain under government management and control. Regardless of future use of the land now occupied by the INEEL, the federal government has an obligation to provide adequate institutional controls (e.g., limit access) to areas that pose a significant risk to human health until that risk diminishes to an acceptable level for the intended purpose.

- To the extent practical, new development to support the INEEL mission will be encouraged in developed facility areas to take advantage of existing infrastructures. Such redevelopment will reduce environmental degradation associated with construction activities in previously undeveloped areas.

- No residential or agricultural development will occur within INEEL boundaries. Grazing and other controlled activities, such as use by tribes, will be allowed to continue in the buffer area.

The RBESV is based on the premise that the INEEL Site, as it currently exists, will remain intact for the foreseeable future. Most of the developed areas of the Site will remain industrial areas for the foreseeable future. Likewise, the undeveloped areas, which constitute the majority of the Site, will continue to be used as a buffer area and for ecological and cultural preservation, environmental research, and controlled grazing and hunting. Land use at the INEEL at the end of the EM cleanup mission is expected to be much the same as the current land use, with the exception that DOE's EM operations will be completed, and responsibility for operations and long-term stewardship will be transferred to the LPSO, currently DOE's NE Office. NE operations at the risk-based end state are not discussed in this document.

Typically, CERCLA risk assessments for the INEEL have been based on both current and future land-use scenarios. The CERCLA human health risk assessments quantified potential carcinogenic (cancer-causing) and noncarcinogenic adverse health effects. Despite an assumption of long-term industrial use at the INEEL, many of the earlier CERCLA baseline risk assessments were conducted using a hypothetical residential scenario. In general, the hypothetical residential scenarios assumed continued institutional controls for 100 years, after which a resident might occupy a contaminated site and engage in subsistence farming. The residential scenarios were consistent with EPA guidance and modeled a person living on the Site 350 days a year for 30 years, beginning 100 years from a baseline date. The baseline dates varied from one ROD to another. Some were based on the 1995 land-use planning decisions; others were based on the year that the RI/FS or ROD was signed. It was assumed that future residents would construct 10-ft basements beneath their homes. Therefore, they could be exposed to contaminants through spreading of the excavated materials around the perimeter of the house.

The assessments also examined the potential risk to current and future workers and to ecological receptors. The occupational scenarios modeled nonintrusive industrial use (i.e., disturbances to 4 ft below ground surface) without restrictions. The current occupational scenario that was analyzed lasts 25 years from the present. The future occupational scenarios started 100 years from the baseline date and last 25 years. These conservative scenarios were believed to allow for all impacts of any potential future land use.

Remedial action objectives (RAOs) were developed in accordance with the National Contingency Plan and CERCLA RI/FS guidance. RAOs specify contaminants and media of concern, potential exposure pathways, and remediation goals. RAOs are specific risk criteria that take into consideration the assumed future land uses at the INEEL. RAOs are developed for specific media (i.e., soil, perched water, or groundwater). Applicable RAOs for a particular site or group of sites depend on the specific media involved.

To meet the RAOs, remediation goals are established. Remediation goals establish acceptable exposure levels that are protective of human health and the environment. These goals generally are quantitative cleanup levels based upon human health and the environment and are based upon the results of a baseline risk assessment and evaluation of anticipated exposures and risks for selected remedial alternatives. A 1×10^{-4} (1 in 10,000) cumulative carcinogenic risk or cumulative hazard index of 1 for noncarcinogenic contaminants, whichever was more restrictive for a given contaminant, was the primary basis for determining remediation goals for release sites. Remediation goals for contaminated soil are based on soil concentrations that satisfy the 1×10^{-4}-carcinogenic-risk goal or noncarcinogenic hazard index of 1 for current workers, future workers, and residents. Risk-based remediation goals are used to verify the effectiveness of the selected remedial action and to determine if additional remedial action is necessary before closing a particular release site.

Conceptual site models provide, in block diagram form, information regarding the hazards, pathways, receptors, and barriers (current and planned) between the hazards and receptors. The conceptual site models, which were prepared during baseline risk assessments and published in approved CERCLA documents, have been updated to reflect current (2003) conditions and modified to show anticipated conditions at the end state. Since the CERCLA baseline risk assessments evaluated risk to hypothetical residential receptors, the conceptual site models in this document include residential receptors. However, there is no current residential use of the INEEL Site, and no future residential use will be allowed. The public is protected from hazards by restricted access to the Site. Workers are protected by a combination of administrative procedures, restricted access, and other controls.

The eight hazard areas are as follows:

- Section 4.1—Sitewide Soil and Groundwater
- Section 4.2—Test Area North
- Section 4.3—Idaho Nuclear Technology and Engineering Center
- Section 4.4—Radioactive Waste Management Complex
- Section 4.5—Central Facilities Area
- Section 4.6—Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area
- Section 4.7—Test Reactor Area
- Section 4.8—Argonne National Laboratory-West.

4.1 Sitewide Soil and Groundwater

This section discusses the Sitewide soil area and groundwater. These areas were included in WAG 6 and WAG 10 in the FFA/CO. On a Sitewide basis, groundwater concerns related to the Snake River Plain Aquifer are included in WAG 10. The groundwater portion of this section provides a general overview of groundwater contamination at the INEEL Site. Site-specific groundwater contamination is discussed in more detail in Sections 4.2, 4.3, 4.4, 4.5, and 4.7.

4.1.1 Sitewide Soil

The Sitewide soil area includes all INEEL land outside the fenced boundaries of the Site's primary facility areas. Remaining occupied or utilized facilities in the Sitewide soil area include the INEEL firing range (a security force training center), the Experimental Breeder Reactor I historical site, the entrance guard gate facilities, and small structures and utility buildings, such as pumphouses and communications buildings.

The consolidation and management of contaminated soil from the INEEL at a single location to prevent exposure of human and ecological receptors was one of the remedial decisions documented in the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999b). The INEEL CERCLA Disposal Facility (ICDF), located just outside the INTEC facility fence, was constructed in 2003 (see Figure 4-3a1b). The facility includes waste storage and treatment areas, a landfill, and two evaporation ponds to manage landfill leachate and other liquids. The ICDF landfill (for soil and debris) and evaporation ponds (for liquids only) are engineered facilities for CERCLA hazardous and radioactive contaminants. To protect the aquifer, located 460 ft below ground, a system of multiple liners and liquid collection and diversion points is part of the design.

Sitewide soil includes WAG 6 and WAG 10, designated under the FFA/CO. WAG 6 includes the Experimental Breeder Reactor I and the nearby Boiling-Water Reactor Experiment (BORAX) Area, which includes the sites of five separate experimental reactors that have been deactivated, decontaminated, and decommissioned.

WAG 10 encompasses the INEEL Site area that falls outside of the other WAGs. Hazards associated with this area include potential unexploded ordnance (UXO) and associated explosive contaminants remaining from munitions testing activities. The hazard area is extensive, comprised of approximately 217,000 acres. As necessary, WAG 10 also encompasses areas beyond the INEEL boundaries that may have been impacted by INEEL activities. Consequently, WAG 10 comprises a large area, much of which is uncontaminated.

The *Declaration of the Record of Decision for Ordnance Interim Action Operable Unit 10-05* (DOE-ID 1992a), which addressed UXO known or suspected at six sites, was issued in 1992. A comprehensive investigation was completed in 2001, and the *Record of Decision for Experimental Breeder Reactor-1/Boiling Water Reactor Experiment Area and Miscellaneous Sites, Operable Units 6-05 and 10-04* (DOE-ID 2002b) was completed in 2002.

The *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04* (DOE-ID 2001a) included a comprehensive analysis of ecological risk information available from the INEEL WAGs. The purpose of the "INEEL-wide Ecological Risk Assessment" (DOE-ID 2001a) was to compile information from previous investigations of risk to ecological receptors performed for each WAG into a summary of the effects of contamination on the environment of the INEEL as a whole. The information sources used include assessments of the ecologically sensitive areas, ecological sampling onsite, the breeding bird survey, long-term vegetation transects, radiological biota studies, air dispersion modeling, biological surveys for sensitive species or habitat, and ecological risk assessment summaries for the various WAGs. The OU 10-04 ROD (DOE-ID 2002b) concluded that less than 20% of the habitat present on the INEEL is lost to facility activities, and minimal (de minimus) risk is expected to the INEEL's plant and animal communities. However, based on the multiple uncertainties, data gaps, and assumptions in the assessment, it was determined that the INEEL would implement long-term ecological monitoring. The OU 10-04 ROD (DOE-ID 2002b) states, "Monitoring will ensure that expectations regarding the protectiveness of the no action approach to the INEEL-wide ecological risk assessment are met." An ecological conceptual site model from the OU 10-04 ROD (DOE-ID 2002b) is included as Figure 4-1a2a and Table 4-1a. The *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory* (VanHorn, Fordham, and Haney 2003) was submitted to the agencies in September 2003. Fieldwork was initiated in 2003 to collect baseline samples.

4.1.1.1 Current State. Main sources of contamination in WAG 10 include the Organic Moderated Reactor Experiment Leach Pond (OMRE-01) and UXO areas (WAG 10). The UXO areas are shown on Figure 4-1a1b. The remaining CERCLA sites are too small to be visible on the map. Major contaminants are lead, mercury, cesium-137, strontium-90, trinitrotoluene (TNT), royal demolition explosive (RDX), and UXO (see Figure 4-1a2b). Cesium-137 is one of the more common contaminants of concern (COCs) at the INEEL. Cesium-137 is found in radioactive waste associated with the operation of nuclear reactors and spent fuel reprocessing plants. It can enter the body when it is inhaled or ingested. Exposure to cesium-137 can result in malignant tumors and shortening of life. The EPA has established an MCL of 4 mrem per year for beta-particle and photo radioactivity from man-made radionuclides in drinking water. Cesium-137 is covered under this MCL. The average concentration of cesium-137, which is assumed to yield 4 mrem per year, is 200 pCi/L. Cesium-137 has a half-life of 30 years and, therefore, often can be remediated within acceptable timeframes through natural decay.

Nine sites currently require institutional controls to protect against human exposure to contaminants. Institutional controls include warning signs and control of activities to restrict drilling and excavation. Each of these sites is briefly summarized below:

- EBR-08—Fuel Oil Tank—The EBR-08 Fuel Oil Tank is the site of an underground storage tank that was removed during the 1990 tank program. Soil under the tank showed evidence of leakage. The primary COC is diesel. All of the diesel-contaminated soil was removed, with the exception of two small areas that could not be accessed because of equipment limitations. The excavation was backfilled with clean soil (DOE-ID 2001a). The ROD selected remedy is institutional controls that restrict the site to industrial land use until discontinued, based on the results of a 5-year review.

- BORAX-01—Leach Pond Associated with BORAX Reactors—This site was used from 1954 to 1964 to collect low-level radioactively contaminated liquid discharges from the BORAX II through V experiments. In 1984, the pond was backfilled with clean soil, graded, and reseeded. In 1992, the associated piping and a small volume of underlying contaminated soil were removed. COCs at the leach pond associated with BORAX II through V reactors are primarily subsurface metals and radionuclides, with the primary COC being cesium-137. The ROD selected action is maintenance of institutional controls to prevent exposure to contaminated soil.

- BORAX-02—Site of Buried BORAX I Reactor—This BORAX I reactor was used between 1953 and 1954 for dozens of stress tests to explore reactor safety. The reactor was deliberately destroyed in 1954 during a final test designed to determine its inherent safety under extreme conditions. The excursion was more destructive than had been predicted, and the steam explosion scattered fuel plate fragments a distance of 200–300 ft. Immediately following the reactor excursion, a cleanup activity was conducted to physically remove and reprocess the scattered radioactive material. In 1955, the remaining aboveground structures were removed, the reactor was buried in place along with surrounding radionuclide-contaminated soil, and the area contaminated from the excursion was covered with 6 in. of gravel. The site was remediated in 1996 in accordance with the *Record of Decision: Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment–1 Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)* (INEEL 1996). All shrubs, roots, signs, fencing, and other debris were removed from the contaminated area and placed in a layer on top of the original burial ground. Soil, with radionuclide contamination exceeding action levels, was excavated to a depth of 1 ft and placed over the original burial ground. Soil sampling verified that no areas remained with contamination exceeding the action levels. An engineered barrier, consisting of basalt riprap, was constructed over the site. Subsequently, because of the presence of contamination in the soil to the south of the reactor burial ground, additional in situ surveys were performed, and a risk assessment for the residual radiological surface contamination at the site was prepared in 2002. From the results of the assessment, it was concluded that the dose to both current and future receptors is acceptable although two areas of contamination may exceed risk-based levels. However, the residual cesium-137 activity at the site will decay to acceptable risk levels in approximately 130 years, and current institutional controls and land-use restrictions will be adequately protective of human receptors until that time. This site was subsequently included in the OU 6-05 and 10-04 ROD (DOE-ID 2002b). The ROD selected remedy is no further action with institutional controls to maintain integrity of the containment barrier and to prevent unauthorized intrusion into the capped area. Institutional controls will be required for approximately 300 years until the cesium-137 decays to acceptable levels for unrestricted use.

- BORAX-08—BORAX V Ditch—The COC at this site is cesium-137. In 1995, a non-time-critical removal action was conducted at the site. Approximately 1,178 yd^3 of radionuclide-contaminated soil were removed from the ditch. Sampling in the summer of 2000 confirmed that remaining contamination was below action levels. The ROD selected remedy is no further action with institutional controls. Institutional controls are maintained to prevent exposure to contaminated soil.

- BORAX-09—Entombed BORAX II through V Reactor Buildings—Reactor experiments were conducted at this site between 1953 and 1964. The site consists of the entombed belowground structures remaining from the Argonne Experimental Facility (AEF-601), subfloor concrete foundations and reactor components, and other remaining artifacts of the BORAX V experiment. Concrete shield blocks seal the AEF-601 pits, trenches, and access shaft, all of which have been backfilled with soil. A DD&D removal and containment action was conducted at the site from 1996 through 1997. All remaining aboveground structures and systems were removed, and the subfloor levels of the reactor building were entombed. Lead shielding was removed from the BORAX V reactor pit and was sent off-Site for recycling. The mixed waste streams were incinerated at the Waste Experimental Reduction Facility. Belowgrade pits and trenches were backfilled with soil. Radioactively contaminated soil excavated from the head of the BORAX-08 ditch was placed in the reactor building access shaft. The concrete shield blocks were replaced over these areas. The remaining reactor building systems, including two reactor vessels (BORAX II, III, IV, and V) and approximately 780 ft^3 of materials containing asbestos, were buried in the belowgrade concrete structure. The reactor vessel was entombed with concrete and buried under clean soil. The primary COC is cesium-137. The ROD selected remedy is no further action and institutional controls to prevent unauthorized intrusion into the entombment structures and buried waste. Institutional controls include warning signs, control of activities (drilling and excavation), and property lease requirements to control future land use.

- OMRE-01—Organic Moderated Reactor Experiment Leach Pond—The leach pond was used for wastewater disposal from the Organic Moderated Reactor Experiment reactor. The reactor operated form 1957 to 1963. The COCs are radionuclides (primarily cesium-137). The ROD selected remedy is no further action and institutional controls to prevent exposure to contaminated soil. This is accomplished through warning signs, control of activities (drilling and excavating), and property lease requirements to control future land use.

- STF-02—Gun Range—The Security Training Facility area has been used since 1983 for security force practice maneuvers including small arms target practice in a berm. Approximately 61 tons of lead and 3.4 tons of copper may be present at the site. The human health risk is from lead. The average concentration exceeds the EPA's (Region 9) 400-mg/kg preliminary remediation goal for lead. The ROD selected remedy is removal, treatment, and disposal of soil. Institutional controls are used to prevent exposure to contaminated soil. These include visible access restrictions (warning signs) and control of activities (drilling or excavating.). Interim controls will be maintained to protect workers until the selected remedies have been implemented.

- WAG 10 UXO—Multiple Sites with Potential UXO—For ordnance areas, the COC is UXO from aerial bombing practice, naval artillery testing, explosive storage-bunker testing, and ordnance disposal. Munitions used for bombing and target practice are likely to be inert although it is suspected that some UXO might be present within the ranges. For the explosives sites, TNT and RDX were identified as COCs based on results of the human health risk assessment. Contamination consists of larger fragments of TNT and RDX that could pose an explosives hazard and TNT and RDX that have dissolved into the soil, resulting in unacceptable risk from ingestion and dermal exposure to current and future workers. Multiple sites with potential UXO include:

- Ordnance areas

  - ORD-03: CFA-633, Naval Firing Site and Downrange Area (including 17 smaller ordnance sites: ORD-04, ORD-05, ORD-07, ORD-11, ORD-12, ORD-13, ORD-14, ORD-16, ORD-17, ORD-18, ORD-19, ORD-20, ORD-22, ORD-25, ORD-26, ORD-27, and ORD-28)

  - ORD-09: Twin Buttes Bombing Range

  - ORD-01: Arco High-Altitude Bombing Range.

- TNT- and RDX-contaminated soil sites

  - ORD-15: Experimental Field Station

  - ORD-10: Fire Station II Zone and Range Fire Burn Area

  - ORD-24: Land Mine Fuse Burn Area

- ORD-08: National Oceanic and Atmospheric Administration
- ORD-06: Naval Ordnance Disposal Area.

- ORD-21—Juniper Mine—For the Juniper Mine, an estimated 16,000 lb of explosive material remain buried 135 ft below ground (buried in 1974). The ROD selected remedy is no further action with institutional controls. Institutional controls are warning signs and control of activities (drilling and excavating).

4.1.1.2 End State. A map showing the Sitewide soil area at the risk-based end state is included in Figure 4-1b1b. A Sitewide soil conceptual site model for the risk-based end state is provided as Figure 4-1b2b. No ecological conceptual site model for the risk-based end state is provided because adequate data are not yet available to accurately predict effects to ecological receptors from low levels (minimal risk) of contaminants over long periods of time. For these reasons, ecological monitoring is proposed. Monitoring will be focused on detecting possible effects to populations at the Site and providing necessary data to verify modeling and help eliminate uncertainties. The Sitewide ecological monitoring program will provide critical information for continued assessment of this ecosystem. It will also provide the baseline data needed to make informed decisions in the future.

The UXO sites are currently planned to be remediated as required by November 2015. The planned remediation involves visual and geophysical surveys of the areas that have been identified as having a higher risk of containing UXO. However, there are limits to the effectiveness of these methodologies. It is cost prohibitive to search every inch of land to a depth of several feet. In addition, because of freeze-thaw cycles, ordnance continues to work its way up to the surface over the years. These limitations, coupled with the large geographic area that potentially may contain UXO, make it very difficult to free release areas with potential UXO contamination, as it is not possible to ensure that every potential piece of UXO has been identified. Therefore, even if these sites are remediated as scheduled, they will still require permanent institutional controls to protect humans from potential contact with UXO. As a result, a potential variance from the selected remedy would be to survey and remediate only those areas that have planned future activities or where potential UXO has been identified.

For the explosives sites, TNT and RDX were identified as COCs based on results of the human health risk assessment. Contamination consists of larger fragments of TNT and RDX that could pose an explosives hazard and TNT and RDX that have dissolved into the soil, resulting in unacceptable risk from ingestion and dermal exposure to human health. These sites are to be remediated by 2015. If remediation is conducted as described in the ROD, it is anticipated that institutional controls will not be required.

The STF-02 gun range will be remediated by August 2018. If remediation is conducted as described in the ROD, it is anticipated that institutional controls will not be required following remediation of the site.

All of the BORAX sites are expected to remain under institutional control for radionuclide contamination past 2035 until the cesium-137 decays to acceptable levels. This is also true for the OMRE-01 leach pond site.

It is also anticipated that institutional controls will remain in effect for the EBR-08 Fuel Oil Tank site past 2035.

Although no remedial action is required for the Juniper Mine, there is significant uncertainty as to the explosive characteristics of the buried material. Institutional controls will therefore remain in effect past 2035.

The ICDF will be closed in accordance with the substantive and applicable requirements of the Hazardous Waste Management Act (HWMA) and RCRA. Closure requirements will include access restrictions to prevent intrusions into the closed area. Access restrictions, institutional controls, monitoring, and maintenance will remain in place for as long as the contents of the landfill remain a threat to human health or the environment if uncontrolled.

4.1.1.3 Variances. Potential variances have been identified for the UXO areas, areas contaminated with TNT and RDX, and the gun range. These variances are described in Table 5-1.

The ROD selected remedy for the UXO sites requires a survey of the entire 208,000 acres (325 square miles) that may contain UXO. A potential variance would be to clean up only those areas where UXO has been identified through other activities or where remediation is needed because of future planned activities. UXO poses a physical danger through the possibility of it exploding when handled or contacted, especially by machinery. UXO encounters are relatively uncommon, and there has never been an accidental detonation at the INEEL caused by human contact. No historical occurrences of unintentional detonation by ecological receptors have been recorded. It would be unlikely for an ecological receptor to strike an ordnance item with sufficient force to explode it. Therefore, UXO was determined by the ROD to pose no unacceptable risk to ecological receptors.

Geophysical investigations for buried munitions are seldom 100% effective. In many cases, a munition is buried too deep, is too small to be detected, or is constructed of a material difficult to detect. Undetected ordnance that is buried may be brought to the ground surface through frost heaving or erosion. In addition, because the total amount of munitions buried at a site is rarely known, complete recovery cannot be documented.

For the TNT and RDX areas and the STF-02 gun range, the ROD selected remedies were based on future-use scenarios that included residential receptors after 100 years. It is proposed that an evaluation be conducted to determine the level of cleanup required to protect occupational and ecological receptors.

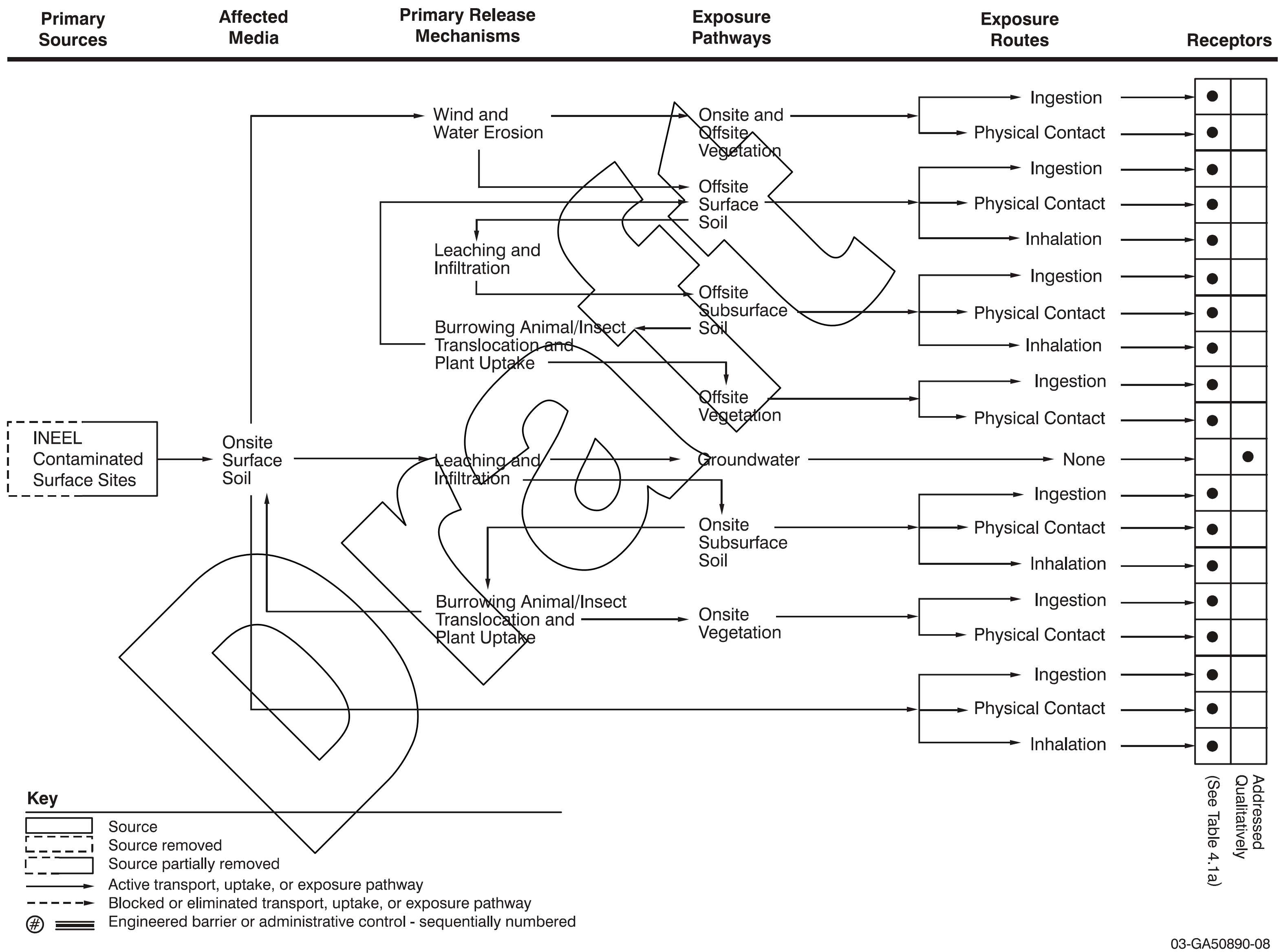

Figure 4-1a2a. Site ecological receptors conceptual site model—current state.

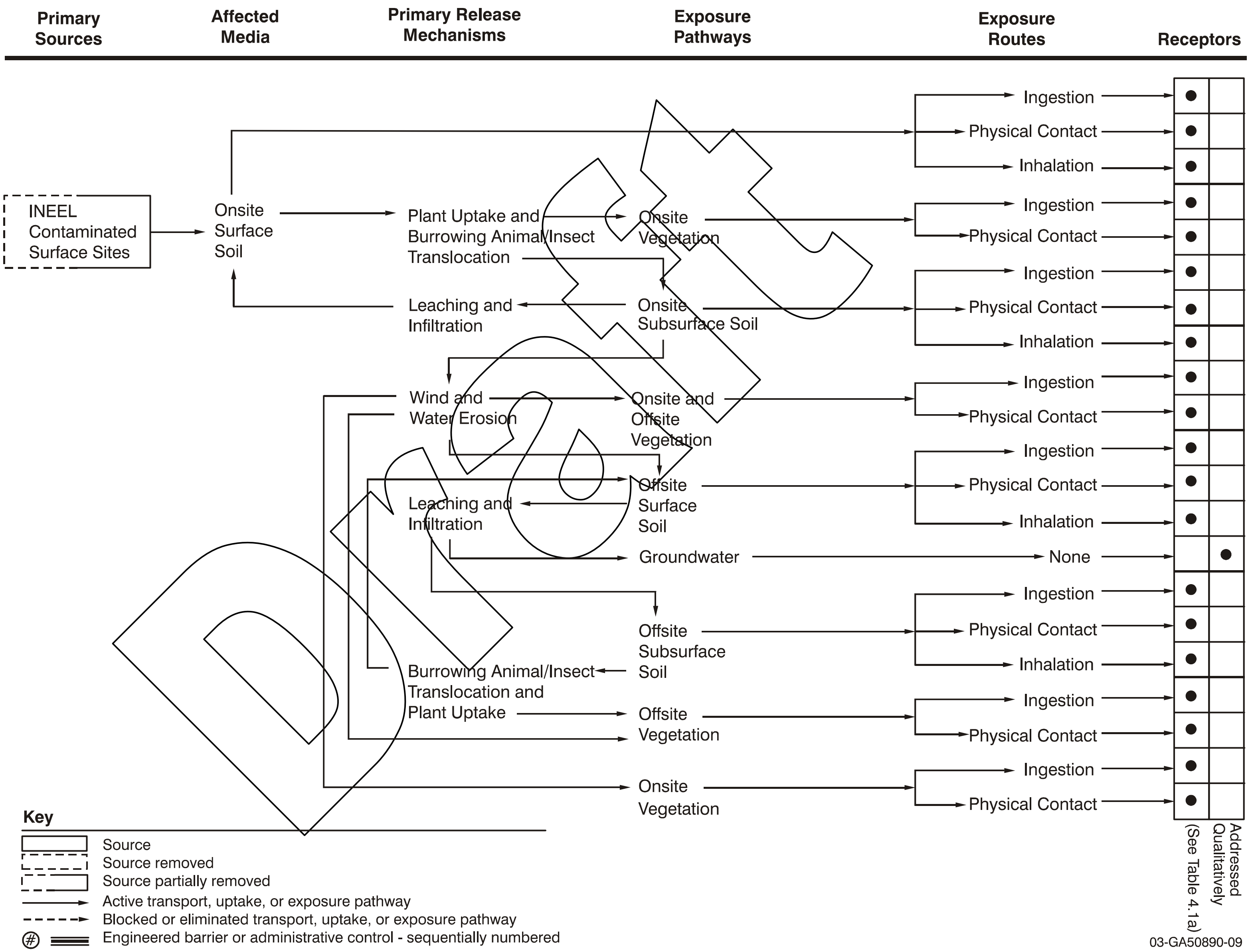

Figure 4-1a2a (continued). Site ecological receptors conceptual site model—current state.

Table 4-1a. Summary of exposure media and ingestion routes for Idaho National Engineering and Environmental Laboratory functional groups.

Receptor	Surface Soil	Subsurface Soil	Vegetation	Sediment	Prey Consumption		
					Invertebrates	Mammals	Birds
Amphibians (A232)	X	X			X		
Great Basin spadefoot toad	X	X			X		
Avian herbivores (AV122)	X						
Mourning dove	X						
Avian (aquatic) herbivores (AV143)			X	X			
Blue-winged teal			X	X			
Avian insectivores (AV222)	X				X		
Sage sparrow	X				X		
Avian carnivores (AV322)						X	
Loggerhead shrike						X	X
Ferruginous hawk						X	
Avian carnivores (AV322A)	X	X			X	X	
Burrowing owl	X	X			X	X	
Avian omnivores (AV422)			X		X	X	X
Black-billed magpie			X		X	X	X
Mammalian herbivores (M122)	X		X				
Mule deer	X		X				
Mammalian herbivores (M122A)	X	X	X				
Pygmy rabbit	X	X	X				
Mammalian insectivores (M210A)	X				X		
Townsend's western big-eared bat	X				X		
Mammalian carnivores (M322)	X					X	
Coyote	X					X	
Mammalian omnivores (M422)	X	X	X		X		
Deer mouse	X	X	X		X		
Reptilian insectivores (R222)	X	X			X		
Sagebrush lizard	X	X			X		
Plants	X	X					

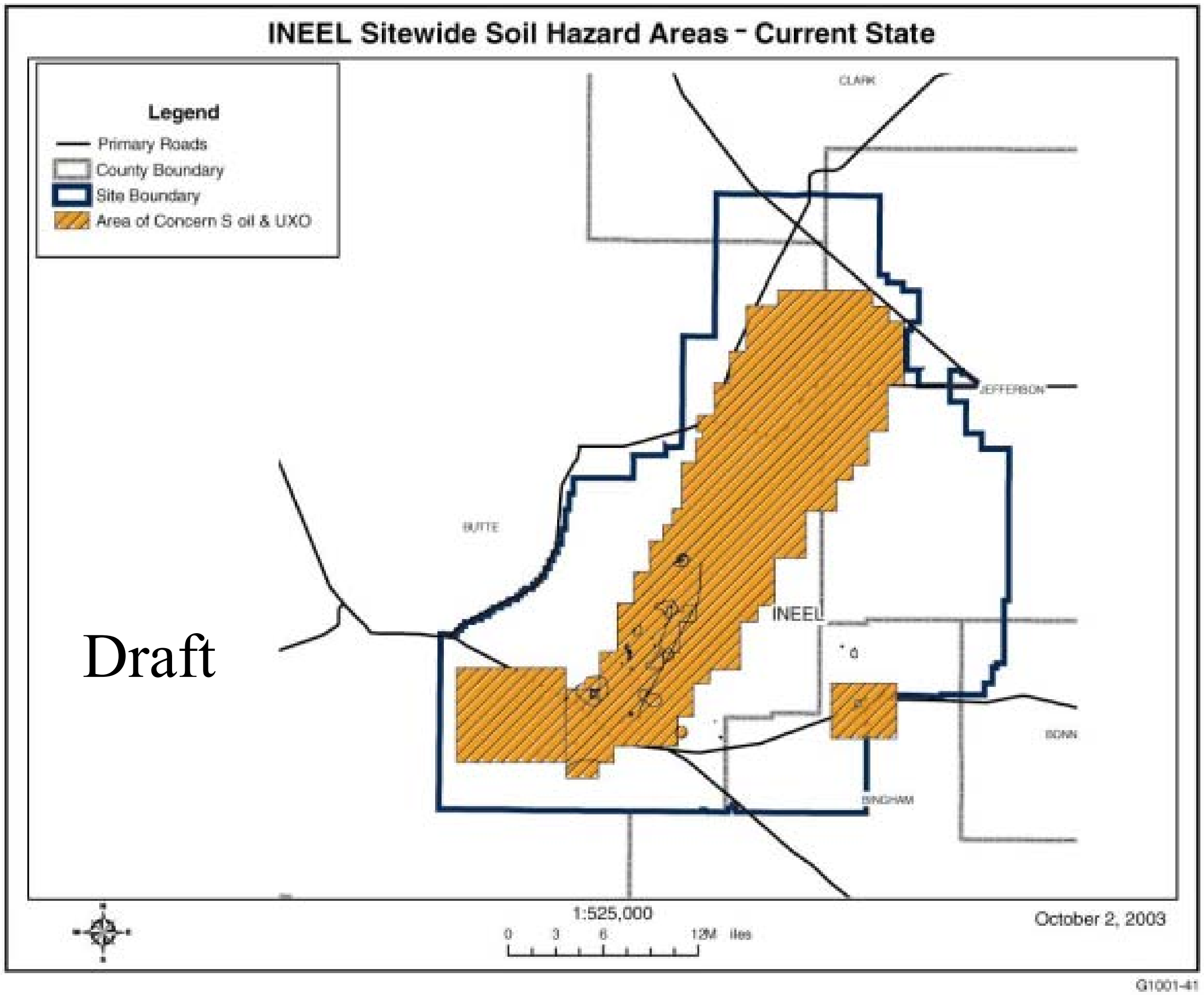

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Figure 4-1a1b. Sitewide soil map—current state.

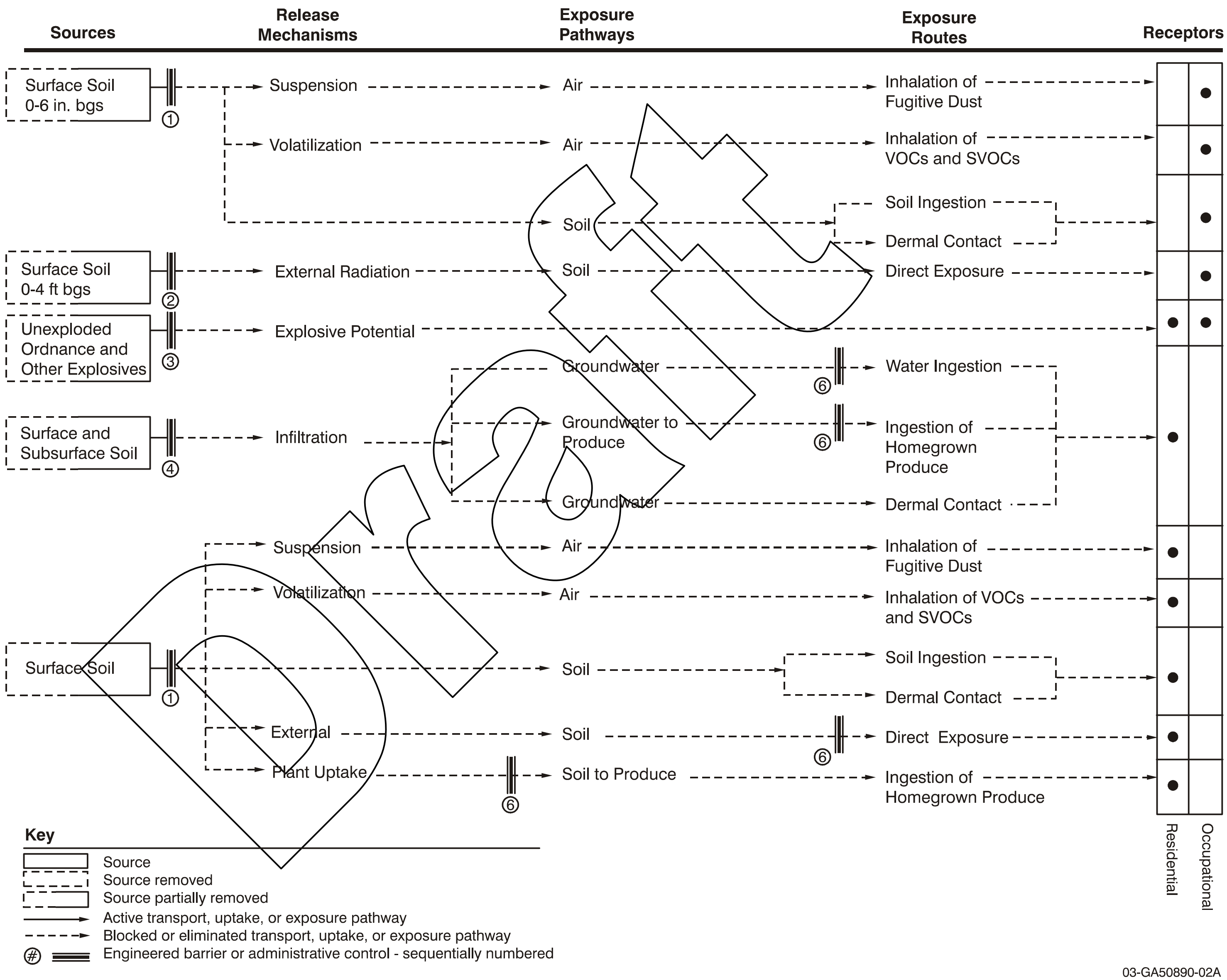

Figure 4-1a2b. Sitewide soil conceptual site model—current state.

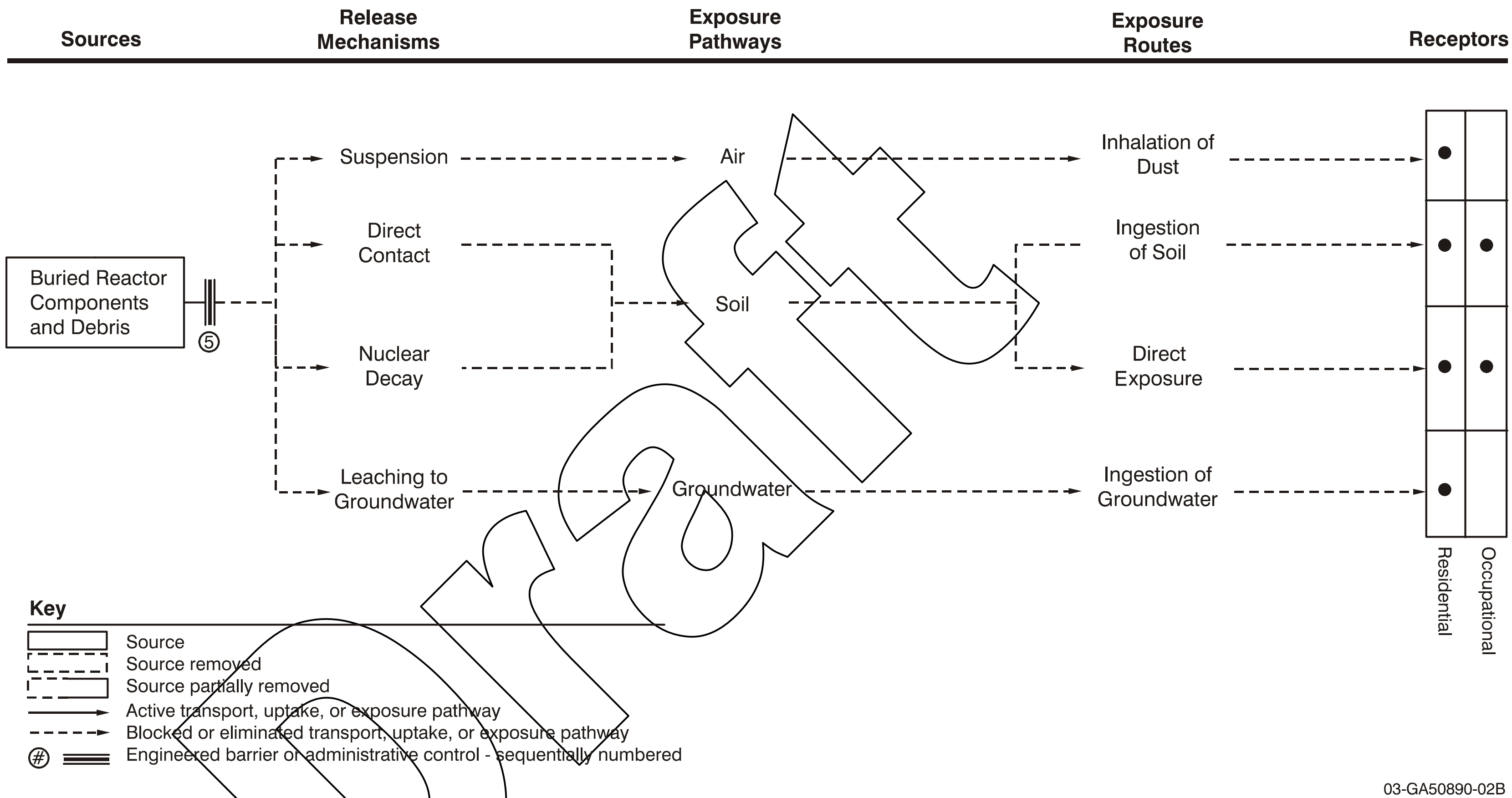

Figure 4-1a2b (continued). Sitewide soil conceptual site model—current state.

SVOC = semivolatile organic compound

Narrative for Figure 4-1a2b Sitewide Soil Conceptual Site Model—Current State

In the Sitewide soil hazard area, Sites EBR-08, Borax-01, Borax-02, Borax-08, and Borax-09 have been remediated. No further action is planned for these sites or for OMRE-01 and ORD-21. Remedial actions are still required for the STF-02 gun range, which has lead and copper contamination, and for the ordnance areas, which contain potential UXO and soil contaminated with explosive chemicals. Institutional controls are in place for all of the sites listed above, so there are no open pathways to human receptors.

The steps taken to mitigate or remove these hazards are as follows:

1. The only sites with remaining surface contamination are the STF-02 gun range and the ordnance areas. The surface contaminated soil was removed from EBR-08 and BORAX-08. The contaminated soil was covered with clean soil or an engineered barrier at BORAX-01, BORAX-02, and BORAX-09. Although some surface contamination was identified at OMRE-01, levels were below action levels, and no further action is required at this site.

   Institutional controls are in place at the STF-02 gun range and the ordnance areas to protect workers and the public. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

2. Radionuclide-contaminated soil was excavated and removed from BORAX-08. Some radionuclide-contaminated soil remains at BORAX-01, BORAX-02, and BORAX-09. Radionuclide contamination at OMRE-01 was determined to be below risk-based levels, so no further action is needed.

   Workers are protected from direct exposure to radionuclide contamination through institutional controls. These controls include posting of signs at contaminated sites, radiological training, and work control processes used to identify hazards and mitigation measures for planned work activities.

3. Some UXO has been removed at some of the higher-risk ordnance sites. However, the majority of the areas with potential UXO have not been surveyed or cleaned up. In addition, the Juniper Mine site (ORD-21) contains buried explosive material.

   Institutional controls are in place to protect workers and the public from inadvertent contact with explosive materials. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities. The Juniper Mine has institutional controls in place, including visible access restrictions (warning signs) and work control processes to prevent drilling and excavation.

4. Institutional controls to protect the public include site access restrictions and warning signs.

5. Buried reactor components are found at BORAX-02 and BORAX-08. The BORAX-02 reactor and contaminated soil were buried in place, and an engineered barrier was constructed over the site. The BORAX-09 reactor was entombed with concrete and buried under clean soil. Long-term institutional controls, including visible access restrictions (warning signs) and work control processes to restrict drilling and excavation, are in place while the cesium-137 decays to acceptable risk-based levels.

6. The entire INEEL Site has restricted access to prevent intrusion by the public. Visible access restrictions (warning signs) are in place at sites with institutional controls.

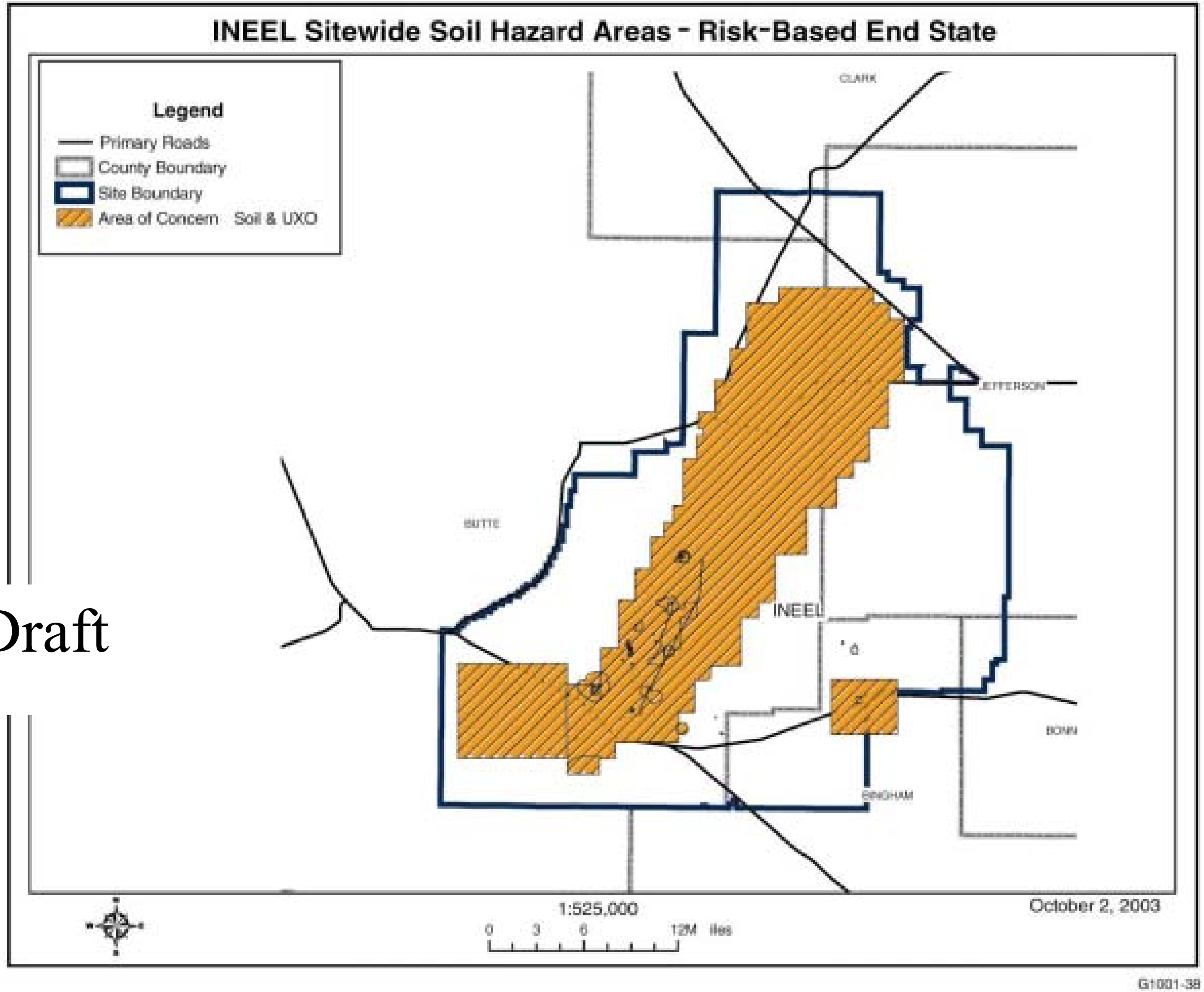

Figure 4-1b1b. Sitewide soil map—risk-based end state.

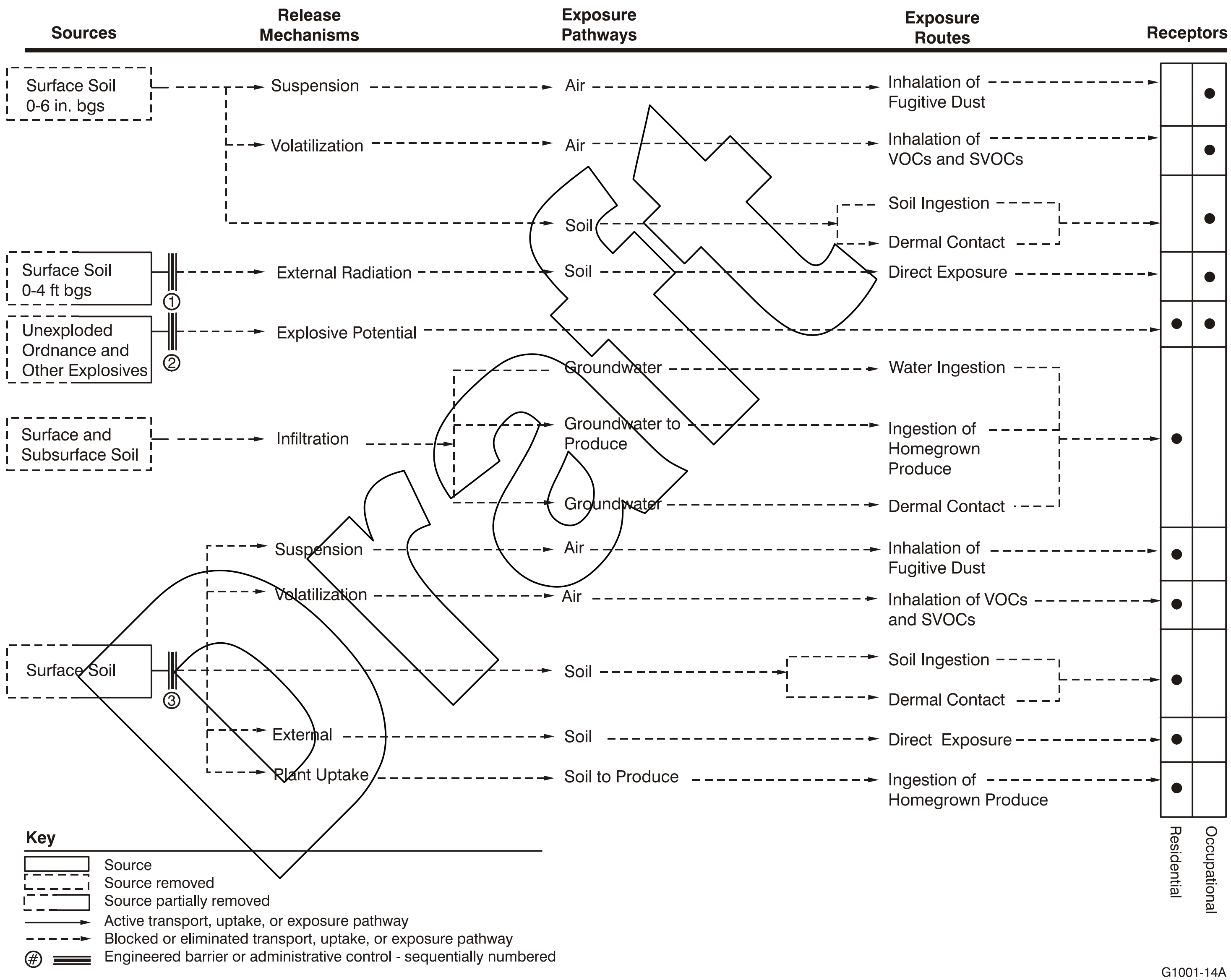

Figure 4-1b2b. Sitewide soil conceptual site model—risk-based end state.

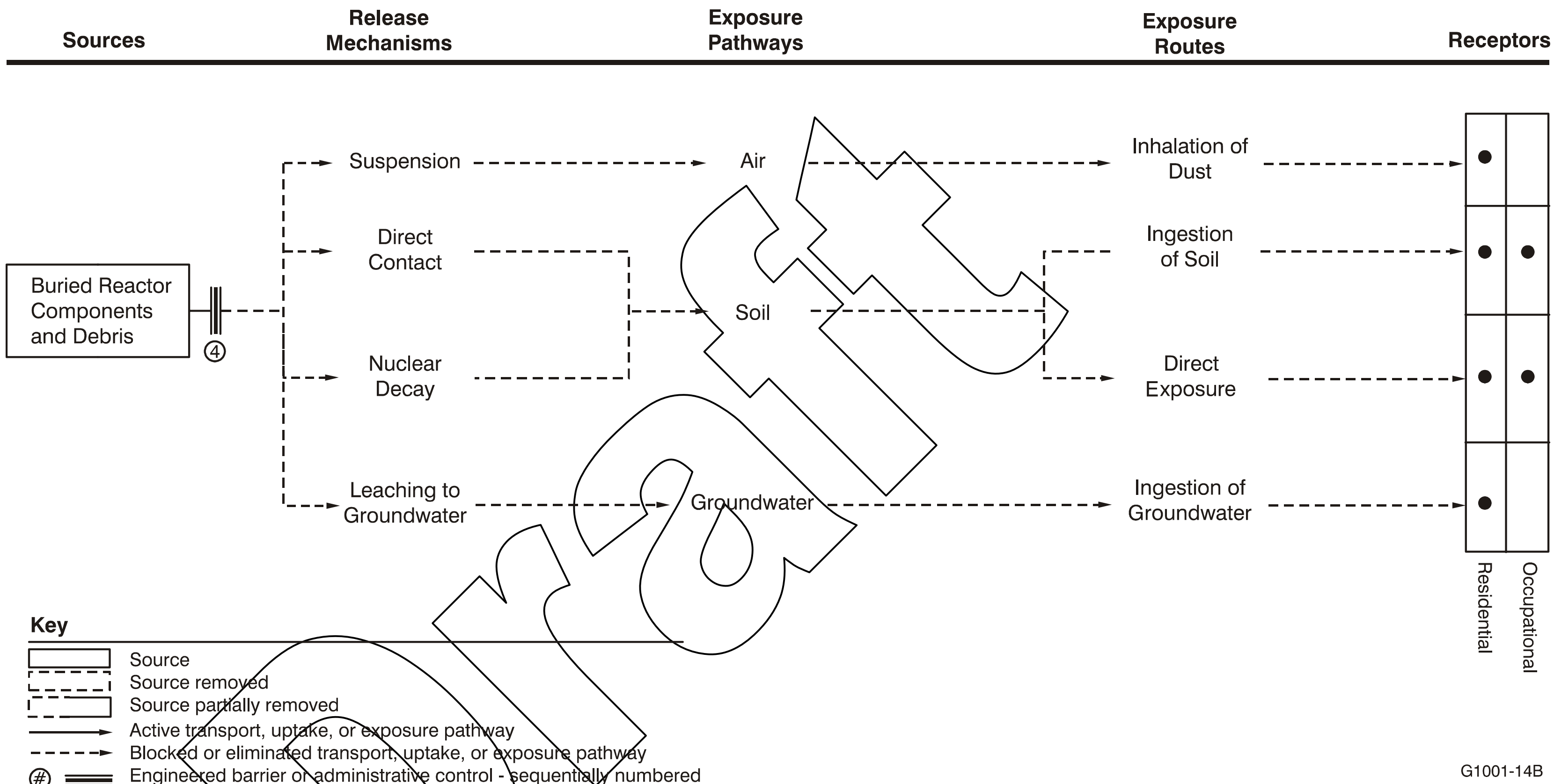

Figure 4-1b2b (continued). Sitewide soil conceptual site model—risk-based end state.

SVOC = semivolatile organic compound

Narrative for Figure 4-1b2b Sitewide Soil Conceptual Site Model—Risk-Based End State

Remedial actions will be completed for the STF-02 gun range, which has lead contamination. The selected remedy is excavation of contaminated soil and disposal in the ICDF. Lead that can be recovered from the soil will be recycled off-Site or treated before disposal. If the ROD selected remedy is implemented, no institutional controls are expected to be required at the gun range after cleanup. The ordnance areas will require long-term institutional controls. Institutional controls will also be required at the ORD-21 Juniper Mine. The BORAX sites and OMRE-01 leach pond site will require long-term institutional controls until cesium-137 decays to acceptable levels. It is also possible that EBR-08 Fuel Oil Tank site may require institutional controls past 2035 because of residual diesel contamination in subsurface soil.

The entire INEEL Site will continue to have restricted access to prevent intrusion by the public. Workers will be protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

The steps taken to mitigate or remove these hazards are as follows:

1. Some radionuclide-contaminated soil will remain at BORAX-01, BORAX-02, BORAX-09, and OMRE-01. Although no further action is needed, long-term institutional controls will be required at these sites. Workers will continue to be protected from direct exposure to radionuclide contamination through institutional controls. These controls include posting of signs at contaminated sites, radiological training, and work control processes used to identify hazards and mitigation measures for planned work activities.

2. Selected removal of UXO will have taken place at some of the higher-risk ordnance sites. In addition, cleanup of the TNT and RDX sites to appropriate and approved levels will have been completed. The ORD-21 Juniper Mine site will still contain buried potentially explosive material 135 ft below ground.

   Institutional controls will be required at the ordnance areas and the Juniper Mine to protect workers and the public from inadvertent contact with explosive materials. The INEEL Site will continue to have restricted access to prevent intrusion by the public. Workers will be protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities. The Juniper Mine will continue to have institutional controls in place, including visible access restrictions (warning signs) and work control processes to prevent drilling and excavation.

3. Some radionuclide-contaminated soil will remain at BORAX-01, BORAX-02, BORAX-09, and OMRE-01. Although no further action is needed, long-term institutional controls will be required to protect the public from exposure at these sites. The entire INEEL Site has restricted access and use to prevent intrusion by the public. Visible access restrictions (warning signs) are in place at sites with institutional controls.

4. Buried reactor components are found at BORAX-02 and BORAX-08. The BORAX-02 reactor and contaminated soil were buried in place, and an engineered barrier was constructed over the site. The BORAX-09 reactor was entombed with concrete and buried under clean soil. Long-term institutional controls, including visible access restrictions (warning signs) and work control processes to restrict drilling and excavation, will be required while the cesium-137 decays to acceptable risk-based levels.

4.1.2 Groundwater

Past and current activities at the INEEL, including reactor research, nuclear fuel reprocessing, nuclear waste storage, and other nuclear research, represent real or perceived risks to the eastern Snake River Plain Aquifer. Quantification of these risks requires improved understanding of local (e.g., waste disposal practices) and regional (groundwater recharge and mixing) processes that influence the quality of groundwater in the aquifer.

The aquifer is composed of two systems. The shallow, or effective, portion of the aquifer occurs from the water table (200–650 ft below land surface) to a depth of 980–1640 ft below land surface. Fast-moving, (5–34.5 ft/day), cold (48–60ºF) calcium- and magnesium-rich water characterizes this part of the aquifer. The deeper portion of the aquifer is characterized by slower moving (0.02–0.3 ft/day), warm (>85ºF) water. Recharge to the aquifer is primarily from the drainage of highlands north of the plain. Water in the aquifer flows generally southwestward and is discharged to the Snake River through a series of springs near Hagerman, Idaho, approximately 160 miles southwest of the INEEL. The INEEL covers about 9% of the aquifer. Depth to water varies from approximately 200 ft in the northeast corner of the INEEL to 1,000 ft in the southeast corner. Water-table contours for the aquifer below the INEEL are depicted in Figure 4-1c. The regional flow is to the south-southwest, though locally the direction of groundwater flow is affected by recharge from rivers, surface water spreading areas, groundwater pumping, and heterogeneity in the aquifer. Across the southern INEEL, the average gradient of the water table is approximately 5 ft/mile.

In areas where significant surface water percolates into the subsurface, lenses of water perch on low-permeability layers above the regional aquifer. These zones of perched water are associated with sources of surface water, such as the Big Lost River and unlined percolation ponds at facilities. They are of no economic importance but, where contaminated, can act as a continuing source of contamination with the potential of driving contaminants to the underlying aquifer.

Currently, approximately 290 wells are used to monitor the aquifer and perched water beneath the INEEL. DOE and the U.S. Geological Survey monitor the wells to satisfy various site-specific program objectives, while a few wells are monitored independently by smaller programs (e.g., ANL-W and the State of Idaho Oversight Program). The wells are monitored as often as quarterly, ranging to annually, depending upon the data needs.

WAG 10 includes regional aquifer concerns related to the INEEL that cannot be addressed on a WAG-specific basis. To address Sitewide groundwater issues and potential new sites, OU 10-08 was added under WAG 10. Information from the OU 10-08 investigation will be used to develop a baseline for groundwater information for institutional control and monitoring at the INEEL.

4.1.2.1 Current State. Figure 4-1a1c shows the current extent of plumes at the INEEL. Only those constituents above the Idaho Groundwater Quality Standards (or MCLs) for each facility are plotted. These plumes have generally reached a state of equilibrium with natural processes of diffusion, dispersion, sorption, and decay and appear stagnant or, in the case of tritium (caused by radioactive decay), appear to be retreating. The outermost contour value and constituent for each plume are listed in Table 4-1b. Discussions of plumes at the scale of individual facilities can be found in the following sections. In addition to the plumes shown, one monitoring well at INTEC is above MCLs for technetium-99, and two monitoring wells at CFA are above MCLs for nitrate. These are further discussed in Sections 4.3 and 4.5.

Table 4-1b. Idaho National Engineering and Environmental Laboratory Sitewide groundwater plumes—current state outermost contour values and constituents.

Facility	Contaminant	Contoured Value at Outer Edge of Plume (maximum contaminant level)
WAG 1 Test Area North	Trichloroethene	5 μg/L
WAG 2 Test Reactor Area	Chromium	100 μg/L
WAG 3 Idaho Nuclear Technology and Engineering Complex	Strontium-90	8 pCi/L
WAG 7 Radioactive Waste Management Complex	Carbon tetrachloride	5 μg/L

WAG = waste area group

Contaminated perched water has been identified at INTEC, TRA, and RWMC. Contaminated perched water exceeding MCLs will not be used for human consumption, and, therefore, the distribution of contaminants in perched water is not shown on a summary map. The preferred remedial action for sites with contaminated perched water is to remove or isolate the source of surface water contributing to the perched zone. Uncontaminated perched water may continue to be present because of the influence of the Big Lost River.

4.1.2.2 End State. Although active cleanup at the INEEL Site is expected to be completed by 2035, remediation of the aquifer at some sites is expected to continue beyond that date. CERCLA decisions and selection of remedies have been based on no contaminants above MCLs remaining in the aquifer by 2095. CERCLA 5-year reviews will be conducted to evaluate progress toward the RAOs. If trends indicate that the RAO may not be achieved, additional remediation actions may be identified as required by CERCLA. There are no plumes shown on Figure 4-1b1c because no modeling has been conducted to predict the condition of groundwater contamination in 2035, and all COCs are expected to be below MCLs at the points of compliance by 2095. Ability to reduce COCs below MCLs was one of the considerations used to select the CERCLA remedies.

4.1.2.3 Variances. No potential variances related to groundwater remediation have been proposed.

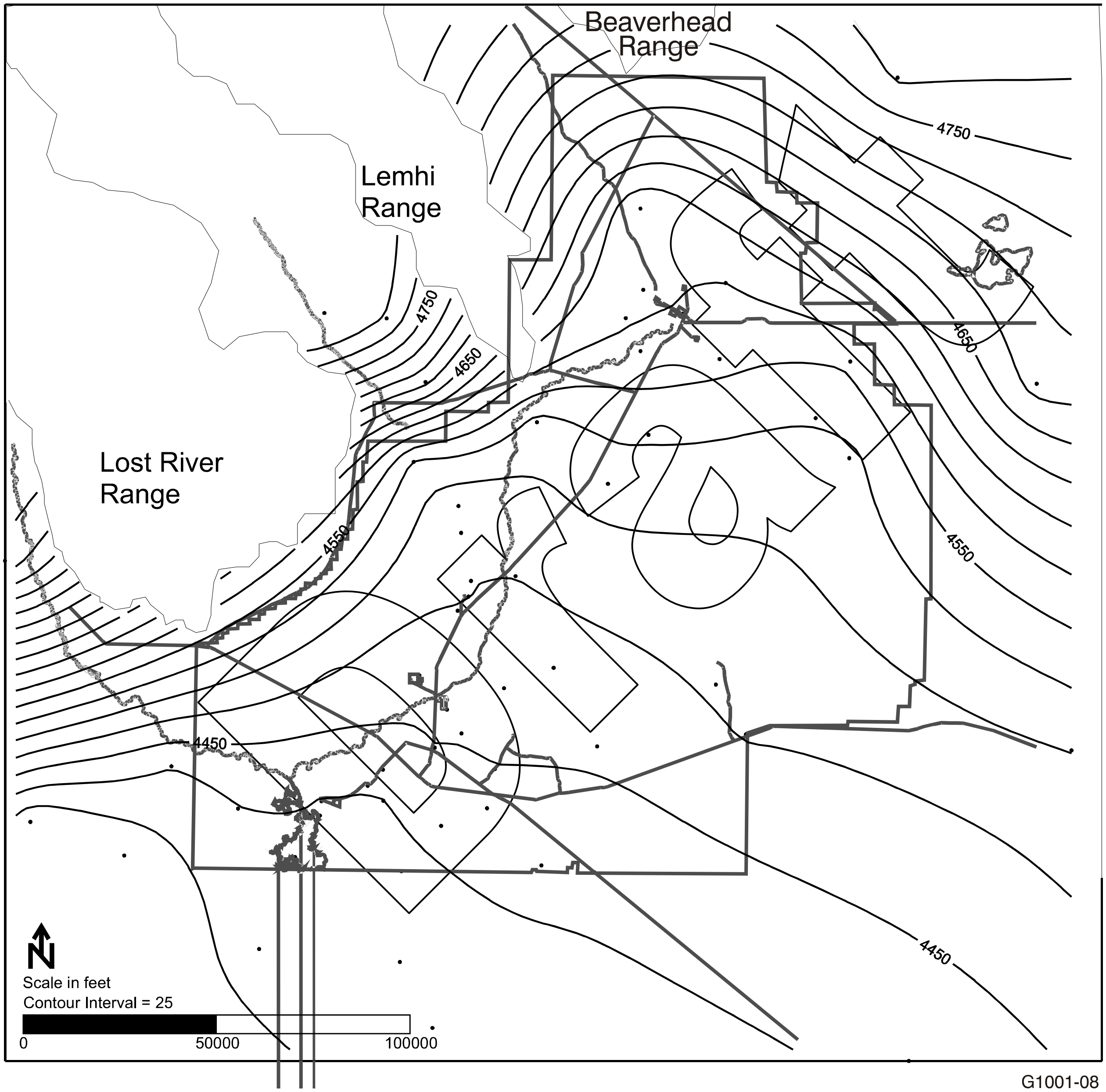

Figure 4-1c. Idaho National Engineering and Environmental Laboratory water table.

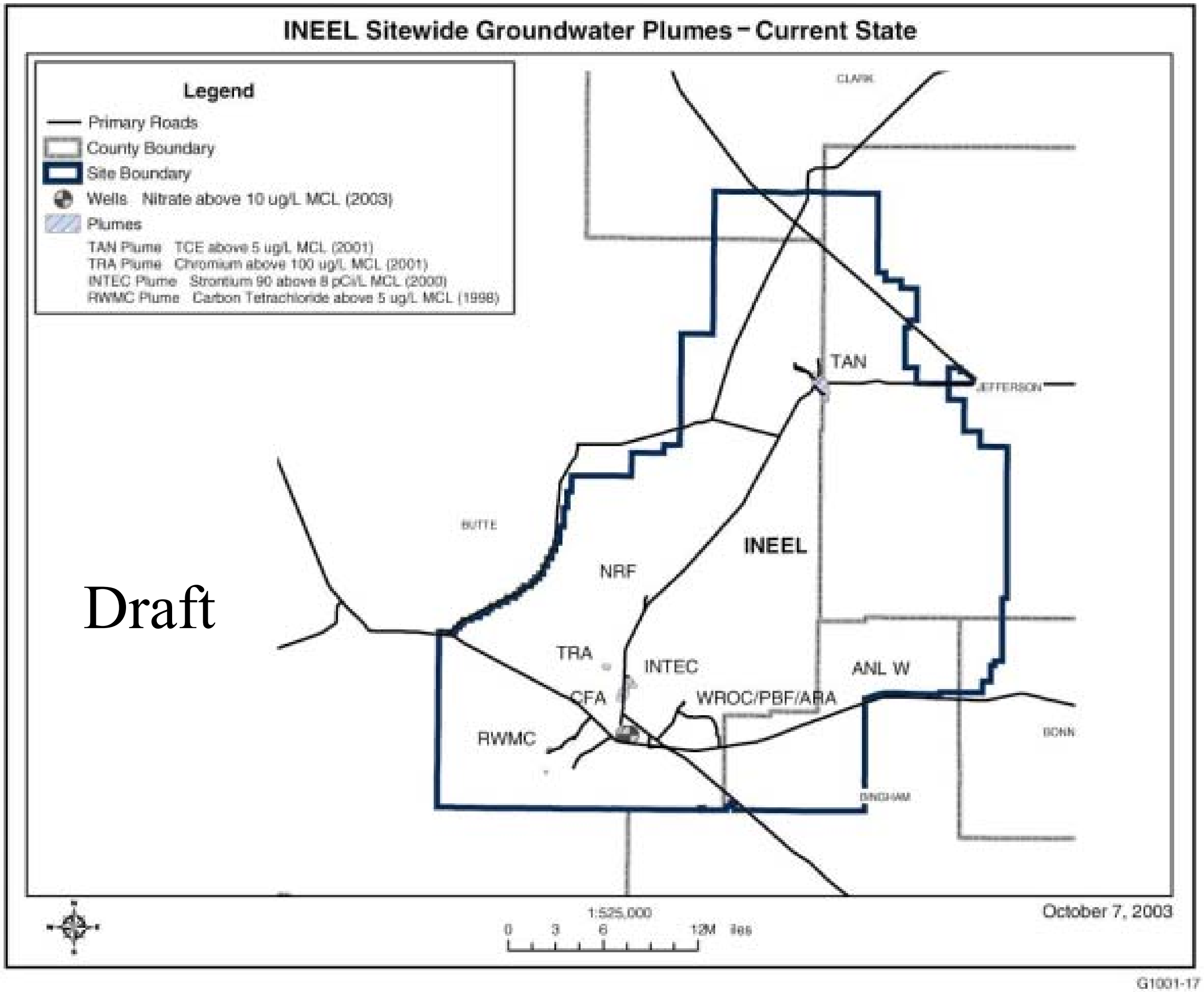

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Figure 4-1a1c. Sitewide groundwater map—current state.

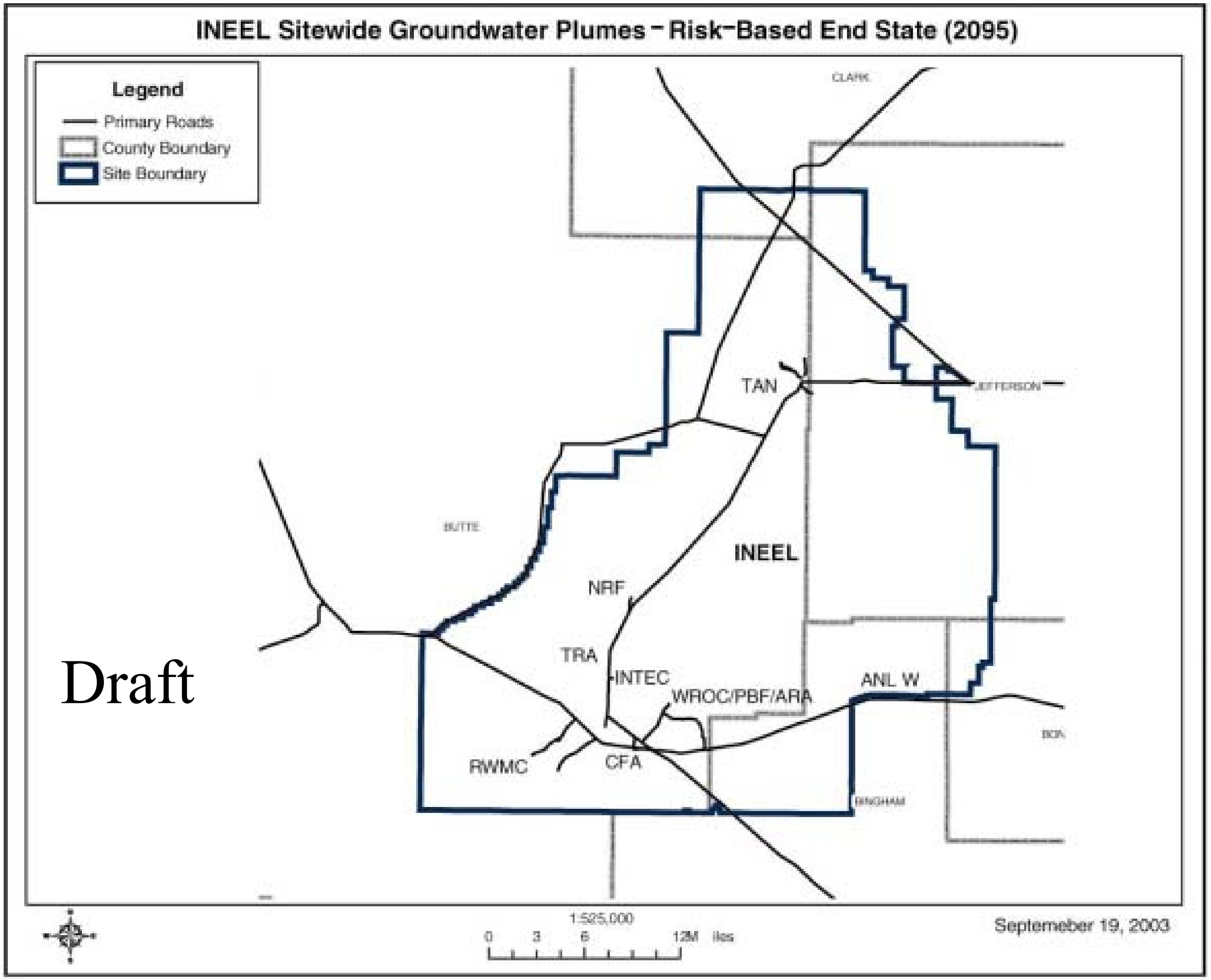

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Figure 4-1b1c. Sitewide groundwater map—risk-based end state.

4.2 Test Area North

Test Area North (TAN) was established in the 1950s by the U.S. Air Force and Atomic Energy Commission Aircraft Nuclear Propulsion Program to support nuclear-powered aircraft research. TAN is located approximately 50 miles northwest of Idaho Falls in the northern portion of the INEEL and extends over an area of approximately 12 square miles (see Figure 4-2). TAN is composed of two active operations areas: the Contained Test Facility and the Technical Support Facility (TSF). The third and fourth areas, the Water Reactor Research Test Facility (WRRTF) and the Initial Engine Test (IET) area, are inactive. TAN also maintains a small medical facility, a fire station, and a cafeteria.

The major program now located at the Contained Test Facility is the Specific Manufacturing Capability, which develops and produces tank armor for the U.S. Army. This program has a long-term mission and is managed by NE.

Three RODs exist for TAN: *Record of Decision for the Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23), Operable Unit 1-07A* (DOE-ID 1992b), *Record of Decision: Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action, Operable Unit 1-07B* (DOE-ID 1995d), and *Final Record of Decision for Test Area North, Operable Unit 1-10* (DOE-ID 1999a). A ROD amendment, expected to be signed in January 2004, is titled *Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B* (DOE-ID 2001b). There is also an *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2003b).

Figure 4-2. Aerial view of the Technical Support Facility at Test Area North with the Contained Test Facility in the background.

4.2.1 Current State

Sites addressed in the OU 1-10 ROD (DOE-ID 1999a) include tanks, spills, pits, and disposal sites. Surface and subsurface contaminants include radionuclides (cesium-137, cobalt-60, strontium-90, and uranium isotopes), metals (barium, cadmium, chromium, mercury, and silver), and VOCs (benzene, toluene, ethylbenzene, xylene, and trichloroethene [TCE]). A map showing current hazards at TAN is shown in Figure 4-2a1. The two sites not displayed on the map are the IET-04 (IET Stack Rubble Site), located north of TSF, and TSF-39 (TSF Transite [Asbestos] Contamination), located northwest of TSF.

The OU 1-10 ROD (DOE-ID 1999a) addresses remedial actions for eight identified release sites within TAN that may present an imminent and substantial endangerment to human health and the environment. These sites include:

- Intermediate-Level (Radioactive) Waste Disposal System (TSF-09) and Contaminated Tank Southeast of Tank V-3 (TSF-18), referred to as the V-Tanks
- PM-2A Tank Contents and Contaminated Soils (TSF-26), referred to as the PM-2A Tanks
- TAN/TSF-1 Area (Soil Area) (TSF-06, Area B), referred to as the contaminated soil area
- TAN Disposal Pond (TSF-07)
- TSF Burn Pit (TSF-03) and WRRTF Burn Pits I, II, III, and IV (WRRTF-01), referred to as the burn pits
- WRRTF Fuel Leak (WRRTF-13), referred to as the fuel leak.

For the V-Tanks (TSF-09 and TSF-18) containing liquids and sludges, the OU 1-10 ROD is currently being amended. The potential COCs for the three tanks are metals (e.g., mercury, chromium, and lead), VOCs (e.g., tetrachloroethene, trichloroethene, and carbon tetrachloride), semivolatile organic compounds (e.g., polychlorinated biphenyls), and radionuclides (e.g., cesium-137, cobalt-60, strontium-90, and various isotopes of plutonium and uranium) (Blackmore et al. 1997; INEEL 1994). The proposed remedy will include removal and treatment of VOCs and semivolatile organic compounds by chemical oxidation; stabilization of the tank contents; removal of the tanks and piping; and disposal of the tank contents, tanks, and piping at the ICDF. The contaminated soil will be excavated and disposed of at the ICDF. The excavation will be backfilled and recontoured. Institutional controls consisting of signs, access controls, and land-use restrictions may be established and maintained depending on the results of postremediation sampling.

For the PM-2A Tank Contents and Contaminated Soils (TSF-26), the selected remedy is soil excavation, tank content removal and treatment (if needed), and disposal. This will include removal of the tanks and contents and disposal at the ICDF. TSF-26 remediation includes excavation of contaminated soil and disposal at the ICDF and backfill, contouring, and revegetation of the area. Institutional controls consisting of signs, access controls, and land-use restrictions may be established and maintained depending on the results of postremediation sampling.

For the soil contamination area (TSF-06, Area B), the selected remedy is excavation and disposal. Surface soil at this site was contaminated by windblown radioactive particles from the contaminated soil at the PM-2A Tanks site. The COC is cesium-137. This will include excavation of the contaminated soil; disposal at the ICDF; and backfill, contour, and revegetation of the area.

For the TAN Disposal Pond (TSF-07), the selected remedy is limited action, which included soil sampling at the end of use to determine the levels of cesium-137 present. The pond is currently in use and will undergo assessment when operations cease. Although contamination was left in place, it will naturally decay to acceptable levels within the 100-year institutional control period. Maintenance of existing institutional controls and environmental monitoring will continue until 2097 to allow the remaining cesium-137 to decay to acceptable levels.

For the TSF Burn Pit (TSF-03), the remediation will include removal of the contaminated soil; disposal at the ICDF; and backfill, recontour, and revegetation. No institutional controls will be required after remediation.

For the WRRTF Burn Pits (WRRTF-01), the remediation will consist of the application of a soil cap over Burn Pits II and IV with revegetation and institutional controls, based on the presence of asbestos above action levels. The remedy also includes placement of permanent granite monuments. Pits I and III no longer require remediation (soil covers) or institutional controls and are changed to no action sites.

Six release sites that potentially pose risks to human health are the TSF-06, Area B, contaminated soil area, the TSF-07 TAN Disposal Pond, the TSF-09 and TSF-18 V-Tanks soil contamination, the TSF-26 PM-2A Tanks soil contamination area, and the TSF-08 mercury spill. In addition, there are three sites (WRRTF-01 Burn Pits, TSF-03 Burn Pit, and WRRTF-13 Fuel Leak) that contain contaminants (i.e., cesium-137, asbestos, and petroleum hydrocarbons) at concentrations greater than regulatory limits. Four currently operational facilities (Radioactive Parts Security Storage Area Buildings TAN-647 and TAN-648 and Pads, TAN-607 Hot Shop Facility, and Radioactive Liquid Waste Treatment and Transfer/Storage Buildings [TAN-616 and TAN-666]) have been identified in the CERCLA ROD as having potential for producing releases in the future. All these sites are under institutional control, as well as 10 other sites.

There are two other sites with known radioactive contamination. The first site is TSF-06, Area 10 (the buried Heat Transfer Reactor Experiment vessel site), where contamination is fixed to the surfaces of a reactor vessel that is buried inside a vault located more than 10 ft below ground surface. The primary contaminants for this site are assumed to be cesium-137, cobalt-60, and strontium-90. The second site is IET-04 (the buried IET Stack Rubble Site), where contamination is fixed to the surfaces of stack rubble that also is buried greater than 10 ft below ground surface. The contamination at these two sites is not predicted to migrate away from the buried material, so it is not expected that humans or ecological receptors will be exposed to it.

Two other release sites, TSF-09 and TSF-18 (the V-Tanks) and TSF-26 (the PM-2A Tanks), contain highly contaminated liquid and sludge waste. These tanks were part of a system that collected and treated radioactive liquid waste from TAN operations, beginning with the Aircraft Nuclear Propulsion Program in the 1950s and early 1960s. The tanks contain various amounts and concentrations of radionuclides, organic compounds (including polychlorinated biphenyls), and inorganic compounds (including metals, such as mercury). There is no evidence that contamination has leaked from the tanks; however, the soil surrounding the tanks was contaminated by waste spilled during tank transfer operations.

A conceptual site model was developed as part of the *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (Blackmore et al. 1997) and the *Comprehensive Remedial Investigation and Feasibility Study Supplement for the Test Area North Operable Unit 1-10 at the Idaho*

National Engineering and Environmental Laboratory (DOE-ID 1998a). This model, which has been updated to reflect 2003 conditions, is shown in Figure 4-2a2a.

The OU 1-07B ROD (DOE-ID 1995d) addresses remedial action for the TSF injection well (TSF-05) and surrounding groundwater contamination (TSF-23). The TSF injection well was used from 1953 to 1972 to dispose of TAN liquid waste into the fractured basalt of the Snake River Plain Aquifer. This waste included organic, inorganic, and low-level radioactive wastewater added to industrial and sanitary wastewater. The contaminants identified at concentrations above risk-based levels in the groundwater are organic TCE; cis- and trans-1,2-dichloroethene; and radionuclides (strontium-90, tritium, cesium-137, and uranium-234). OU 1-07B is defined as the groundwater beneath TAN that has, or is expected to have, concentrations of TCE above the Safe Drinking Water Act MCL. TCE is being used as the indicator constituent for defining the groundwater plume because it is the most widely distributed COC in TAN groundwater.

Exposure scenarios evaluated in the *Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at the Idaho Nuclear Engineering and Environmental Laboratory* (Kaminsky et al. 1994) considered industrial and residential long-term (chronic) exposures. Chronic exposures evaluated assumed contaminant exposures to workers over a 200-year period and to residents living in the study area over a 30-year period. The groundwater conceptual site model from the baseline risk assessment was updated to reflect 2003 conditions and is shown in Figure 4-2a2b.

A number of sites at TAN are under institutional control, and some will remain under institutional control after 2035. The WAG 1 sites currently under the institution control area are listed below:

- IET-04 Stack Rubble Pit—The COCs are radionuclides.
- TSF-03 Burn Pit—The COC is lead.
- TSF-05 Injection Well—The COCs are trichloroethene, other volatile organics, and some radionuclides.
- TSF-06, Area 1, TAN/TSF Soil Area, soil area—The COC is radionuclides. The radionuclides include cobalt-60, cesium-137, thorium-232, and uranium-238.
- TSF-06, Area 5, TAN/TSF Soil Area, Radioactive Soil Berm—The COC is radionuclides, including cobalt-60 and cesium-137.
- TSF-06, Area 11, TAN/TSF Soil Area, TSF-06 Ditch—The COC is radionuclides, including cobalt-60, cesium-137, and europium-154.
- TSF-06, Area B, TAN/TSF Soil Area, soil area—The COC is cesium-137.
- TSF-07 Disposal Pond—The COC is cesium-137.
- TSF-08 Heat Transfer Reactor Experiment III Mercury Spill Sites 13B and 13C—The COC is mercury.
- TSF-09 TSF Intermediate-Level (Radioactive) Waste Disposal System—The COC is cesium-137.
- TSF-10 Drainage Pond—The COCs are metals and radionuclides.

- TSF-18 Contaminated Tank Southeast of Tank V-3—The COC is cesium-137.
- TSF-23 Contaminated Groundwater Beneath TSF—The COCs are trichloroethene, other volatile organics, and radionuclides, including strontium-90, hydrogen-3, cesium-137, and uranium-234.
- TSF-26 PM-2A Tanks—The COC is cesium-137.
- TSF-28 Sewage Treatment Plan and Sludge Drying Beds—The COC is radionuclides.
- TSF-29 Acid Pond—The COC is radionuclides, including americium-241, curium-234/244, cesium-137, neptunium-237, and uranium-235.
- TSF-39 Transite (Asbestos) Contamination—The COC is asbestos.
- TSF-42 TAN-607 Room-161 Contaminated Pipe—The COC is radionuclides.
- TSF-43 Radioactive Parts Security Storage Area Buildings 647 and 648 and pads—The COC is radionuclides.
- WRRTF-01 Burn Pits I, II, III, and IV—The COC is lead.

Institutional controls consist of visible access restrictions, control of activities, and prevention of well drilling. During DOE control postoperations, the controls consist of access restrictions and control of activities and property lease requirements including control of land use if required based on results of remedial action. Institutional controls will be used indefinitely unless the site is released based upon documentation in a 5-year review.

TAN also has a number of tanks and other items identified as requiring characterization or closure under RCRA as identified in the VCO between the Idaho Department of Health and Welfare and the DOE. RCRA closure is the required action for TAN-616 Low-Level Radioactive Waste System (VCO number TAN-008) and tanks identified in VCO number TAN-005, including TAN-020 Heat Transfer Reactor Experiment Mercury Contamination Sump (Loss-of-Fluid Test Facility) and TAN-031 TSF Demineralized Water System.

4.2.2 End State

Facilities at TAN will be closed to industrial standards. By 2024, all facilities at TAN with no identified future use will be removed. WRRTF will be deactivated and decommissioned by 2008. The bulk of the Loss-of-Fluid Test Facility will be deactivated and decommissioned by 2022. TAN-607 Hot Shop will be deactivated by 2012 and decommissioned by 2018, with all remaining decommissioning at TAN completed by 2024 (not including NE-owned buildings). Items that pose no threat to occupants or that provide utilities to occupants will remain. These include roads, railroad tracks, drainage wells, drainage ponds, electrical substations, parking lots, paved lay-down areas, concrete or asphalt pads, fences, utility poles, utility lines, foundations below grade, uncontaminated underground piping, and berms. A map showing the risk-based end state for TAN is shown in Figure 4-2b1. TSF-39 (TSF-39 Transite [Asbestos] Contamination) will require institutional controls past 2035, but is not shown on the map because it is located too far from the other TAN facilities to be visible on the map.

Remediation of sites under the OU 1-10 ROD (DOE-ID 1999a) is planned to be completed by 2008, with the exception of potential contaminated soil under buildings or structures (i.e., collocated facilities). For example, the V-Tank contents, tanks, and associated piping will be removed, and the surrounding soil will be excavated and disposed of. The TSF-07 Disposal Pond, the TSF-09 and TSF-18 V-Tanks soil area, the TSF-26 PM-2A Tanks soil area, the WRRTF-01 Burn Pits, the TSF-08 Mercury Spill Area, the TSF-10 Drainage Pond, and the TSF-39 TSF Transite Contamination Area may require institutional controls beyond 2035, depending on results of the 5-year reviews. A risk-based end state conceptual site model is shown in Figure 4-2b2a.

By 2035, active remedial action of the contaminated groundwater plume at TAN is expected to be complete. However, monitoring and maintenance of the residual plume and institutional controls will continue as part of the monitored natural attenuation remedy until the entire plume reaches the RAOs identified in the Fiscal Year 2001 *Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B* (DOE-ID 2001b). The timeframe identified for all remediation activities to be complete and for the plume to meet RAOs is 2095.

Cleanup of TAN groundwater involves application of three technologies to remediate three zones of the contaminated plume: in situ bioremediation (hot spot), pump and treat (medial zone), and monitored natural attenuation (distal zone). To implement the in situ bioremediation process, sodium lactate is injected into the aquifer to stimulate naturally occurring microbes in the subsurface to digest and break down contaminants. Pump-and-treat technology is used to extract contaminated groundwater from the aquifer, treat it to remove the hazardous constituents, and reinject clean water back into the aquifer. Monitored natural attenuation takes advantage of naturally occurring bacteria to break down the hazardous waste chemical, TCE, into harmless end products.

By 2035, monitored natural attenuation is anticipated to be the only portion of the remedial action still being used to clean up the contaminated aquifer. A risk-based end state conceptual site model is shown in Figure 4-2b2b. Analysis of groundwater data collected from 1989 to 1997 provided the basis for recommending monitored natural attenuation. By comparing TCE concentrations in the distal zone to those of two other contaminants, tetrachloroethene and tritium, it has been determined that TCE is degrading at a rate that will meet cleanup objectives. Monitoring data will be evaluated to verify that the aquifer will be restored by 2095.

4.2.3 Variances

A potential variance related to contaminated soil at TAN is discussed in Table 5-1. The ROD selected remedy was based on scenarios that included residential receptors after 100 years. It is proposed that an evaluation be conducted to determine the level of cleanup that would be required to protect occupational receptors, assuming no future residential use of the TAN site and surrounding area.

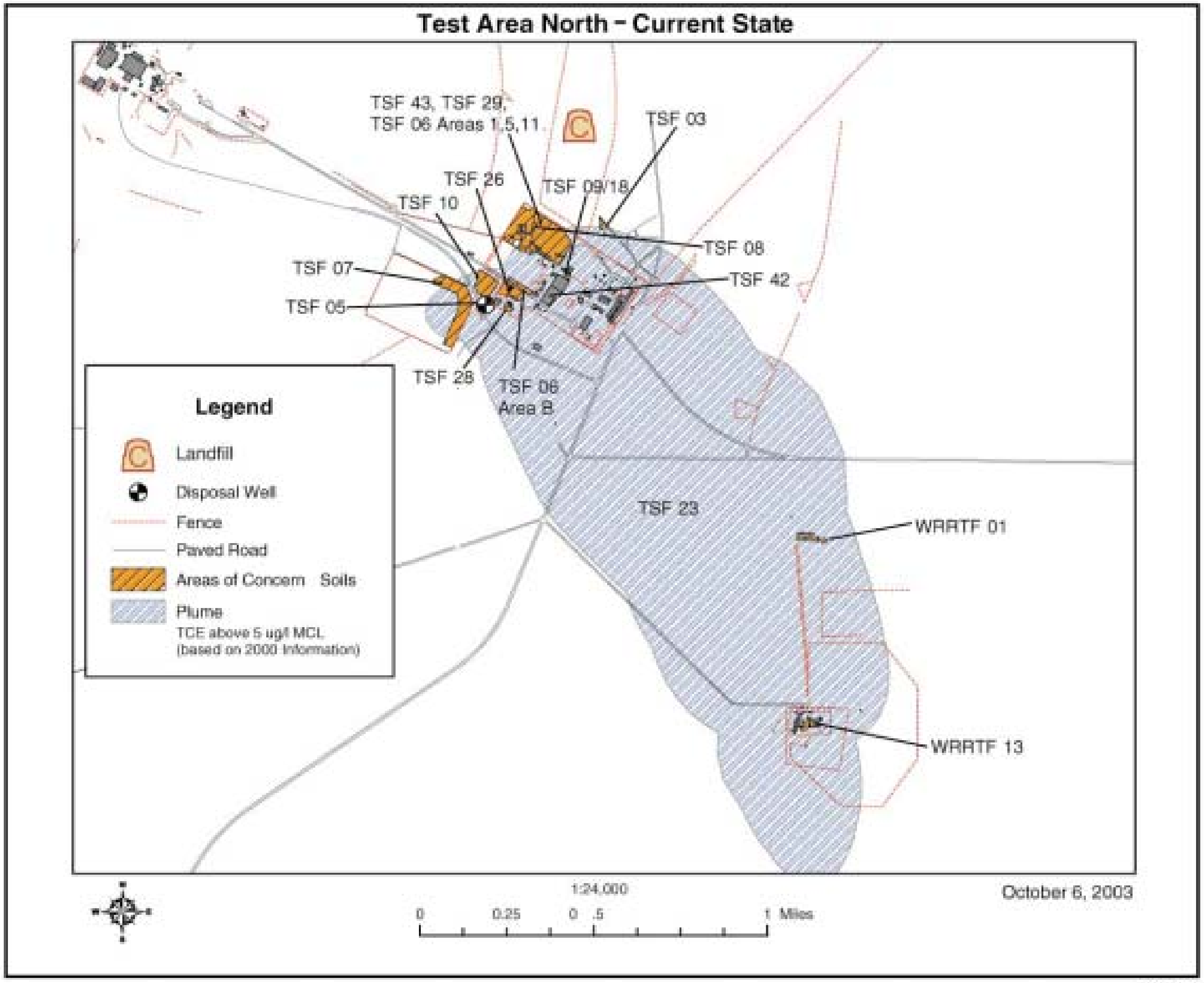

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Figure 4-2a1. Test Area North map—current state.

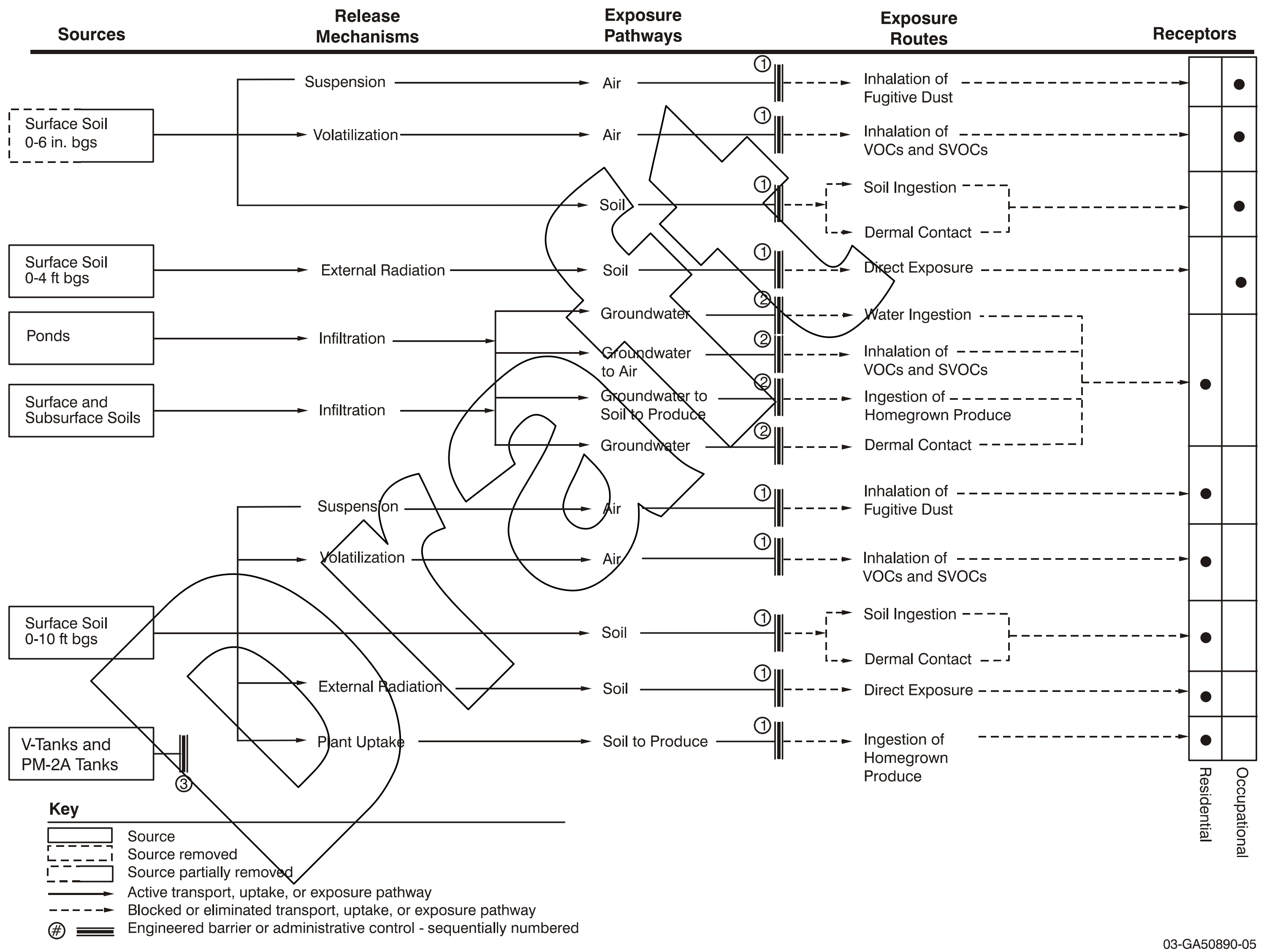

Figure 4-2a2a. Test Area North conceptual site model—current state.

SVOC = semivolatile organic compound

Narrative for Figure 4-2a2a Test Area North Conceptual Site Model—Current State

The OU 1-10 ROD (DOE-ID 1999a) addresses remedial actions for eight identified release sites within TAN that may present an imminent and substantial endangerment to human health and the environment. To date, characterization activities and removal of approximately 532 m^3 of contaminated soil have been performed.

The steps taken to mitigate or remove these hazards are as follows:

1. Sites that present an unacceptable risk to human health and the environment have institutional controls, and access is restricted. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities. The federal government will ensure that access and use restrictions are maintained and enforced until an acceptable risk level is attained.

2. The sites include the TSF-07 Disposal Pond, the TSF-10 Drainage Pond, and the TSF-29 Acid Pond. The TSF-07 Disposal Pond is an unlined disposal pond located southwest of TSF outside the facility fence. The TSF-07 Disposal Pond is currently in use and will undergo assessment when operations cease. The TSF-10 Drainage Pond is for surface water discharge. The TSF-10 Drainage Pond is a no further action site with institutional controls, because metals and low-level radionuclide contamination may be present. The TSF-29 Acid Pond is an unlined pond east of the Radioactive Parts Security Storage Area that received radioactive and treated wastewater from 1955 to 1958 in support of the Aircraft Nuclear Propulsion Program. In 1976, the TSF-29 Acid Pond was partially backfilled with soil containing radioactive particles from cleanup operations around TSF. It is also a no further action site with institutional controls. The sites are posted and have restricted access and use.

3. The V-Tanks buried at TSF-09/18 and the PM-2A Tanks buried at TSF-26 are currently administratively controlled. The sites are fenced and posted with signs that identify them as CERCLA sites. Entry into the sites requires radiological control precautions. The purpose of these controls is to keep worker exposures as low as reasonably achievable and to prevent the spread of contaminated soil. As-low-as-reasonably-achievable controls reduce occupational risks at these sites to acceptable levels. Risks from the tank contents were not evaluated in the *WAG-1 OU 1-10 Comprehensive Remedial Investigation/Feasibility Study Baseline Risk Assessment Technical Memorandum* (Burns 1995) because there is no evidence to indicate that the tanks have ever leaked. Therefore, potential pathways to receptors are not shown on the conceptual site model. Liquid-level measurements track the fluid levels in tanks V-1, V-2, and V-3. Tank contents were included in the site's feasibility study evaluation because they are so highly contaminated that they would produce unacceptable human health and ecological risks if they were to escape into the environment.

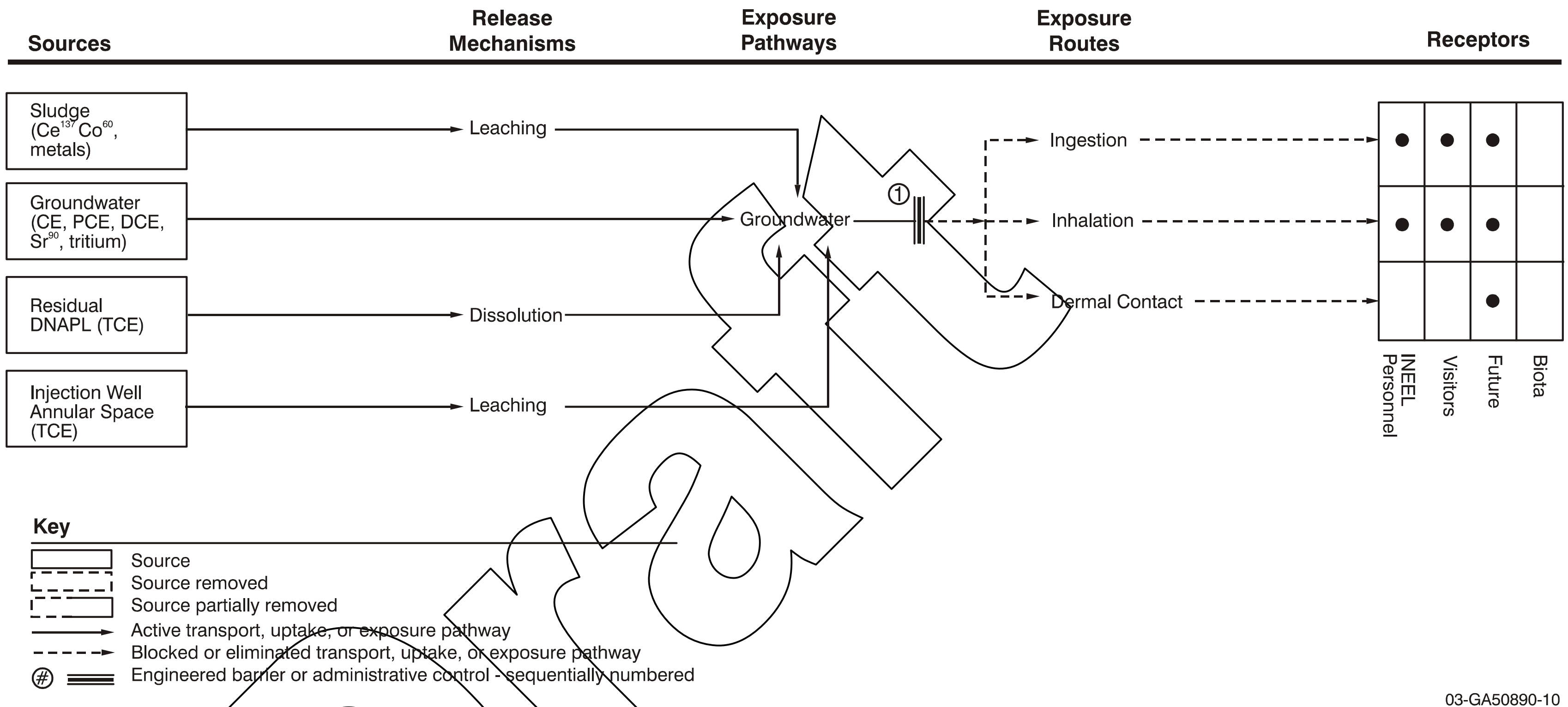

Figure 4-2a2b. Test Area North groundwater conceptual site model—current state.

Ce^{137} = cesium-137	DNAPL = dense nonaqueous phase liquid
Co^{60} = cobalt-60	PCE = tetrachloroethene
DCE = 1,2-dichloroethene	Sr^{90} = strontium-90

Narrative for Figure 4-2a2b Test Area North Groundwater Conceptual Site Model—Current State

To implement the in situ bioremediation process, sodium lactate is injected into the aquifer to stimulate naturally occurring microbes in the subsurface to digest and break down contaminants. Pump-and-treat technology is used to extract contaminated groundwater from the aquifer, treat it to remove hazardous constituents, and reinject clean water back into the aquifer. Monitored natural attenuation takes advantage of naturally occurring bacteria to break down the hazardous waste chemical, TCE, into harmless end products.

The steps taken to mitigate or remove these hazards are as follows:

1. In situ bioremediation in the hot spot, pump and treat in the medial zone, and monitored natural attenuation in the distal zone. Occupational access will be restricted until completion of the remediation is verified by postremediation sampling. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

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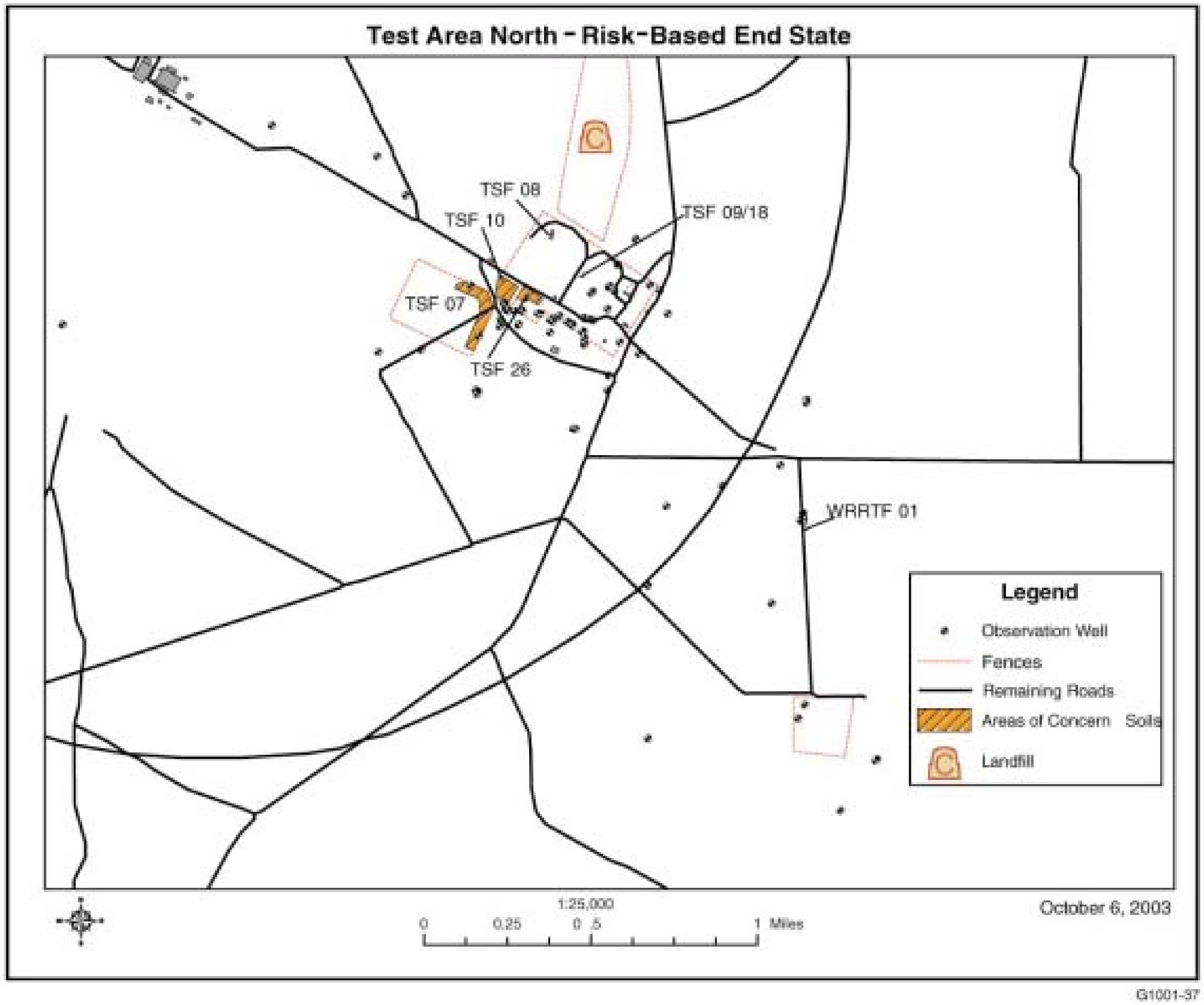

Figure 4-2b1. Test Area North map—risk-based end state.

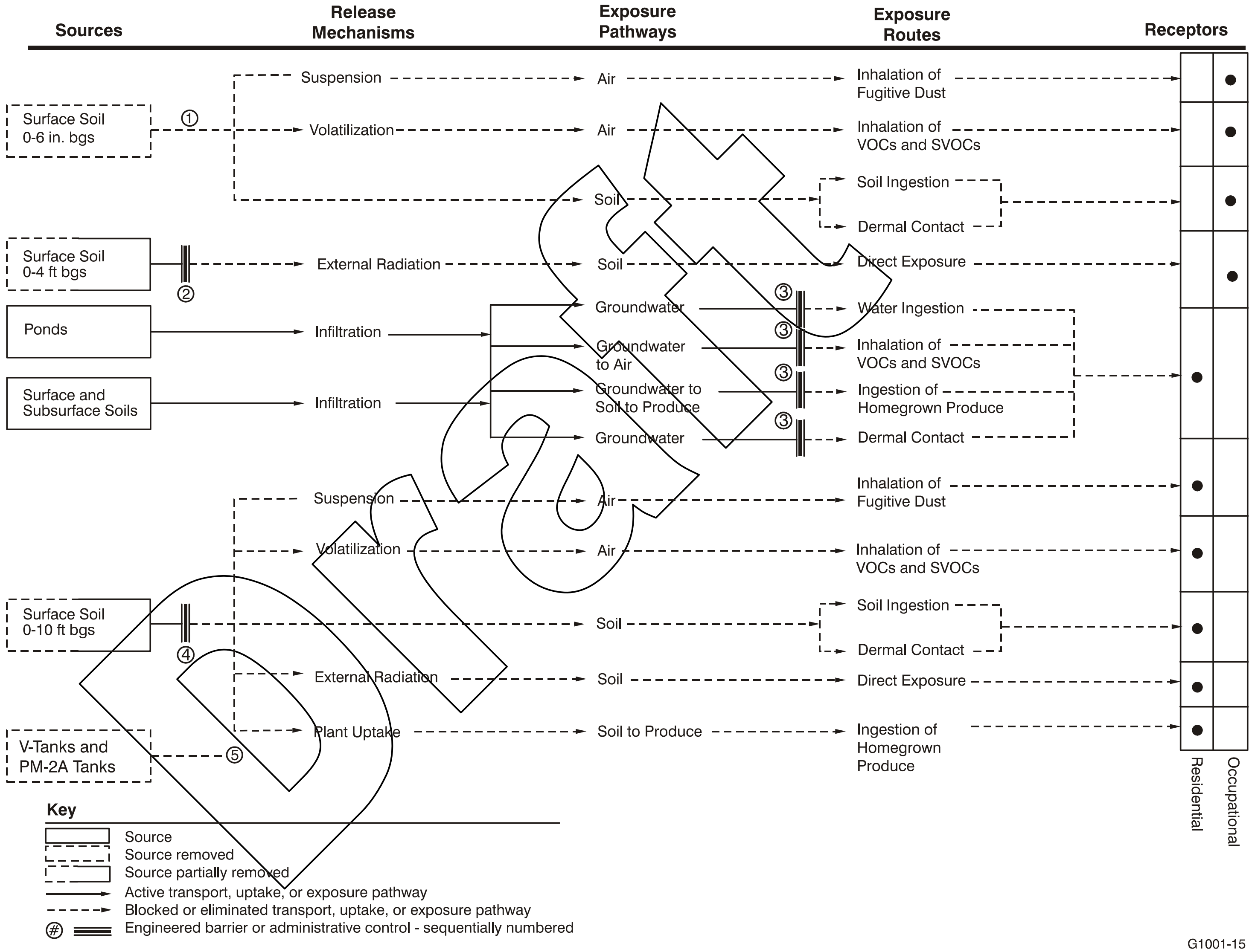

Figure 4-2b2a. Test Area North conceptual site model—risk-based end state.

SVOC = semivolatile organic compound

Narrative for Figure 4-2b2a Test Area North Conceptual Site Model—Risk-Based End State

Remediation of all sites under the OU 1-10 ROD (DOE-ID 1999a) is planned to be completed by 2008, with the exception of potential contaminated soil under buildings or structures (i.e., collocated facilities). For example, the V-Tank contents, tanks, and associated piping will be removed, and the surrounding soil will be excavated and disposed of. The TSF-07 Disposal Pond, the TSF-09 and TSF-18 V-Tanks soil, the TSF-26 PM-2A Tanks soil area, the WRRTF-01 Burn Pits, the TSF-088 Mercury Spill Area, the TSF-10 Drainage Pond, and the TSF-39 Transite Contamination Area may remain under institutional control beyond 2035 depending on results of the 5-year remedy effectiveness reviews.

The steps taken to mitigate or remove these hazards are as follows:

1. For the Surface Soil (0–6 in. bgs) contamination area (i.e., TSF-06, Area 3), the selected remedy is excavation and disposal. This will include excavation of the contaminated soil; disposal at the ICDF; and backfill, contour, and revegetation of the area. The source of contamination will be removed breaking the pathway by which a future receptor may be exposed.

2. For the Surface Soil (0–4 ft bgs) contamination areas (e.g., TSF-06, Areas 5, 7, 9, and 11 and Area B), the OU 1-10 ROD (DOE-ID 1999a) selected remedy is excavation and disposal. This will include excavation of the contaminated soil; disposal at the ICDF; and backfill, contour, and revegetation of the area. The source of contamination will be removed breaking the pathway by which a future receptor may be exposed. The OU 1-10 ROD (DOE-ID 1999a) selected remedy for some Surface Soil (0–4 ft bgs) contamination areas (e.g., TSF-29 and TSF-39) was no further action with institutional controls. These sites are posted and restrict occupational access and use.

3. Pond sites include the TSF-07 Disposal Pond, the TSF-10 Drainage Pond, and the TSF-29 Acid Pond. The OU 1-10 ROD (DOE-ID 1999a) selected remedy for these sites was limited action or no further action with institutional controls, since cesium-137 will decay to less than unrestricted land-use concentrations within 100 years. The sites are posted and have restricted access and use.

4. For the Surface Soil (0–10 ft bgs) contamination areas (e.g., LOFT-12 and TSF-06, Area 1), the selected remedy is excavation and disposal. This will include excavation of the contaminated soil; disposal at the ICDF; and backfill, contour, and revegetation of the area. The source of contamination will be removed breaking the pathway by which a future receptor may be exposed. The Surface Soil (0–10 ft bgs) site that may require institutional controls beyond 2035 is the TSF Mercury Spill Area, where it was reported that mercury leaked onto the ground and railroad system. This site was selected for a potential phytoremediation treatability study under WAG 10. In the *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2003b), Pits I and III no longer require remediation (soil covers) or institutional controls and are changed to no action sites. The remedy for Pits II and IV has been changed to native soil cover, and the COC is asbestos.

5. For the V-Tanks buried at TSF-09/18 and the PM-2A Tanks buried at TSF-26, the proposed remedy is soil and tank removal, ex situ treatment of tank contents, removal of ancillary lines and surrounding soil, and disposal. Institutional controls consisting of signs, access control, and land-use restrictions may be established depending on the results of sampling activities. Risks from the tank contents were not evaluated in the *WAG-1 OU 1-10 Comprehensive Remedial Investigation/Feasibility Study Baseline Risk Assessment Technical Memorandum* (Burns 1995) because there is no evidence to indicate that the tanks have ever leaked. Therefore, potential pathways to receptors are not shown on the conceptual site model.

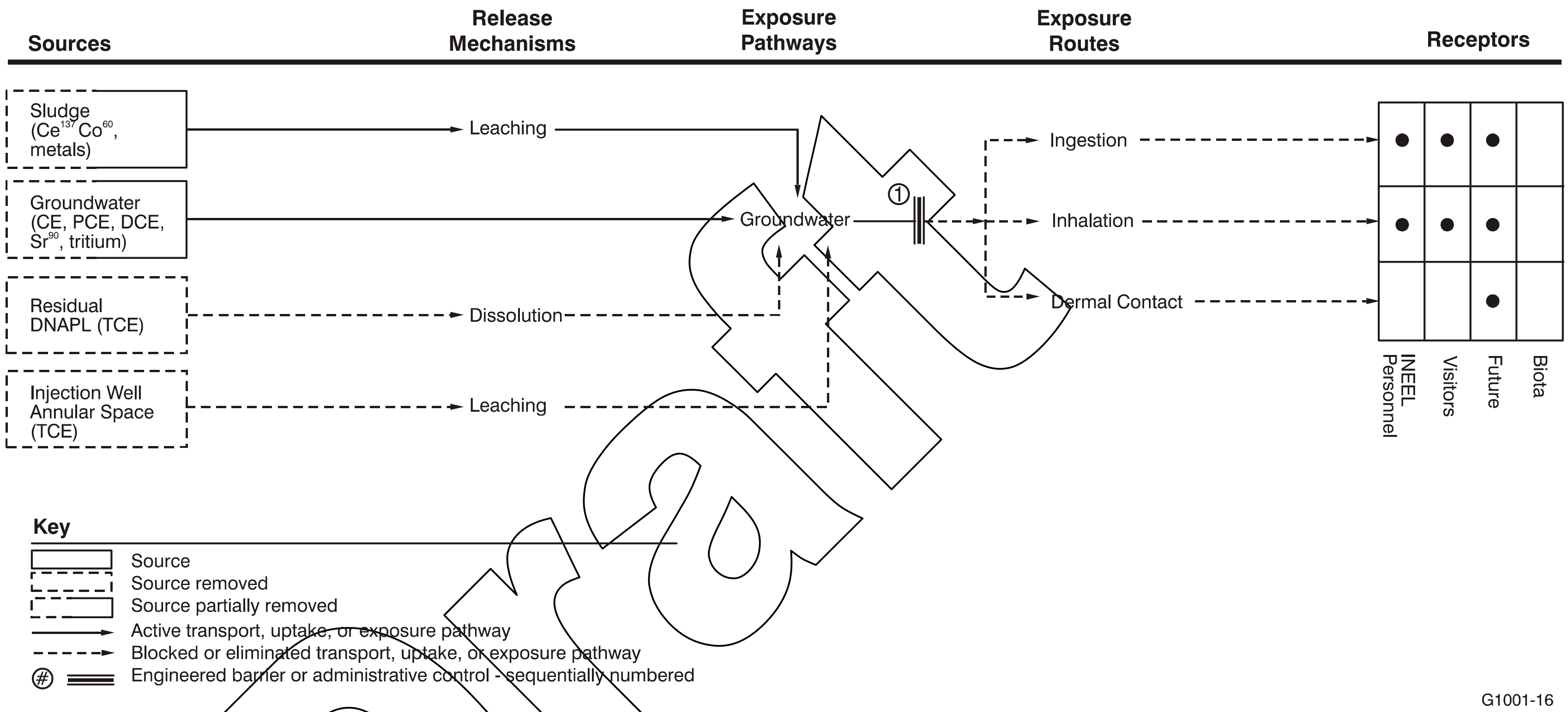

Figure 4-2b2b. Test Area North groundwater conceptual site model—risk-based end state.

Ce^{137} = cesium-137
Co^{60} = cobalt-60
DCE = 1,2-dichloroethene
DNAPL = dense nonaqueous phase liquid
PCE = tetrachloroethene
Sr^{90} = strontium-90

Narrative for Figure 4-2b2a Test Area North Groundwater Conceptual Site Model—Risk-Based End State

By 2035, active remedial action of the contaminated groundwater plume at TAN is expected to be complete. However, monitoring and maintenance of the residual plume and institutional controls will continue as part of the monitored natural attenuation remedy until the entire plume reaches the RAOs identified in the Fiscal Year 2001 *Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B* (DOE-ID 2001b). The timeframe identified for all remediation activities to be complete and for the plume to meet RAOs is 2095. The steps taken to mitigate or remove these hazards are as follows:

1. Monitoring and maintenance of the residual plume and institutional controls will continue as part of the monitored natural attenuation remedy until the entire plume reaches the RAOs. Occupational access will be restricted until completion of the remediation is verified by postremediation sampling. The entire INEEL Site has restricted access and use to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

4.3 Idaho Nuclear Technology and Engineering Center

Situated in the south-central portion of the INEEL, the Idaho Nuclear Technology and Engineering Center (INTEC) has been in operation since 1952 and historically has been a uranium reprocessing facility for defense projects. Irradiated defense nuclear fuel was processed to recover unused uranium. After fuel dissolution and extraction, high-level liquid waste was stored in stainless steel underground tanks in the tank farm. The high-level liquid waste was calcined, and the resultant granular solids (calcine) were stored in stainless steel bins encased in thick concrete vaults. In 1992, DOE announced that the reprocessing component of the INTEC mission would be phased out. This decision led to the phaseout of all fuel dissolution, solvent extraction, product denitration, and other related processes at INTEC. Other missions have included research, storage of spent nuclear fuel, and waste management.

Past disposal practices, once considered acceptable, have been found to be potentially detrimental to the environment. Over past decades, radioactivity and other contaminants from INTEC processing plants and support systems have been released to surface and subsurface environments. Perched water exists in basalts and sedimentary interbeds at INTEC at elevations ranging between 100 and 420 ft below ground surface and has been contaminated by downward transport of COCs. The aquifer was impacted by operation of the INTEC injection well, which was used to directly dispose of service wastewater to the subsurface environment from 1952 to 1986. Although these operational releases would not meet current standards, they did meet rules and standards of the times.

Cleanup activities at INTEC will include DD&D of facilities, RCRA closures, actions driven by the VCO, and CERCLA remedial and removal actions. INTEC is designated as WAG 3 in the FFA/CO. Remedial actions for INTEC WAG 3 release sites have been grouped according to shared characteristics or common contaminant sources and a single remedy identified for all release sites within a given group.

With the exception of the tank farm, INTEC is currently being remediated under *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999b). The majority of INTEC CERCLA remedial action information provided in this section is derived from this ROD or the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)* (Rodriguez et al. 1997), which preceded the ROD. As will be discussed in more detail to follow, INTEC also will be remediated under OU 3-14 RI/FS and ROD documentation (yet to be completed) for the tank farm soil release sites. Other sources of information include the *Final Environmental Impact Statement* (DOE 2002b) and the *Performance Management Plan* (DOE-ID 2002a).

For INTEC release sites that pose a potential threat to both human health and ecological receptors, it is assumed that remedies selected to protect human health also will address ecological risks. The OU 10-04 ROD (DOE-ID 2002b) determined that no additional actions were needed at WAG 3 sites to protect ecological receptors.

INTEC land-use assumptions used to develop the risk-based RAOs were based on industrial use until 2095, with loss of federal control and potential residential use thereafter. The human health RAOs developed for seven specific groupings of soil and groundwater release sites at INTEC are specified in the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999b).

4.3.1 Current State

The current mission of the plant is to receive and store spent nuclear fuel and to store and treat radioactive and mixed waste.

There are approximately 129 buildings, 9 temporary buildings, 4 trailers, and 177 structures in the plant area. The types of buildings include administrative, maintenance, process, storage, laboratory, and special use and comprise roughly 1,217,631 ft^2. The condition of the buildings and structures generally corresponds to their age. The average age of the buildings and structures is 20 years. Figure 4-3 illustrates the current layout of the INTEC physical plant.

Figure 4-3. Aerial view of the Idaho Nuclear Technology and Engineering Center.

Figures 4-3a1a and 4-3a1b depict the INTEC current state and illustrate the currently existing buildings, structures, areas of contaminated surface soil, an existing HWMA/RCRA postclosure landfill unit (CPP-633), and buildings and structures.

The conceptual site model, which has been updated to reflect conditions in 2003, is included as Figure 4-3a2. The seven groups and major elements of the risk-based remediation alternatives or interim actions pursuant to the ROD are described below.

4.3.1.1 Tank Farm Soil Interim Actions. Tank farm soil was contaminated as a result of historic spills and leaks from piping and valve boxes during transfers of liquid high-level waste. No evidence has been found to indicate that any of the tanks have leaked. Based on results of drilling and sampling, the extent of contamination has been found to extend to the soil-basalt interface at approximately 45 ft below ground surface. COCs identified at concentrations above risk-based levels include cesium-137, europium-154, plutonium-238, plutonium-239, plutonium-240, plutonium-241, strontium-90, technetium-99, and uranium-235. Some soil within the tank farm contains high levels of radioactivity, which present risks of potential leaching and transport of contaminants to the perched water or the aquifer. If the soil is disturbed, it could present a risk of direct radiation exposure to workers or the public. It is estimated that contaminated soil at the tank farm comprises 95% of the contaminant inventory at INTEC. Limited site investigations have been conducted at these sites because many of the spill areas are located in operational and radioactive areas.

Because current information regarding the nature and extent of tank farm contamination is inadequate to support selection of a final remedy, a separate RI/FS for the tank farm is planned. The tank farm is now referenced as OU 3-14, and remedial actions will be integrated with RCRA closure requirements. Interim actions to minimize contaminant migration from the tank farm are specified in the OU 3-13 ROD (DOE-ID 1999b) and are summarized in the following paragraph.

Access to the tank farm has been restricted by way of institutional controls to control exposure to workers and prevent exposure to the public. Implementation of surface water controls is under way to minimize infiltration through potentially contaminated soil. Measures to minimize this infiltration include: (1) diverting storm water away from contaminated soil with diversion channels designed and built to accommodate and route the 25-year, 24-hour storm event, (2) grading and surface sealing the tank farm soil, and (3) improving exterior building drainage to direct water away from contaminated areas.

4.3.1.2 Soil under Buildings and Structures. The soil under buildings and structures is comprised of release sites that are located beneath some INTEC buildings and structures. These sites consist of soil contamination that resulted from past hazardous or radioactive liquid spills, leaks, and plant operations. Because of inaccessibility of most of these sites, only limited soil characterization data are available. Knowledge of the processes and waste streams at these sites and estimates of the potential leak or spill volumes were used to determine the types and quantities of contaminants that may be present at these sites. COCs identified at concentrations above risk-based levels include americium-241, cesium-137, cobalt-60, iodine-129, neptunium-237, plutonium-228, plutonium-239, plutonium-240, plutonium-241, strontium-90, technetium-99, tritium, uranium-235, mercury, arsenic, and chromium.

The primary hazards are risks of direct radiation exposure to workers or the public caused by intrusion into contaminated soil and potential soil contaminant leaching and transport to the perched water table or the aquifer.

Until buildings and structures above the sites are closed and DD&D occurs, it is assumed that the building or structure will limit infiltration of water through the contaminated soil and prevent direct exposure to contaminated soil. Institutional controls, such as site-access restrictions and periodic inspections of buildings and structures, will be used to limit infiltration and prevent human exposure to contaminated soil. Currently, buildings CPP-601, CPP-627, and CPP-640 are in the deactivation planning phase. There are also a number of RCRA closures in these facilities. All of these activities are scheduled to be completed by 2012.

4.3.1.3 Other Surface Soil. The other surface soil sites generally consist of soil contamination that resulted from inadvertent spills and leaks of radioactive waste, decontamination solutions, spent fuel storage water, storage of radionuclide-contaminated equipment, fallout from past emissions, and other plant-generated wastewater. Based upon the results of drilling and sampling, contamination generally occurs in the upper few feet of the soil, though some sites have contamination that extends to the surface soil-basalt interface at a depth of about 40 ft. Because of the generally small area and contaminant mass of most release sites, quantities of the following COCs are not believed to pose a significant threat to groundwater: americium-241, cesium-137, cobalt-60, europium-152, europium–154, plutonium-128, plutonium-239, plutonium-240, plutonium-241, strontium-90, uranium-235, mercury, lead, and chromium. The principal threat to human health is by external exposure to radionuclide COCs identified at concentrations above risk-based levels.

The purpose of the selected risk-based remedies is to prevent external exposure to radionuclides at these sites. The selected remedial action, which includes removing contaminated soil and debris above the 1E-4 risk level, was based on an assumption of potential residential use in 2095 and beyond. Contaminated soil and debris that meet waste acceptance criteria will be disposed of at the newly constructed ICDF. The excavation will be backfilled with clean soil. To prevent inadvertent occupational exposure to radionuclides remaining at the release sites following remediation, the sites will be surveyed, and contamination left in place will be recorded for institutional control purposes.

4.3.1.4 Perched Water. Perched water at INTEC occurs at depths ranging between 100 and 420 ft in the basalt and the sedimentary interbeds beneath the facility. The perched water originated from local recharge by infiltration from sources such as precipitation, the Big Lost River, the former INTEC percolation ponds, the sewage treatment ponds, and lawn irrigation inside the facility fence. The perched water has been contaminated by downward transport of COCs, including tritium, iodine-129, and strontium-90 from overlying surface soil and from two instances when the INTEC injection well casing failed and allowed service wastewater to be released to the perched zones. INTEC perched water does not currently pose a direct human health or environmental threat since it is not used for drinking water; however, perched water does pose a threat as a contaminant transport pathway to the aquifer. Therefore, a response action is necessary to minimize or eliminate the transport of contaminants from this pathway.

The selected remedy for perched water is institutional controls with aquifer recharge control. This remedy includes use of institutional controls to prevent use of perched water during INTEC operations and to prevent future drilling into or through the perched zone. The original former INTEC percolation ponds were estimated to contribute approximately 70% of the perched water recharge. A significant step toward controlling recharge beneath INTEC has been achieved by taking the original INTEC percolation ponds out of service and routing newly generated, uncontaminated service waste to new percolation ponds outside of the INTEC perched water area. Construction is planned for 2004 to tie the treated effluent from the sewage treatment plant into the service wastewater system to further minimize perched water recharge.

4.3.1.5 Snake River Plain Aquifer. Groundwater in the aquifer has been contaminated by past INTEC operational waste disposal activities. Release site CPP-23 (OU 3-02) consists of the former INTEC injection well, which was the primary source of contamination to the aquifer during its operation from 1952 through 1986. Primary contaminants in the wastewater released to the aquifer were radionuclides, with tritium comprising over 96% of the total contaminant activity, and lesser amounts of strontium-90, iodine-129, cesium-137, and technetium-99. The injected wastewater also contained sodium, chloride, and other nonradioactive chemicals.

Subsequent contaminant migration has produced a large contaminant plume in the aquifer that contains relatively low concentrations of tritium, strontium-90, iodine-129, and technetium-99 extending south of INTEC. As of 2003, only strontium-90 and technetium-99 still exceed MCLs in the aquifer at one or more monitor wells. Figure 4-3a1b shows the current extent of the INTEC strontium-90 plume that exceeds MCLs. In May 2003, technetium-99 above MCLs was detected in a single monitoring well, located in the northern part of INTEC inside the fence line. The source of the technetium-99 has not yet been determined. Work is under way to evaluate technetium-99 in the groundwater.

The remedy specified in the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999b) was institutional controls with monitoring and contingent remediation. Institutional controls are currently in place, and groundwater monitoring is being performed to ensure that the RAOs for the aquifer are met by 2095, as required. Concentrations are declining for all of the Snake River Plain Aquifer COCs identified in the OU 3-13 final ROD (DOE-ID 1999b). Five-year reviews will be conducted as required under CERCLA to assess the effectiveness of the selected remedial alternative. The first 5-year remedy effectiveness review for OU 3-13 is due in October 2005.

4.3.1.6 Buried Gas Cylinders. Awaiting cleanup, site CPP-84 is located outside the current INTEC security fence. The site consists of a buried trench where approximately 40 to 100 compressed gas cylinders were previously disposed of. Gases in the cylinders may include acetylene, compressed air, argon, carbon dioxide, helium, nitrogen, or oxygen. These gasses do not pose a human health risk but are considered a safety hazard because ruptures of the cylinders could lead to personal injury, fire, or explosion. The buried cylinders pose a safety hazard to inadvertent intruders (i.e., back hoe operators or drillers). However, institutional controls are in place to protect workers and the public.

The selected remedy pursuant to the ROD includes removing gas cylinders using a contractor specializing in gas cylinder removal; treating cylinder contents, if necessary; and recycling or disposing of empty gas cylinder containers. The agencies may elect to pursue a contingent remedy of capping in place if safety concerns with excavation and removal prevent implementation of the selected remedy.

4.3.1.7 SFE-20 Hot Waste Tank System. The SFE-20 Hot Waste Tank System consists of a concrete vault containing an abandoned liquid mixed-waste storage tank. The tank contains about 35 gal of sludge. Although there were spills within the tank vault and pump pit, no data exist to determine if contamination exists under SFE-20. The major threat posed by the SFE-20 Hot Waste Tank System is a potential release to underlying soil, subsequent leaching and transport of contaminants to the aquifer, and subsequent exposure of future groundwater users to radionuclides through ingestion. Preliminary investigation in 1984 indicated the tank sludge contained elevated levels of cesium-137, cesium-134, cobalt-60, strontium-90, and isotopes of europium, plutonium, and uranium. The selected, risk-based remedial alternative for the SFE-20 Hot Waste Tank System is removal, treatment, and disposal. This alternative includes:

- Removal and onsite treatment of the tank contents and off-Site disposal of the tank and its contents
- Land disposal of the vault and other debris at the ICDF
- Any contaminated soil that may exist beneath the structure exceeding risk-based levels will be excavated and disposed of in the ICDF.

Since the IDEQ has determined that the SFE-20 system has stored mixed waste, RCRA closure of the SFE-20 tank system will also be required.

4.3.1.8 Other Idaho Nuclear Technology and Engineering Center Closure Requirements. For the past several years, efforts have been under way to consolidate spent nuclear fuel from various INEEL locations to INTEC. Spent nuclear fuel is currently stored in dry storage facilities, as well as in a modern and compliant fuel storage basin. The *Settlement Agreement* (DOE 1995) requires that all spent nuclear fuel be shipped to an off-Site repository by 2035.

Calcined high-level waste is safely and compliantly stored in calcine storage bins at INTEC. The *Settlement Agreement* (DOE 1995) requires that the calcine be ready for shipment to an off-Site repository by 2035.

The Waste Calcining Facility (WCF) (CPP-633) treated acidic aqueous waste generated from the reprocessing of spent nuclear fuel. In 1998, the WCF was closed with waste in place (landfill closure) and covered with a concrete cap under an approved HWMA closure plan. After completing closure activities, DOE submitted a postclosure care permit application. The IDEQ has issued a RCRA Part B postclosure permit. The permit establishes procedural requirements for groundwater characterization and monitoring, maintenance, and inspection procedures for the WCF to ensure continued protection of human health and the environment.

There are many RCRA hazardous waste units at INTEC. These will all require RCRA closure under approved closure plans.

The Tank Farm Facility includes 11 belowground 300,000-gal stainless steel tanks, four belowground 30,000-gal stainless steel tanks, and auxiliary equipment. Constructed in the 1950s and 1960s and used continually since 1956, the tank farm stored liquid waste generated by spent nuclear fuel reprocessing operations, ancillary operations, and decontamination waste from reprocessing facilities at INTEC. Two significant releases from tank farm piping to surrounding soil have occurred. No known releases have occurred from the tanks themselves to environmental media. The releases are subject to interim actions and eventual remediation under WAG 3 OU 3-14, as described earlier. The tank farm is also subject to RCRA closure requirements. Five of the 300,000-gal tanks were emptied in 2002, and cleaning of these tanks is in progress. The four 30,000-gal tanks have also been emptied and flushed.

In June of 2000, DOE and Idaho Department of Health and Welfare, Division of Environmental Quality, entered into a VCO with respect to potential RCRA issues at the INEEL. Attached to the VCO, an action plan established enforceable milestones within which DOE must achieve compliance with regard to specific issues or "covered matters." INTEC VCO items that remain open for completion include SITE-TANK-005 and NEW-CPP-016. SITE-TANK-005 includes approximately 146 tanks requiring hazardous waste determinations or verification of empty. NEW-CPP-016 encompasses eight tank system components that were part of the water treatment system for the spent nuclear fuel storage basin in CPP-603. Tank systems characterized as containing RCRA hazardous waste will require RCRA closure. The closure approach could range from clean closure to performance-based closure to closure at landfill standards. At this point, VCO-driven HWMA/RCRA closures conducted at INTEC have not included closure to landfill standards; hence, they have not materially impacted the visual or physical end state.

4.3.2 End State

Figures 4-3b1a and 4-3b1b illustrate the INTEC risk-based end state at 2035 as influenced by the many projects and activities carried out under the regulatory and project framework described above.

The INTEC 2035 end state, as shown in the conceptual site model in Figure 4-3b2, will require completion of FFA/CO specified actions, VCO closures, RCRA closures, and INTEC-specific strategic initiatives as spelled out in the *Performance Management Plan* (DOE-ID 2002a).

The *Final Environmental Impact Statement* (DOE 2002b) is perhaps the most appropriate source of information for the disposition of INTEC high-level waste facilities, including those that possess HWMA/RCRA interim status or permitted units. While the final ROD is pending, the *Final Environmental Impact Statement* examines facility disposition alternatives in detail. Both DOE and the State of Idaho have individually designated performance-based closure methods as their preferred alternative for disposition of high-level waste facilities at INTEC. These closure methods include options for clean closure, performance-based closure, and closure to landfill standards. Closure to landfill standards is required if mixed hazardous waste is left in place. The *Final Environmental Impact Statement* also suggests that all newly constructed facilities necessary to implement waste processing alternatives examined by this environmental impact statement would be designed and constructed in a manner that facilitates clean closure. Therefore, the *Final Environmental Impact Statement* preferred alternative for disposition of new facilities is clean closure. The *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 1999b) supports this overall closure approach through a deferred action remedy for soil under buildings and structures, noting that if the completed DD&D configuration is assessed as inadequate for long-term protection of human health and the environment, then contaminated soil will be capped in conformance with applicable and relevant hazardous waste landfill closure requirements (IDAPA 58.01.05.008 [40 CFR 264.310]) with an engineered barrier or removed and disposed of at the ICDF.

4.3.2.1 Tank Farm Closure. The tank farm closure described below typifies the current and anticipated closure strategy for hazardous waste tank systems closed under the HWMA/RCRA. Compliance with the "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" (40 CFR 265.111 and 40 CFR 265.197) requirements for closure of tank systems will be demonstrated by sampling the final rinsate solutions from decontamination efforts and comparing the resulting analytical data with risk-analysis-derived action levels. Risk-based action levels are developed by defining the acceptable excess cancer risk and hazard quotient thresholds and calculating corresponding action levels based upon these risk and hazard thresholds. The excess cancer risk and hazard quotients are calculated for appropriate facility-specific exposure pathways and COCs based upon the developed action levels.

Under the terms of the 1992 consent order (and subsequent modifications) between the IDEQ and the DOE, DOE must permanently cease use of all tanks in the tank farm or bring the tanks into compliance with RCRA requirements for secondary containment by December 31, 2012. DOE plans to close the tanks because high-radiation fields would make compliance with secondary containment requirements difficult, and a need for storage of this magnitude is not anticipated after 2012. Five tanks—WM-182, WM-183, WM-184, WM-185, and WM-186—were emptied in 2002, ahead of the date required in *The Notice of Noncompliance Consent Order* (IDEQ 1992), and cleaning of these tanks is under way, to be completed by September 30, 2004. HWMA/RCRA closure plans for the five tanks describe a strategy for clean closure to site-specific action levels; however, in the event that these action levels cannot be attained, a contingent landfill closure plan has been developed. Cleaning of the other six 300,000-gal tanks will occur as the sodium-bearing waste is removed during treatment (planned for completion by 2021). The INTEC tank farm also contains four 30,000-gal tanks, which were previously emptied and flushed and will also be closed as part of the tank farm closure activities. The final closure plan will address closure requirements and any required postclosure care of the tank farm.

The tanks will be closed in phases. The closure of Tanks WM-182 and WM-183 is the first phase and is currently under way. Results of the confirmatory sampling of these two tanks are being reviewed and will be published in early 2004. Tanks WM-184, WM-185, and WM-186 will be closed in phase two, and the initial cleaning and sampling of these tanks was completed in 2003. Tanks WM-180, WM-181, WM-187, WM-188, WM-189, and WM-190 will be cleaned and closed in subsequent phases as the current inventory of sodium-bearing waste is processed for permanent disposal during planned future treatment campaigns. Final cleaning and closure of the four 30,000-gal tanks (WM-103, WM-104, WM-105, and WM-106) is planned in 2004.

Migration of tank farm soil contaminants also poses a potential future risk to the aquifer. Evaluation of these risks and potential remedial actions will be the focus of a RI/FS under OU 3-14. Based upon groundwater monitoring and contaminant transport modeling, the contaminant plume is not expected to migrate beyond the INEEL boundary at concentrations exceeding MCLs, and strontium-90 levels in the aquifer south of INTEC are expected to fall below the Idaho groundwater quality standard by 2095. Therefore, no contaminant plumes exceeding MCLs are shown on the end state map (see Figure 4-3b1a). Work is under way to evaluate technetium-99 in the aquifer, and appropriate actions will be identified.

4.3.2.2 Other Cleanup and Closure Activities. All required VCO actions will be completed by 2012. The *Settlement Agreement* (DOE 1995) requires that all spent nuclear fuel be removed from the INEEL Site by January 1, 2035, for shipment to an off-Site repository.

The calcine will be characterized, retrieved, treated if necessary, and packaged in canisters for disposal in the Yucca Mountain repository. RCRA closure of the calcine storage bins will take place after the calcine has been retrieved and packaged for shipment. The *Settlement Agreement* (DOE 1995) requires that the calcine be ready for shipment by 2035.

Some facilities within INTEC are being considered for long-term use to support the future NE mission. By 2035, all facilities without future missions will have undergone inactivation and DD&D. Some foundations may remain where grouting and capping were not necessary. Facilities associated with soil under buildings and structures, such as CPP-601, CPP-624, and CPP-640 fuel reprocessing complex; CPP-603 basins; CPP-659 calcination building; and CPP-604, CPP-605, and CPP-649 rare gas plant and process equipment waste evaporator, will be grouted and capped. The tank farm will be RCRA closed, grouted, and capped. Necessary fences and signs will remain as required by OU 3-13 and the eventual OU 3-14 RODs and institutional control plans. Roads and other minimal infrastructure will remain and be maintained as necessary to access and manage the capped buildings and structures.

Groundwater remediation and monitoring are expected to continue beyond 2035. The end state for groundwater cleanup is 2095, at which time no contaminants above MCLs are expected to remain at established points of compliance.

4.3.3 Variances

A potential variance related to soil under buildings and structures, and other surface soil has been identified and is discussed in Table 5-1. The ROD selected remedy was based on scenarios that included residential receptors after 100 years. It is proposed that an evaluation be conducted to determine the level of cleanup that would be required to protect occupational receptors, assuming no future residential use of the INTEC site and surrounding area.

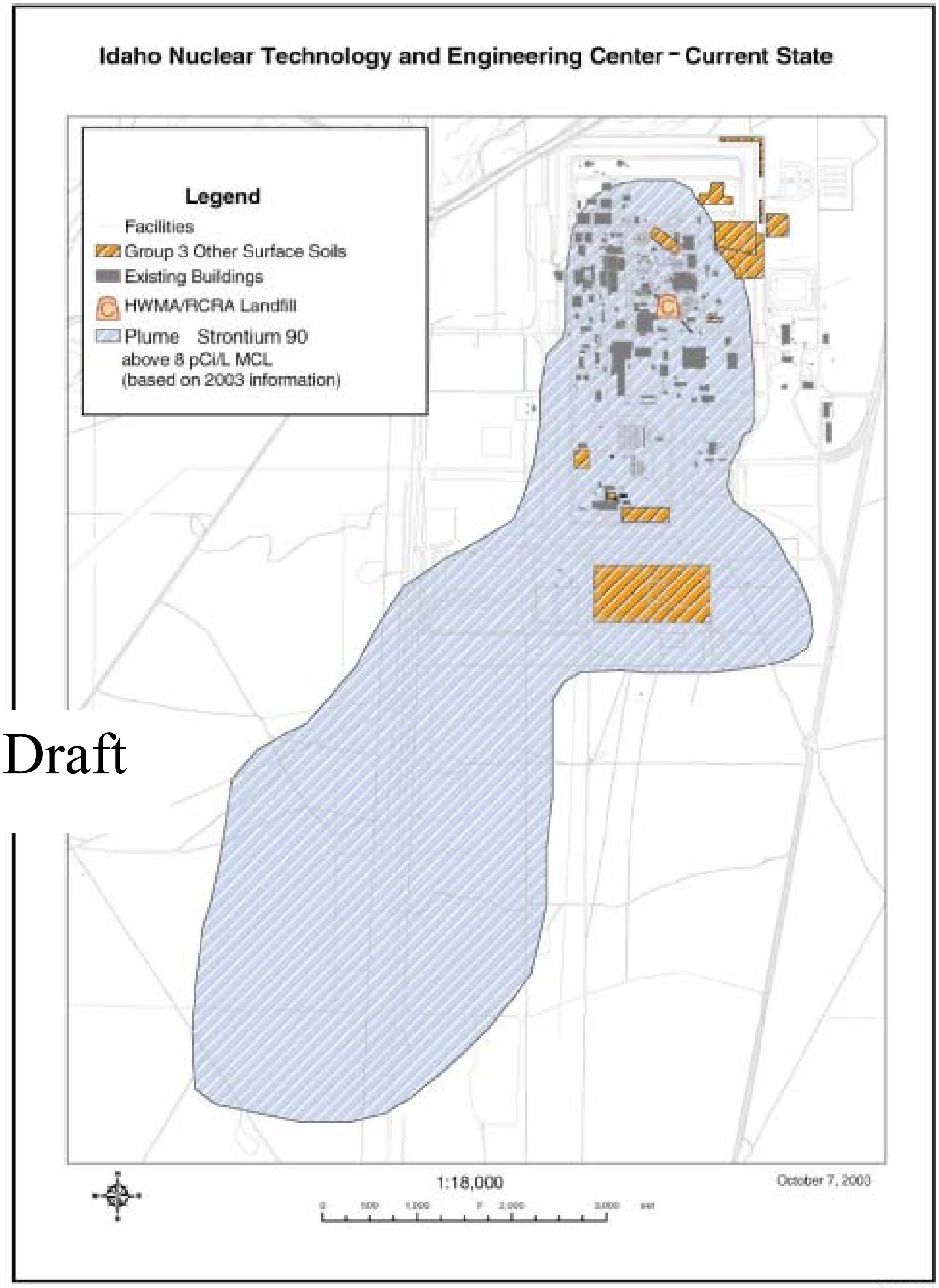

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Figure 4-3a1a. Idaho Nuclear Technology and Engineering Center map—current state.

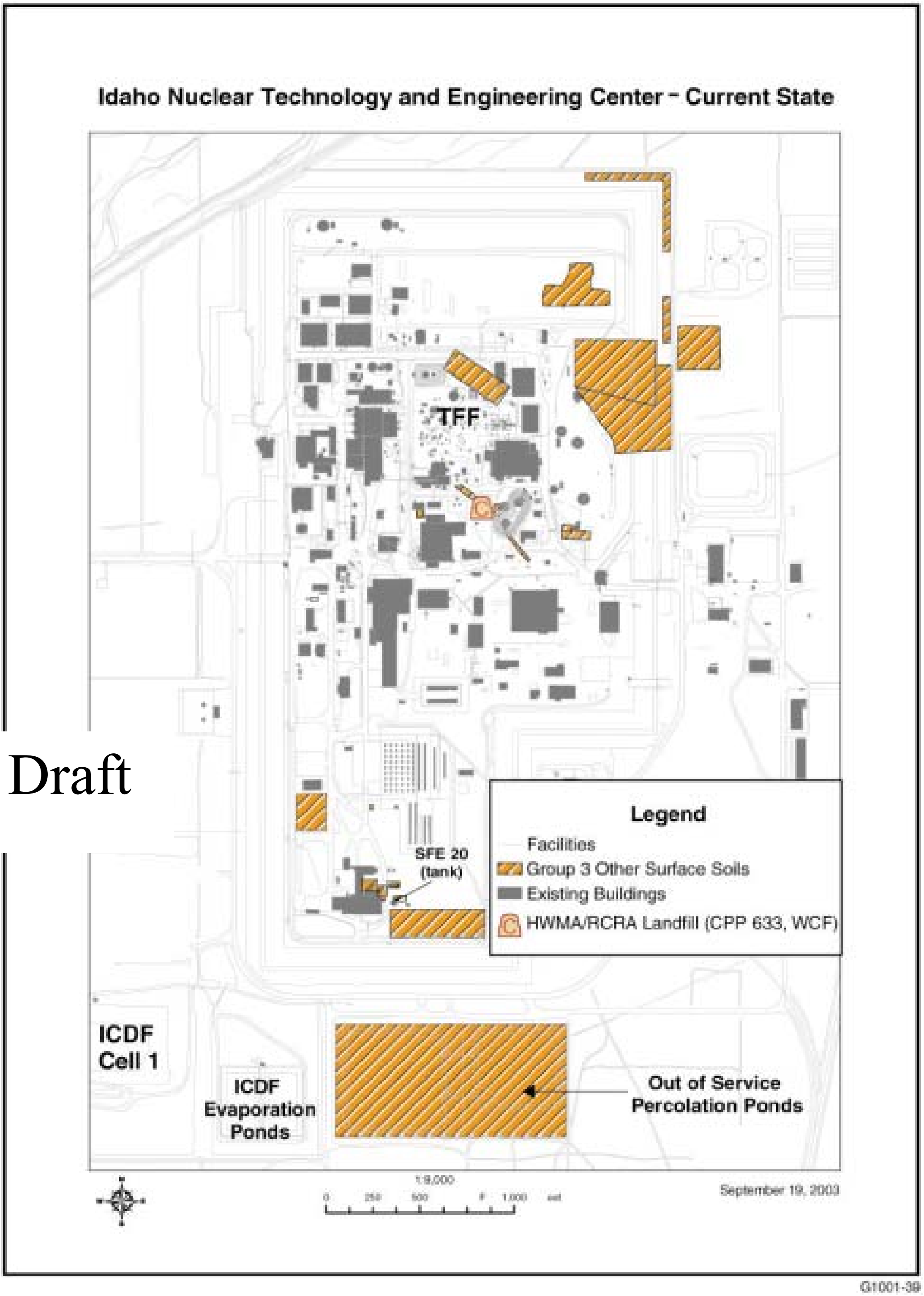

Figure 4-3a1b. Idaho Nuclear Technology and Engineering Center facility detail map—current state.

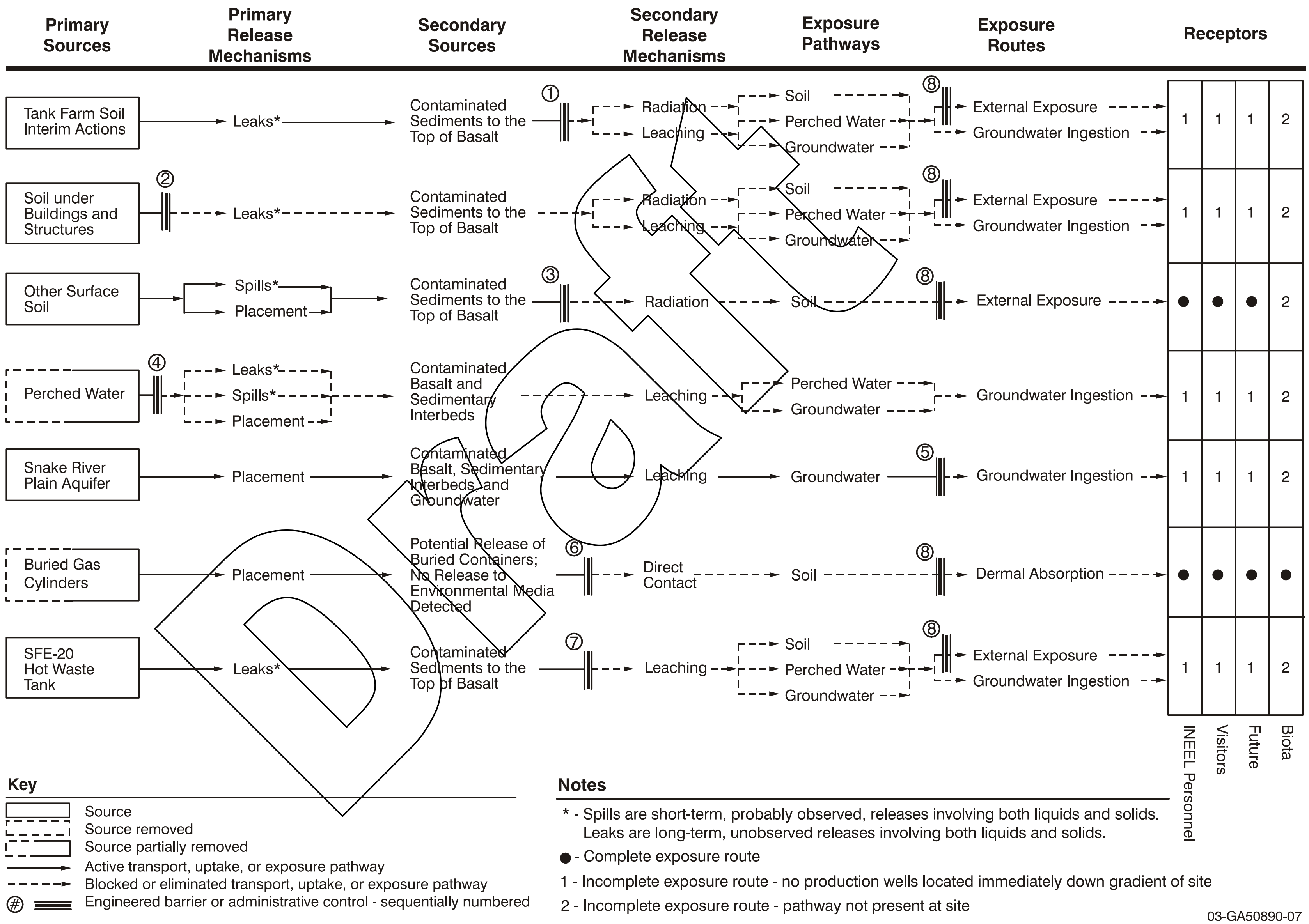

Figure 4-3a2. Idaho Nuclear Technology and Engineering Center conceptual site model—current state.

Narrative for Figure 4-3a2 Idaho Nuclear Technology and Engineering Center Conceptual Site Model—Current State

The remediation field activities performed to date for OU 3-13 are:

- Tank Farm Soil Interim Actions. The majority of the Tank Farm Soil Interim Actions have been completed. These activities include construction of an evaporation pond, surface sealing outside of the tank farm fence, and constructing and upgrading the INTEC storm water collection system, including grading and lining ditches with concrete, installing new culverts, and installing a new storm water lift station. The remaining interim action activity is to pave hot spots inside the tank farm fence, which is planned for completion in Fiscal Year 2004.

- Soil under Buildings and Structures. No remediation field activities have been performed. A building drainage evaluation was performed for these sites, resulting in no significant changes required for protection.

- Other Surface Soil. No field remediation activities have been performed to date.

- Perched Water. Twenty-one new wells were drilled in and around INTEC in Fiscal Year 2000. A tracer study was conducted at the INTEC percolation ponds and sewage lagoons in Fiscal Year 2001 and 2002. The INTEC percolation ponds were relocated 2 miles southwest of INTEC. The new ponds were put into use in August 2002. In addition, annual perched water sampling has been conducted for the past 3 years.

- Snake River Plain Aquifer. Four borings into the aquifer were drilled in Fiscal Year 2002, and annual groundwater sampling has been performed.

- Buried Gas Cylinders. The hydrogen fluoride cylinders at Site 94 have been removed and disposed of. Remediation of Sites 84 and 94 is planned for completion in Fiscal Year 2004.

- SFE-20 Hot Waste Tank. No field remediation activities have been performed to date.

The steps taken to mitigate or remove these hazards are as follows:

1. The tank farm tanks are equipped with a leak-detection system. Access to the tank farm has been restricted by way of institutional controls to control exposure to workers and prevent exposure to the public. Implementation of surface water controls is under way to minimize infiltration through potentially contaminated soil. Measures to minimize this infiltration include: (1) diverting storm water away from contaminated soil with diversion channels designed and built to accommodate and route the 25-year, 24-hour storm event, (2) grading and surface sealing the tank farm soil, and (3) improving exterior building drainage to direct water away from contaminated areas. The tank farm soil release sites will be remediated under the OU 3-14 ROD scheduled to be submitted to DOE and the agencies in 2010.

2. Soil under Buildings and Structures consists of nine release sites that require institutional controls as part of the selected remedy mandated in the ROD. Until buildings and structures above the sites are closed and DD&D occurs, it is assumed that the building or structure will limit infiltration of water through the contaminated soil and prevent direct exposure to contaminated soil. Institutional controls, such as site access restrictions and periodic inspections of buildings and structures, are used to limit infiltration and prevent human exposure to contaminated soil. Currently, buildings CPP-601, CPP-627, and CPP-640 are in the deactivation planning phase. There are also a number of VCO closures in these facilities. Institutional control signs are posted at these buildings.

3. Other Surface Soil consists of 26 release sites that require institutional controls as part of the selected remedy mandated in the ROD. Unescorted access to INTEC is prohibited, and control of activities includes but is not limited to public notices, radiological work permits or general work orders, personnel training, and the soil disturbance notification process. The remedial design/remedial action work plan is in preparation and will be completed during Fiscal Year 2004.

4. A significant step toward controlling recharge beneath INTEC has been achieved by taking the original INTEC percolation ponds out of service and routing newly generated, uncontaminated service waste to new percolation ponds outside of the INTEC perched water area. Institutional controls are implemented to limit water use while INTEC operations continue and to prevent future drilling of potable water wells inside INTEC. These controls will help minimize migration of contaminants to the Snake River Plain Aquifer, so that the Snake River Plain Aquifer groundwater outside of the current INTEC security fence will meet the applicable State of Idaho groundwater standards by 2095.

5. Institutional controls are currently in place, and groundwater monitoring is being performed to ensure that the RAOs for the aquifer are met by 2095, as required. Concentrations are declining for all of the groundwater COCs identified in the OU 3-13 Final ROD (DOE-ID 1999b). Although not previously identified as a groundwater COC, the occurrence of technetium-99 in the aquifer is currently being investigated to determine concentration trends. Concentrations of technetium-99 above MCLs were discovered in MON-A-230 during the latter part of Fiscal Year 2003. No trending information is available at this time. Institutional controls are to prevent potable water use of the contaminated groundwater while INTEC operations continue and to prevent future drilling of wells near potential sources of contamination. These controls prevent onsite workers and nonworkers from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations. Drinking water from wells is routinely monitored at the INEEL.

6. The Buried Gas Cylinders consist of two gas cylinder sites that require institutional controls as part of the selected remedy mandated by the ROD. The cylinders at CPP-94 were removed, treated, and disposed of in 2001. The cylinders at CPP-84 are planned to be removed in 2004 and remediation completed at both sites. Institutional controls consist of limiting access to only authorized personnel and visible access restrictions, including warning signs, the work control process, and copies of surveyed maps.

7. The SFE-20 Hot Waste Tank System site has institutional controls in place to prevent intrusion into the underlying tank systems, except for approved activities pursuant to the FFA/CO. Access is limited to only authorized personnel or DOE-certified radiation workers. Activities such as drilling or excavating are controlled, and the site has visible access restrictions (e.g., warning signs, the work control process, and copies of surveyed maps).

8. The entire INEEL Site has restricted access to prevent public access. The area within the INTEC fence line is a controlled area. A controlled area is an area to which access is managed by or for DOE to protect individuals from exposure to radiation or radioactive material (10 CFR 835.2). Pedestrian access and vehicular access to INTEC is controlled at two separate, manned barricades. Workers or visitors may access INTEC with a current INEEL badge, INEEL Site Access Training, INEEL Environmental Safety and Health and Quality Assurance Training, and, as required under "Occupational Radiation Protection" (10 CFR 835), General Employee Radiological Training or Radiological Worker I or II Training. Unescorted access to INTEC is prohibited.

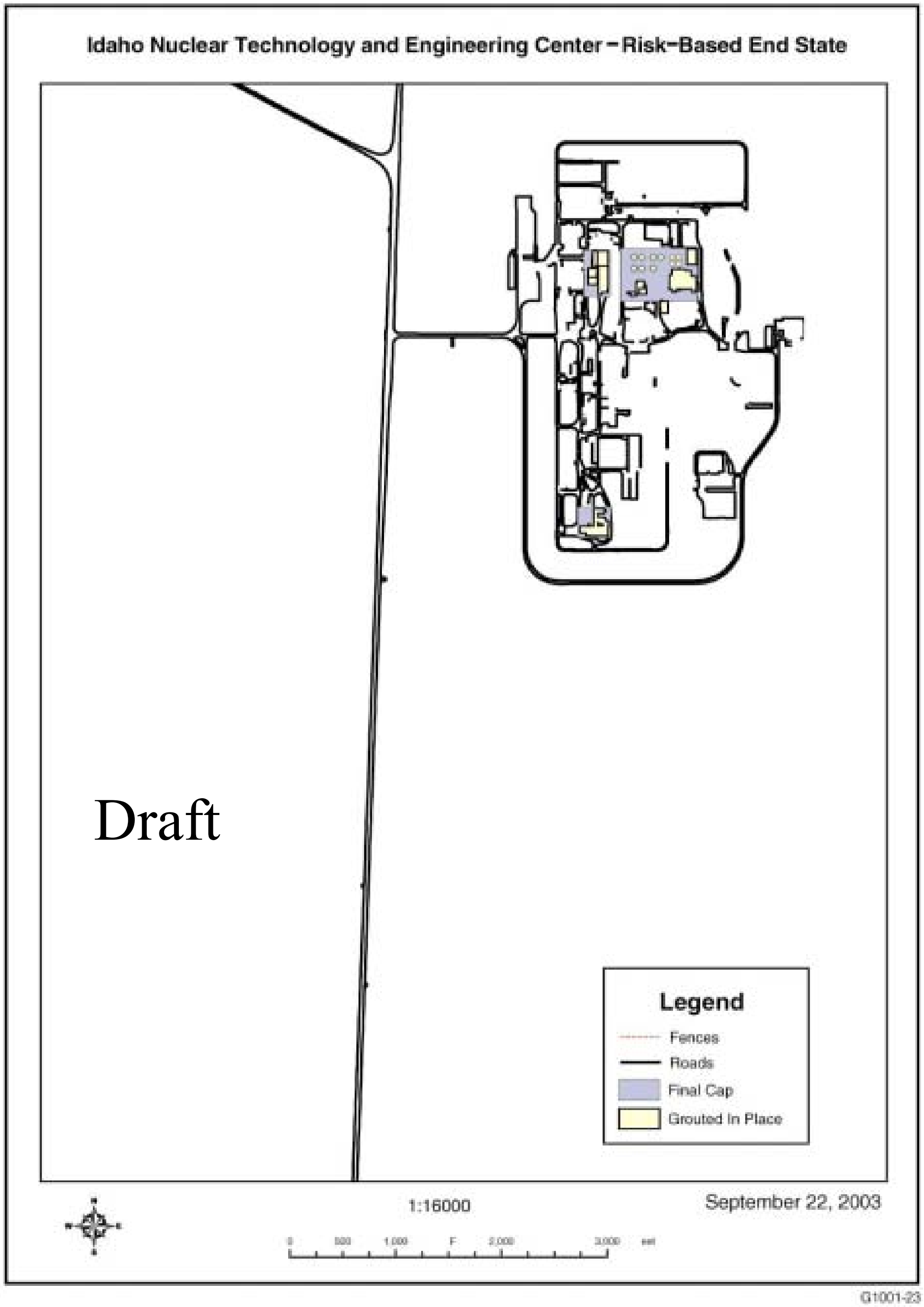

Figure 4-3b1a. Idaho Nuclear Technology and Engineering Center map—risk-based end state.

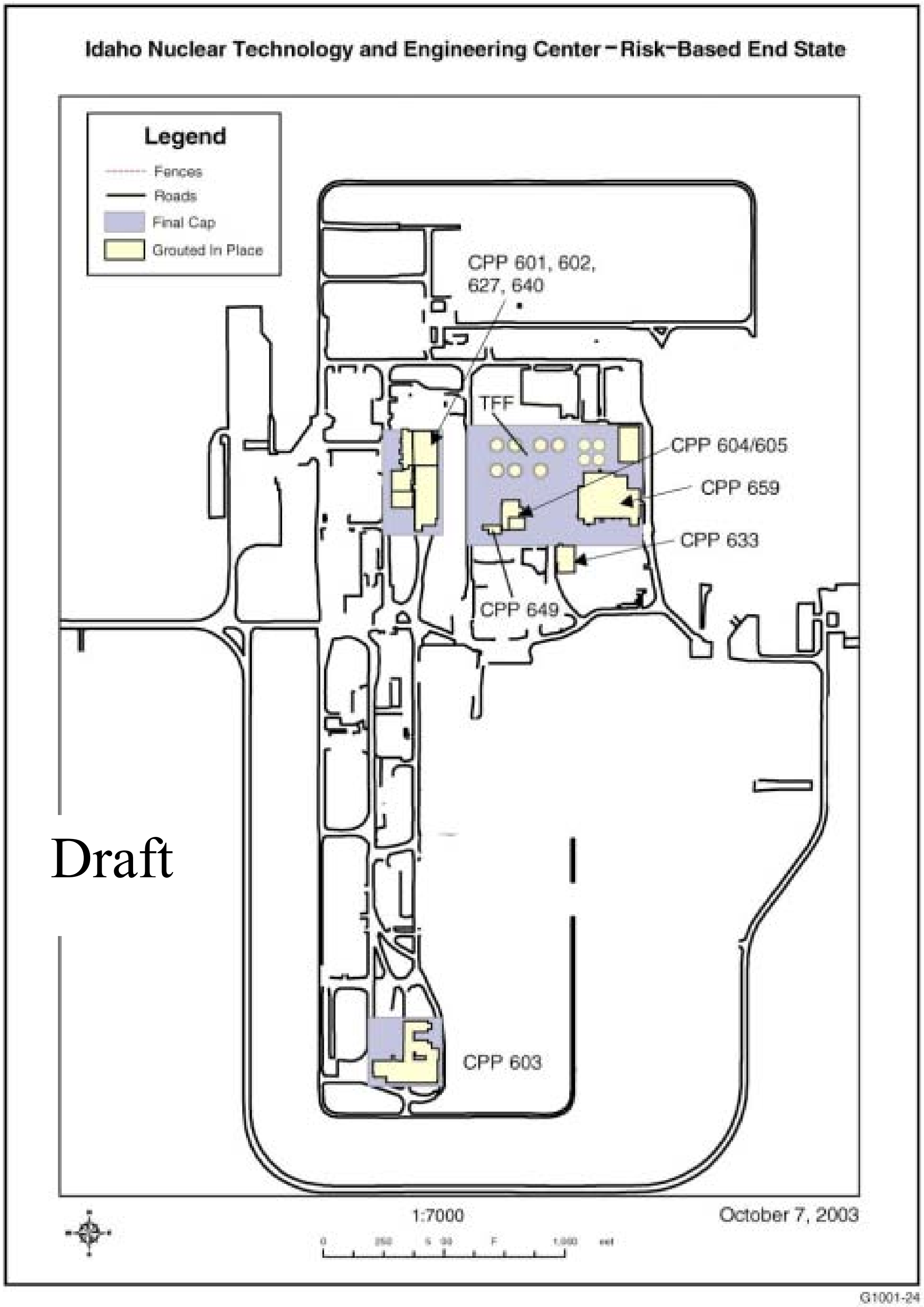

Figure 4-3b1b. Idaho Nuclear Technology and Engineering Center facility detail map—risk-based end state.

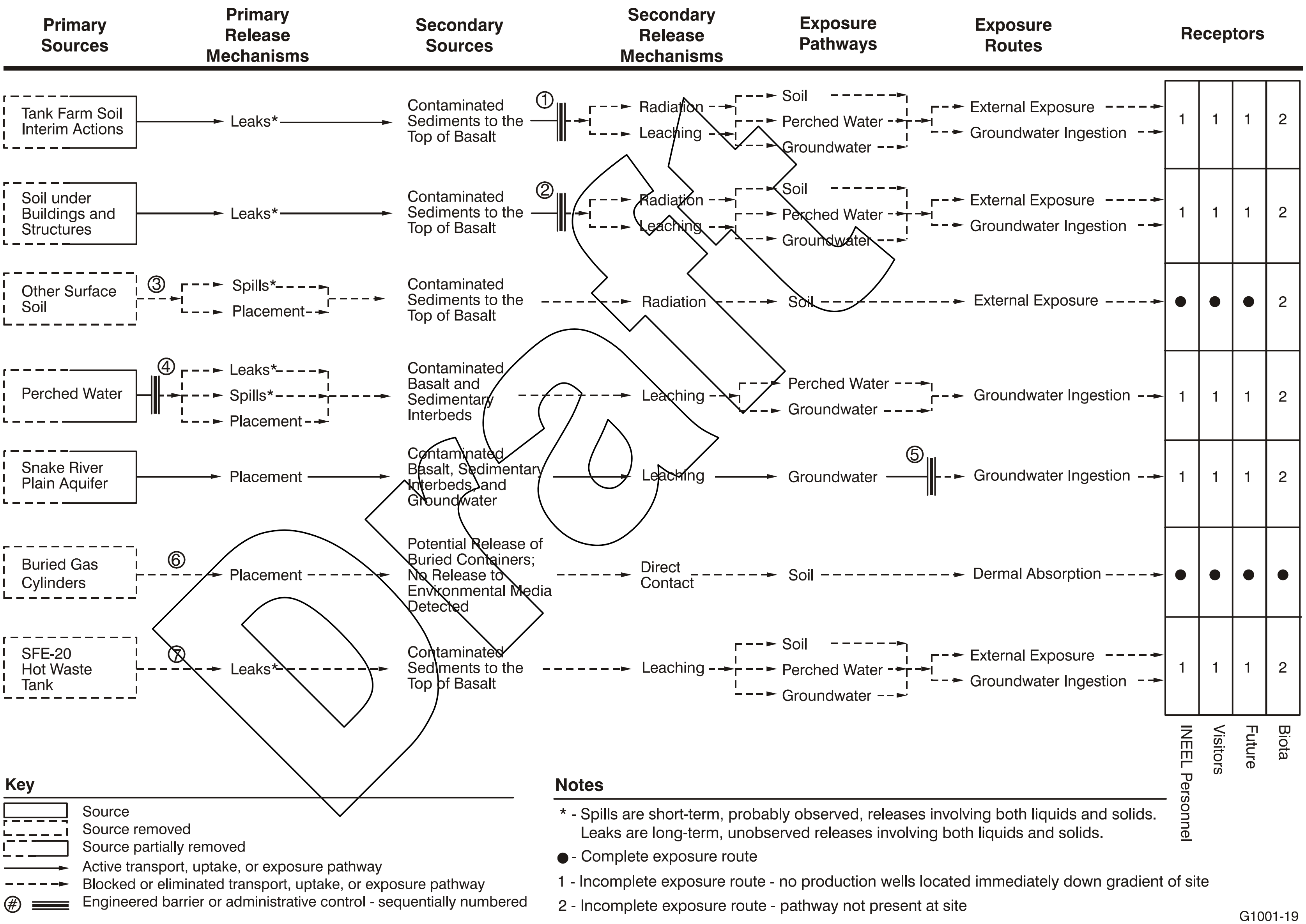

Figure 4-3b2. Idaho Nuclear Technology and Engineering Center conceptual site model—risk-based end state.

Narrative for Figure 4-3b2 Idaho Nuclear Technology and Engineering Center Conceptual Site Model—Risk-Based End State

The INTEC 2035 end state will require completion of FFA/CO specified actions, VCO closures, RCRA closures, and INTEC-specific strategic initiatives as spelled out in the *Performance Management Plan* (DOE-ID 2002a).

The steps taken to mitigate or remove these hazards are as follows:

1. Tank Farm Soil Interim Actions include restricting access to control exposure to the public from soil at the tank farm; accommodating a one-in-25-year, 24-hour storm event with surface water run-on diversion channels; minimizing precipitation infiltration by grading and surface-sealing tank farm soil located at selected areas sufficient to divert 80% of the average annual precipitation on these areas; and improving drainage systems surrounding the tank farm to direct water away from contaminated areas. The tank farm soil release sites will be remediated under the OU 3-14 ROD scheduled to be submitted to DOE and the agencies in 2010.

2. Upon completion of DD&D, those sites will be capped in place, or contaminated soil will be excavated and disposed of at the ICDF.

3. The selected remedial action, which includes removing contaminated soil and debris above the 1E-4 risk level, was based on an assumption of potential residential use in 2095 and beyond. Contaminated soil will be replaced with clean soil, so that the land can be used without incurring occupational exposures to radionuclides. Contaminated soil and debris will be disposed of at the newly constructed ICDF. To prevent inadvertent occupational exposure to radionuclides remaining at the release sites following remediation, the sites will be surveyed, and contamination left in place will be recorded for institutional control purposes.

4. Institutional controls to prevent use of perched water and future drilling of potable water wells into or through the perched zone.

5. Implementation of institutional controls and groundwater monitoring will continue to ensure that the RAOs for the aquifer are met by 2095, as required. Institutional controls will prevent future drilling of potable water wells near potential sources of contamination. These controls will help prevent onsite workers and nonworkers during the institutional control period from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations. Drinking water from wells is routinely monitored at the INEEL. Five-year reviews will be conducted as required under CERCLA to assess the effectiveness of the selected remedial alternative.

6. The selected remedy pursuant to the ROD includes removing the gas cylinders using a contractor specializing in gas cylinder removal; treating cylinder contents, if necessary; and recycling or disposing of the empty gas cylinder containers. The agencies may elect to pursue a contingent remedy of capping in place if safety concerns with excavation and removal prevent implementation of the selected remedy.

7. The selected, risk-based remedial alternative for the SFE-20 Hot Waste Tank System is removal, treatment, and disposal. This alternative includes removal and onsite treatment of the tank contents, off-Site disposal of the tank and its contents, and land disposal of the vault and other debris at the ICDF. Any contaminated soil that may exist beneath the structure exceeding risk-based levels will be excavated and disposed of in the ICDF. Since the SFE-20 system contains mixed waste, RCRA closure of the SFE-20 tank system will also be required.

4.4 Radioactive Waste Management Complex

The Radioactive Waste Management Complex (RWMC) is located in the southwestern corner of the INEEL (see Figure 4-4). The facility encompasses a total of 177 acres and is divided into three separate areas by function: the Subsurface Disposal Area (SDA), the Transuranic Storage Area (TSA), and the administration and operations area. The mission of the facility from 1952 to 1970 was to manage disposal of radioactive waste. Since 1970, the mission has been to manage disposal of LLW and to store, treat, and prepare stored transuranic waste for off-Site shipment and disposal.

Figure 4-4. Aerial view of the Radioactive Waste Management Complex.

The RWMC facility is located in a depression surrounded by basaltic and lava ridges. The ground surface is relatively flat, and the elevation is about 5,000 ft above sea level. The Snake River Plain Aquifer lies beneath the facility at a depth of about 600 ft.

The SDA, comprising the western two-thirds of RWMC, is a disposal facility for radioactive waste. The original facility, established in 1952, covered 13 acres in the western portion of the SDA and was called the Nuclear Reactor Testing Station Burial Ground. The SDA currently is 97 acres in size and consists of 21 pits, 58 trenches, 21 soil vault rows, and an abovegrade asphalt pad (Pad A). Since 1952, 147,053 m^3 of nontransuranic waste, mainly from the INEEL, were disposed of at the SDA (DOE-ID 1998b). From 1954 through 1970, 67,460 m^3 of transuranic waste, mostly from the Rocky Flats Plant in Colorado, were disposed of at the SDA. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued by 1983. A portion of the SDA, Pits 17–20, is active and currently used for LLW disposal from operations on the INEEL Site.

The TSA was added to the east side of the SDA in 1970 and encompasses 58 acres. The TSA was first used to segregate and retrievably store waste with transuranic radionuclides, and this retrievable waste storage has been maintained since 1970. Waste stored in the TSA is being retrieved and prepared for transfer to the Waste Isolation Pilot Plant near Carlsbad, New Mexico. Presently, the TSA stores approximately 62,000 m^3 of transuranic waste in buildings and on covered, aboveground storage pads.

The 22-acre administration and operations area at RWMC includes administrative offices, maintenance buildings, equipment storage, and miscellaneous support facilities. These facilities support SDA and the TSA operations and maintenance at RWMC.

The following three RODs have been signed for RWMC:

- *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1993)—This ROD addresses interim action in Pit 9 at the RWMC SDA. The specified interim action is to retrieve transuranic and other waste buried in the pit. The *Agreement to Resolve Disputes, the State of Idaho, United States Environmental Protection Agency, United States Department of Energy* (DOE 2002d) established specific requirements for retrieval of waste and completion of the OU 7-13/14 ROD.

- *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area* (DOE-ID 1994a)—This ROD addresses organic contamination in the vadose zone beneath RWMC. VOCs have migrated from organic waste buried in the SDA. The remedy provides for vapor vacuum extraction and treatment of organic vapors.

- *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1994b)—This ROD includes remedial actions to enhance, recontour, maintain, and monitor the soil and rock cover at Pad A and establishes long-term institutional controls at the site.

The comprehensive ROD for the entire RWMC, including the buried waste area, is currently scheduled to be issued in 2007.

4.4.1 Current State

Maps showing the current state of RWMC are provided in Figures 4-4a1a and 4-4a1b. The current mission of the facility is to manage, in a safe and environmentally sound manner, the disposal of low-level radioactive waste and the storage of transuranic waste. In addition, recent construction of the Advanced Mixed Waste Treatment Project will expand the RWMC's waste management operations to include treating and preparing the 62,000 m^3 of stored transuranic waste for shipment out of Idaho.

Active LLW disposal is ongoing within the SDA portion of RWMC. About 4,000–5,000 m^3 of low-level radioactive waste are disposed of at the SDA each year. Under the *Performance Management Plan* (DOE-ID 2002a), the goal is to continue disposal of contact-handled LLW through 2008 and to continue disposal of remote-handled LLW through 2009. The SDA is surrounded by a security fence.

Numerous measures are currently in place to limit the potential for occupational or public exposures to waste disposed of in the SDA. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring are also conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and releases by way of surface water. A variety of different modeling studies and research have been and continue to be conducted to assess the potential for contaminant migration and to focus monitoring and other protective measures on likely routes of potential exposure. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA, security fences and access controls, and land-use controls that restrict public access to the INEEL Site.

Site characterization activities include drilling wells for characterizing and monitoring purposes, sampling various aspects and features of the area, and characterizing waste. CERCLA remedial designs and actions to be performed include retrieval and treatment of waste from Pit 9 and treatment of volatile organic contamination in the vadose zone using vapor vacuum extraction technology. Long-term monitoring of the vadose zone and aquifer is being conducted to track trends in existing contamination and to provide information to assess contaminant release and migration.

Past disposal practices, once considered acceptable, are no longer acceptable under current regulations. The full extent of environmental contamination caused by the use of these former practices at RWMC is being investigated. Decisions to remediate the contamination will be based on regulatory requirements and risk to human health and the environment.

The TSA, a 58-acre area located in the southern section of the facility, is dedicated to the temporary storage of contact-handled and remote-handled transuranic waste. This area consists of the Advanced Mixed Waste Treatment Project and waste storage facilities.

In December 1996, DOE awarded a privatization contract for construction and operation of the Advanced Mixed Waste Treatment Project. The project's mission is to retrieve and treat about 62,000 m^3 of INEEL transuranic waste currently stored at the TSA. Facility operations will prepare the waste for shipment to New Mexico's Waste Isolation Pilot Plant in accordance with the *Settlement Agreement* (DOE 1995) between the State of Idaho, DOE, and U.S. Navy. The Advanced Mixed Waste Treatment Project is expected to begin operations in 2004. All operations will be completed no later than December 2018, after which the facility will undergo RCRA closure and DD&D.

Buried waste within the trenches, pits, and soil vault rows at the SDA poses a potential risk to human health by way of several pathways shown in the current state conceptual model (see Figure 4-4a2).

The nature and extent of contamination associated with the SDA in all environmental media will be presented in the OU 7-13/14 RI/FS. Initial human health and ecological contaminant screening has been performed and will be used to define contaminants for analysis.

The ongoing evaluation of nature and extent of contamination considers the following depth intervals: (1) the waste zone; (2) the vadose zone outside of the waste zone from depth intervals of 0 to 35 ft, 35 to 140 ft, and 140 to 250 ft; and (3) the vadose zone and aquifer at depths greater than 250 ft.

Some contaminants of concern have been detected at low concentrations in the vadose zone. Most vadose zone detections are in the 0- to 35-ft and 35- to 140-ft intervals (Olson et al. 2003). Contaminants of concern detected in the vadose zone are carbon tetrachloride, nitrates, carbon-14, and uranium isotopes. Other contaminants, including americium-241, tritium, iodine-129, plutonium-238, plutonium-239/240, strontium-90, and technetium-99, also have been detected in the vadose zone. Technetium-99 is regularly detected in one set of lysimeters at the west end of the SDA at concentrations around 10 times lower than the MCL. In addition, carbon tetrachloride is regularly detected in the vadose zone, though concentrations decrease significantly below 140 ft and again below the 250 ft. Because carbon tetrachloride migrates in the gaseous phase, it also has been detected hundreds of feet laterally away from buried waste but still within the boundaries of the INEEL (Holdren et al. 2002).

Carbon tetrachloride has been measured slightly above the MCL (5 μg/L) in the aquifer, with a one-time maximum value of 9 μg/L. Low concentrations of nitrate, carbon-14, and tritium, well below

MCLs, also have been detected in the aquifer near the SDA. Enough data have not been collected to determine a trend at this time.

The monitoring network at RWMC has been greatly expanded since 1998 with 22 additional vadose zone lysimeters, four upgradient aquifer wells, an aquifer well inside the SDA, and more than 300 probes in the buried waste. The expanded network will continue to produce data for ongoing evaluation of source release into the vadose zone, contaminant migration through the vadose zone, and potential impacts to the aquifer beneath the SDA. Monitoring data will also support future remediation by providing a baseline for remediation goals. Vadose zone water and gas monitoring is also being initiated in ports that have been recently installed within the active LLW disposal pit.

A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration and release through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction with treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal.

The current conceptual site model considers hypothetical residential and occupational scenarios for the following exposure pathways: air inhalation, direct exposure, groundwater ingestion, food ingestion, soil ingestion, and crop ingestion (Holdren et al. 2002). Buried waste in the trenches, pits, and soil vault rows at the SDA poses unacceptable risk to human health as shown in the current state conceptual model. Residual soil contamination within the TSA also may require remediation.

4.4.2 End State

Current plans call for disposal of LLW in the SDA to be discontinued by 2009. A federal task force has been chartered to assess the viability of this plan as well as other alternatives for LLW disposal. Stored waste at the TSA will be retrieved and shipped off-Site by 2018. RWMC has not been identified to have a long-term NE mission. Therefore, it is anticipated that the buildings and infrastructure will be removed before 2035. No remediation will be required in the administration area beyond building demolition.

Under the FFA/CO, the final remedy for RWMC will be determined in the future. The enforceable schedule to complete the OU 7-13/14 comprehensive RI/FS for RWMC is to submit a draft remedial investigation/baseline risk assessment in August 2005, a draft feasibility study by December 2005, and a draft ROD by December 2006.

The feasibility study for the overall remediation of all buried waste in the RWMC will evaluate the full range of alternative remedial actions possible for the SDA and determine their comparative effectiveness, difficulty, cost, and other factors. As with any site with buried hazardous substances, the range of alternatives could include excavation and removal of all buried waste and disposal at another location; selective removal and redisposal elsewhere of some or all higher-risk waste, including some or all of the several acres containing transuranic waste; immobilization of waste, such as through in situ grouting, to prevent movement in the environment to other soil, air, or groundwater; use of earthen or artificial materials to cap the waste burial areas in order to limit infiltration of rain and snowmelt through the waste and subsequent transport of contaminants into the aquifer; and combinations of these approaches.

The completed draft feasibility study will be submitted for Idaho Division of Environmental Quality and EPA comment no later than December 2005. The revised, final feasibility study will be the basis for drafting a proposed plan and draft ROD that will undergo revision based on Idaho Division of Environmental Quality and EPA comments. The final ROD will address public comments and provide legally binding remedial decisions for the RWMC.

Since the final remedy has not yet been determined, no end state maps or end state conceptual site models are provided. The final selection of a remedial action must await completion of the ROD for OU 7-13/14.

4.4.3 Variances

No potential variances related to RWMC have been identified, as the remedial action for OU 7-13/14 has not yet been selected.

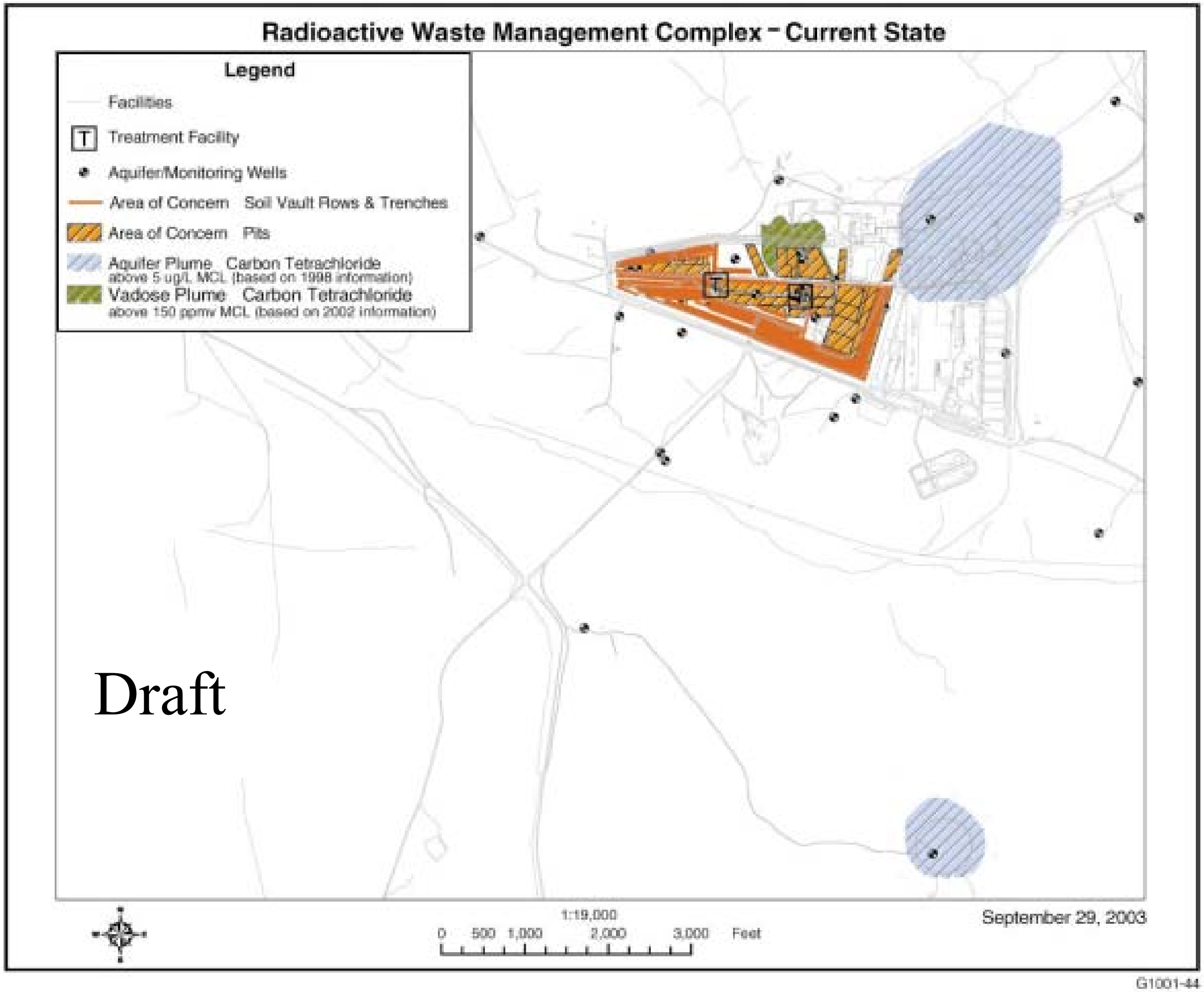

Figure 4-4a1a. Radioactive Waste Management Complex map—current state.

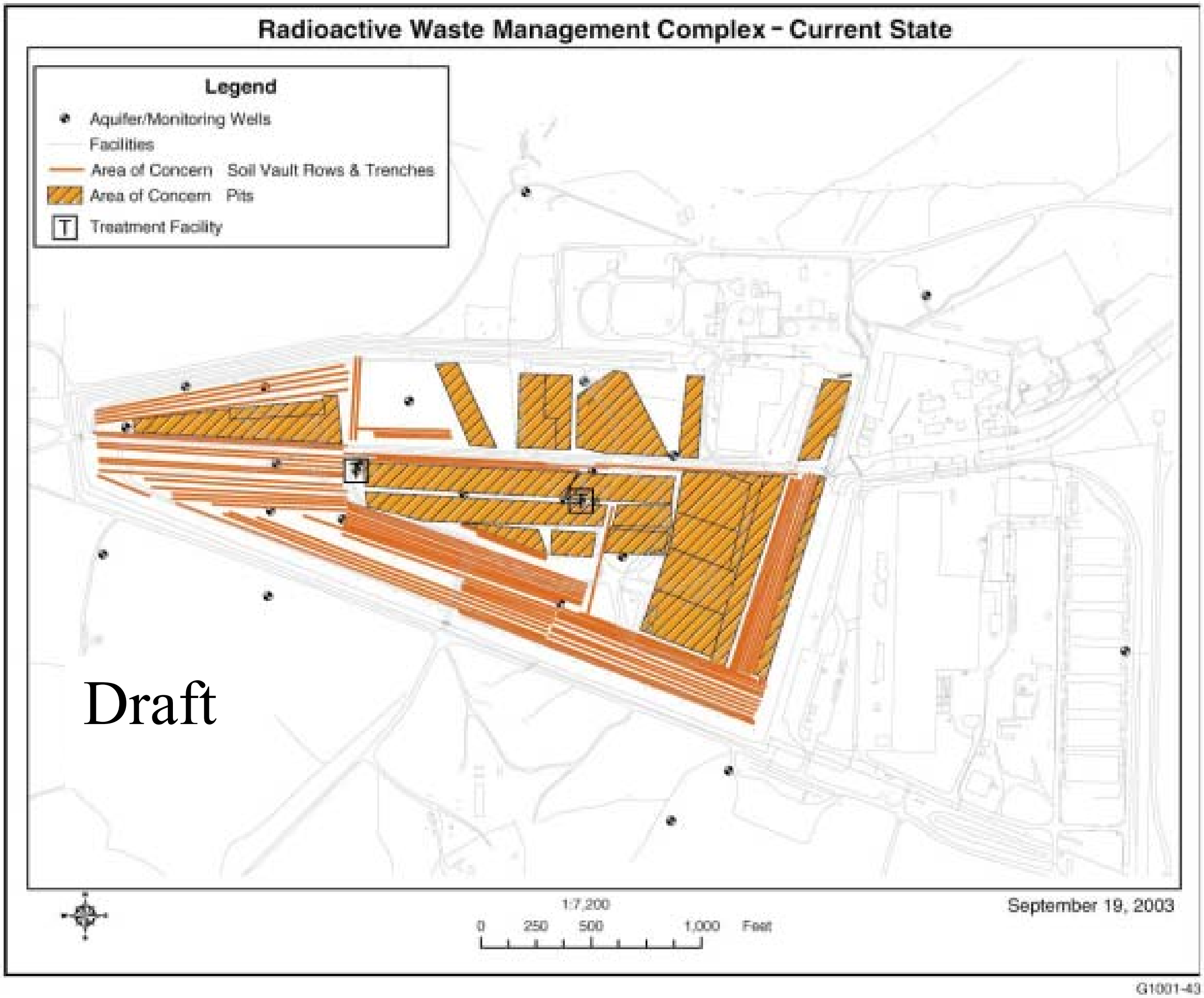

Figure 4-4a1b. Radioactive Waste Management Complex facility detail map—current state.

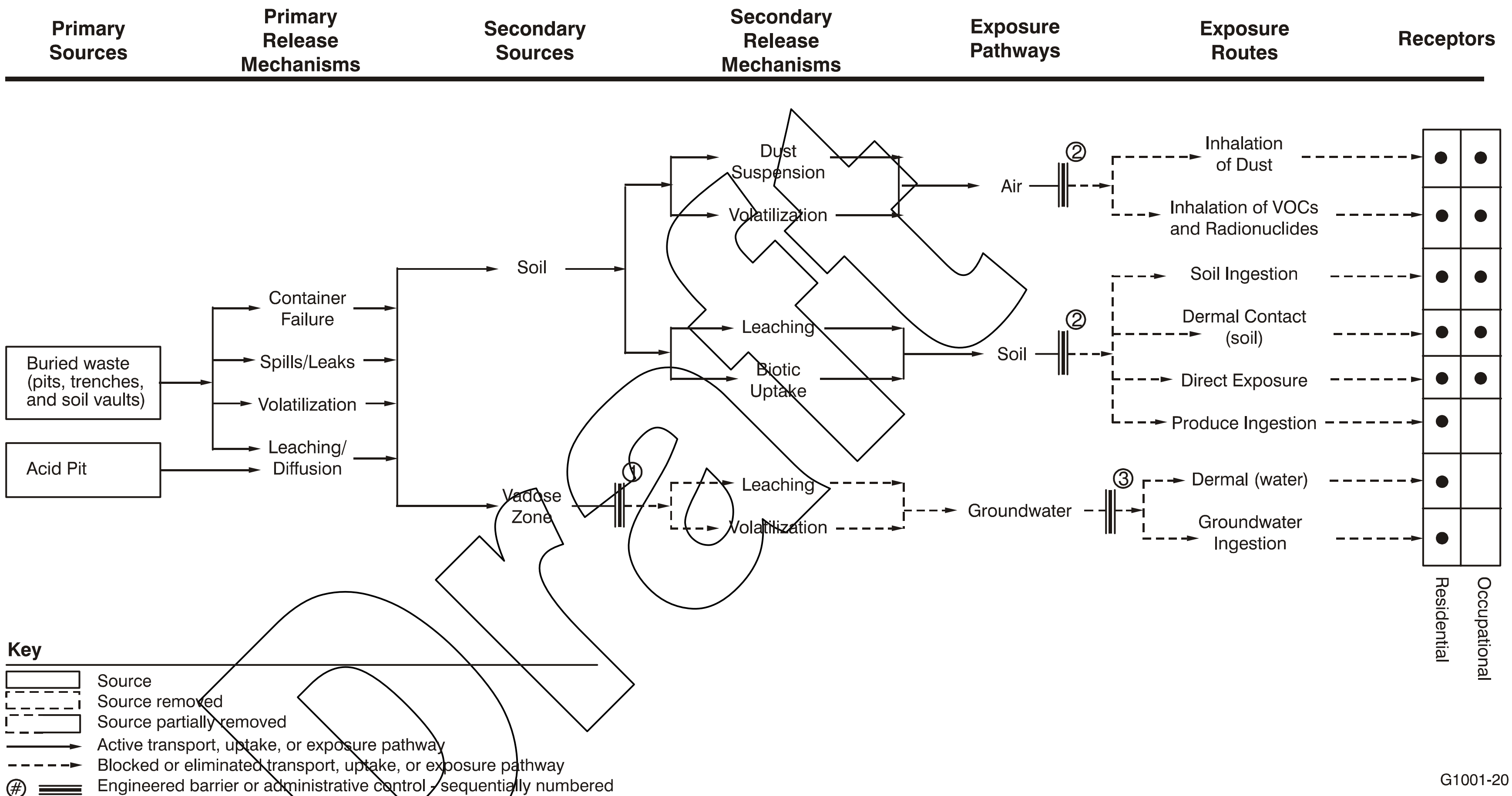

Figure 4-4a2. Radioactive Waste Management Complex conceptual site model—current state.

Narrative for Figure 4-4a2 Radioactive Waste Management Complex Conceptual Site Model—Current State

The primary area of concern at the RWMC is the SDA. The SDA is 97 acres in size and consists of 21 pits, 58 trenches, and 21 soil vault rows. The SDA was used as a land disposal facility for radioactive and mixed waste from 1952 through the present. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued in 1983. A portion of the SDA, Pits 17–20, is still active and used for LLW disposal from operations on the INEEL Site.

The Acid Pit received liquid organic and inorganic waste from 1954 to 1961. Some of the waste was contaminated with low-level radioactivity. Typically, liquid waste was poured directly into the pit. Lime was sometimes added to neutralize acids. Closure operations in 1961 included filling the pit with a soil cover to match the local gradient and revegetation. In 1997, as part of a CERCLA treatability study, portions the Acid Pit site were grouted with approximately 3,300 gal of grout. At this time, all that remains of most of the contamination at the Acid Pit is a grout monolith (Holdren et al. 2002).

VOCs (i.e. carbon tetrachloride, methylene chloride, and tetrachloroethylene) and nitrates pose the most imminent risk. Carbon tetrachloride has been detected in the aquifer slightly above the MCL and is being extracted from the vadose zone to reduce risk. Mobile long-lived fission and activation products are the next most immediate concern.

The steps taken to mitigate or remove these hazards are as follows:

1. A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration and release through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction with treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal.

2. The entire INEEL Site has restricted access to prevent intrusion by the public. In addition, the RWMC site and surrounding area end state will include restricted industrial surface and groundwater use with appropriate institutional controls to address remaining hazards until such time as acceptable risk levels for unrestricted use are attained. The SDA is surrounded by a security fence. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring are also conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and releases by way of surface water. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA.

3. The entire INEEL Site has restricted access to prevent intrusion by the public. Other institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. An extensive groundwater-monitoring program is in place at RWMC. Drinking water wells used to supply potable water to the work force are located outside of the SDA and are routinely monitored for water quality. No contamination in the aquifer has been detected beyond the Site boundary.

4.5 Central Facilities Area

The Central Facilities Area (CFA) is located in the south-central portion of the INEEL and has been used since 1949 to house many support services for all of the operations at the INEEL, including laboratories, security operations, fire protection, a medical facility, communication systems, warehouses, a cafeteria, vehicle and equipment pools, and the bus system (see Figure 4-5). CFA was designated WAG 4 in the FFA/CO. Fifty-two potential contaminant release sites were identified at CFA, including landfills, underground storage tanks, aboveground tanks, dry wells, disposal ponds, soil contamination sites, and a sewage plant.

Three CERCLA RODs issued in 1992, 1995, and 2000 addressed 52 release sites. Sites investigated at CFA include landfills, spills, ponds, storage tanks, dry wells, a sewage treatment plant, and buildings and structures. All sites are addressed in the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (DOE-ID 2000a).

Figure 4-5. Aerial view of the Central Facilities Area.

4.5.1 Current State

A current state map showing CFA is included as Figure 4-5a1. The final site at CFA that required remedial action, the Disposal Pond (CFA-04), was remediated in the fall of 2003. There are five sites at CFA that require institutional controls because of residual contamination—three closed landfills (CFA-01, CFA-02, and CFA-03), the CFA French Drains (CFA-07), and the CFA Sewage Treatment Plant Drainfield (CFA-08). Each of these sites is briefly discussed below. A current state conceptual site model for CFA is included as Figure 4-5a2.

The CFA-04 Disposal Pond was used from approximately 1953 to 1969 to collect run-off from CFA and to dispose of laboratory waste. Mercury and radionuclides from research activities were contained in the wastewater discharges. Simulated calcine, a dry granular material contaminated with mercury, was dumped at the edge of the pond and subsequently dispersed by wind, contaminating soil north of the Disposal Pond. The selected alternative for the Disposal Pond was excavation, treatment by stabilization with Portland cement, and disposal in the ICDF. Excavation was completed in October 2003. The excavated material was contaminated soil and asbestos-containing material. Soil with low levels of mercury and no radioactivity above background levels was placed in the CFA landfill. Radioactive soil with low levels of mercury was placed in the ICDF, and approximately 960 yd^3 of material were staged for treatment with Portland cement before disposal in the ICDF. The excavation was backfilled with clean soil to preexcavation grade, graded to blend in with the surrounding terrain, and revegetated. Long-term institutional controls are not anticipated for CFA-04 but will be evaluated after remediation is complete.

The CFA-08 Sewage Treatment Plant Drainfield was used to dispose of sanitary wastewater and wastewater from the INEEL laundry. From 1955 to 1995, the laundry cleaned protective clothing contaminated with low levels of radionuclides. The discharge contained residual quantities of radionuclides. The only COC is cesium-137, which poses a potential human health risk. The selected alternative for CFA-08 was containment. The site was capped with an engineered protective cover in 2002. The cover will isolate the waste, inhibit intrusion by plants and animals, reduce water infiltration, and prevent wind dispersal of the waste while the cesium-137 decays. Institutional controls will be used to restrict access and intrusion. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE-ID 1996).

The CFA-01, CFA-02, and CFA-03 Landfills, a total area of approximately 35 acres, contain trash, cafeteria garbage, wood, masonry, scrap metal, weeds, gravel, asphalt, and asbestos. Asbestos and various chemicals are potentially present but at concentrations below risk-based levels. Even though the risk assessment indicated the landfills did not present an unacceptable risk to human health, remedial actions were conducted because of uncertainty regarding waste type and composition. The three landfills were capped with engineered native soil covers in 1997. Institutional controls include signs and permanent markers, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. A fourth landfill at CFA is currently operating. Groundwater monitoring for VOCs, metals, and nitrates; vadose zone gas monitoring; infiltration monitoring; and maintenance of the landfill covers are required under the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (DOE-ID 2000a).

The CFA-07 French Drains received diluted acids and bases. These two drains were unlined, concrete block cylinders, approximately 4 ft in diameter and 8 ft deep. The cylinders have been removed. It is suspected that lead concentrations above 400 mg/kg and radionuclides may be present at depths greater than 13 ft. This site was determined to require no further action, but institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements.

The Snake River Plain Aquifer underlies the CFA landfills at a depth of 476–495 ft below ground. Groundwater monitoring has been conducted in order to ensure drinking water standards are not exceeded in the aquifer because of migration of contaminants from the landfills. Groundwater samples were collected from 11 wells in the vicinity of the CFA landfills and analyzed for VOCs, anions, metals, and alkalinity. Nitrate was the only analyte that was detected above an MCL. Nitrate concentrations greater than the 10-mg/L MCL for sensitive populations were present in CFA-MON-002 (19.8 mg/L) and CFA-MON-A-003 (11 mg/L) (see Figure 4-5a1). The 10-mg/L MCL applies if the water is available to sensitive populations, such as infants below 6 months of age. A higher MCL of 20 mg/L applies if the water is not available to infants below 6 months of age or to other sensitive populations. The nitrate concentrations have remained stable from 1995 through 2002, with one exception of low values in 1997. Concentrations in all other wells at CFA had nitrate concentrations less than 4 mg/L (INEEL 2003).

The CFA-04 Disposal Pond appears to be the probable source of nitrate in the two wells, as it is located upgradient of the wells. Liquid laboratory waste deposited in the pond between 1953 and 1969 is believed to have included nitrate-containing materials. Since the CFA-04 site was remediated in 2003, nitrate concentrations are expected to decrease. The OU 4-13 ROD (DOE-ID 2000a) predicted that nitrate concentrations would be below 10 mg/L by 2015. Further investigation of the elevated nitrate concentrations was not required by the ROD; however, annual determinations of nitrate levels will continue and be evaluated during 5-year reviews. After the nitrate concentration falls below the MCL of 10 mg/L, annual reporting to the state and EPA will cease (DOE-ID 2000a).

4.5.2 End State

A map showing CFA at the 2035 end state is provided as Figure 4-5b1. The CFA-08 Sewage Treatment Plant Drainfield will remain under institutional control until radioactive decay reduces the cesium-137 concentration to below risk-based levels in about 185 years. It is expected that institutional controls will also still be required at the CFA landfill sites and at CFA-07 (French Drain site) to prevent intrusion (drilling and excavation) in these areas. It is not anticipated that CFA-04 will require institutional controls. A conceptual site model for CFA at the risk-based end state is provided as Figure 4-5b2.

NE is now designated as the laboratory's LPSO and has assumed ownership of the laboratory's common-use support facilities and infrastructure, which include all of the 72 buildings at CFA. New programs are anticipated to be funded and will require either new construction or support from existing CFA facilities. DOE will determine which of the buildings will be needed for future missions. Since CFA will have a long-term nuclear mission, Figure 4-5b1 shows all of the current state facilities and structures although it is possible that some of the buildings may be decommissioned by 2035.

4.5.3 Variances

No variances have been identified for CFA, as all active remediation has been completed.

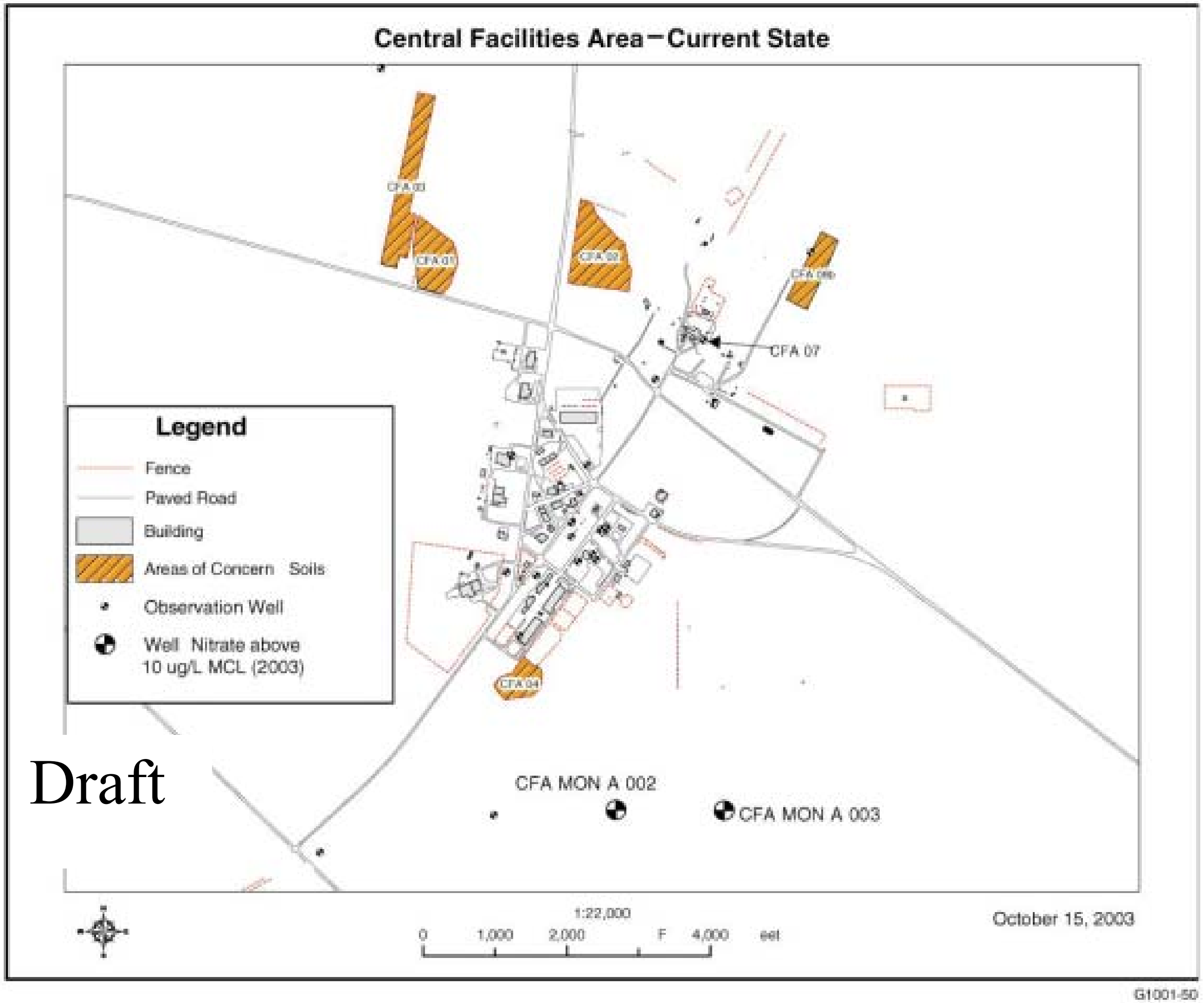

Figure 4-5a1. Central Facilities Area map—current state.

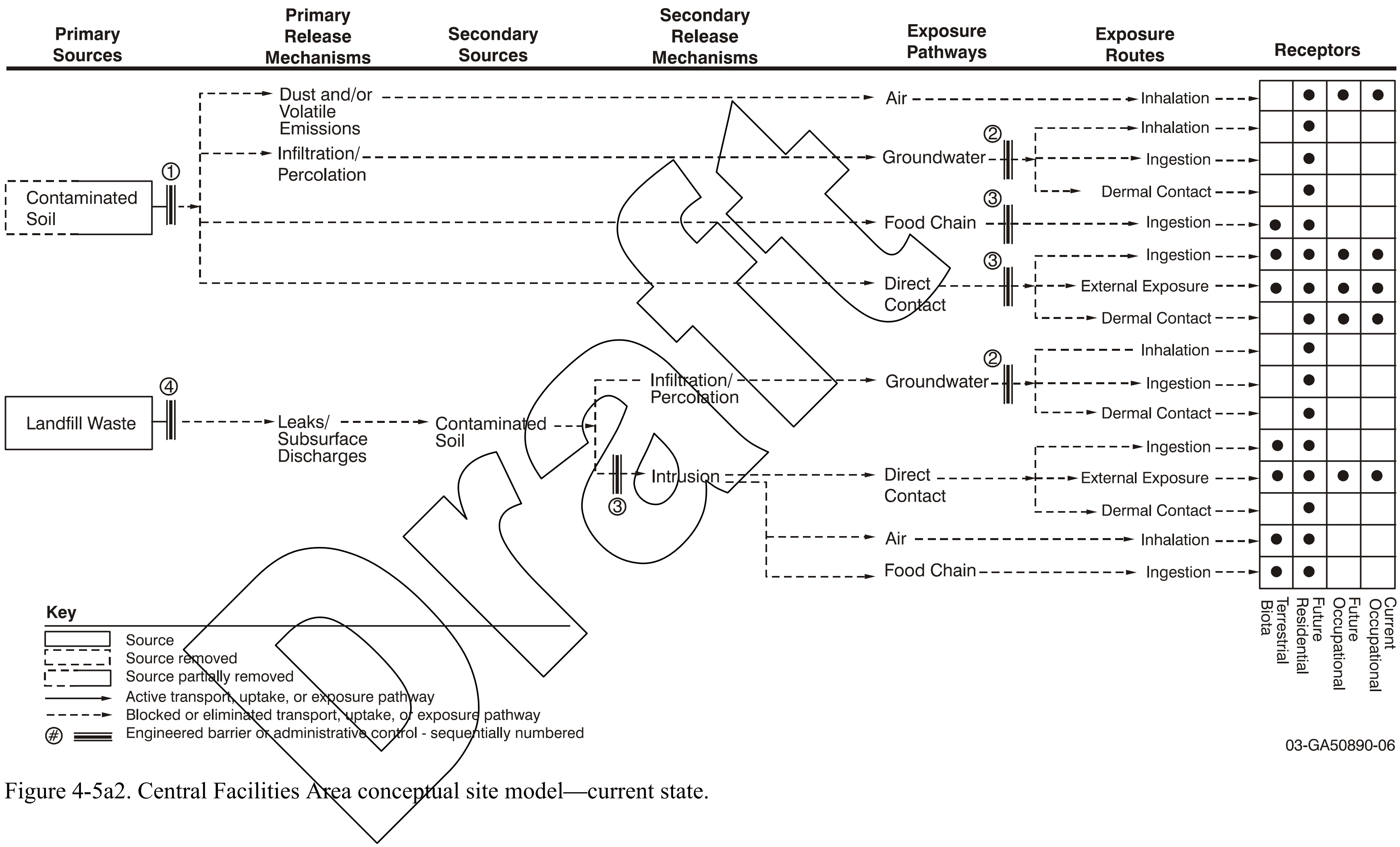

Figure 4-5a2. Central Facilities Area conceptual site model—current state.

Narrative for Figure 4-5a2 Central Facilities Area Conceptual Site Model—Current State

All active remedial actions have been completed. There are currently five sites where institutional controls are in place because residual contamination precludes unrestricted access. These areas include:

- Three capped landfill sites (CFA-01, CFA-02, and CFA-03).
- The CFA-07 French Drain site. The French Drains have been removed, and the site does not present a human health risk to a depth of 10 ft. However, institutional controls are in place to control activities, such as drilling or excavation, as residual lead and radionuclide contamination is suspected at depths below 13 ft.
- The CFA-08 Sewage Treatment Drainfield site. This area contains cesium-137 above risk-based levels and has been capped with an engineered native soil cover. Institutional controls are maintained to protect occupational and hypothetical residential receptors while the radionuclides decay. The estimated time for the cesium-137 to decay to levels that do not present a risk for residential use is 185 years.

One additional site, the CFA-04 Disposal Pond area was recently remediated by excavation and removal of contaminated soil. It is not anticipated that institutional controls will be needed at this site. Confirmatory sampling and calculations will be used to verify that the average residual mercury concentration is below the final remediation goal.

The steps taken to mitigate or remove these hazards are as follows:

1. The selected remedy for the CFA-04 site was excavation of mercury contaminated with disposal in the ICDF, thus removing the source of contamination. The CFA-08 site was capped with an engineered native soil cover in 2002. The cover isolates the contaminated soil, inhibits intrusion by plants and animals, reduces water infiltration, and prevents dust or volatile emissions from the site. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the Site institutional controls database. The source of contamination at the CFA-07 site was also removed; however, some residual contamination is suspected to remain below 13 ft. Therefore, institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements. The entire INEEL Site has restricted access to prevent intrusion by the public.

2. Nitrate concentrations are above the 10-mg/L MCL for sensitive populations (e.g., infants below 6 months of age) in two monitoring wells at CFA. The source of the elevated nitrate is believed to be the CFA-04 Disposal Pond site. This site was remediated in 2003, so nitrate concentrations are expected to decrease. Nitrate concentrations are determined annually. Nitrate concentrations and trends will be evaluated during the 5-year reviews to determine if any actions are needed.

   No unacceptable risks were predicted through the groundwater pathway from sites at WAG 4 in the *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2000b). The entire INEEL Site has restricted access to prevent intrusion by the public.

3. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

4. The three landfill sites were capped with engineered native soil covers in 1997. Institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. Groundwater monitoring for VOCs, metals, and nitrates; vadose zone gas monitoring; infiltration monitoring; and maintenance of the landfill covers are conducted as required by the OU 4-13 ROD (DOE-ID 2000a).

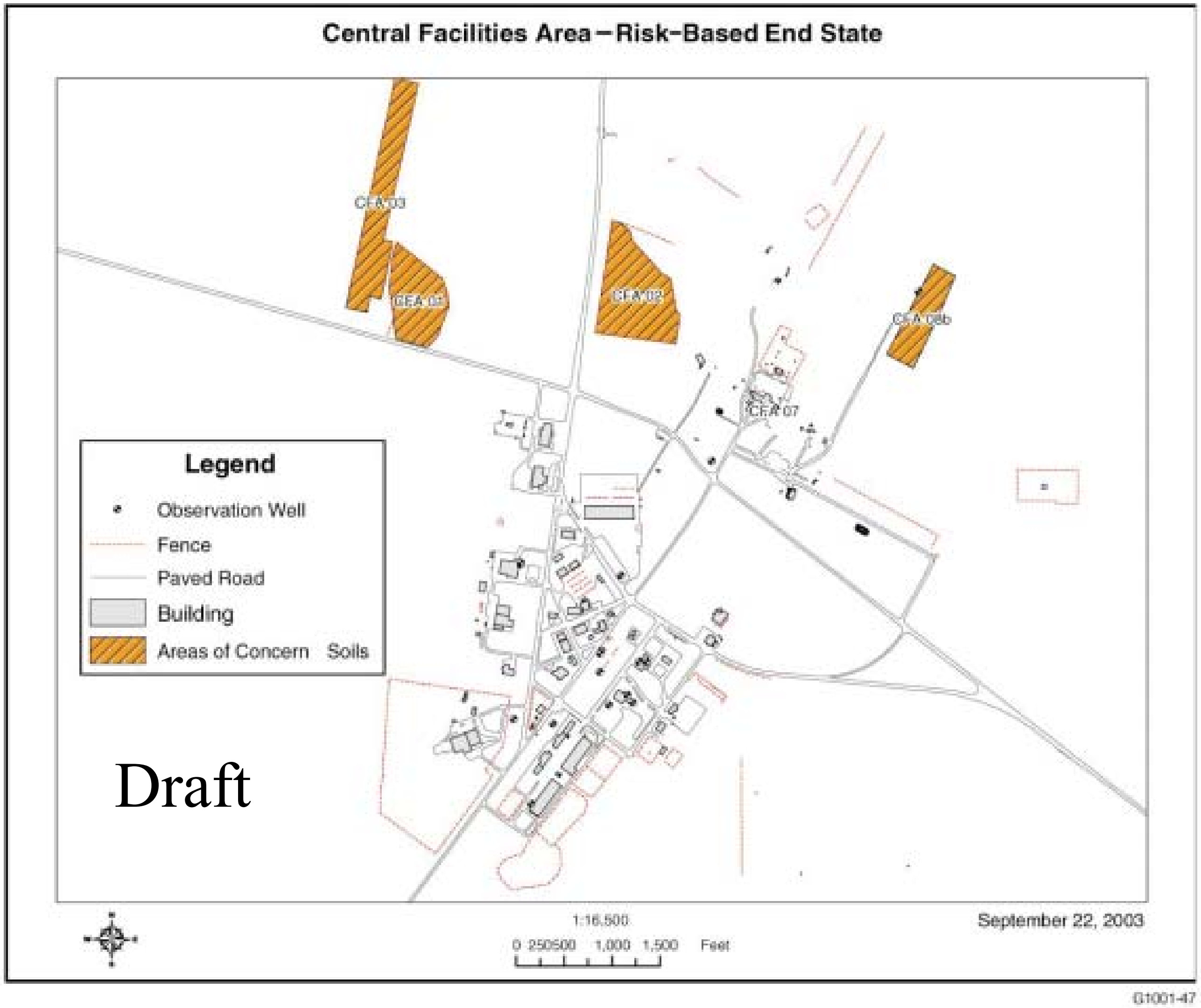

Figure 4-5b1. Central Facilities Area map—risk-based end state.

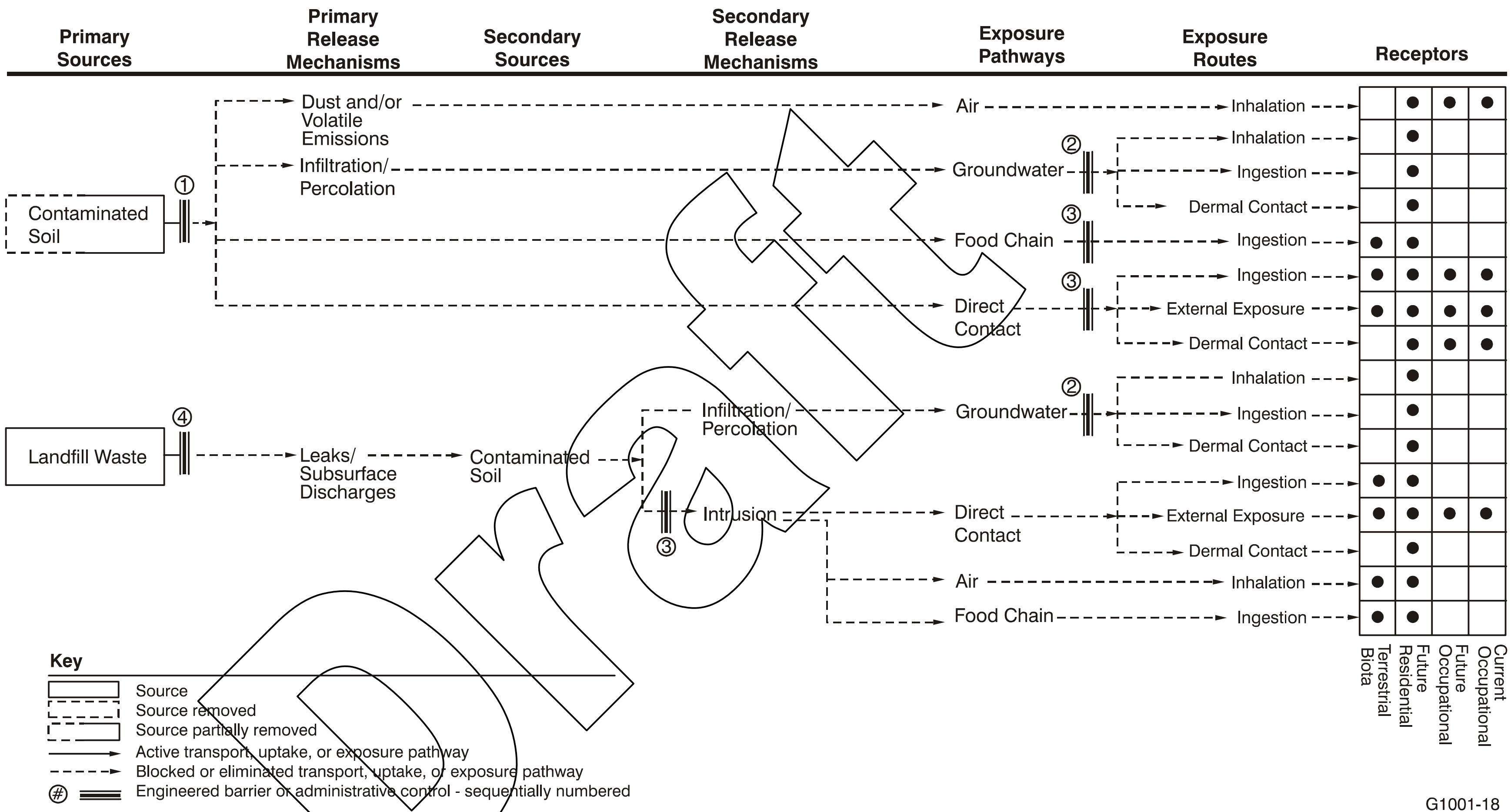

Figure 4-5b2. Central Facilities Area conceptual site model—risk-based end state.

Narrative for Figure 4-5b2 Central Facilities Area Conceptual Site Model—Risk-Based End State

At the end of the EM cleanup mission, it is expected that institutional controls will continue to be required to protect human health at all but one of the sites that currently require institutional controls. The four sites where institutional controls will continue to be required include:

- Three capped landfill sites (CFA-01, CFA-02, and CFA-03)
- The CFA-07 French Drain site. The French Drains have been removed, and the site does not present a human health risk to a depth of 10 ft. However, institutional controls are in place to control activities, such as drilling or excavation, as residual lead and radionuclide contamination is suspected at depths below 13 ft.
- The CFA-08 Sewage Treatment Drainfield site. This area contains cesium-137 above risk-based levels and has been capped with an engineered native soil cover. Institutional controls will be maintained to protect occupational and hypothetical residential receptors while the radionuclides decay. The estimated time for the cesium-137 to decay to levels that do not present a risk for residential use is 150 years following the end of the EM cleanup mission.

The steps taken to mitigate or remove these hazards are as follows:

1. The CFA-08 site was capped with an engineered native soil cover in 2002. The cover isolates the contaminated soil, inhibits intrusion by plants and animals, reduces water infiltration, and prevents dust or volatile emissions from the site. Institutional controls include visible access restrictions, control of activities (drilling or excavation), and publication of surveyed boundaries and descriptions of land-use controls in the Site institutional controls database. The source of contamination at the CFA-07 site was also removed; however, some residual contamination is suspected to remain below 13 ft. Therefore, institutional controls were established to prohibit future residential land use at depths greater than 10 ft. These controls consist of property transfer requirements. The entire INEEL Site has restricted access and use to prevent intrusion by the public.

2. All groundwater at CFA will be below MCLs at the end state. The entire INEEL Site has restricted access and use to prevent intrusion by the public.

3. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

4. The three landfill sites were capped with engineered native soil covers in 1997. Institutional controls include signs and permanent markers, control of activities (drilling and excavation), maintenance of the covers, and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. It is possible that some of the monitoring activities currently required by the OU 4-13 ROD (DOE-ID 2000a) may be discontinued based on the results of 5-year reviews.

4.6 Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area

The Waste Reduction Operations Complex (WROC), Power Burst Facility (PBF), and Auxiliary Reactor Area (ARA) are located fairly close together in the south-central portion of the INEEL Site and were all experimental reactor facilities built in the 1950s.

The ARA-I facility was built in 1957 to support the Stationary Low-Power Reactor No. 1 (SL-1). The SL-1 reactor was built in 1957 and operated intermittently from 1958 until it was destroyed by an accident in January 1961. The ARA facility housed several Army Reactor Program experiments until the program was phased out in 1965. The main buildings at ARA-II were converted to offices and welding shops. The ARA-II facility also housed several minor structures, such as a guardhouse, a well house, a chlorination building, a decontamination and laydown building, a power extrapolation building, an electrical substation, and several storage tanks. The ARA-I and ARA-II facilities were formally shut down in 1988 and 1986, respectively. Decontamination and complete dismantlement were initiated in 1995 and have been completed. Construction of the ARA-III facility was completed about 1959 to house the Army Gas Cooled Reactor Experiment research reactor. Experiments with the reactor continued until the plant was deactivated in 1961. In 1963, the ARA-IV facility was modified to support the Mobile Low-Power Reactor series of tests conducted at ARA-IV and remained active until late 1965 when the army reactor program was phased out. In 1969, two buildings were constructed at ARA-III to provide additional laboratory and office space in support of other INEEL programs. The facility was shut down in 1989. Decontamination and complete dismantlement was initiated in 1990 and completed in 1999. The ARA-IV facility was build to accommodate the Mobile Low-Power Reactor I, an active project from 1957 to 1964. The Nuclear Effects Reactor was operated at ARA-IV from 1967 to 1970. The area was closed down until 1975, at which time it was used temporarily for some welding qualification work. DD&D was performed in 1984 and 1985. Since 1985, the area has been used occasionally for testing explosives in powered-metal manufacture experiments. A small control building, a bunker, the buried remains of two leach pits, and a sanitary waste system are all that remain.

PBF and the Control Area were originally built in the late 1950s for remote control of Special Power Excursion Reactor Test (SPERT) experiments. Later, the PBF reactor was constructed in 1972, put on standby in 1985, and shut down in 1998. Fuel was recently removed from the reactor pools and is now in dry storage at INTEC. Cleanup activities are scheduled to be complete by 2012. The Control Area facilities provide raw water storage and distribution, administrative offices, instrument and mechanical work areas, and data acquisition resources.

The buildings that currently house WROC were originally built to contain the SPERT reactors. The SPERT reactor tests involved four reactors. SPERT-I reactor was operated from 1955 to 1964. It was decommissioned in 1964 and demolished in 1985. The SPERT-II reactor was operated from 1960 to 1964. After the reactor was removed, the facility was converted for research purposes. The SPERT-II area is also used for temporary storage of uncontaminated lead. The lead is stored outside in cargo containers stacked on asphalt pads. The SPERT-III reactor was constructed in the late 1950s and operated from 1958 to 1968. The reactor building was decontaminated in 1982, and the building was modified to contain the Waste Experimental Reduction Facility Incinerator (see Figure 4-6). All four SPERT reactor vessels are buried in the RWMC. Decontamination and dismantlement of the incinerator was completed in 2003, and the RCRA closure certification was approved by the State of Idaho on October 7, 2003. The SPERT-IV reactor was operational from 1961 to 1970. After the reactor was removed, the building was converted to a mixed waste storage facility. All waste stored in the building was removed in September 2003, and the facility will undergo RCRA closure in 2004. Various reactor areas have housed secondary missions, including reduction of low-level radioactive waste, development of waste treatments, storage of waste, incineration of waste, and laboratory operations.

Three RODs and two time-critical removal actions have been completed at ARA and PBF. The OU 5-05 and 6-01 ROD (INEEL 1996), which addressed the ARA-06 SL-1 Burial Ground and 10 additional sites, was implemented in 1996. The *Power Burst Facility Record of Decision: Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5* (DOE-ID 1992c) addressed the PBF-08 Corrosive Waste Sump and the PBF-10 Evaporation Pond. Remediation of these areas was completed in 1994. The *Record of Decision: Auxiliary Reactor Area-1 Chemical Evaporation Pond, Operable Unit 5-10* (DOE-ID 1992d) addressed the ARA-01 Chemical Evaporation Pond.

Figure 4-6. Aerial view of the Waste Experimental Reduction Facility with the Control Area shown in the distance.

Fifty-five sites of known or suspected contaminant release were evaluated in the OU 5-12 comprehensive ROD completed in February 2000. The *Record of Decision for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12* (DOE-ID 2000c) identified five contaminated soil sites (ARA-01, ARA-12, ARA-23, ARA-25, and PBF-16), one sanitary waste system site (ARA-02), and one radionuclide tank site (ARA-16) as requiring remediation.

In addition to the CERCLA cleanup activities, a release investigation of a heating fuel release near building PER-620 is being conducted in accordance with Idaho's *Risk-Based Corrective Action Guidance Document for Petroleum Releases* (IDEQ 1996). The PER-722 underground storage tank is located immediately next to and on the north side of the PBF reactor building (PER-620). The tank is a 10,000-gal, single-walled carbon steel tank that was used to supply heating fuel to PBF-620. The tank was installed in 1971 and had been in continual use until the discovery of a possible leak in June 2002. During routine gauging of the tank, a decrease in product level was observed, and a release was reported to the IDEQ. Following removal of the remaining product from the tank, a state-certified vendor performed a tank-tightness determination on June 28, 2002. The results of that test confirmed the presence of a leak in

PER-722. Engineering calculations indicate that as much as 17,000 gal of product may have leaked into the subsurface between November 1999 and June 2002.

The contaminants of potential concern include those associated with No. 2 diesel fuel and include benzene, toluene, ethyl benzene, and xylenes and polynuclear aromatic hydrocarbons, including acenapthene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, benzo(g,h,i)perylene, chrysene, fluorene, fluoranthene, naphthalene, phenanthrene, and pyrene. In April 2003, a single core hole was installed near the PER-722 tank to a depth of 140 ft below land surface. Evidence of diesel contamination was present in the core and continued to the bottom of the coring. Based on review of the data collected from the core hole, the IDEQ has requested additional characterization to further define the extent of contamination into the underlying basalt and sedimentary interbeds and to determine if an impact to the Snake River Plain Aquifer may exist. The results of the additional characterization will determine if further action may be warranted.

4.6.1 Current State

A map showing the current state of this area is included as Figure 4-6a1. To date, remedial actions at sites ARA-02, ARA-16, ARA-25, and PBF-16 have been completed. Remedial actions at sites ARA-01, ARA-12, and ARA-23 will be completed by 2005. Site ARA-01 will be remediated to address human health risks from arsenic and potential risks to ecological receptors from exposure to selenium and thallium. Site ARA-12 will be remediated to address human health risks from silver-108m and cesium-137 and ecological risks from copper, mercury, and selenium in surface and subsurface soil. An area of elevated gamma activity to the southwest of the site also will be remediated. Site ARA-23, which includes the radiological contaminated soil around ARA-I and ARA-II, the remaining reactor foundation, and remaining underground utilities within the facility fences, will be remediated to address the human health risks from cesium-137. A conceptual site model that represents the current state conditions is provided as Figure 4-6a2.

Currently, institutional controls are maintained at the following sites:

- ARA-01 ARA-I (Chemical Evaporation Pond). The COCs are arsenic and potential risks to ecological receptors from exposure to selenium and thallium.

- ARA-02 ARA-I (Sanitary Waste System). The COCs were lead, Aroclor-1242, radium-226, cesium-137, uranium-235, and uranium-238.

- ARA-03 ARA-I (lead sheeting pad near ARA-627). The COC was cesium-137. Soil was removed as part of the DD&D of ARA-I and disposed of at the RWMC. Because of the presence of cesium-137, the site has been restricted to industrial use with institutional controls.

- ARA-06 ARA-II (Stationary Low-Power Reactor No. 1 Burial Ground). In 1996, a remedial action consisting of an engineered barrier was implemented because of exposure to radiological contaminated soil and waste from the 1961 SL-1 reactor accident and cleanup.

- ARA-07 ARA-II (Seepage Pit to East) (ARA-720A). No COCs were identified for this site; however, based on historical analytical data, residual cesium-137 contamination that warrants institutional controls exists.

- ARA-08 ARA-II (Seepage Pit to West) (ARA-720B). No COCs were identified for this site; however, based on historical analytical data, residual cesium-137 contamination that warrants institutional controls exists.

- ARA-12 ARA-III (Radioactive Waste Leach Pond). The COCs are silver-108m and cesium-137.

- ARA-16 ARA-I (Radionuclide Tank). The soil COC was cesium-137.

- ARA-23 (radiological contaminated surface soil around ARA-I and ARA-II). The COC is cesium-137.

- ARA-24 ARA-III (windblown soil). A contaminated pipeline embedded in concrete 20 ft below grade remains.

- ARA-25 ARA-I (soil beneath the ARA-626 Hot Cells). The COCs were arsenic, cesium–137, and radium-226. There are potential risks to ecological receptors from exposure to copper and lead.

- PBF-10 PBF (Reactor Area Evaporation Pond) (PBF-733). The COC was cesium-137. An interim action was completed in 1994 and in 1995 when the pond liner was removed, the berm was pushed into the pond, and the area was graded and seeded with native grass.

- PBF-12 PBF SPERT-I (Leach Pond). The COC was cesium-137.

- PBF-13 PBF (Reactor Area Rubble Pit). There is no unacceptable risk, but the site contains construction waste, possibly friable asbestos.

- PBF-21 PBF SPERT-III (Large Leach Pond). The COCs were cesium-137 and uranium-238. The contamination is covered by an 8-ft-thick layer of soil.

- PBF-22 PBF SPERT-IV (Leach Pond) (PBF-758). The COC was cesium-137.

- PBF-26 PBF SPERT-IV (lake). The COCs were arsenic, Aroclor-1254, cesium-137, uranium-235, and uranium-238.

There are still open VCO actions at PBF. These will be completed in 2004.

4.6.2 End State

A map and conceptual site model showing anticipated conditions at the end state are included as Figures 4-6b1 and Figure 4-6b2.

Following the first 5-year remedy effectiveness review in 2005, it is anticipated that maintenance of institutional controls at five of the sites that have been remediated (ARA-01, ARA-02, ARA-12, ARA-16, and ARA-23) will be discontinued. Because of its proximity to the ARA-23 site, contaminated soil that comprises ARA-03 may very well be remediated by default, thereby negating the need for institutional controls. Institutional controls were never a requirement for PBF-16.

Remediation of all sites will be completed by 2005. However, institutional controls to restrict access will be required in 2035 at the following sites because of continued radionuclide contamination, unless a 5-year remedy effectiveness review determines that institutional controls are no longer required:

- ARA-06 ARA-II (Stationary Low-Power Reactor No. 1 Burial Ground)
- ARA-07 ARA-II (Seepage Pit to East) (ARA-720A)
- ARA-08 ARA-II (Seepage Pit to West) (ARA-720B)
- ARA-24 ARA-III (windblown soil)
- ARA-25 ARA-I (soil beneath ARA-626 Hot Cells)
- PBF-10 PBF (Reactor Area Evaporation Pond) (PBF-733)
- PBF-12 PBF SPERT-I (Leach Pond)
- PBF-13 PBF (Reactor Area Rubble Pit)
- PBF-21 PBF SPERT-III (Large Leach Pond)
- PBF-22 PBF SPERT-IV (Leach Pond) (PBF-758)
- PBF-26 PBF SPERT-IV (lake).

The WROC area is expected to have a long-term mission supporting various NE programs.

4.6.3 Variances

A potential variance related to cleanup of the three remaining ARA sites has been identified and is described in Table 5-1. The ROD selected remedy was based on scenarios that included residential receptors after 100 years. It is proposed that an evaluation be conducted to determine the level of cleanup that would be required to protect occupational receptors, assuming no future residential use of the ARA sites and surrounding area.

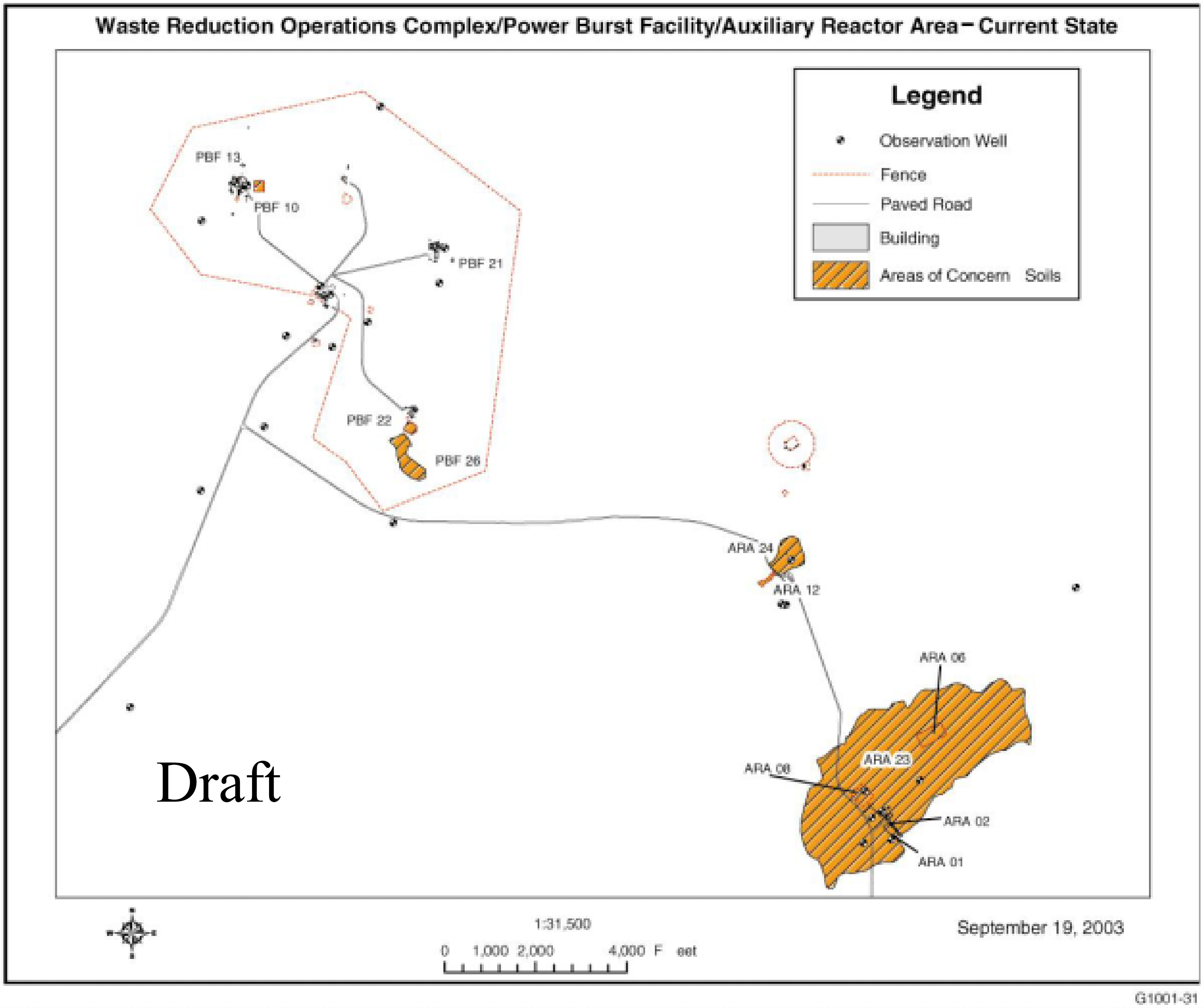

Figure 4-6a1. Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area map—current state.

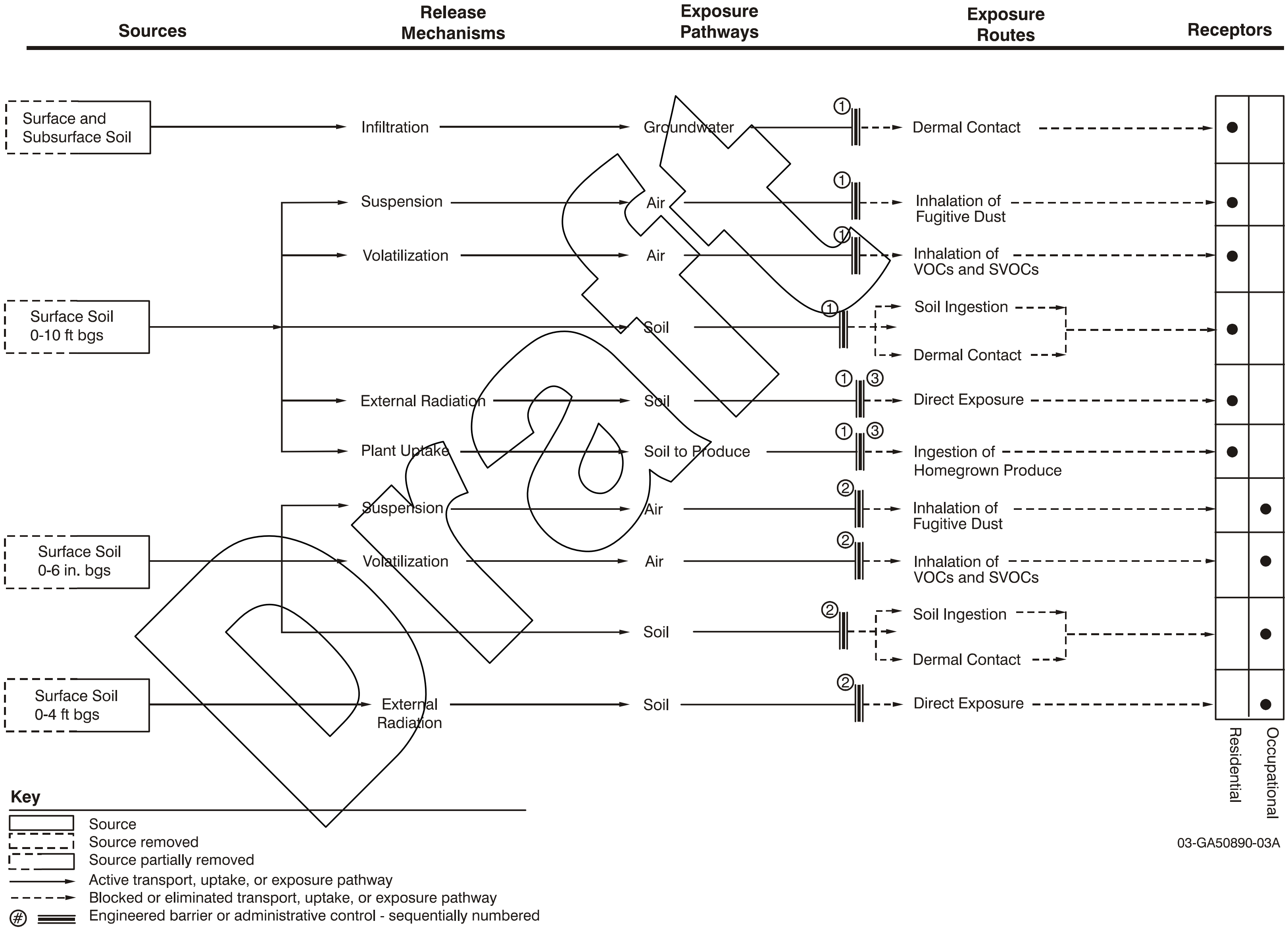

Figure 4-6a2. Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area conceptual site model—current state.

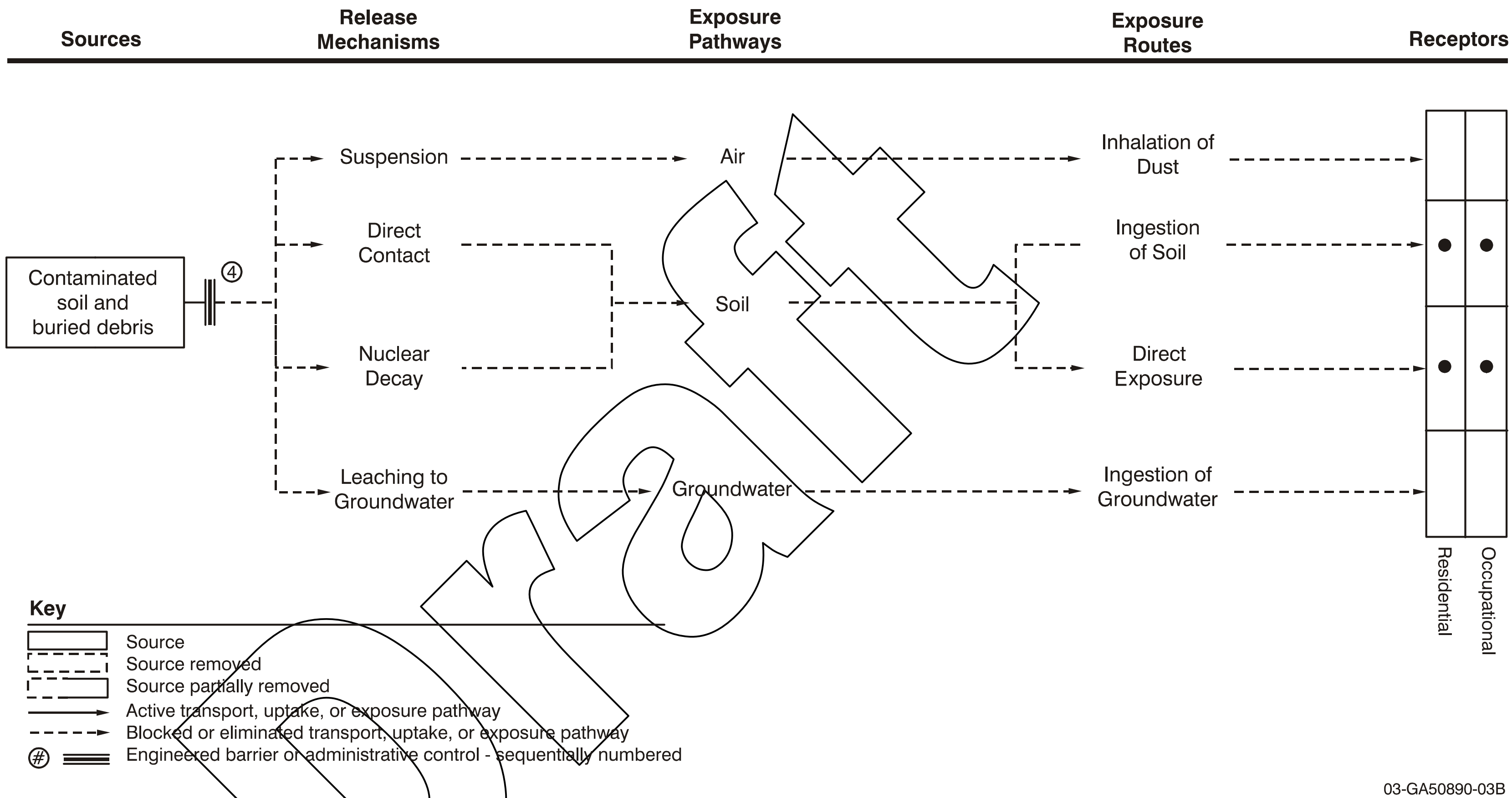

Figure 4-6a2 (continued). Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area conceptual site model—current state.

SVOC = semivolatile organic compound

Narrative for Figure 4-6a2 Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area Conceptual Site Model—Current State

All remedial actions have been completed, except for sites ARA-01, ARA-12, and ARA-23. All remedial actions will be completed by 2005. Site ARA-01 will be remediated to address human health risk from arsenic and potential risks to ecological receptors from exposure to selenium and thallium. Site ARA-12 will be remediated to address human health risks from silver-108m and cesium-137 and ecological risks from copper, mercury, and selenium in surface and subsurface soil. An area of elevated gamma activity to the southwest of the site also will be remediated. Site ARA-23, which includes the radiological contaminated soil around ARA-I and ARA-II and the remaining reactor foundation and the remaining underground utilities within the facility fences, will be remediated to address the human health risks from cesium-137.

The steps taken to mitigate or remove these hazards are as follows:

1. Institutional controls are in place at sites ARA-01, ARA-12, and ARA-23 until remediation is implemented as prescribed in the ROD. The selected remedial action for these sites is removal and on-Site disposal at the ICDF. The estimated volume of contaminated soil is 1,373,243 ft^3. Institutional controls are maintained at 14 other sites that have been remediated.

   The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

2. Workers are protected from direct exposure to radionuclide contamination through institutional controls. These controls include posting of signs at contaminated sites, radiological training, and work control processes used to identify hazards and mitigation measures for planned work activities.

3. The entire INEEL Site has restricted access to prevent intrusion by the public. Visible access restrictions (warning signs) are in place at sites with institutional controls.

4. For the SL-1 Reactor Burial Ground, containment by capping with an engineered long-term barrier provides overall protection of human health and the environment. Isolation both inhibits migration of contaminants from the burial ground and allows time for radioactive decay of the primary contributor to the overall risk (i.e., cesium-137 and progeny). The risk diminishes to 1E-04 in approximately 400 years.

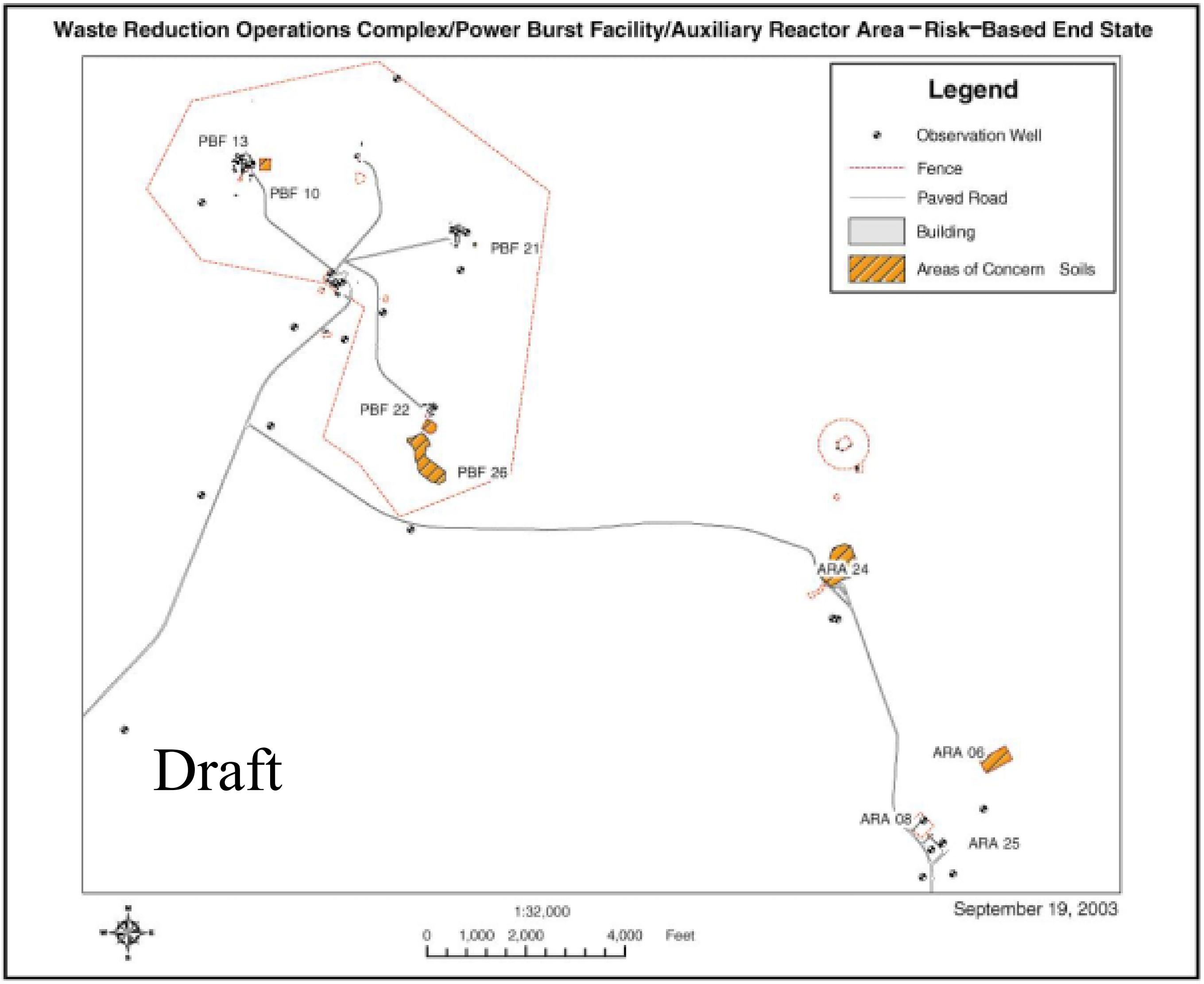

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Figure 4-6b1. Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area map—risk-based end state.

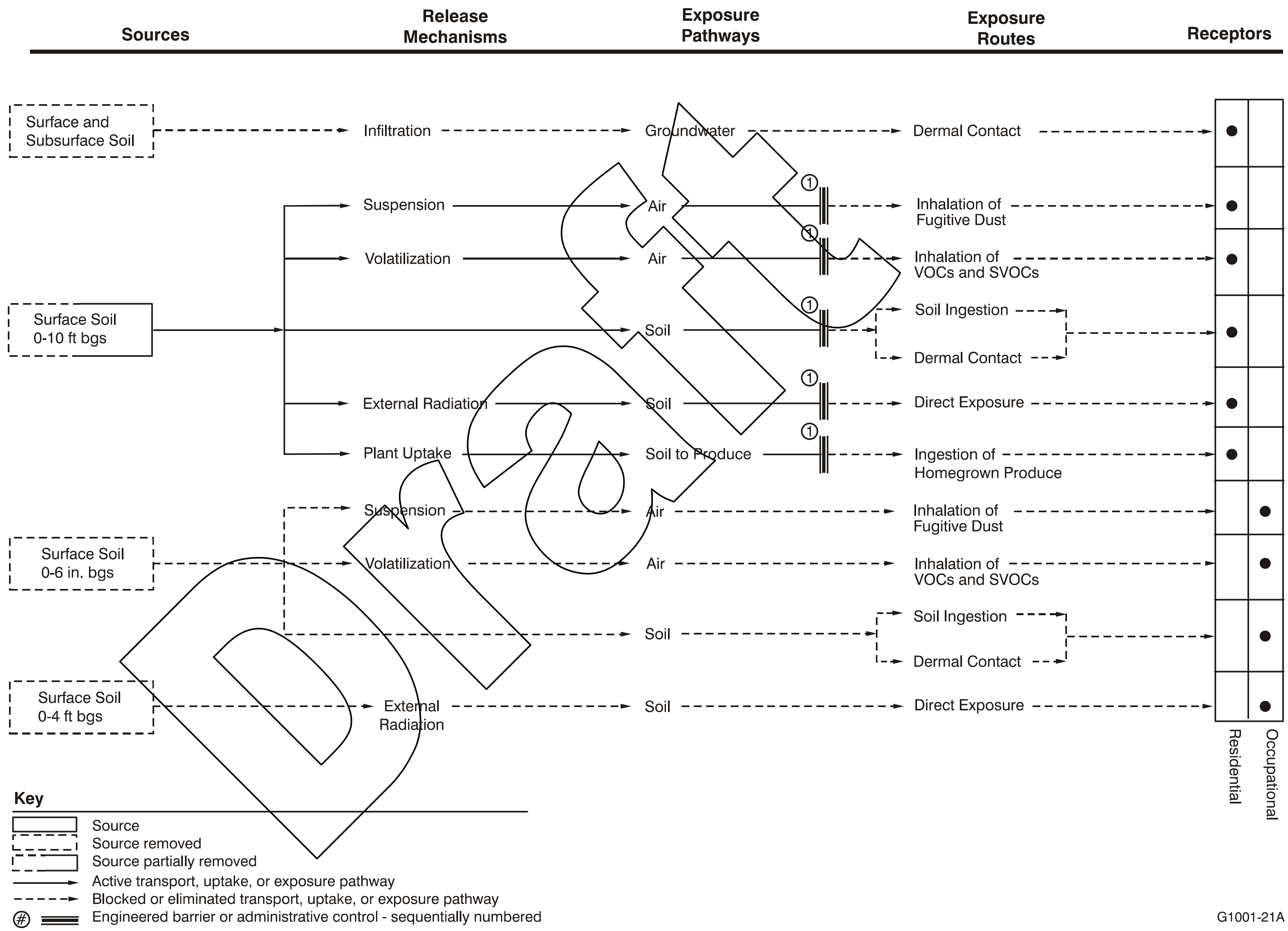

Figure 4-6b2. Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area conceptual site model—risk-based end state.

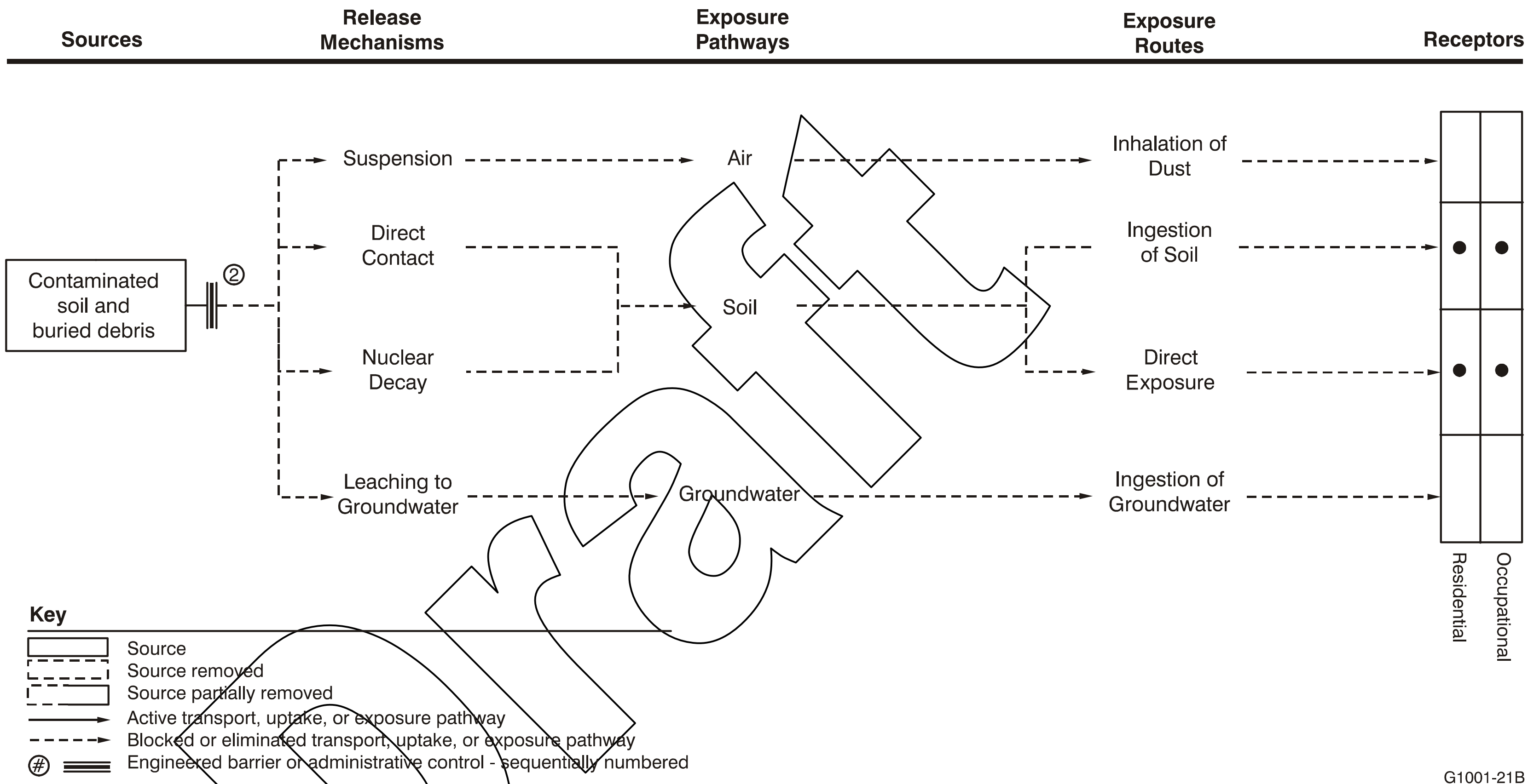

Figure 4-6b2 (continued). Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area conceptual site model—risk-based end state.

SVOC = semivolatile organic compound

Narrative for Figure 4-6b2 Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area Conceptual Site Model—Risk-Based End State

Remediation of all sites will be completed by 2005. Institutional controls at sites ARA-06, ARA-07, ARA-08, ARA-24, ARA-25, PBF-10, PBF-12, PBF-13, PBF-21, PBF-22, and PBF-26 will be required because of continued radionuclide contamination, unless a 5-year remedy effectiveness review determines that institutional controls should not be maintained.

The steps taken to mitigate or remove these hazards are as follows:

1. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

2. For the SL-1 Reactor Burial Ground, containment by capping with an engineered long-term barrier provides overall protection of human health and the environment. Isolation both inhibits migration of contaminants from the burial ground and allows time for radioactive decay of the primary contributor to the overall risk (i.e., cesium-137 and progeny). The risk diminishes to 1E-04 in approximately 400 years.

4.7 Test Reactor Area

Since the early 1950s, the Test Reactor Area (TRA), located in the south-central portion of the INEEL Site, has provided facilities for operation of experimental nuclear reactors, physics and chemistry laboratories, administrative space, and other plant support. There are currently 89 buildings at TRA, ranging in age from those built in the early 1950s to newly constructed buildings and structures (see Figure 4-7).

Figure 4-7. Aerial view of the Test Reactor Area.

Three major reactors have been built at TRA, including the Materials Test Reactor (MTR), the Engineering Test Reactor (ETR), and the Advanced Test Reactor (ATR). An additional reactor, the ATR Criticality Facility at TRA, is a full-scale, low-power version of the ATR designed to provide physics data. The Materials Test Reactor and Engineering Test Reactor are no longer operational.

The primary mission of TRA is continued operation of the ATR, the world's largest test reactor, which is used to conduct irradiated material testing, nuclear safety research, and nuclear isotope production. The ATR's current primary mission is reactor fuels and core component development and testing for the Naval Nuclear Propulsion Program. The ATR also will continue its long-term mission of radioisotope production for medical, industrial, and research applications. The ATR is planned to provide major support in the development of next-generation nuclear power systems and other advanced nuclear technologies. In addition to the ATR, several other significant nuclear operations are conducted at the TRA, which include radiochemistry laboratory operations, hot cell operations, and the Safety and Tritium Applications Research Program.

TRA was designated as WAG 2 (OU 2-13) in the FFA/CO. The main sources of contamination at TRA include the Warm Waste Pond, the Chemical Waste Pond, and the Sewage Leach Pond. Seepage from these infiltration ponds and the injection well contaminated groundwater beneath TRA, principally with chromium and tritium.

Fifty-five sites of known or suspected contaminant release at TRA were evaluated in the *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997a). The *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997b) determined that four sites would require active action and that four sites would require limited action. The remaining 47 sites were determined to require no further action. The *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13* (DOE-ID 2000d) identified seven of the 47 sites, which were listed previously as no action sites, requiring specific institutional controls to prevent a possible threat to human health and the environment. These seven sites along with the eight sites identified as requiring action in the *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997b) bring the total number of sites requiring institutional controls to 15.

Two earlier RODs for TRA were the *Record of Decision: Test Reactor Area Perched Water System, Operable Unit 2-12* (DOE-ID 1992e) and the *Declaration of the Record of Decision for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory* (DOE-ID 1991b).

4.7.1 Current State

A current state map of TRA is included as Figure 4-7a1. A current state conceptual site model for TRA is included as Figure 4-7a2.

The ETR and MTR have both been deactivated. Both facilities have been defueled, but the reactor vessels are still in place. Cleanup of the MTR canal is in progress. The ETR building is currently not being used. The MTR building is currently used for a variety of activities including office space, special projects, and warehouse facilities. Cleanup activities at the ETR and MTR buildings are scheduled to be complete by 2020.

There are still a number of open VCO actions at TRA, which involve characterization of tanks and tank systems and RCRA closures. These are all scheduled to be complete by 2012.

The active remediation work for OU 2-13 was completed in December 1999. Remedial actions include consolidating and capping contaminated sediments, removing contaminated materials, implementing institutional controls, and monitoring the decrease of contamination in groundwater through radioactive decay, dispersion, and natural attenuation. The *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c) found that remedies are performing as expected and are continuing to provide protection of human health and the environment. Potential short-term threats are being addressed through institutional controls. In the long term, the remedies are expected to be protective when groundwater cleanup goals are achieved through monitored natural attenuation.

There are currently 15 sites where institutional controls are in place because residual contamination precludes unrestricted access. These sites include the covered Warm Waste Pond (TRA-03); the covered Chemical Waste Pond (TRA-06); the covered Sewage Leach Pond (TRA-13) and surrounding soil contamination area (TRA-13SCA); the operating Cold Waste Pond (TRA-08); the Soil Surrounding Hot Waste Tanks at TRA-613 (TRA-15); the soil surrounding Tanks 1 and 2 at TRA-630 (TRA-19); the Brass Cap Area (TRA-Y); the Warm Waste Retention Basin (TRA-04); three polychlorinated biphenyl spill sites at TRA-619, TRA-626, and TRA-653; the North Storage Area (TRA-34); the Hot Tree Site (TRA-X); and Perched and Snake River Basin Aquifer Groundwater (TRA-GW). The sites are shown on Figure 4-7a1.

Active remediation was conducted at four pond sites: the Cold Waste Pond, the Warm Waste Pond, the Chemical Waste Pond, and Sewage Leach Pond and Berm. The Cold Waste Pond (TRA-08) is still in use today. In 1999, approximately 80 yd^3 of cesium-137 contaminated soil were removed from this site and transported to the Warm Waste Pond for disposal. The Chemical Waste Pond (TRA-06) was covered with an engineered soil cover that was reseeded with native vegetation to control erosion. There are no restrictions on industrial land use at these two sites. The Warm Waste Pond (TRA-03) was capped with an engineered soil cover and covered by a 2-ft-thick riprap layer to inhibit human intrusion. The Sewage Leach Pond and Berm (TRA-13) were remediated by excavation of soil contaminated with cesium-137 concentrations greater than 23.3 pCi/g from the berms and by placement of contaminated soil in the bottom of the Sewage Leach Pond. The area was then covered with an engineered soil cover and reseeded with native vegetation to control erosion. TRA-03 and TRA-13 both require institutional controls to control occupational access and activities for more than 30 years.

The four limited-action sites include TRA-15, TRA-19, TRA-Y, and TRA-13SCA. Actions taken at these sites were limited to institutional controls, with a contingent excavation and disposal option for TRA-19 and the Brass Cap Area to be used if necessary. The institutional controls include restricting occupational access and prohibiting residential use. This is accomplished through restricted access to the INEEL Site, warning signs at contaminated areas, and control of activities (drilling and excavation).

The remaining seven sites are under institutional control to restrict access until contaminant concentrations decrease to levels that allow for unlimited use and unrestricted access. For most of these sites, the institutional controls restrict use of the sites to industrial land use only for varying periods of time. The three polychlorinated biphenyls contaminated sites were remediated in 1990 to remove polychlorinated biphenyls contaminated soil to meet the 25-ppm limit for industrial sites defined by Toxic Substances Control Act requirements. Residual contamination at these sites is below Toxic Substances Control Act levels for industrial areas but greater than the 10-ppm requirement for unrestricted use. Therefore, permanent institutional controls are required to prohibit future residential use.

There are three water bodies beneath TRA: (1) a shallow-perched water zone, (2) a deep-perched water zone, and (3) the Snake River Plain Aquifer. The selected remedy for TRA groundwater was "no action with monitoring." The *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12* (Dames & Moore 1993) specified that sampling and analysis for all COCs would be performed quarterly for six deep-perched water wells and semiannually for four aquifer wells.

The primary COCs identified for the aquifer are chromium and tritium. Tritium levels in all aquifer wells are below the MCL and are expected to continue to decrease because of radioactive decay and dilution. Measured concentrations of chromium levels currently exceed the MCL (100 μg/L) in two wells. The unfiltered chromium levels are approximately 160 μg/L in TRA-07 and approximately 130 μg/L in USGS-065. The chromium levels have shown a decreasing trend since 1990 and are expected to decline below the MCL by 2012 for all wells. This projection is supported by groundwater data collected and summarized in the *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c).

Groundwater modeling completed before signing of the OU 2-12 ROD (DOE-ID 1992e) predicted the dissipation of perched water within 7 years following cessation of discharge to all disposal ponds. The new mission for the INEEL, which will keep TRA operational for at least another 20 years, will cause perched water to persist beneath TRA beyond the modeling assumptions used in the risk assessment. The primary source of water to the perched water system, the Cold Waste Pond, receives only uncontaminated effluent. There has been a general decreasing trend in concentrations for chromium, tritium, strontium-90, and cobalt-60 in the perched water zone. Exceptions to the general decreasing trend include increasing or flat activities of strontium-90 in four perched water wells and a recent increase of cobalt -60 in one well. Because of the high Kd (i.e., soil-water partitioning coefficient) values of these contaminants and the fact that pre-ROD modeling used similar concentrations in perched water to model impact to the aquifer, it seems unlikely that the downward transport of perched water containing strontium -90 or cobalt-60 could significantly impact the aquifer in the short term. Diesel was discovered during drilling of one well during the remedial investigation in 1990. Product floating on the deep-perched water body has been observed in this well intermittently since that time, and it has been the subject of several investigations. The results of the modeling determined that the diesel did not pose an unacceptable risk to the aquifer. However, the source and aerial extent of the diesel plume have never been fully characterized, and it was determined during the first 5-year review that additional characterization of this problem is warranted. Ongoing discussions with the agencies will define activities to fully evaluate the perched water contamination and long-term impacts on the aquifer given that TRA operations are expected to continue for at least another 20 years.

Additional detailed information on current state conditions at TRA is available from the *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003c).

4.7.2 End State

A map showing TRA at the 2035 end state is provided as Figure 4-7b1. It is anticipated that institutional controls at the following sites will be discontinued within 30 years:

- TRA-04 (the Warm Waste Retention Basin surficial sediments)
- TRA-06 (the Chemical Waste Pond)
- TRA-08 (the Cold Waste Disposal Pond)
- TRA-34 (soil at North Storage Area)
- TRA-X (soil contamination at Hot Tree Site).

Institutional controls will be maintained at the Warm Waste Pond and the Sewage Leach Pond. The Sewage Leach Pond (TRA-13) will require controls through approximately 500 years. TRA-03 (the Warm Waste Pond) will require controls for 100 years because of radioactive contamination. Institutional controls at these sites include warning signs, control of activities (drilling or excavating), and notice to affected stakeholders. Institutional controls at TRA-15, TRA-19, TRA-Y, TRA-13SCA, and the three polychlorinated biphenyl contaminated sites still will be required at completion of the EM cleanup mission. TRA-13SCA and TRA-15 are expected to be available for unrestricted industrial use at that time, but controls still will be needed to prohibit residential use.

A conceptual site model for TRA at the risk-based end state is provided as Figure 4-7b2.

NE is now designated the LPSO and has assumed ownership of most of the buildings at TRA. NE will determine which of the buildings will be needed for future missions. Since TRA will have a long-term nuclear mission, Figure 4-7b1 shows all of the current state facilities and structures although it is possible that some TRA buildings may be decommissioned before the end of the EM mission.

4.7.3 Variances

No potential variances have been identified for TRA, as all active remediation work has been completed.

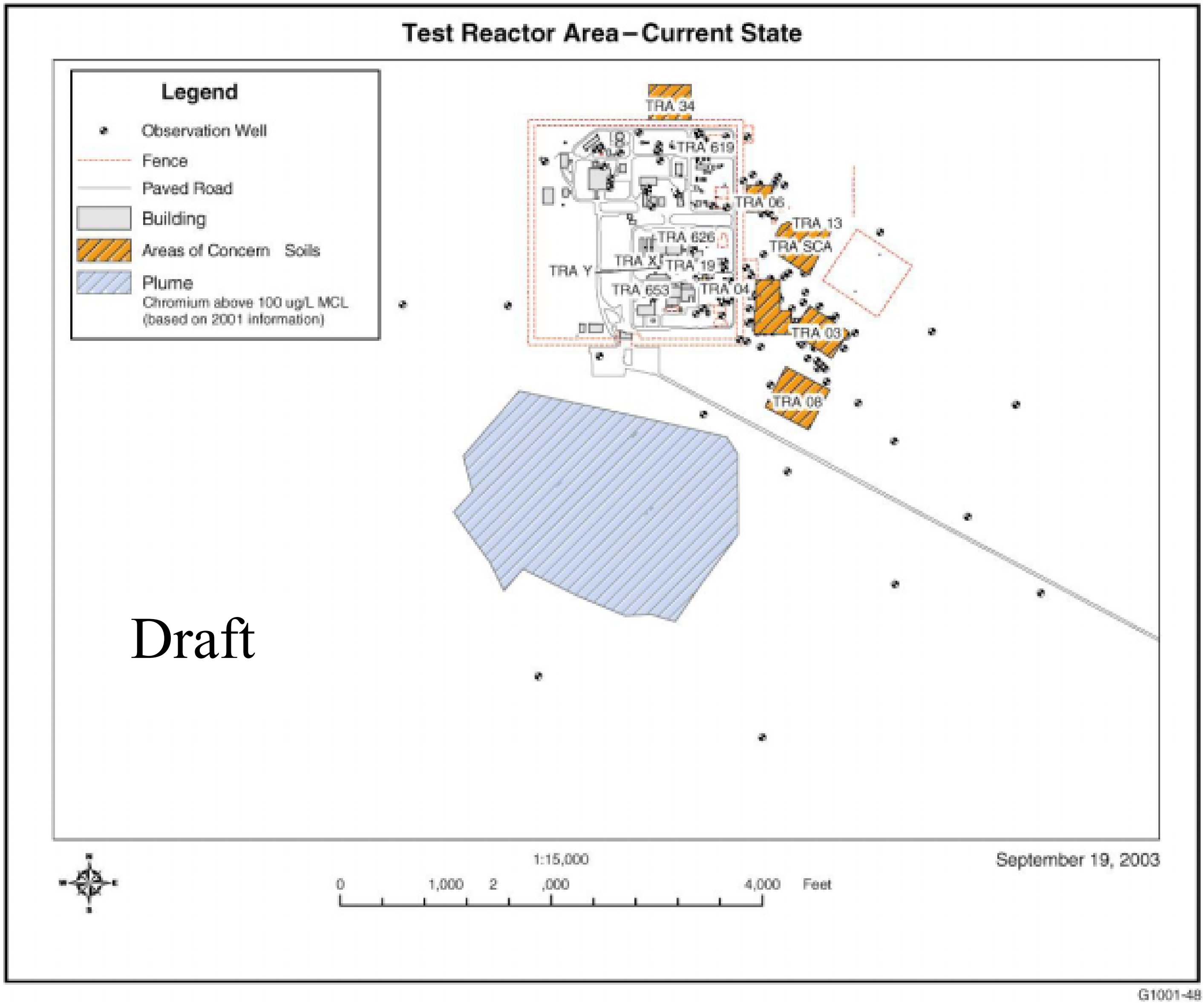

Figure 4-7a1. Test Reactor Area map—current state.

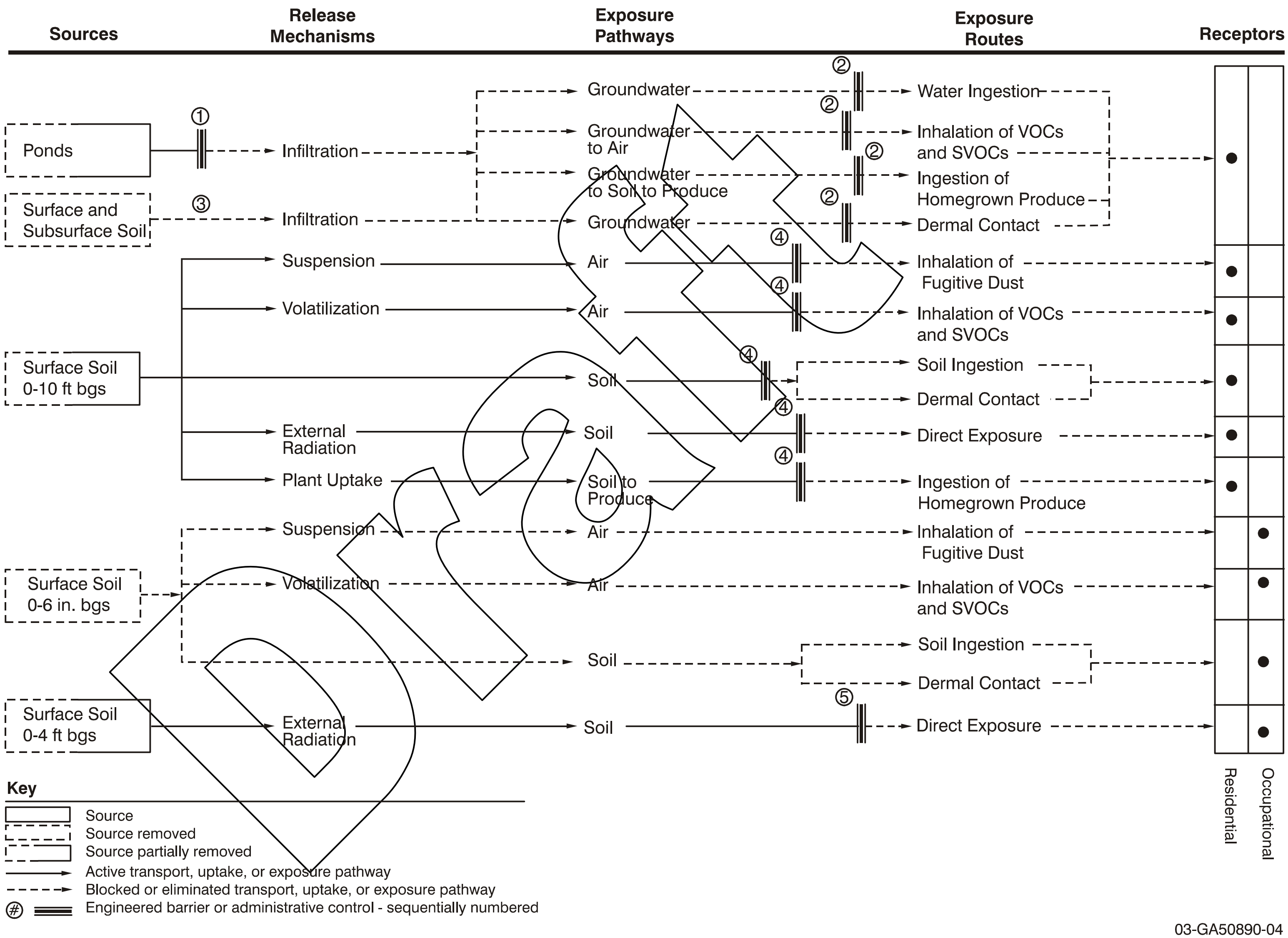

Figure 4-7a2. Test Reactor Area conceptual site model—current state.

SVOC = semivolatile organic compound

Narrative for Figure 4-7a2 Test Reactor Area Conceptual Site Model—Current State

All active remedial actions required by the OU 2-13 ROD (DOE-ID 1997b) have been completed. During the first 5-year remedy effectiveness review for OU 2-13 conducted in 2003, it was found that the remedies are performing as expected and are continuing to provide protection of human health and the environment (DOE-ID 2003c).

Institutional controls are in place because residual contamination precludes unrestricted access in the following 15 areas:

- Three out-of-service, covered pond sites (TRA-03 Warm Waste Pond, TRA-06 Chemical Waste Pond, and TRA-13 Sewage Leach Pond) and one operating pond, the TRA-08 Cold Waste Pond
- Three sites with polychlorinated biphenyl contamination that have been cleaned up to meet Toxic Substances Control Act requirements
- Seven sites with residual radionuclide contamination in subsurface soil (i.e., TRA-13SCA, TRA-15, TRA-19, TRA-Y, TRA-04, TRA-34, and TRA-X)
- Contamination in perched water zones and the Snake River Plain Aquifer (TRA-GW).

The steps taken to mitigate or remove these hazards are as follows:

1. The selected remedy for the Warm Waste Pond (TRA-03) was containment by capping. This pond was capped with an engineered soil cover with a 2-ft-thick layer of riprap. Before capping, this site was used as a disposal facility for contaminated soil from other parts of the INEEL. The Chemical Waste Pond (TRA-06) was capped with an engineered soil cover and revegetated. Mercury contamination is present at depths below 14 ft. The Sewage Leach Pond and Berm (TRA-13) were remediated by removing soil contaminated with cesium-137 at concentrations greater than 23.3 pCi/g from the berms, placing the contaminated soil in the pond basin, and covering the pond with a 10-ft-thick engineered soil cover. The Cold Waste Pond was remediated by removing soil contaminated with cesium-137 from the basin and disposing of the contaminated soil in the Warm Waste Pond. This pond is still in use for disposal of uncontaminated wastewater. Contamination in the groundwater is being remediated through monitored natural attenuation, radioactive decay, and dispersion.

2. Long-term institutional controls are in place for all four ponds. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities.

3. All surface and subsurface soil with potential to impact the groundwater has been removed.

4. Areas with residual soil contamination that still present unacceptable risk to hypothetical residential receptors include three sites with polychlorinated biphenyl contamination (TRA-619, TRA-626 and TRA-653). The residual polychlorinated biphenyl contamination at these sites is below the 25-ppm action level defined by Toxic Substances Control Act requirements but above the 10-ppm cleanup level that would be required for residential use of the sites. Permanent institutional controls to prevent residential use of these sites are required.

   There are also a number of sites with residual radionuclide levels. TRA-15, TRA-19, TRA-Y, TRA-04, TRA-34, and TRA-X all currently require institutional controls to protect potential residential receptors. Institutional controls consist of restricted access to prevent intrusion by the public and warning signs.

5. Areas with residual soil contamination that require institutional controls to protect occupational receptors include TRA-15, TRA-19, and the soil contamination area in the vicinity of the Sewage Leach Pond (TRA-13). The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

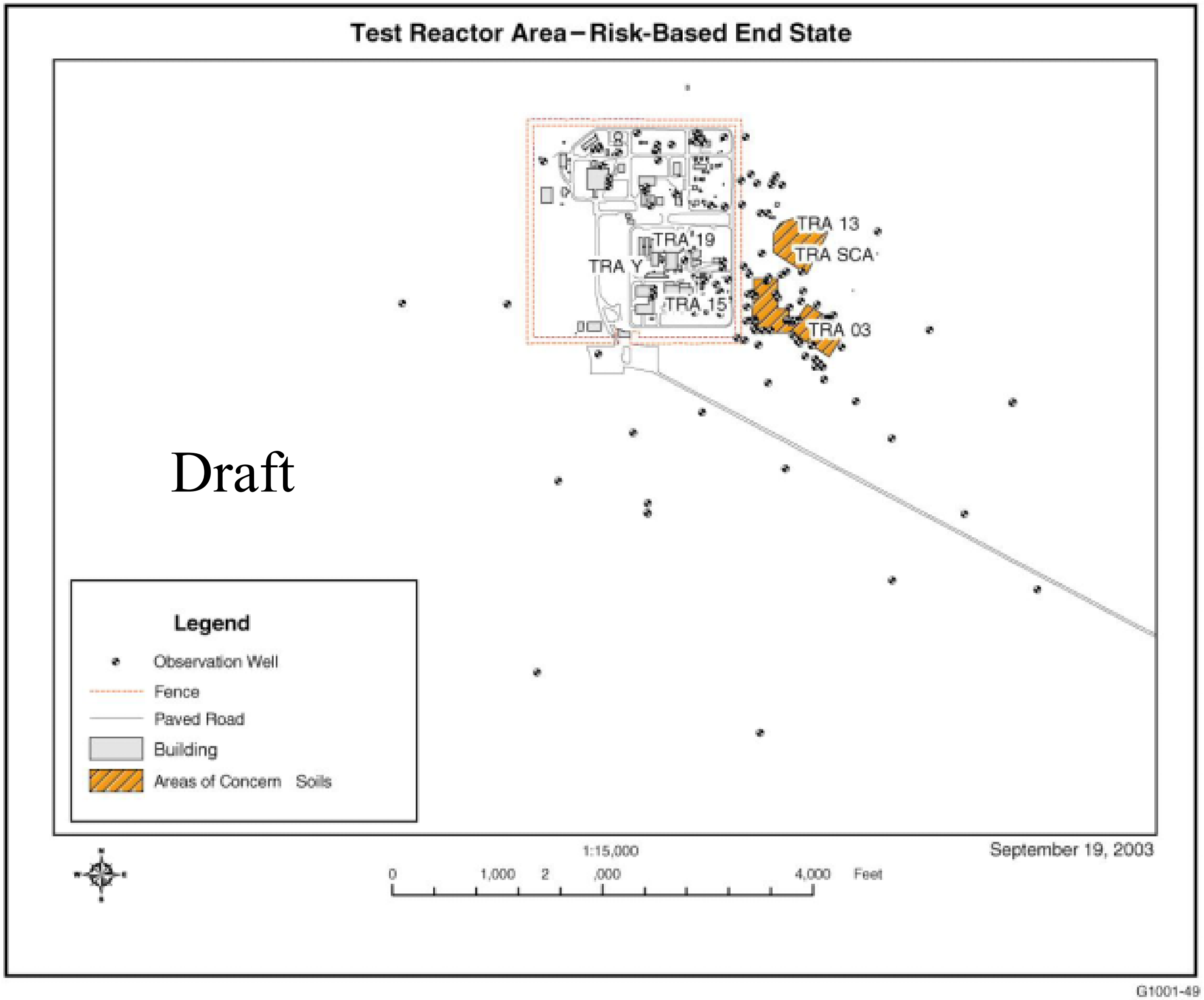

Figure 4-7b1. Test Reactor Area map—risk-based end state.

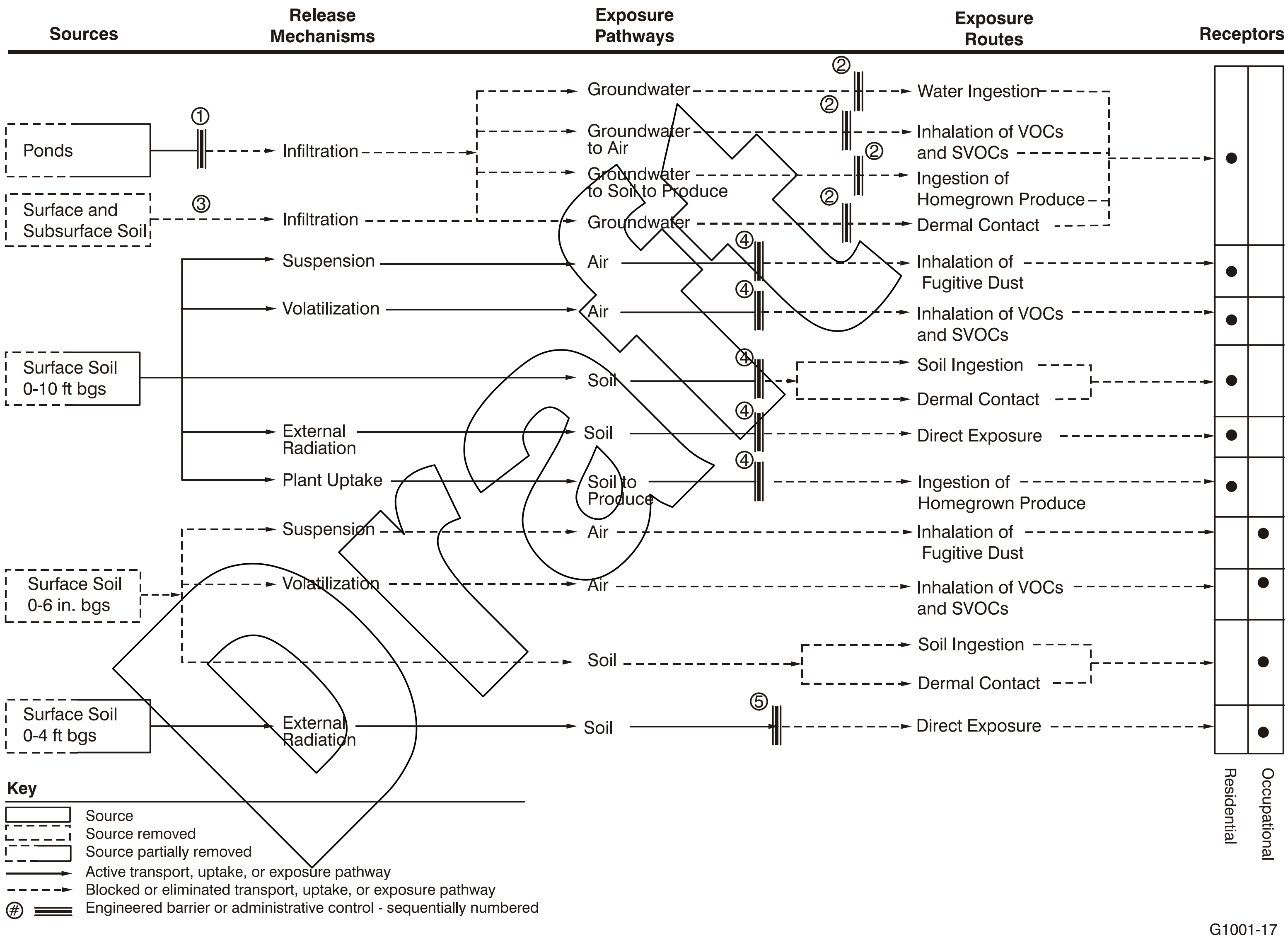

Figure 4-7b2. Test Reactor Area conceptual site model—risk-based end state.

SVOC = semivolatile organic compound

Narrative for Figure 4-7b2 Test Reactor Area Conceptual Site Model—Risk-Based End State

Chromium concentrations in the groundwater will be below MCLs before 2035. It is anticipated that the following sites still will require institutional controls because of residual contamination:

- Two out-of-service, covered pond sites, TRA-03 Warm Waste Pond and TRA-13 Sewage Leach Pond, will require institutional controls for 100 years and 500 years, respectively, because of residual radionuclides.
- Three sites with polychlorinated biphenyl contamination that have been cleaned up to meet Toxic Substances Control Act requirements will require permanent institutional controls to preclude residential use. (Industrial use is unrestricted.)
- Four sites with residual radionuclide contamination in subsurface soil include TRA-13SCA, TRA-15, TRA-19, and TRA-Y.

The steps taken to mitigate or remove these hazards are as follows:

1. The Warm Waste Pond (TRA-03) was capped with an engineered soil cover with a 2-ft-thick layer of riprap. Before capping, this site was used as a disposal facility for contaminated soil from other parts of the INEEL. The Sewage Leach Pond and Berm (TRA-13) were remediated by removing soil contaminated with cesium-137 at concentrations greater than 23.3 pCi/g from the berms, placing the contaminated soil in the pond basin, and covering the pond with a 10-ft-thick engineered soil cover.
2. Long-term institutional controls will need to be maintained at TRA-03 and TRA-13 to protect hypothetical residential receptors. The entire INEEL Site has restricted access to prevent intrusion by the public.
3. All surface and subsurface soil with potential to impact the groundwater has been removed.
4. Areas with residual soil contamination that will still present unacceptable risk to hypothetical residential receptors at the end state include three sites with polychlorinated biphenyl contamination (TRA-619, TRA-626, and TRA-653). The residual polychlorinated biphenyl contamination at these sites is below the 25-ppm action level defined by Toxic Substances Control Act requirements but above the 10-ppm cleanup level that would be required for residential use of the sites. Permanent institutional controls to prevent residential use of these sites will be required.

   It is expected that TRA-13SCA, TRA-15, TRA-19, and TRA-Y will still require institutional controls to protect potential residential receptors. (Continued need for institutional controls is evaluated through the 5-year reviews.) Institutional controls consist of restricted access to prevent intrusion by the public and warning signs.

5. Areas with residual soil contamination that will probably still require institutional controls to protect occupational receptors will include TRA-19 and TRA-Y. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities.

4.8 Argonne National Laboratory-West

Argonne National Laboratory-West (ANL-W) was established in the 1950s by the Atomic Energy Commission to support advanced nuclear reactor and nuclear fuel design and testing. ANL-W is located approximately 32 miles west of Idaho Falls, Idaho, in the southeastern portion of the INEEL. The ANL-W administrative boundary covers approximately 1,200 acres (see Figure 4-8). All facilities within ANL-W are currently active with the exception of the EBR-II research reactor, which has been defueled and is undergoing deactivation. There are three other research reactors that are either operating or are being maintained in a standby condition. There are also two large hot cell facilities within ANL-W that are dedicated to spent nuclear fuel reprocessing research, development, and demonstration. ANL-W has a fire station, a cafeteria, and a small medical dispensary. ANL-W facilities are administered by the DOE Chicago Operations Office until Fiscal Year 2005, when the DOE Idaho Operations Office will become the administrator. ANL-W will have a long-term mission as an NE research and development facility. The facilities at ANL-W will be major assets in implementing future nuclear energy missions.

Figure 4-8. Aerial view of Argonne National Laboratory-West.

The *Final Record of Decision, Argonne National Laboratory-West, Operable Unit 9-04* (ANL-W 1998) was signed for the ANL-W OUs on September 29, 1998. Sites being remediated under the ROD include open ditches, an excavated soil mound, and the Industrial Waste Pond. Contaminants are found in ditch and pond sediments at a depth of less than 3 ft below land surface. Contaminants in the ditch sediments include nonradioactive metals such as chromium, mercury, zinc, and silver. These contaminants originated from historical use of industrial water treatment chemicals and photographic process discharges. Contaminants in the soil mound and Industrial Waste Pond sediments include cesium-137. A map showing current human health risk sites at ANL-W is shown in Figure 4-8a1.

4.8.1 Current State

The OU 9-04 ROD (ANL-W 1998) addresses remedial actions for the following eight release sites within ANL-W that may present an unacceptable risk to human health and the environment:

- Industrial Waste Pond sediments (ANL-01)
- Ditch A (ANL-01)
- Ditch B (ANL-01)
- Main Cooling Tower Blowdown Ditch (ANL-01A)
- Sewage Lagoon sediments (ANL-04)
- Interceptor Canal—canal portion (ANL-09)
- Interceptor Canal—excavated soil mound (ANL-09)
- Industrial Waste Lift Station Discharge Ditch (ANL-35).

Three release sites pose potentially unacceptable risks to human health. These are the Industrial Waste Pond sediments (ANL-01), Interceptor Canal, and Interceptor Canal excavated soil mound (ANL-09). The Industrial Waste Pond and Interceptor Canal sites have shallow-depth cesium-137 contamination resulting from an inadvertent discharge of radioactive liquid waste from the ANL-W analytical laboratory in 1969. A conceptual site model was developed as part of the *Comprehensive RI/FS for Argonne National Laboratory-West Operable Unit 9-04 at the INEEL (Final)* (ANL-W 1997). This model has been updated to reflect 2003 conditions and is shown in Figure 4-8a2.

Four sites in OU 9-04 underwent phytoremediation for 4 years (1999–2002) and now have reduced concentrations of contaminants. These sites are the Interceptor Canal—excavated soil mound (ANL-09), the Industrial Waste Lift Station Discharge Ditch (ANL-35), the Main Cooling Tower Blowdown Ditch (ANL-01A), and Ditch A (ANL-01). These four sites were sampled in 2003 to verify that the remediation goals in the ROD had been met. Sample results received in November of 2003 verified that remediation goals were met in three of the four sites. The Ditch A (ANL-01) site did not reach the ROD remediation goal for mercury, and its sediments will be excavated in Fiscal Year 2004. The excavated soil will be disposed of in the ICDF.

4.8.2 End State

The Interceptor Canal also will remain an occupational health risk site while its cesium-137 contamination decays (50 years). The Ditch B site was excavated in 1999 and poses no further risk. The Industrial Waste Pond sediments also are scheduled for excavation and disposal in Fiscal Year 2004. The Industrial Waste Pond will pose no further risk to human health after its remediation. ANL-W Sewage Lagoon sediments (ANL-04) will remain active at least until the 2035 timeframe. The lagoons have low concentrations of mercury in the sediments that pose a risk to ecological receptors only. The sewage lagoon sediments will be excavated and disposed of in an appropriate landfill when the lagoons are closed sometime after 2035.

The two ANL-W sites that would pose an unacceptable risk to occupational health risk in 2035 are the Interceptor Canal excavated soil mound (ANL-09) and the Interceptor Canal itself. A map of the risk-based end state is provided as Figure 4-8b1, and the conceptual site model for the end state is shown in Figure 4-8b2. The risk from these sites will gradually diminish as the residual cesium-137 contaminants decay away. Both sites will pose no risk to occupational (worker) health by 2053. Institutional controls currently in place at the Interceptor Canal soil mound and the Interceptor Canal itself provide protection for human receptors. Both sites are posted to prevent access, and ANL-W procedures document precautions to be taken while working near these areas.

4.8.3 Variances

No potential variances have been identified for ANL-W.

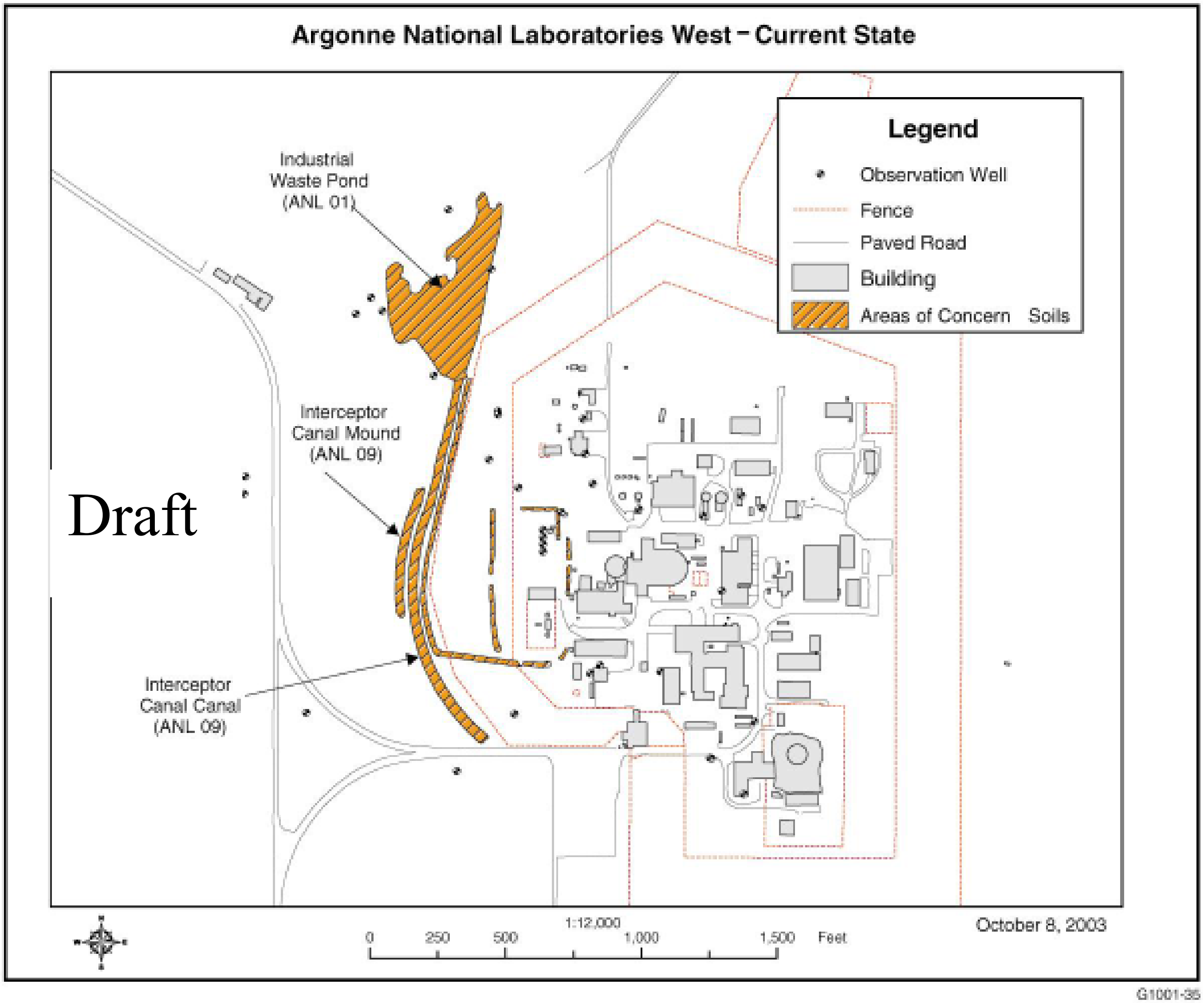

Figure 4-8a1. Argonne National Laboratory-West map—current state.

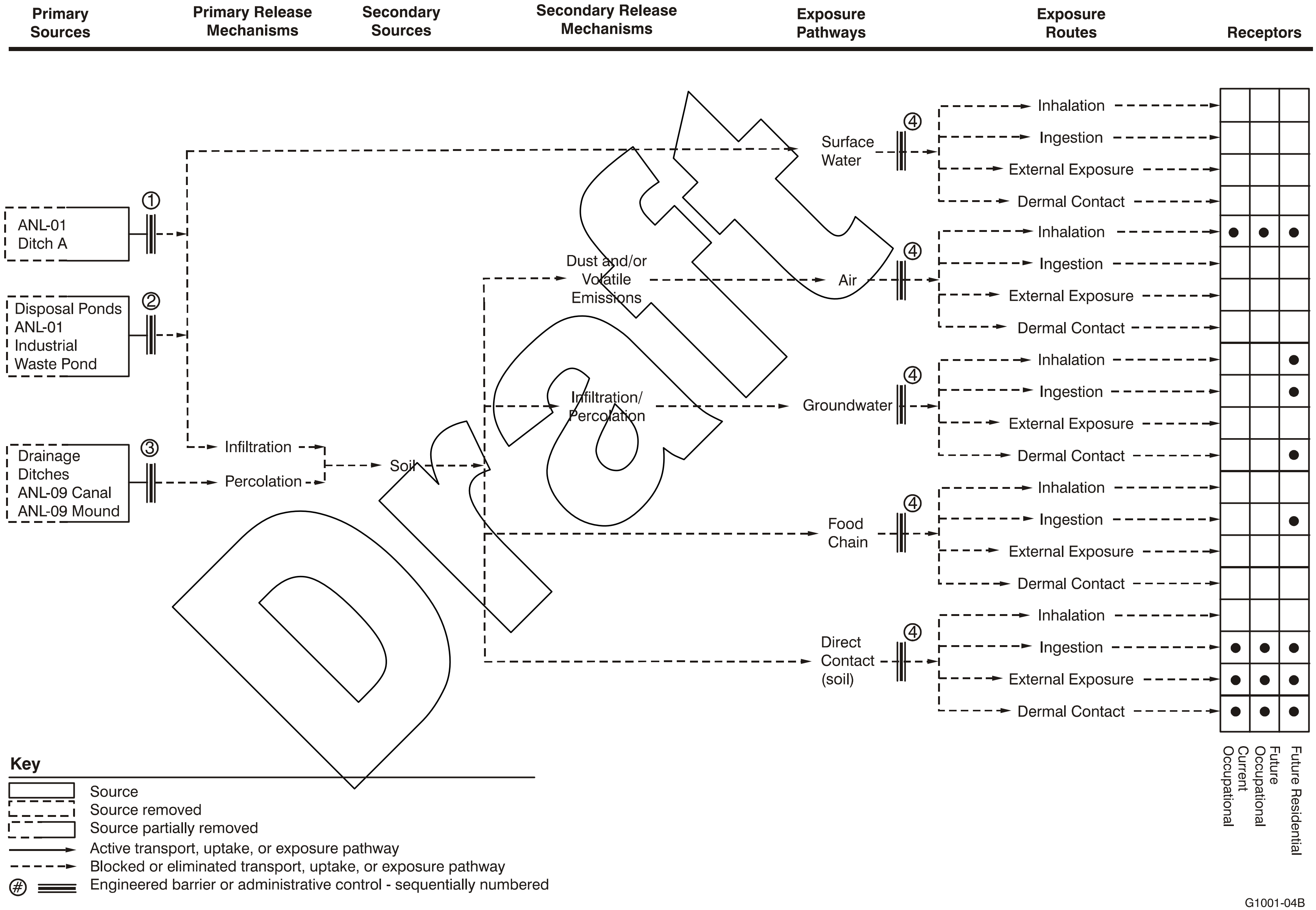

Figure 4-8a2. Argonne National Laboratory-West conceptual site model—current state.

Narrative for Figure 4-8a2 Argonne National Laboratory-West Conceptual Site Model—Current State

There are currently four areas where institutional controls are in place because residual contamination precludes unrestricted access. These areas include:

- One operating storm water and cooling tower water discharge pond (ANL-01 Industrial Waste Pond)
- One storm water drainage ditch (ANL-09 Interceptor Canal)
- One mound of soil dredged from the Interceptor Canal (ANL-09 Interceptor Canal mound)
- One drainage ditch with shallow-depth nonradioactive metal contamination in soil (ANL-01 Ditch A).

The steps taken to mitigate or remove these hazards are as follows:

1. The ANL-01 Ditch A underwent phytoremediation from 1999 to 2002. One contaminant, mercury, remains at levels slightly above remediation goals. The Ditch A soil with residual mercury contamination will be excavated in fiscal year 2004, and the soil will be disposed of in the ICDF. No long-term institutional controls will be required for Ditch A after excavation.

2. The selected remedy for the ANL-01 Industrial Waste Pond was extraction of the pond sediment contaminants by phytoremediation. This pond has been in use since 1960 to provide storm water and cooling tower drainage for the ANL-W site. There was an inadvertent discharge of radioactive liquids in the late 1960s, and the discharge of industrial cooling tower water was treated with toxic metal slimicides. The pond sediments are contaminated with cesium-137, chromium-3, selenium, mercury, and zinc. The Industrial Waste Pond will be remediated in fiscal year 2004 by implementing the ROD contingent remedy of excavation and disposal of sediments that are contaminated to levels above remediation goals. The excavated soil would be transported to the ICDF. No long-term institutional controls will be required for the Industrial Waste Pond site after it is excavated.

3. The ANL-09 Interceptor Canal has long-term institutional controls in place to protect workers from exposure to residual cesium-137 contamination until 2023. Workers are protected by posted signs and through the work control process.

   The ANL-09 Interceptor Canal mound soil was leveled and remediated to ROD remediation goals using phytoremediation from 1999 to 2002. Long-term institutional controls (i.e., posted signs, work controls, and site access controls) are in place to protect workers and the public from exposure to residual cesium-137 contamination. The remaining cesium contamination will decay to unrestricted-worker-use levels by 2053 and unrestricted residential-use levels by 2098.

4. The entire INEEL Site has restricted access to prevent intrusion by the public. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, and through the work control process used to identify hazards and mitigation measures for planned work activities. Precautions to be taken while working near these areas are documented in ANL-W procedures.

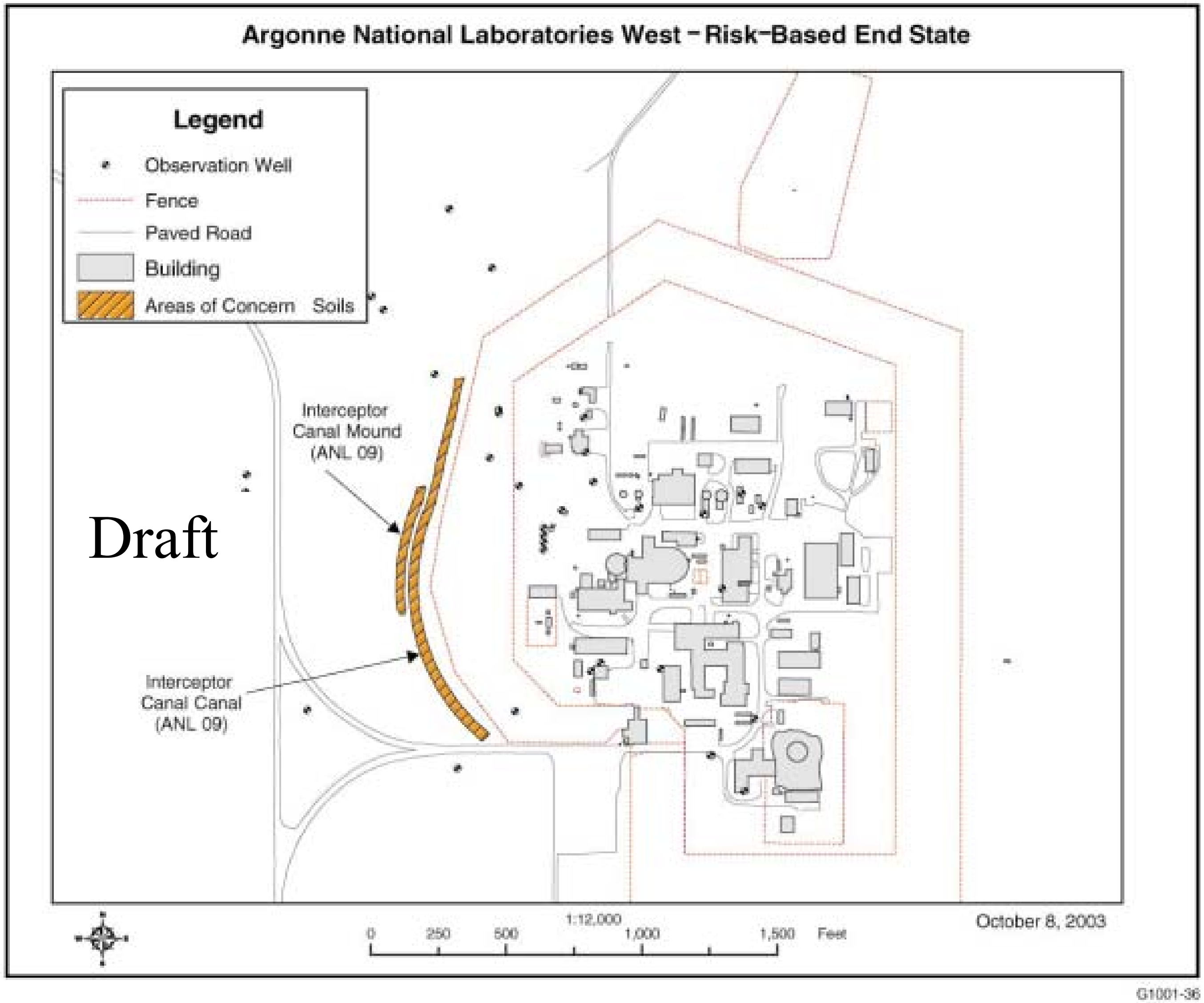

Figure 4-8b1. Argonne National Laboratory-West map—risk-based end state.

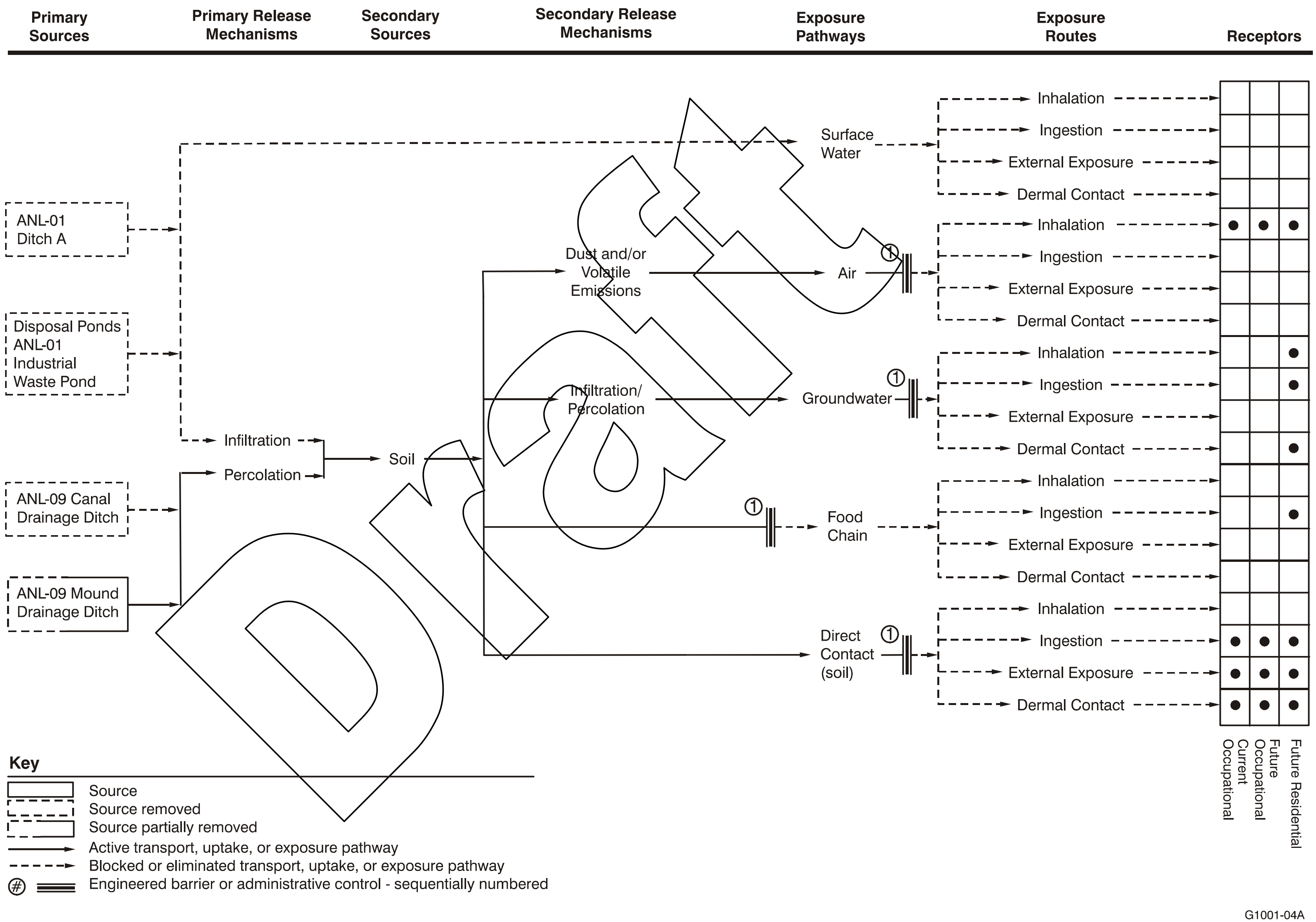

Figure 4-8b2. Argonne National Laboratory-West conceptual site model—risk-based end state.

Narrative for Figure 4-8b2 Argonne National Laboratory-West Conceptual Site Model—Risk-Based End State

It is anticipated that the following two sites at ANL-W will require institutional controls because of residual cesium-137 contamination:

- One storm water drainage ditch (ANL-09 Interceptor Canal)
- One mound of soil dredged from the Interceptor Canal (ANL-09 Interceptor Canal mound).

The steps taken to mitigate or remove these hazards are as follows:

1. Long-term institutional controls will be required at the ANL-09 Interceptor Canal mound site until 2098 to protect hypothetical residential receptors. The site will have restricted access to prevent intrusion by the public. Institutional controls to protect workers will be required until 2053. These controls include posted signs and work control processes that limit worker activities in this area.

5. VARIANCES

Previous CERCLA risk assessments and remedial action objectives for the INEEL have generally assumed potential future residential use of facility areas, following 100 years of federal government control. The federal government owns land occupied by the INEEL Site, which was acquired by DOE's predecessor agencies through public land withdrawals and land acquisitions to conduct nuclear energy research. DOE is capable and obligated to control access and use of the land. Accordingly, risk assessments and remedial action decisions based on future residential land-use scenarios may require more conservative cleanup actions than warranted under more realistic future land-use scenarios, such as industrial with institutional control of access and use, or use as a National Environmental Research Park. For example, a residential scenario usually assumes that future residents will construct 10-ft basements beneath their homes, requiring evaluation and cleanup of contaminants to a depth of 10 ft. In contrast, an industrial scenario limits evaluation and cleanup to the top 6 in. of soil for inhalation and ingestion and to the top 4 ft for external exposure.

DOE Policy 455.1 (2003) requires that once sites have developed their risk-based end state visions, they reevaluate their cleanup activities and strategic approaches to determine if they are appropriate to propose and pursue changes to site baseline documents and affected regulatory agreements.

Table 5-1 lists potential variances between currently planned environmental cleanup objectives and what would be necessary if cleanup decisions were based on land-use scenarios that do not include future residential use. No decisions have been made regarding the variances. They are simply cleanup activities that DOE believes merit further evaluation to determine if they are necessary and a wise expenditure of taxpayer dollars. Cost-benefit analyses and risk assessments will be needed to evaluate whether the variances should be pursued and to ensure that the proposed alternatives are protective of human health and the environment.

Identification of a different end state in the RBESV does not necessarily signal intent by DOE to change its planned course of action at the site. There are many factors that will contribute to any such decision; significant factors are the benefit that would accrue to the taxpayer and the value of any improvement in protection of human health and the environment. If DOE ultimately decides to seek changes to the current compliance agreements, decisions, or statutory and regulatory requirements, those changes will be made in accordance with applicable requirements and procedures. If DOE determines that it is appropriate to propose changes to current cleanup plans and agreements, such changes must be approved through the appropriate legal and regulatory channels with input from stakeholders and regional governmental agencies.

Table 5-2 summarizes the remaining scope of cleanup work at the INEEL. This table compares current cleanup objectives to the proposed risk-based end state for each of the hazard areas and provides the basis for potential variances listed in Table 5-1.

Table 5-1. Variance table.

ID No.	Description of Variance	Impacts (in Terms of Scope, Cost, Schedule, and Risk)	Barriers in Achieving Risk-Based End State	Recommendations
V-1	**Areas with Potential UXO and Other Explosive Materials:** The OU 10-04 ROD (DOE-ID 2002b) currently requires extensive survey and cleanup of the areas that have a higher risk of containing residual UXO and other explosive materials (e.g., TNT or RDX) from World War II era activities. Since public access and land use can be controlled by DOE, a potential variance would be to survey and clean up only those areas where ordnance and explosive materials present a risk to workers because of planned near-term use. The ROD selected remedy was based on an assumption of potential residential use after 100 years. Cleanup levels and actions could be based on industrial standards and other appropriate nonresidential land-use scenarios (such as a National Environmental Research Park) that do not include residential use of the area.	Scope: The area that would require geophysical surveys and cleanup would be reduced by as much as 75%. Institutional controls will be required, as implemented to date, whether or not the area is thoroughly surveyed and cleaned up, because of the inherent difficulty in finding UXO that was buried below surface on impact and because of freeze-thaw cycles, which continue to bring ordnance to the surface. Cost: The cost for complete removal of UXO is estimated at $22 million. Some cleanup of ordnance would still be required, but it is estimated that the savings could be as much as $15 million. The total estimated cost for cleanup of the TNT- and RDX-contaminated sites is $730K. Some additional savings may be possible from cleanup of the TNT and RDX sites to standards that do not include residential scenarios. Schedule: Significant schedule acceleration may be possible. Risk: Risk is currently managed through institutional controls, such as restricted public access and fieldwork control and execution processes. At the INEEL Site, there has never been an incident of a human or animal triggering an explosion as the result of an encounter with UXO, TNT, or RDX, so no increased risk is expected.	U.S. Environmental Protection Agency and State of Idaho agreement to modify the OU 10-04 ROD (DOE-ID 2002b) would be needed.	An evaluation should be conducted to determine the remedial actions needed to protect human health and the environment, assuming no future residential use in areas with potential UXO and other explosive materials. If the currently required work scope is not justified, discussions should be initiated with agencies regarding the preferred regulatory path forward.
V-2	**Firing Range Lead Contamination:** The OU 10-04 ROD (DOE-ID 2002b) currently requires the removal of lead contaminants to residential standards and the recycling and disposal of contaminated soil at the ICDF or at another approved facility A potential variance would be to establish cleanup levels and actions based on industrial	Scope: If cleanup levels were established based upon long-term industrial or other appropriate land use rather than on future residential use after 100 years, it is likely that the quantity of soil requiring excavation and removal would be reduced, and it is possible that some areas may not need remediation. Cost: A cost-benefit analysis has not yet been conducted.	U.S. Environmental Protection Agency and State of Idaho agreement to modify the OU 10-04 ROD (DOE-ID 2002b) would be needed.	An evaluation should be conducted to determine the remedial actions needed to protect human health and the environment, assuming no future residential use in the area of the firing range. If the currently required work scope is not justified, a cost-benefit analysis should be conducted to determine

Table 5-1. (continued).

ID No.	Description of Variance	Impacts (in Terms of Scope, Cost, Schedule, and Risk)	Barriers in Achieving Risk-Based End State	Recommendations
	standards and other appropriate nonresidential land-use scenarios (such as a National Environmental Research Park) that do not include residential use of the firing range and surrounding area.	Schedule: It is likely that the remediation work could be completed sooner. Risk: No increased risk to workers or the public is anticipated, as cleanup levels will be protective of human health and the environment for the planned future land use.		if the potential savings justify further action. If so, discussions should be initiated with agencies regarding the preferred regulatory path forward.
V-3	**INTEC Contaminated Soil:** The OU 3-13 ROD (DOE-ID 1999b) was based on the assumption that government control of the Site would continue for only 100 years (through 2095), followed by potential residential use. The end state vision for the INTEC facility includes entombment and capping of several facilities with a need for long-term institutional controls. A potential variance would be to establish cleanup levels and actions based on scenarios that do not include future residential use of the INTEC site and surrounding area.	Scope: There are two major groups of soil at INTEC that require cleanup. One is soil under buildings and structures, and the other is other surface soil. If cleanup levels were established based on long-term industrial use rather than on future residential use after 100 years, it is likely that the quantity of soil that would require excavation and removal may be reduced by as much as 75%, and it is possible that some areas may not need remediation. Cost: A cost-benefit analysis has not yet been conducted. Schedule: It is expected that the remediation work could be completed sooner. Risk: No increased risk to workers or the public is anticipated, as cleanup levels will be protective of human health and the environment for the planned future land use.	The OU 3-13 remedial design/remedial action work plan has been drafted, and review by agencies is in progress. U.S. Environmental Protection Agency and State of Idaho agreement to modify the OU 3-13 ROD (DOE-ID 1999b) would be needed.	An evaluation should be conducted to determine the remedial actions needed to protect human health and the environment, assuming no future residential use of INTEC. If the currently required work scope is not justified, a cost-benefit analysis should be conducted to determine if the potential savings justify further action. If so, discussions should be initiated with agencies regarding the preferred regulatory path forward.
V-4	**TAN Contaminated Soil:** The OU 1-10 ROD (DOE-ID 1999a) was based on the assumption that government control of the Site would continue for only 100 years (through 2097), followed by potential residential use. A potential variance would be to establish cleanup levels and remedial actions based on scenarios that do not include future residential use of the TAN site and surrounding area.	Scope: Considerable remediation work remains to be done under the OU-1-10 ROD (DOE-ID 1999a), including considerable soil removal associated with the V-Tank closure and other remediation actions. If cleanup levels were established on long-term industrial use rather than future residential use after 100 years, it is likely that the quantity of soil that would require excavation and removal would be reduced, and it is possible that some areas may not need remediation. Preliminary estimates indicate that the volume of soil that would require excavation could be reduced by approximately 6,000 yd^3.	U.S. Environmental Protection Agency and State of Idaho agreement to modify the OU 1-10 ROD (DOE-ID 1999a) would be needed.	An evaluation should be conducted to determine if the selected remedies are necessary, assuming no future residential use of TAN. If the currently required work scope is not justified, a cost-benefit analysis should be conducted to determine if the potential savings justify further action. If so, discussions with agencies should be initiated regarding the preferred regulatory path forward.

Table 5-1. (continued).

ID No.	Description of Variance	Impacts (in Terms of Scope, Cost, Schedule, and Risk)	Barriers in Achieving Risk-Based End State	Recommendations
		Cost: A cost-benefit analysis has not yet been conducted. Schedule: It is expected that the remediation work could be completed sooner. Risk: No increased risk to workers or the public is anticipated, as cleanup levels will be protective of human health and the environment for the planned future land use.		
V-5	**ARA Soil:** The OU 5-12 ROD (DOE-ID 2000c) was based on the assumption that government control of the Site would continue for only 100 years, followed by potential residential use. A potential variance would be to establish cleanup levels and remedial actions based on scenarios that do not include future residential use of the ARA sites and surrounding area.	Scope: Three sites at ARA remain to be remediated (ARA-01, ARA-12, and ARA-23). If cleanup levels were established based on long-term industrial use (or other appropriate nonresidential land use such as a National Environmental Research Park) rather than on future residential use after 100 years, it is likely that the quantity of soil that would require excavation and removal would be reduced, and it is possible that some areas may not need remediation. Preliminary estimates indicate that approximately 50,000 yd^3 of soil remain to be excavated. Cost: A cost-benefit analysis has not yet been conducted. Schedule: It is expected that the remediation work could be completed significantly faster. Risk: No increased risk to workers or the public is anticipated, as cleanup levels will be protective of human health and the environment for the planned future land use.	U.S. Environmental Protection Agency and State of Idaho agreement to modify the OU 5-12 ROD (DOE-ID 2000c) would be needed.	An evaluation should be conducted to determine if the selected remedies are necessary, assuming no future residential use of the ARA sites. If the currently required work scope is not justified, a cost-benefit analysis should be conducted to determine if the potential savings justify further action. If so, discussions with agencies should be initiated regarding the preferred regulatory path forward.

ARA = Auxiliary Reactor Area
ICDF = INEEL CERCLA Disposal Facility
INTEC = Idaho Nuclear Technology and Engineering Center
OU = operable unit
RDX = royal demolition explosive
ROD = record of decision
TAN = Test Area North
TNT = trinitrotoluene
UXO = unexploded ordnance

Table 5-2. Remaining scope of cleanup work at the Idaho National Engineering and Environmental Laboratory Site.

Test Reactor Area *1997 ROD; no active remediation necessary at 47 of 55 contaminated sites.* *Note: active remediation now complete at Test Reactor Area with the exception of a few contaminated areas near actively used buildings and piping. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls and restricted groundwater use and monitoring. Post active remediation phase (institutional control period): unrestricted industrial surface and groundwater use except for certain contaminated areas, which will have continued access and use restrictions. Five-year remedy effectiveness reviews until all risks have been mitigated. Remediation objectives: • Contaminated groundwater beneath facility is within EPA MCLs. • Certain discharge ponds with contamination exceeding agreed-upon risk-based contaminant concentrations contained by engineered native soil cover with continued institutional controls (e.g., Warm Waste Ponds). • Other contaminated soil that would exceed agreed-upon risk-based contaminant concentrations has been relocated to an acceptable soil repository. (Areas with radioactive decay to below risk-based levels would be available for unrestricted use.) • Selected facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Groundwater remediation	Implement WAG 2 ROD—monitored natural attenuation until contaminant concentrations are less than MCLs.	Same	No
Surplus facilities	DD&D to industrial standards. Dispose of debris on-Site.	Same	No
Materials Test Reactor and Engineering Test Reactor and associated facilities and structures	DD&D, removal, or entombment. Use National Environmental Policy Act of 1969 or CERCLA nontime-critical removal action process to determine final end state.	Same	No
WAG 2—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same	No
Perched water monitoring	Implement WAG 2 ROD—monitor perched water to confirm that contaminant levels continue to decrease.	Same	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same	No

Table 5-2. (continued).

Test Area North *The 1995 OU 1-07B ROD, modified in 2001 with developments in technology, and the 1999 OU 1-10 ROD; no active remediation needed for 83 of 94 contaminated sites. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls and restricted groundwater use and monitoring along with ongoing aquifer contamination plume containment and remediation operations (pump and treat and bioremediation) until agreed upon objectives are achieved. Post active remediation phase (institutional control period): unrestricted industrial surface and groundwater use except for certain contaminated areas (e.g., burn pits and landfills), which will have continued access and use restrictions. Five-year remedy effectiveness reviews until all risks have been mitigated. Remediation objectives: • Contaminated groundwater beneath facility is within EPA MCLs. • Residual contamination in Burn Pits II and IV contained by engineered native soil cover with continued institutional controls. • Other contaminated soil that would exceed agreed-upon risk-based contaminant concentrations has been relocated to an acceptable soil repository. (Areas with radioactive decay to below risk-based levels would be available for unrestricted use.) • Selected facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Groundwater remediation—trichloroethene	Implement OU 1-7B ROD. Pump and treat, bioremediation, and monitor until contaminant concentrations are less than MCLs. Ensures control of further migration of contaminants into groundwater and is compliant with the National Contingency Plan groundwater protection strategy.	Same.	No

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Soil remediation	Implement OU 1-10 ROD. Excavate contaminated soil to a depth of 10 ft for a residential basement scenario (or until acceptable level of contamination is reached) and dispose of in ICDF. Establish institutional controls for any contamination left in place. Includes contaminated soil associated with PM-2A Tanks and V-Tanks.	Change cleanup basis from residential use after 100 years to industrial use with institutional controls until risk has been reduced to levels acceptable for unrestricted use. Excavate contaminated soil to a depth of 4 ft for an industrial footing scenario (or until acceptable level of contamination is reached) and dispose of in ICDF, or cap and leave contamination in place. Establish institutional controls for any contamination left in place and maintain controls until risk levels are acceptable for unrestricted use.	Yes
Burn pits remediation	Implement OU 1-10 ROD	Same.	No
V-Tanks remediation	Implement OU 1-10 ROD, including RCRA closure.	Same.	No
PM-2A Tank remediation	Implement OU 1-10 ROD, including RCRA closure.	Same.	No
Surplus facilities	DD&D to industrial standards. Dispose of debris on-Site.	Same.	No
WAG 1—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same.	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same.	No

Table 5-2. (continued).

Waste Reduction Operations Complex, Power Burst Facility, and Auxiliary Reactor Area *2000 ROD; no active remediation needed for 48 of 55 contaminated sites. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls and groundwater monitoring. Post active remediation phase (institutional control period): unrestricted industrial surface and groundwater use except for certain contaminated areas, which will have continued access and use restrictions (e.g., SL-1 reactor contamination area and nine other areas with residual contamination). Five-year remedy effectiveness reviews until all risk has been mitigated. Remediation objectives: • Residual contamination in the SL-1 reactor contamination area contained by engineered cover with continued institutional controls necessary for 400 years. • Land-use restrictions through institutional controls for other areas where residual contamination was determined not necessary to be removed. • Contaminated soil from tank system excavation, and five other sites that would exceed agreed-upon risk-based contaminant concentrations have been relocated to an acceptable soil repository. (Areas with radioactive decay to below risk-based levels would be available for unrestricted use.) • Auxiliary Reactor Area tank systems and contents removed, treated, and disposed of in an acceptable repository. • Selected facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Soil remediation	Implement OU 5-12 ROD. Excavate contaminated soil to a depth of 10 ft for a residential basement scenario (or until acceptable level of contamination is reached) and dispose of in ICDF. Establish institutional controls for any contamination left in place.	Change cleanup basis from residential use after 100 years to industrial use with institutional controls until risk has been reduced to levels acceptable for unrestricted use. Excavate contaminated soil to a depth of 4 ft for an industrial footing scenario (or until acceptable level of contamination is reached) and dispose of in ICDF or cap and leave contamination in place. Establish Institutional Controls for any contamination left in place and maintain controls until risk levels are acceptable for unrestricted use.	Yes

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
RCRA permitted facilities	RCRA closure.	Same.	No
Surplus facilities	DD&D to industrial standards. Dispose of debris on-Site.	Same.	No
Power Burst Facility reactor and associated facilities and structures	DD&D, removal, or entombment. Use National Environmental Policy Act of 1969 or CERCLA nontime critical removal action process to determine final end state.	Same.	No
WAG 5—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same.	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same.	No

Table 5-2. (continued).

Central Facilities Area *2000 ROD; no active remediation needed for 47 of 52 contaminated sites. All active remediation has been completed. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls and groundwater monitoring. Post active remediation phase (institutional control period): unrestricted industrial surface and groundwater use except for certain contaminated areas, which will have continued access and use restrictions (e.g., Central Facilities Area landfills and sewage drain field). Five-year remedy effectiveness reviews until all risk has been mitigated. Remediation objectives: • Contaminated soil at the sewage drain field contained by an engineered covered with institutional controls until cesium decays to acceptable levels (approximately 190 years) • Other contaminated soil that would exceed agreed-upon risk-based contaminant concentrations has been relocated to an acceptable soil repository • Central Facilities Area landfills remain capped in place with groundwater monitoring and institutional controls • Selected facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Groundwater remediation—nitrates	Implement WAG 4 ROD—monitored natural attenuation until contaminant concentrations are less than MCLs. May need to install two additional wells.	Same	No
WAG 4—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same	No

Table 5-2. (continued).

INEEL Sitewide Open Areas *2002 ROD for most areas; details of end-state for groundwater outside facilities still being developed. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with some public access for specifically agreed-upon activities (e.g., EBR-1 Reactor Museum, tribal gatherings, and public highway rest area) with appropriate access and institutional controls and restricted groundwater use and monitoring. Post active remediation phase (institutional control period): unrestricted industrial and special-case surface use with access controls and unrestricted groundwater use except for certain contaminated areas, which will have continued access and use restrictions (e.g., firing and bombing ranges). Five-year remedy effectiveness reviews until all risk has been mitigated. Remediation objectives: • Unexploded ordnance and materials and soil contaminated with explosives and lead exceeding risk-based levels for industrial use will be excavated and disposed of (lead recycled if possible) at an appropriate facility. As part of this remedy, groundwater will be monitored. Institutional controls and access restrictions will be implemented as part of the remedy. • Facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Unexploded ordnance TNT- and RDX-contaminated soil Firing range soil pile lead contamination	Implement OU 10-04 ROD. Remove and dispose of and destroy unexploded ordnance identified through an extensive survey of INEEL. Establish institutional controls for possible unexploded ordnance not identified through extensive survey of INEEL. Excavate contaminated TNT and RDX soil to a depth where an acceptable level of contamination is reached and dispose of in ICDF. Remove lead and other contaminants to an acceptable level and dispose of in ICDF. Recovered lead and copper fragments to be recycled if feasible.	Change cleanup basis from residential use after 100 years to industrial use with institutional controls until risk has been reduced to levels acceptable for unrestricted use. Remove and dispose of and destroy unexploded ordnance as it is identified as has been historically done at INEEL and in areas where future planned uses require remediation. Establish institutional controls to ensure protection of site users from unexploded ordnance. Perform value engineering analysis to determine practical methods to survey and remove the TNT and RDX contamination. Focus excavation of TNT- and RDX-contaminated soil to selected areas where it is necessary from a worker protection, public-visitor scenario, and ecological perspective.	Yes

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
		Remove contaminated soil to a depth where an acceptable level of contamination is reached and disposed of in ICDF. Establish institutional controls for any TNT and RDX contamination left in place. Evaluate cost of lead contamination remediation to residential standards versus industrial with institutional controls and present remedy with lowest life-cycle cost to regulators for consideration.	
Complete remediation and closure of all Voluntary Consent Order tanks	RCRA close applicable tanks.	Same.	No
10-08 ROD groundwater and newly identified release sites	CERCLA—FFA/CO process will be used to develop and implement ROD remedial actions using future industrial use with institutional controls as the basis.	Same.	No
WAG 10—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same.	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same.	No

Table 5-2. (continued).

Idaho Nuclear Technology and Engineering Center *1999 ROD; no active remediation needed for 40 of 101 contaminated sites (details of end state for tank farm contaminated soil and groundwater beneath Idaho Nuclear Technology and Engineering Center facility boundary still being developed but continued restricted use assumed). Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls, groundwater monitoring, and restricted groundwater (including perched water zones) use. CERCLA-approved engineered landfill meeting applicable or relevant and appropriate requirements. Post active remediation phase (institutional control period): restricted industrial surface and groundwater use. Five-year remedy effectiveness reviews until all risks have been mitigated. Remediation objectives: • Contaminated groundwater outside the Idaho Nuclear Technology and Engineering Center facility boundary is within EPA MCLs (institutional controls to prevent use in interim). • Contaminated soil that would exceed agreed-upon risk-based contaminant concentrations has been relocated to an acceptable soil repository. (Areas with radioactive decay to below risk-based levels would be available for unrestricted use.) • Engineered contaminated soil and debris repository with material meeting agreed-upon waste acceptance criteria with access restrictions. • SFE-20 tank removed, treated, and disposed of in an acceptable repository. • Facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Sodium-bearing waste	In accordance with 1995 Settlement Agreement, process and dispose of off-Site.	Same.	No
High-level waste tanks and associated systems	RCRA closure. DOE Order 435.1 closure.	Same.	No
Calcine and associated storage facilities, structures, and systems	In accordance with 1995 Settlement Agreement, retrieve, process, package, and have road ready to dispose of off-Site by 2035.	Same.	No
Environmental Management managed legacy spent nuclear fuel	In accordance with 1995 Settlement Agreement, remove from the State of Idaho by 2035.	Same.	No
Legacy denitrator product special nuclear material	Repackage and transfer product to another site.	Same.	No

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Legacy unirradiated light water breeder reactor fuel	Transfer fuel to another site. A recommended path forward will be submitted by September 30, 2004.	Same.	No
Environmental Management managed legacy special nuclear material to another site	Transfer material to another site.	Same.	No
Contaminated soil under buildings and structures	Implement 3-13 ROD. As DD&D occurs, determine if soil needs to be removed. Excavate contaminated soil to a depth of 10 ft for a residential basement scenario (or until acceptable level of contamination is reached) and dispose of in ICDF. Establish institutional controls for any contamination left in place.	Change cleanup basis from residential use after 100 years to industrial use with institutional controls until risk has been reduced to levels acceptable for unrestricted use. Excavate contaminated soil to a depth of 4 ft for an industrial footing scenario (or until acceptable level of contamination is reached) and dispose of in ICDF, or cap and leave contamination in place. Establish institutional controls for any contamination left in place and maintain controls until risk levels are acceptable for unrestricted use.	Yes
Contaminated surface soil	Implement 3-13 ROD. Excavate contaminated soil to a depth of 10 ft for a residential basement scenario (or until acceptable level of contamination is reached) and dispose of in ICDF. Establish institutional controls for any contamination left in place. Estimate 150,000 m^3.	Change cleanup basis from residential use after 100 years to industrial use with institutional controls until risk has been reduced to levels acceptable for unrestricted use. Excavate contaminated soil to a depth of 4 ft for an industrial footing scenario (or until acceptable level of contamination is reached) and dispose of in ICDF, or cap and leave contamination in place. Establish institutional controls for any contamination left in place and maintain controls until risk levels are acceptable for unrestricted use.	Yes

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Groundwater remediation in Snake River Plain Aquifer outside the Idaho Nuclear Technology and Engineering Center fence	Implement 3-13 ROD. Monitored natural attenuation with contingent remedy if action level reached.	Same.	No
SFE-20 Hot Waste Tank removal	Implement 3-13 ROD. Remove and dispose of in accordance with RCRA.	Same.	No
Buried gas cylinders	Implement 3-13 ROD. Remove and dispose of in accordance with appropriate regulations.	Same.	No
Tank farm contaminated soil interim action	In accordance with atomic research development, cover three hot spots by September 2004 and pursue 3-14 ROD planning date of 2006 versus enforceable milestone of May 2010.	Same.	No
Tank farm contaminated soil ROD (OU 3-14)	CERCLA—FFA/CO process will be used to develop and implement ROD remedial actions using future industrial use with institutional controls as the basis.	Same.	No
RCRA permitted facilities	RCRA closure.	Same.	No
Surplus facilities	DD&D to industrial standards. Dispose of debris on-Site.	Same.	No
WAG 3—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same.	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same.	No

Table 5-2. (continued).

Radioactive Waste Management Complex—Subsurface Disposal Area	During active remediation phase: industrial surface use with appropriate institutional controls and restricted groundwater use and monitoring. Post active remediation phase (institutional control period): restricted industrial and groundwater use with appropriate institutional controls. Five-year remedy effectiveness reviews until all risks have reached acceptable levels for unrestricted use. Remediation Objectives: • Contaminated groundwater outside the facility (Radioactive Waste Management Complex) boundary is within EPA MCLs • Facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
Stored transuranic waste	Complete processing and disposal off Site of stored transuranic waste.	Same	No
Unirradiated uranium-233 stored at the Transuranic Storage Area	Transfer or ship unirradiated uranium-233 stored at the Transuranic Storage Area to another U.S. Department of Energy site.	Same	No
Contact-handled low-level waste disposal at the Radioactive Waste Management Complex	Close out contact-handled low-level waste disposal at the Radioactive Waste Management Complex.	Same	No
Remote-handled low-level waste disposal at the Radioactive Waste Management Complex	Close out remote-handled low-level waste disposal at the Radioactive Waste Management Complex.	Same	No
Groundwater contamination	Implement OU 7-08 ROD. Vapor vacuum extraction of volatile organic compounds from the vadose zone under the Transuranic Storage Area until acceptable concentration of contaminants is reached.	Same	No
Subsurface Disposal Area Pre-ROD accelerated risk reduction	Implement accelerated Transuranic Storage Area landfill waste removal, stabilization, and containment actions.	Same	No
Subsurface Disposal Area ROD	CERCLA—FFA/CO process will be used to	Same	No

Table 5-2. (continued).

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
(OU 7-13/14)	develop and implement ROD remedial actions using future land use of industrial and landfill with institutional control as the basis.		
RCRA permitted facilities	RCRA closure.	Same	No
Surplus facilities	DD&D to industrial standards. Dispose of debris on-Site.	Same	No
WAG 7—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same	No

Table 5-2. (continued).

Argonne National Laboratory-West *1998 ROD; no active remediation needed for 33 of 41 contaminated sites.* *Note: active remediation activities complete with the exception of ANL-01 Industrial Waste Pond, which will be remediated in Fiscal Year 2004. Any newly identified sites will be addressed under OU 10-08.*	During active remediation phase: industrial surface use with appropriate institutional controls and restricted groundwater use and monitoring. Post active remediation phase (institutional control period): unrestricted industrial surface and groundwater use. Five-year remedy effectiveness reviews until all risks have been mitigated. Remediation objectives: • Contaminated soil that would exceed agreed-upon risk-based contaminant concentrations will be phytoremediated or relocated to an acceptable soil repository • Selected facilities decontaminated and decommissioned.

Remaining Cleanup Objectives	Current End State Plan	Risk-Based End State	Potential Variance Yes or No
ANL-01 Industrial Waste Pond	Phytoremediation at the Industrial Waste Pond was not successful, so the area will be remediated in Fiscal Year 2004 by implementing the ROD-contingent remedy of excavation and disposal of the sediments that are contaminated to levels above remediation goals. The excavated soil will be disposed of in the ICDF. No long-term institutional controls will be required for this site.	Same	No
WAG 9—post closure management	Implement post closure maintenance, monitoring, institutional controls, and 5-year remedy reviews.	Same	No
Turnover area to LPSO for LTS	Continue 5-year remedy reviews.	Same	No

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
DD&D = deactivation, decontamination, and decommissioning
EPA = U.S. Environmental Protection Agency
FFA/CO = Federal Facility Agreement and Consent Order
ICDF = INEEL CERCLA Disposal Facility
INEEL = Idaho National Engineering and Environmental Laboratory
LPSO = lead program secretarial office
LTS= long-term stewardship
MCL = maximum contaminant level
OU = operable unit
RCRA = Resource Conservation and Recovery Act
RDX = royal demolition explosive
ROD = record of decision
TNT = trinitrotoluene
WAG = waste area group

6. REFERENCES

10 CFR 835, 2002, "Occupational Radiation Protection," *Code of Federal Regulations*, Office of the Federal Register, February 2002.

40 CFR 264, 2002, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, Office of the Federal Register, April 2002.

40 CFR 265, 2002, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, Office of the Federal Register, February 2002.

ANL-W, 1997, *Comprehensive RI/FS for Argonne National Laboratory-West Operable Unit 9-04 at the INEEL (Final)*, W7500-0000-ES-02, Argonne National Laboratory-West, October 1997.

ANL-W, 1998, *Final Record of Decision, Argonne National Laboratory-West, Operable Unit 9-04*, W7500-000-ES-04, Argonne National Laboratory-West, September 1998.

Blackmore, C. S., D. E. Burns, T. S. Green, S. M. Lewis, D. L. Michael, and I. E. Stepan, 1997, *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10557, Rev. 0, U.S. Department of Energy Idaho Operations Office, November 1997.

Braun, Julie B., 2003, *INEEL Historic Architectural Properties Management Plan*, INEEL/EXT-02-01338, Rev. 0, Idaho National Engineering and Environmental Laboratory, October 2003.

Burns, D. E., 1995, *WAG-1 OU 1-10 Comprehensive Remedial Investigation/Feasibility Study Baseline Risk Assessment Technical Memorandum*, INEL-95/0342, Idaho National Engineering and Environmental Laboratory, June 1995.

Dames & Moore, 1993, *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12*, EGG-ER-10547, Rev. 1, Idaho National Engineering and Environmental Laboratory, August 1993.

DOE O 435.1, 2001, "Radioactive Waste Management," U.S. Department of Energy, August 2001.

DOE P 455.1, 2003, "Use of Risk-Based End States," U.S. Department of Energy, July 2003.

DOE, 1995, *Settlement Agreement*, U. S. Department of Energy, Environmental Management; U.S. Navy, Naval Nuclear Propulsion Program; and State of Idaho, October 1995.

DOE, 2002a, *Top-to-Bottom Review of the EM Program, February 4, 2002*, U.S. Department of Energy, February 2002.

DOE, 2002b, *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement*, U.S. Department of Energy.

DOE, 2002c, *Agreement-in-Principle between the Shoshone-Bannock Tribes and the United States Department of Energy*, U.S. Department of Energy, December 2002.

DOE, 2002d, *Agreement to Resolve Disputes, the State of Idaho, United States Environmental Protection Agency, United States Department of Energy*, U.S. Department of Energy and U.S. Environmental Protection Agency, April 2002.

DOE-ID, 1991a, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* Administrative Record No. 1088-06-29-120, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 1991.

DOE-ID, 1991b, *Declaration of the Record of Decision for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory*, Administrative Record No. 3320, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, December 1991.

DOE-ID, 1992a, *Declaration of the Record of Decision for Ordnance Interim Action Operable Unit 10-05*, Administrative Record No. 5137, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, June 1992.

DOE-ID, 1992b, *Record of Decision for the Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23), Operable Unit 1-07A*, Administrative Record No. 5202, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, September 1992.

DOE-ID, 1992c, *Power Burst Facility Record of Decision: Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5*, Administrative Record No. 5204, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, September 1992.

DOE-ID, 1992d, *Record of Decision: Auxiliary Reactor Area-1 Chemical Evaporation Pond, Operable Unit 5-10*, Administrative Record No. 5232, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, December 1992.

DOE-ID, 1992e, *Record of Decision: Test Reactor Area Perched Water System, Operable Unit 2-12*, Administrative Record No. 5230, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, December 1992.

DOE-ID, 1993, *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory,* Administrative Record No. 5569, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, October 1993.

DOE-ID, 1994a, *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area*, Administrative Record No. 5761, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, December 1994.

DOE-ID, 1994b, *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory*, Administrative Record No. 5632, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, February 1994.

DOE-ID, 1995a, *Long-Term Land Use Future Scenarios for the Idaho National Engineering Laboratory*, DOE/ID-10440, U.S. Department of Energy Idaho Operations Office, August 1995.

DOE-ID, 1995b, *Idaho National Engineering Laboratory Site Treatment Plan*, DOE/ID-10519, U.S. Department of Energy Idaho Operations Office, September 1995.

DOE-ID, 1995c, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, EIS-0203-F, U.S. Department of Energy Idaho Operations Office, April 1995.

DOE-ID, 1995d, *Record of Decision: Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action, Operable Unit 1-07B*, Administrative Record No. 10139, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, August 1995.

DOE-ID, 1996, *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan*, DOE/ID-10514, U.S. Department of Energy Idaho Operations Office, December 1997.

DOE-ID, 1997a, *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10531, Rev. 0, U.S. Department of Energy Idaho Operations Office, February 1997.

DOE-ID, 1997b, *Final Record of Decision, Test Reactor Area, Operable Unit 2-13*, DOE/ID-10586, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, December 1997.

DOE-ID, 1998a, *Comprehensive Remedial Investigation/Feasibility Study Supplement for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10557, Supplement, Rev. 0, U.S. Department of Energy Idaho Operations Office, November 1998.

DOE-ID, 1998b, *Radioactive Waste Information for 1997 and Record-to-Date*, DOE/ID-10054(97), U.S. Department of Energy Idaho Operations Office, July 1998.

DOE-ID, 1999a, *Final Record of Decision for Test Area North, Operable Unit 1-10*, DOE/ID-10682, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, October 1999.

DOE-ID, 1999b, *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13*, DOE/ID-10660, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, October 1999.

DOE-ID, 2000a, *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13*, DOE/ID-10719, Rev. 2, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, July 2000.

DOE-ID, 2000b, *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10680, Rev. 1, U.S. Department of Energy Idaho Operations Office, July 2000.

DOE-ID, 2000c, *Record of Decision for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12*, DOE/ID-10700, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, January 2000.

DOE-ID, 2000d, *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13*, DOE/ID-10744, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, May 2000.

DOE-ID, 2001a, *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04*, DOE/ID-10807, Rev. 0, U.S. Department of Energy Idaho Operations Office, August 2001.

DOE-ID, 2001b, *Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B*, DOE/ID-10139, Amendment, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, September 2001.

DOE-ID, 2002a, *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory*, DOE/ID-11006, U.S. Department of Energy Idaho Operations Office, July 2002.

DOE-ID, 2002b, *Record of Decision for Experimental Breeder Reactor-1/Boiling Water Reactor Experiment Area and Miscellaneous Sites, Operable Units 6-05 and 10-04*, DOE/ID-10980, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, November 2002.

DOE-ID, 2003a, *INEEL Long-Term Stewardship Implementation Plan*, DOE/ID-11084, Rev. 0, U.S. Department of Energy Idaho Operations Office, September 2003.

DOE-ID, 2003b, *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10*, DOE/ID-11050, Rev. 0, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, April 2003.

DOE-ID, 2003c, *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-11099, Rev. 0, U.S. Department of Energy Idaho Operations Office, September 2003.

Holdren, K. Jean, Bruce H. Becker, Nancy L. Hampton, L. Don Koeppen, Swen O. Magnuson, T. J. Meyer, Gail L. Olson, and A. Jeffrey Sondrup, 2002, *Ancillary Basis for Risk Analysis of the Subsurface Disposal Area*, INEEL/EXT-02-01125, Rev. 0, Idaho National Engineering and Environmental Laboratory, September 2002.

IDEQ, 1992, *Notice of Noncompliance Consent Order*, Idaho Department of Environmental Quality, April 3, 1992.

IDEQ, 1996, *Risk-Based Corrective Action Guidance Document for Petroleum Releases*, Rev. 0, August 1996.

IDEQ, 2000, *Consent Order*, Idaho Department of Environmental Quality, June 14, 2000.

INEEL, 1994, *Preliminary Scoping Track 2 Summary Report for the Test Area North Operable Unit 1-05: Radioactive Contamination Sites*, INEL-94/0135, Rev. 0, Idaho National Engineering and Environmental Laboratory, October 1994.

INEEL, 1996, *Record of Decision: Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment–1 Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)*, INEL-95/0282, Idaho National Engineering and Environmental Laboratory; U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; and Idaho Department of Health and Welfare, Division of Environmental Quality, January 1996.

INEEL, 2003, *Central Facilities Area Landfills 1, II, and III Annual Monitoring Report (2002)*, INEEL/EXT-03-00024, Idaho National Engineering and Environmental Laboratory, September 2003.

Intermountain Demographics, 1996, *2000, 2005, 2010, and 2015 Employment, Population, and Household Forecasts for Bonneville Metropolitan Planning Organization*, April 1996.

Intermountain Demographics, 2000, *Employment, Population, and Household Forecasts for Bannock Planning Organization*.

Intermountain Demographics, 2002, *Demographic Update for Bonneville Metropolitan Planning Organization*, October 2002.

Kaminsky, J. F., K. N. Keck, A. L. Schafer-Perini, C. F. Hersley, R. P. Smith, G. J. Stormberg, and A. H. Wylie, 1994, *Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at the Idaho Nuclear Engineering and Environmental Laboratory*, EGG-ER-10643, Rev. 0, Idaho National Engineering and Environmental Laboratory, January 1994.

Olson, Gail L., L. Don Koeppen, Alva M. Parsons, Paul D. Ritter, and A. Jeffrey Sondrup, 2003, *FY 2002 Environmental Monitoring Report for the Radioactive Waste Management Complex*, INEEL/EXT-03-00055, Rev. 0, Idaho National Engineering and Environmental Laboratory, March 2003.

Rodriguez, R. R., A. L. Schafer, J. McCarthy, P. Martian, D. E. Burns, D. E. Raunig, N. A. Burch, and R. L. VanHorn, 1997, *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final)*, DOE/ID-10534, U.S. Department of Energy Idaho Operations Office, November 1997.

VanHorn, Robin, Carolyn Fordham, and Thomas Haney, 2003, *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory*, INEEL/EXT-02-01191, Rev. 0, Idaho National Engineering and Environmental Laboratory, September 2003.