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Rev. 1

U.S. Department of Energy
Idaho Operations Office

Idaho National Laboratory Environmental Monitoring Plan

April 2008

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

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EXECUTIVE SUMMARY

The Idaho National Laboratory (INL) consists of eight major facilities located in southeastern Idaho within a U.S. Department of Energy (DOE) specified boundary, typically referred to as the "INL Site," and several laboratories and administrative buildings located in Idaho Falls, Idaho, approximately 48 km (30 mi) east of the INL Site boundary. This plan describes routine environmental compliance and surveillance monitoring of airborne and liquid effluents, and ecological and meteorological conditions in and around the vicinity of the INL Site (see Figure E-1).

Environmental monitoring discussed in this plan is conducted in accordance with DOE Order 450.1, "Environmental Protection Program."[1] The objective of DOE Order 450.1 is to provide guidance for implementing sound stewardship practices for protecting the air, water, land, and other natural and cultural resources that may be impacted by DOE operations. This plan provides an overview of the organizations and federal agencies responsible for meeting these stewardship objectives at the INL Site, the rationale for monitoring, the types of media monitored, where the monitoring is conducted, and information regarding access to analytical results. Environmental monitoring activities are conducted by a variety of organizations consisting of:

- Idaho National Laboratory
- Idaho Cleanup Project
- Environmental Surveillance, Education, and Research Program
- United States Geological Survey
- National Oceanic and Atmospheric Administration
- Advanced Mixed Waste Treatment Project.

Compliance monitoring of airborne and liquid effluents is performed to verify compliance with permitting requirements, state and federal regulations, and environmental protection policies and commitments. Surveillance monitoring addressed in this document is driven by DOE order and is performed to identify key contaminants released into the environment, evaluate different pathways through which contaminants move in the environment, and determine the potential effects of these contaminants on the environment.

Nonroutine activities, such as special research studies and the characterization of individual sites for environmental restoration, are outside the scope of this plan. Environmental monitoring activities at Naval Reactors Facility conducted by Bechtel Bettis, Inc. are not included in this plan.

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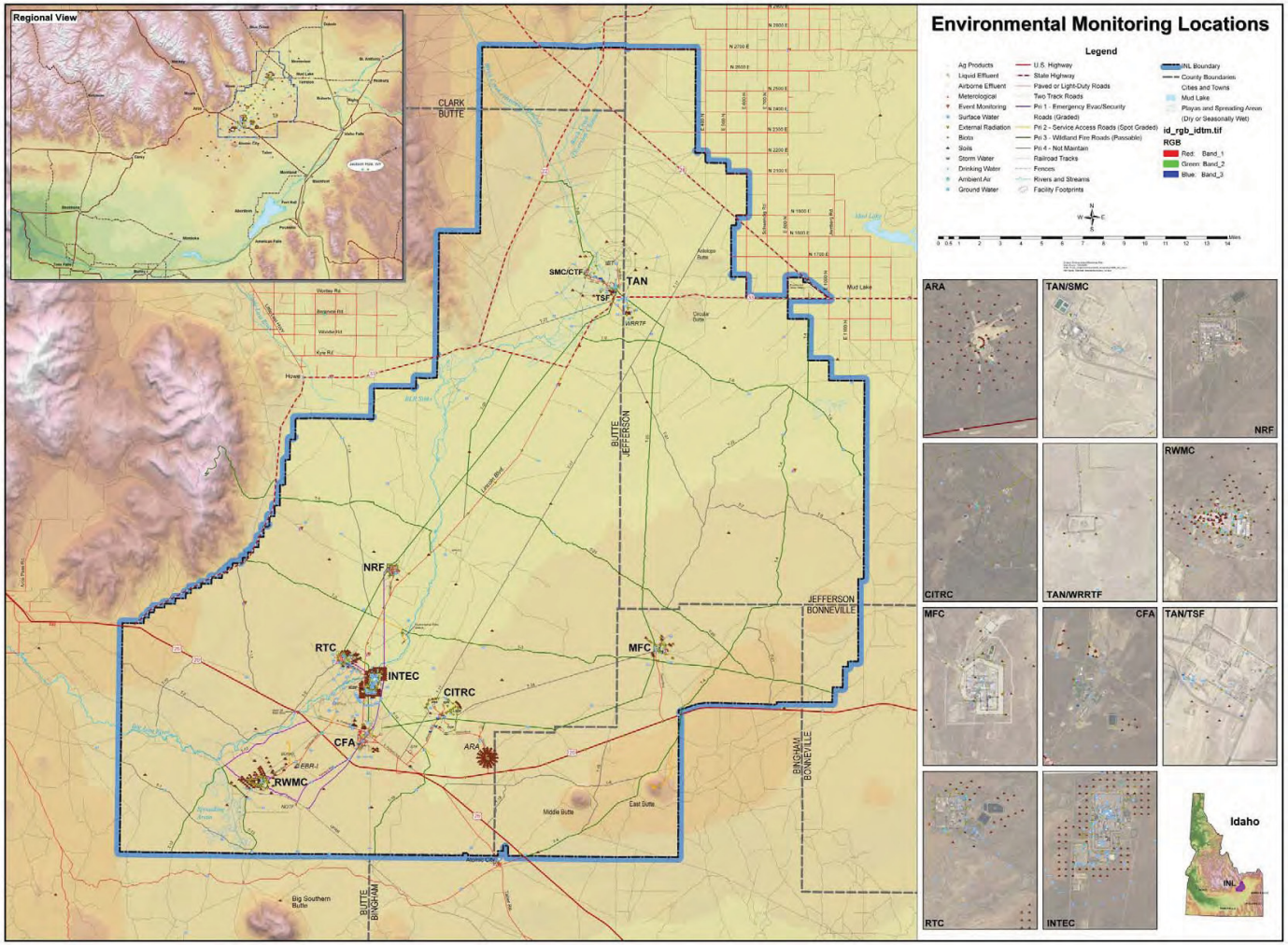

Figure E-1. Sitewide monitoring locations.

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CONTENTS

FIGURES

TABLES

ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Project
ANL-W	Argonne National Laboratory-West (now MFC)
ARLFRD	Air Resources Laboratory Field Research Division
ASER	Annual Site Environmental Report
ASME	American Society of Mechanical Engineers
BBWI	Bechtel BWXT Idaho, LLC
BEA	Battelle Energy Alliance
BNFL	British Nuclear Fuels plc
BBS	Breeding Bird Survey
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
CFR	*Code of Federal Regulations*
CRMO	Cultural Resources Management Office
CWI	CH2M-WG Idaho, LLC
DEQ	Idaho Department of Environmental Quality
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EBR	Experimental Breeder Reactor
EDE	effective dose equivalent
EMS	Environmental Management System
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ESER	Environmental Surveillance, Education, and Research (Program)
GPRS	global positioning radiometric scanner
HPIC	high-pressure ion chambers
HSL	Health Services Laboratory
ICDF	Idaho CERCLA Disposal Facility
ICP	Idaho Cleanup Project
IDAPA	Idaho Administrative Procedures Act
IEMP	Idaho Environmental Monitoring Program
INEEL	Idaho National Engineering and Environmental Laboratory
INEL	Idaho National Engineering Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INL Research Center

M&O	management and operating
MDIFF	mesoscale diffusion
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
MSC	Monitoring and Surveillance Committee
NESHAP	National Emission Standard for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NRF	Naval Reactors Facility
PBF	Power Burst Facility
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
REC	Research and Education Campus
RESL	Radiological and Environmental Sciences Laboratory
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RTC	Reactor Technology Complex
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SMC	Specific Manufacturing Capability
SRPA	Snake River Plain Aquifer
STP	Sewage Treatment Plant
SWC	Sitewide Complex
TAN	Test Area North
TLD	thermoluminescent dosimeter
USGS	United States Geological Survey
USGS-BRD	United States Geological Survey-Biological Resources Division
WAG	Waste Area Group
WIPP	Waste Isolation Pilot Plant
WLAP	Wastewater Land Application Permit
WRRTF	Water Reactor Research Test Facility

Idaho National Laboratory
Environmental Monitoring Plan

1. GENERAL INFORMATION

1.1 Purpose

This plan provides a high-level summary of environmental monitoring currently being performed by various organizations within and around the Idaho National Laboratory (INL) Site as required by U.S. Department of Energy (DOE) Order 450.1, "Environmental Protection Program."[1] The objective of DOE Order 450.1 is to implement sound stewardship practices that protect the air, water, land, and other natural and cultural resources that may be impacted by DOE operations. This plan describes the organizations responsible for conducting environmental monitoring across the INL Site, the rationale for monitoring, the types of media being monitored, where the monitoring is conducted, and where monitoring results can be obtained.

Detailed monitoring procedures, program plans, or other governing documents used by contractors or agencies to implement requirements are referenced in this plan. This plan covers all planned monitoring and environmental surveillance. Nonroutine activities such as special research studies and characterization of individual sites for environmental restoration are outside the scope of this plan.

1.2 INL Site Description

The INL Site is approximately 230,500 hectares (890 mi^2) and is located on the Eastern Snake River Plain in southeastern Idaho (see Figure 1-1). It was established as a nuclear energy research and development (R&D) testing station in the late 1940s and was designated a National Environmental Research Park in 1975. All land within the INL Site is protected as an outdoor laboratory where the effects of energy development, industrial activities on the environment, and the complex ecological relationships of this cool desert ecosystem can be studied. The INL Site is owned by DOE and administered through its Idaho Operations Office (DOE-ID). DOE-ID is charged with overseeing operations at the INL Site.

Subsurface geology consists of successive layers of basalt and sedimentary strata, overlain by wind- and water-deposited sediments. Most of the INL Site is in the closed Mud Lake-Lost River drainage basin, which has been informally named the Pioneer Basin. Surface waters within the Pioneer Basin include the Big Lost River, the Little Lost River, and Birch Creek drainages, all of which provide drainage to the mountain watersheds located to the north and northwest of the INL Site. All three drainages may flow onto the INL Site during high flow years, but are otherwise intermittent. In addition, local rainfall and snowmelt contribute to surface water, mainly during the spring. The portion of surface water that is not lost to evapotranspiration infiltrates into the subsurface. Both aquifer and surface waters are used for irrigating crops and other applications outside the INL Site.

The primary groundwater source of the region is the Snake River Plain Aquifer (SRPA). (See Figure 1-2). The SRPA is approximately 320 km (199 mi) long, 30 to 100 km (20 to 60 mi) wide, and encompasses an area of about 2,500,000 hectares (9,650 mi^2). This sole-source aquifer is one of the most productive in the U.S. As such, it is a source of process and drinking water to more than 200,000 people and supplies irrigation water to a large, regional agricultural and aquaculture economy.

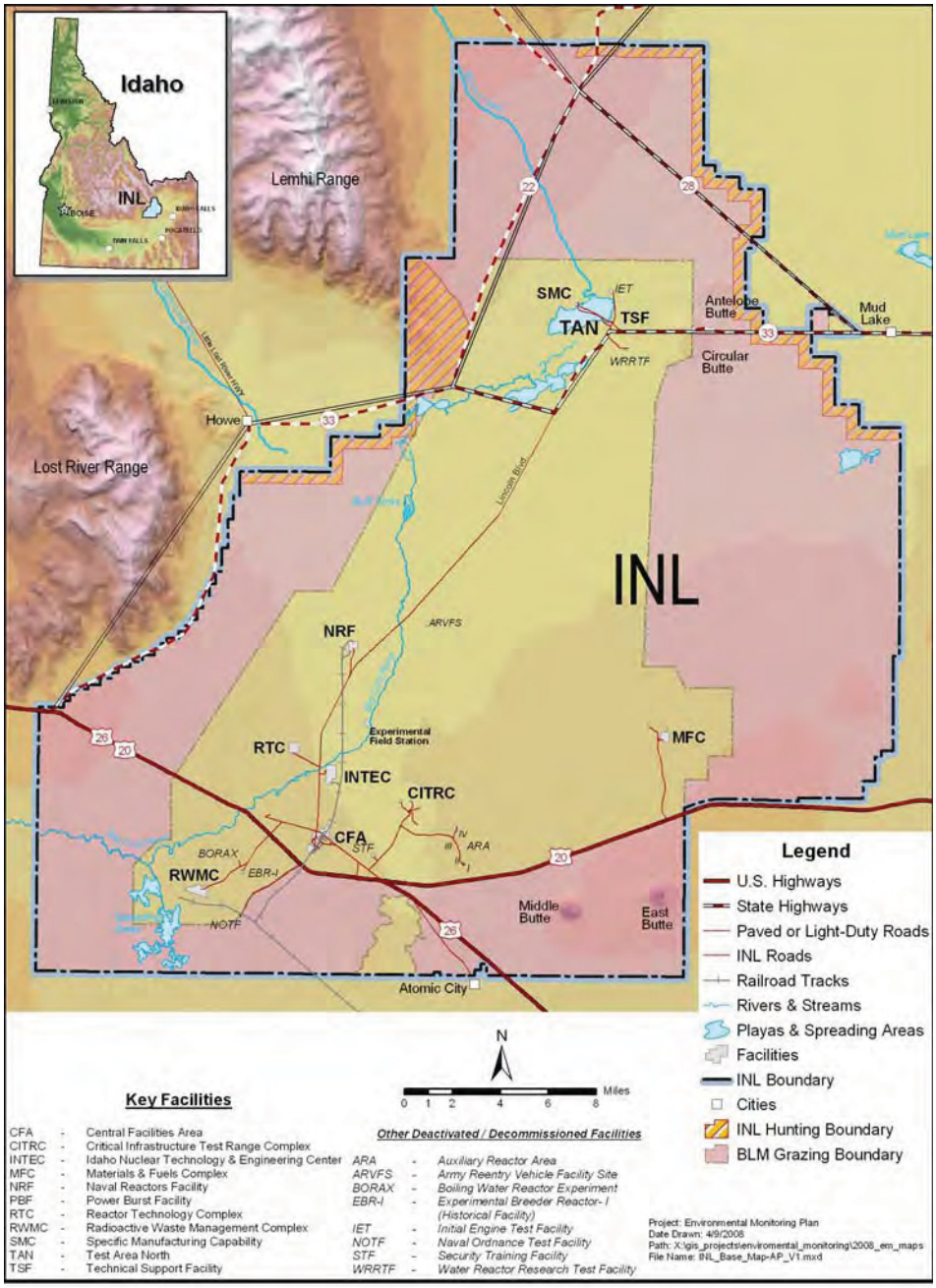

Figure 1-1. Idaho National Laboratory Site.

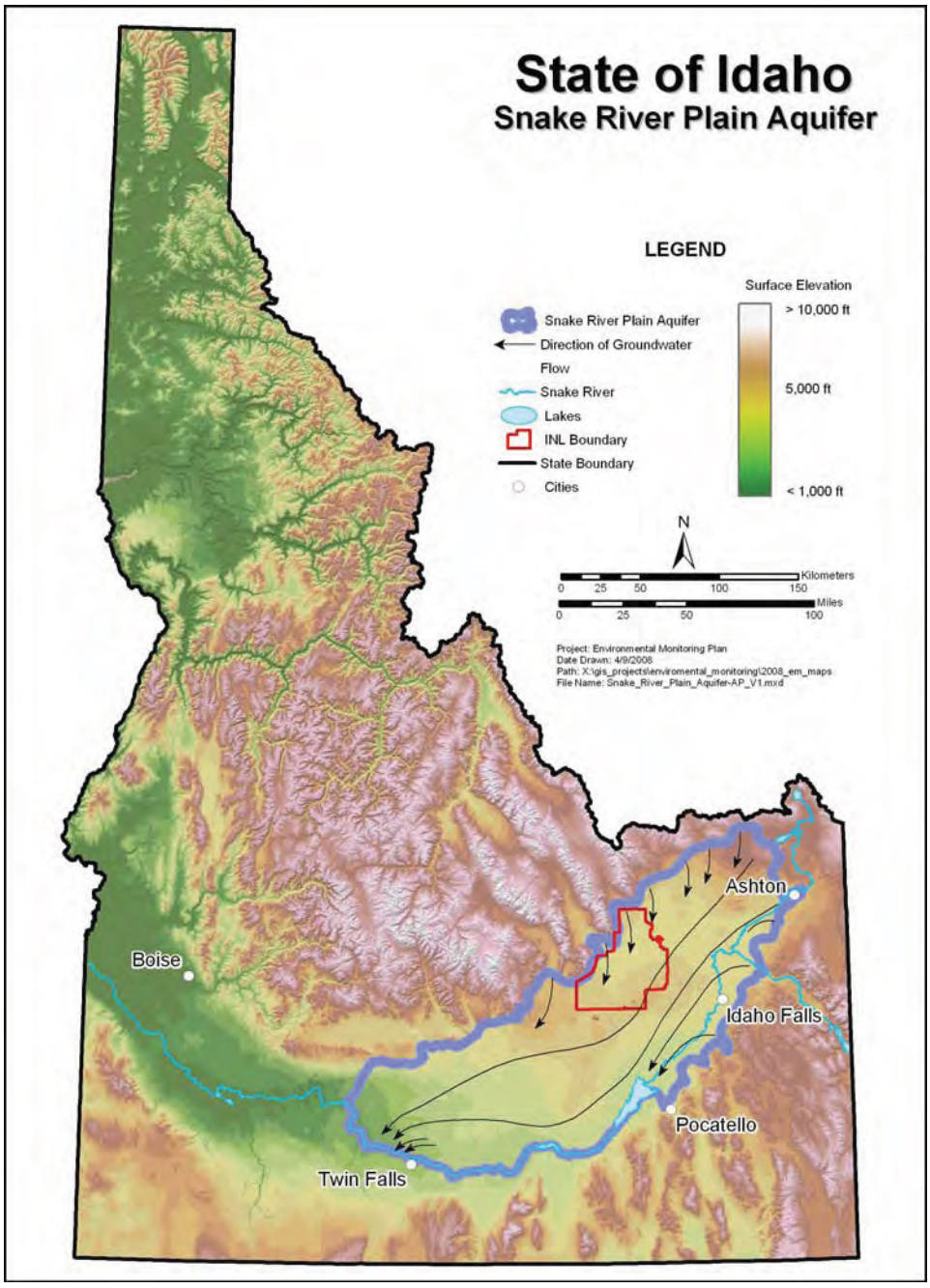

Figure 1-2. Idaho National Laboratory Site in relation to the Snake River Plain Aquifer.

The depth to the SRPA varies from approximately 60 m (200 ft) in the northern part of the INL Site to more than 270 m (900 ft) in the southern part. The aquifer is recharged from infiltrating precipitation and irrigation seepage, runoff from the surrounding highlands, and groundwater underflows from the surrounding watersheds. Groundwater in the SRPA flows generally to the southwest, although locally the direction of flow is influenced by recharge from rivers, surface water, spreading areas, and heterogeneities in the aquifer. Groundwater flow rates in the vicinity of the INL Site range from approximately 1.5 to 6 m (5 to 20 ft) per day.

Annual rainfall at the INL Site is light, and the region is classified as arid to semiarid.[2] The long-term average (from March 1950 through 2002) annual precipitation at the INL Site is 21.6 cm (8.5 in. at the Central Facilities Area [CFA] station). Monthly precipitation is usually highest in April, May, and June and lowest in July and October. The average daily maximum temperature is 31°C (87°F) in July, and the average daily minimum temperature is –15°C (5°F) in January. The INL Site is in the belt of prevailing westerly winds, which are channeled within the plain to produce a west-southwesterly or southwesterly wind at most locations on the INL Site.

1.3 Summary of INL Site Facilities

The INL Site consists of eight major facilities in southeastern Idaho, as well as several laboratories and administrative buildings approximately 48 km (30 mi) east of the INL Site boundary in Idaho Falls, Idaho. Battelle Energy Alliance, LLC (BEA) is the management and operating (M&O) contractor for the INL Site. In this document, BEA will be referred to as the INL contractor. Similarly, CH2M-WG Idaho, LLC (CWI) is the Idaho Cleanup Project (ICP) contractor. CWI will be referred to as the ICP contractor.

1.3.1 INL Contractor Facilities

The CFA houses many technical and support services for the INL contractor including administrative offices, monitoring and calibration laboratories, fire protection, medical services, warehouses, vehicle and equipment pools, and bus operations.

The Research and Education Campus (REC) in Idaho Falls consists of office and classroom complexes and multiple laboratory facilities, including many one-of-a-kind advanced labs dedicated to the full spectrum of physical and life science research. The laboratories are “modular,” with respect to their provisions, for ease of utility tailoring and flexibility. There are other advanced R&D laboratories located in Idaho Falls, including engineering demonstration facilities, robotics laboratories, material research laboratories, and advanced information technology and computer simulation and modeling facilities.

The Materials and Fuels Complex (MFC) is the prime testing center in the U.S. for demonstration and proof-of-concept of nuclear energy technologies. Research and development activities at this facility are focused on areas of national concern, including energy, nuclear safety, spent nuclear fuel treatment, nonproliferation, decommissioning and decontamination technologies, nuclear material disposal, and homeland security.

Reactor Technology Complex (RTC), formerly known as Test Reactor Area, is the world’s most sophisticated nuclear reactor testing complex and has extensive facilities for studying the effects of radiation on materials, testing nuclear fuels, and producing medical and industrial isotopes.

The Critical Infrastructure Test Range Complex (CITRC) is an isolated and secure microcosm of many of the critical infrastructure systems important to the operation of our country, such as power, transportation, cyber, and communications. The INL Site was chosen to be a “Test Range” owing to its remote location and dedication to various research, development, and testing activities.

The CITRC has a number of specific test beds (12 buildings, approx 71,600 ft^2):

- Range Support Area, which consists of office structures, training facility, area power substation, and area water supply system
- National Contraband Detection and Testing Center
- Incident Response Training and Testing Center, Range Control Center facility, and an office building housing the range director's office with other test bed facilities
- Special Programs test facility.

The Specific Manufacturing Capability (SMC) facility, located at Test Area North (TAN) houses a unique project that began with a Memorandum of Understanding between DOE and the U.S. Army in February 1985. Operated by the INL contractor, the SMC Project manufactures armor for the army's M1A2 Abrams battle tank.

1.3.2 Idaho Cleanup Project (ICP) Contractor Facilities

Idaho Nuclear Technology and Engineering Center (INTEC) was established in the 1950s to recover usable uranium in spent nuclear fuel from government reactors and to store spent nuclear fuel. The current work scope at INTEC includes removing excess nuclear material, closing radioactive and hazardous waste tanks, treating liquid radioactive waste at the Integrated Waste Treatment Unit and shipping it off-Site, transferring spent nuclear fuel from wet to dry storage, remediating the spent nuclear fuel basin, treating and disposing of waste, closing liquid waste tanks, remediating contaminated environmental sites, and demolishing facilities.

Radioactive Waste Management Complex (RWMC) managed, stored, and disposed of radioactive waste. Currently, RWMC manages solid transuranic and low-level radioactive waste. RWMC is removing and disposing of targeted waste from the Subsurface Disposal Area, remediating the Subsurface Disposal Area, disposing of transuranic waste at an off-Site facility, and demolishing facilities.

TAN, which is located at the north end of the Site, was built in the 1950s to house the nuclear-powered airplane project. TAN facilities personnel are now closing hazardous waste tank systems, remediating contaminated environmental sites, and demolishing facilities.

The Power Burst Facility (PBF) portion of the CITRC facilities consists of the reactor area and a small portion of the control area. The initial mission for PBF was testing water reactor fuel rods under representative accident conditions. Data from these tests were used to develop and validate fuel behavior computer code for the Nuclear Regulatory Commission. These tests were completed in 1985. Currently, ICP personnel are dispositioning the decommissioned PBF reactor, and demolishing facilities to completely eliminate the PBF footprint.

1.3.3 Naval Reactors Facility (NRF)

The NRF, operated by Bechtel Bettis, Inc., is specifically excluded from detailed discussion in this monitoring plan. As established in Executive Order 12344,[3] the Naval Nuclear Propulsion Program is exempt from the requirements of DOE Orders 450.1 (Reference 1), 5400.5, "Radiation Protection of the Public and the Environment,"[4] and 414.1C, "Quality Assurance."[5] The director, Naval Nuclear Propulsion Program, establishes reporting requirements and methods implemented within the program, including those necessary to comply with appropriate environmental laws. NRF's program is documented in the *Naval Reactors Facility Environmental Monitoring Program*.[6]

1.3.4 Advanced Mixed Waste Treatment Project (AMWTP) Contractor Facility

Bechtel BWXT Idaho, LLC (BBWI, Inc.) currently operates the AMWTP, which retrieves mixed transuranic waste from temporary storage, characterizes the waste, treats the waste to meet disposal criteria, and packages the waste for shipment to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico.

2. INL SITE ENVIRONMENTAL MONITORING OVERVIEW

The INL Site's mission is to ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities. The vision for the site is to be the preeminent nuclear energy laboratory with synergistic, world-class, multi-program capabilities and partnerships within the next ten years. Two of the INL's site-strategic objectives are to develop public trust and confidence in site operations and nuclear programs, and to demonstrate sound environmental stewardship. The environmental policy ensures sound environmental stewardship by requiring that energy and national security R&D efforts be conducted in a manner that protects and preserves human health and the environment. This policy is in full compliance with applicable environmental laws, regulations, and other requirements. Environmental Management Systems (EMS) have been established to implement this policy. EMS, which integrates the environmental functional area into the Integrated Safety Management Systems, is based on the international standard ANSI/ISO 14001, "Environmental Management System."[7]

Comprehensive environmental monitoring and surveillance are conducted in support of the EMS. Environmental monitoring collects and analyzes samples or direct measurements of environmental media. Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance.

Effluent monitoring of airborne emissions and liquid effluents is driven by DOE and Environmental Protection Agency (EPA) requirements, state and federal regulations, and facility operating permits. This type of monitoring refers to the collection and analysis of samples, or measurements of liquid and gaseous effluents for characterizing and quantifying contaminants, assessing radiation exposures of members of the public, providing a means to control effluents at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements. Liquid and airborne effluents from facilities are monitored for radiological and nonradiological parameters.

Environmental surveillance is the collection and analysis of samples or direct measurements of air, water, soil, biota, and agricultural products from DOE sites and their environs. Environmental surveillance activities are discussed in more detail in Section 4 and are conducted to:

- Determine compliance with DOE Order 450.1 (Reference 1)
- Determine potential effects of contaminants on the public and the environment
- Evaluate pathways through which contaminants move in the environment.

In addition to effluent monitoring and environmental surveillance, meteorological conditions are monitored in and around the INL Site. Meteorological monitoring provides information needed to support and interpret the results of other monitoring and surveillance activities, particularly for air dispersion modeling. Meteorological monitoring activities are discussed in Section 5.

Ecological resource monitoring documents sensitive and threatened species on the INL Site, evaluates habitat needs, and monitors biota population trends and weed invasions in disturbed areas. These data better enable the evaluation of environmental impacts of operations and determine restoration and mitigation needs. These activities are discussed in Section 4.7.

Cultural resource monitoring enables the INL Site Cultural Resources Management Office (CRMO) staff to gather baseline data and assess the condition of known cultural resources that have the potential to be impacted by natural processes, unauthorized activities, or inadvertently by project activities. If impacts are noted during monitoring visits, appropriate notifications are made as outlined in DOE/ID-10997, "INL Cultural Resource Management Plan."[8] And as legitimized through Programmatic Agreement between the Idaho State Historic Preservation Office, the Advisory Council on Historic Preservation and DOE-ID.[8] By identifying impacts to cultural resources in this manner and implementing mitigation or

treatment plans, federal stewardship responsibilities are fulfilled by completing actions to avert further deterioration. Certain properties that are of special significance to the Shoshone-Bannock Tribes and other groups are monitored at least once per year while others are chosen based on known threats (i.e., close to public roads, ongoing projects in the vicinity). Because of tribal sensitivities, all projects that will disturb the ground in and around the CITRC area are monitored. Details of the annual monitoring activities are reported to DOE-ID annually in the "INL Monitoring Report" and are summarized for the public in the "INL Cultural Resource Management Program Activities Report." A description of the INL CRMO monitoring program is located in Appendix L of DOE/ID 10997.

A separate system of environmental monitoring and surveillance is activated during environmental events, which may be planned, as in startup of new equipment/process, or unplanned, such as operational events or wild fires. This environmental event monitoring is discussed in Section 6. Environmental reporting on compliance and regulatory sampling is discussed in Section 7.

The locations of monitoring stations within and surrounding the INL Site are shown in Figure 2-1.

2.1 History of Environmental Monitoring at the INL Site

Some of the earliest environmental monitoring on the INL Site was completed by the U.S. Weather Bureau, which created a Research Station in 1948 to support the National Reactor Testing Station, as the INL was then called. The Research Station still exists as the Air Resources Laboratory Field Research Division (ARLFRD) of the National Oceanic and Atmospheric Administration (NOAA). The Station's task was to develop a basic understanding of the regional meteorology and climatology, with a focus on protecting the health and safety of workers and nearby residents using meteorological measurements and transport and dispersion models.

In 1949, the Health and Safety Division of the Idaho Operations Office of the Atomic Energy Commission collected numerous samples to determine the pre-reactor radionuclide background in soil, plants, animals, etc., at the INL Site.[9] The United States Geological Survey (USGS) also began monitoring hydrologic conditions of the SRPA in 1949 by sampling nine onsite wells.

In 1959, the first of several aerial radiological surveys of the INL Site was performed under the direction of the Idaho Operations Office in an attempt to determine the extent of natural and man-made radioactivity. Subsequent aerial surveys performed in 1965, 1974, 1982, and 1990 focused mainly on characterizing facilities and associated regions of the INL Site.[10]

Between 1956 and 1963, ecological research was conducted onsite by Health Services Laboratory (HSL), which focused on movement of radioactive contaminants through the food chain. Rabbits were sampled as indicators of the extent of contamination around INL Site facilities. In 1970, HSL established a routine soil sampling and monitoring program for radionuclides in the surface soils near INL Site facilities and the surrounding area.

In 1973, the Radiological and Environmental Sciences Laboratory (RESL) incorporated a biological component into its program that included extensive studies of radionuclide-contaminated areas and transport by biota from these areas. In 1977, HSL merged with RESL and the RESL Program continued onsite and offsite monitoring through 1993.

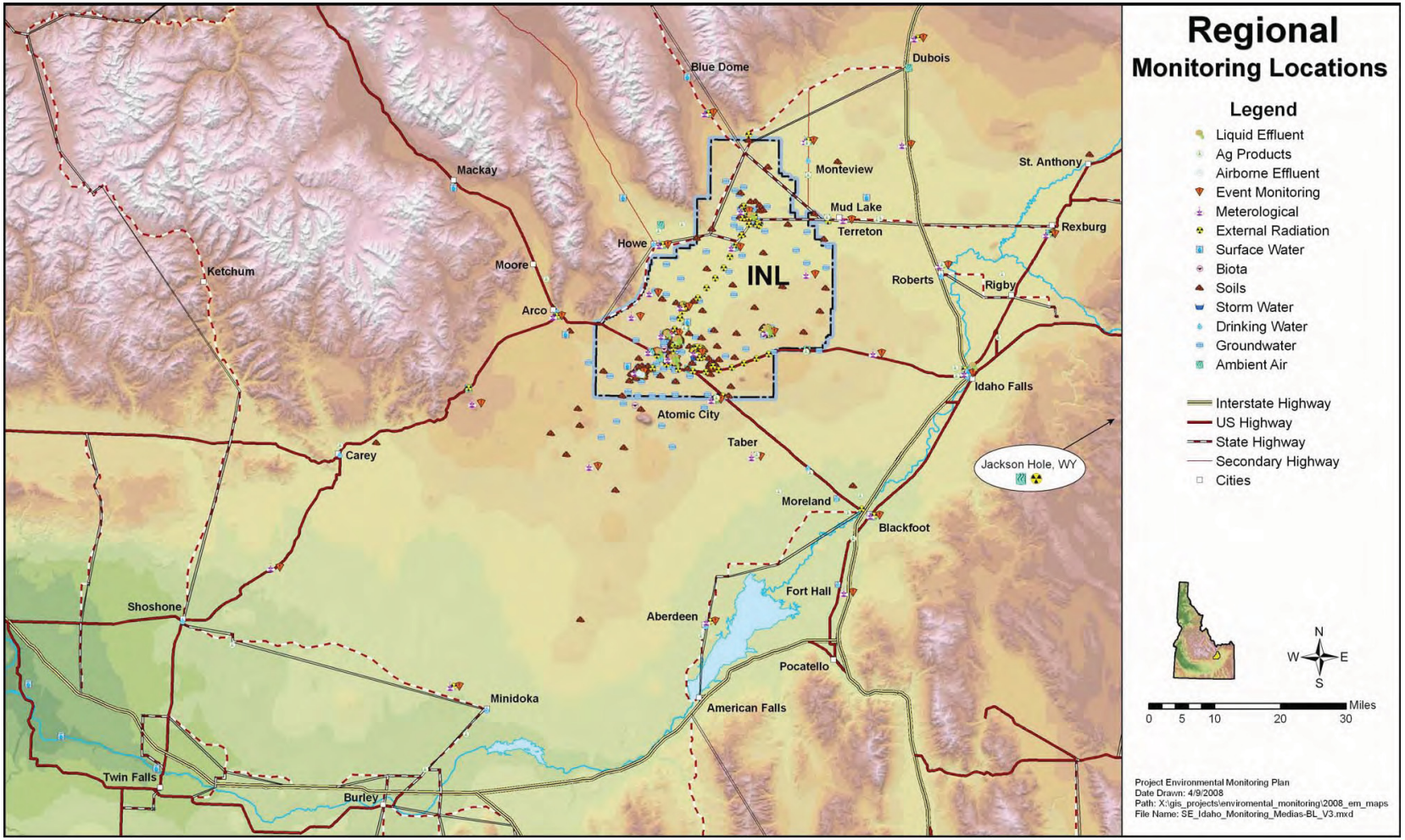

Figure 2-1. Regional monitoring locations.

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In 1989, the INL Site was placed on the National Priorities List found at http://www.epa.gov/superfund/sites/npl/. In 1991, DOE, EPA, and the State of Idaho signed the *Federal Facility Agreement and Consent Order*[11] under 42 USC § 9601, "Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)"[12] to ensure that environmental hazards associated with contaminant releases were identified and remediation was completed. Since 1991, comprehensive remedial investigations/feasibility studies and Records of Decision (RODs) have been completed for most of the 10 Waste Area Groups (WAGs) identified, and remediation in some areas has been completed. As part of CERCLA regulatory commitments, long-term monitoring is ongoing.

Also, in 1989, the Idaho Legislature established a comprehensive state oversight program for the INL Site. In 1990, Idaho became the first state in the nation to negotiate a 5-year agreement (Environmental Oversight and Monitoring Agreement[13]) with DOE to provide funding for independent environmental oversight and monitoring of a DOE facility. Subsequent 5-year agreements are negotiated. Over the years, the INL Oversight Program has developed an effective monitoring network to verify and supplement INL Site monitoring programs and to assure that DOE activities protect Idaho's environment. The INL Oversight Program also provides independent information concerning DOE impacts on the people and environment.

In 1994, DOE transferred the responsibility for onsite environmental surveillance from RESL to the prime INL Site M&O contractor, and all offsite environmental surveillance was transferred to a private contractor under the Environmental Surveillance, Education, and Research (ESER) Program.

In 1996, DOE awarded a private contract to British Nuclear Fuels Limited, Inc. (BNFL, Inc.) to construct and operate the AMWTP near the RWMC. The AMWTP was designed to retrieve, characterize, and treat transuranic-contaminated waste stored at RWMC and prepare it for final offsite disposal. In May of 2005, DOE replaced the privatized contract with BNFL and awarded a 1-year contract to BBWI to manage and operate the AMWTP facility. BBWI assumed responsibility for environmental monitoring within the AMWTP and in March of 2006, DOE awarded a 2-year extension to BBWI to continue to manage and operate the AMWTP facility. BBWI has been granted an additional 1-year extension until April 30, 2009, with an additional 5-month option.

In November 2004, BEA was awarded the M&O contract and assumed operation of the R&D laboratory, which was renamed Idaho National Laboratory on February 1, 2005. This contract award merged ANL-W with INL, which integrated Idaho's nuclear energy capabilities under a single management structure, built a multi-program laboratory with world-class nuclear R&D capabilities, and established a strong science and technology leadership team to partner with DOE to pursue the Department's nuclear technology and security vision for the laboratory. The mission of the INL contractor is to develop advanced nuclear energy technology and other ways of responding to the nation's future energy and national security requirements. The INL contractor assumed operation and management of the major nuclear facilities at the Site: the RTC, which includes the Advanced Test Reactor, a key test facility in developing advanced nuclear systems, fuels, and materials; and MFC, which includes vital facilities in R&D of fuels, and the Space and Security Power System Facility, designed and built to assemble, test, and deliver radioisotope power systems for space exploration and national security missions.

The INL contractor continues to operate the REC, which supports science and technology research in alternative energy, fossil energy, chemistry, materials development, biotechnology, and robotic technology. The SMC, located at TAN, is a unique U.S. Army support project included under INL management.

The INL contractor continues to manage and greatly expand the National and Homeland Security Directorate. This directorate includes important R&D in energy, global, homeland security, national

defense and special programs. The INL contractor also provides site services including maintenance, security, fire protection and medical services, operation of the transportation system, and emergency management services.

In March 2005, CWI was named as the contractor for the ICP. CWI operates INTEC and RWMC. The CWI scope includes remediating legacy wastes decommissioning and dismantling excess environmental management facilities and reactors, managing spent nuclear fuel, treating sodium-bearing waste for disposal at the WIPP in New Mexico, emptying and disposing of all tank farm facility waste tanks, and remediating the Subsurface Disposal Area (SDA) at the RWMC. Their objective is to accelerate and complete cleanup work at the INL Site, while reducing the footprint and legacy cleanup costs.

Environmental monitoring performed by the various contractors in charge of facility operations initially involved limited sampling of liquid and airborne effluents from the facilities to develop waste inventory information and to meet operational monitoring objectives. Over the years, these contractor-run monitoring programs have evolved to ensure compliance with applicable federal, state, and local regulations and protect human health and the environment.

2.2 Environmental Monitoring Organizations

A number of organizations conduct environmental monitoring activities on or in the vicinity of the INL Site. Currently, the S. M. Stoller Corporation manages the ESER Program under a contract with DOE-ID. Two federal agencies, USGS and NOAA, have interagency agreements with DOE-ID to provide water monitoring and research, and meteorological monitoring, respectively. The State of Idaho INL Oversight Program continues to perform independent, nonregulatory monitoring and verify INL Site environmental monitoring activities conducted by DOE and its contractors. The INL Oversight Program, the ESER Program, DOE-ID, NOAA, and the Shoshone-Bannock Tribes collaborate in operating the Idaho Environmental Monitoring Program (IEMP), which consists of Community Monitoring Stations in Idaho Falls, Fort Hall, Blackfoot, Rexburg, the Big Lost River Rest Area, and Terreton.

Both the INL and ICP contractors perform liquid and airborne effluent monitoring, along with environmental surveillance of ambient air, groundwater, drinking water, surface water runoff, soils, biota, and external radiation. Compliance monitoring programs have been instituted to meet the monitoring requirements of federal, state, and local regulations, permits, and DOE orders. Requirements exist to sample drinking water, liquid effluents, injection well basins for storm water runoff, and groundwater. Facilities with airborne emissions are responsible for monitoring airborne effluents in compliance with the standards set forth in Public Law 91-604, "Clean Air Act Amendments of 1990"[14] and IDAPA 58.01.01, "Idaho Administrative Procedures Act"[15] for control of air pollution in Idaho. Those facilities with Wastewater Land Application Permits (WLAPs) are monitored as required by their associated permits.

Both INL and ICP contractors perform CERCLA monitoring at the facilities consisting of groundwater, soil, and ecological monitoring. A majority of the CERCLA monitoring is performed by the ICP contractor, because the INL contractor is only responsible for the CERCLA work at the MFC site. Completing remediation at the INL Site will result in compliance with environmental remediation agreements. Sites with residual contamination will need to be monitored, controlled, operated, and maintained by institutional controls to protect human health and the environment.

Postclosure monitoring is conducted to evaluate the effectiveness of the final remedies and ensure that no additional contamination is occurring. However, even though CERCLA regulates most INL Site stewardship activities, INL expects some stewardship activities to be regulated under the Resource Conservation and Recovery Act (RCRA), including postclosure groundwater monitoring. The monitoring

of facilities operated by both INL and ICP contractors will continue at the remediation areas for the period negotiated in the RODs 5-year review reports, in RCRA closure plans, or in other laws or agreements that govern the remedies.

The staff of CRMO monitors cultural resources for both INL and ICP contractors. CRMO, which is organized within BEA's Energy and Environment Division, provides cultural resource management services to the ICP contractor through an agreement between the two contractors. CRMO also advises and provides services to NRF on a project-by-project basis. CRMO services facilitate a coordinated and seamless management of INL Site cultural resources for DOE-ID and inform and educate stakeholders about the INL Site's more than 13,000-year history of rich and varied human land use. The CRMO staff of professional archaeologists, historians, and anthropologists conducts monitoring to determine if natural events or human activities are impacting INL Site cultural resources and to provide current information regarding the resources' preservation and protection. As required through an agreement between DOE-ID and the Shoshone-Bannock Tribes, the CRMO staff invites tribal participation during monitoring activities of properties that are of importance to them (Agreement-in-Principle 2007).

Table 2-1 lists the environmental monitoring organizations at the INL Site and summarizes the environmental media monitored by each.

Table 2-1. Summary of INL Site environmental monitoring organization activities.

	Organization					
	INL/BEA	ICP/CWI	AMWTP/ BBWI	ESER/ Stoller	USGS	NOAA
Effluent						
Airborne	X	X	X			
Liquid	X	X				
Storm Water	X					
Surveillance						
Ambient Air	X	X		[a]		
Drinking Water	X	X				
Groundwater	X	X			X	
Surface water		X			X	
Soil	X	X		X		
Biota		X		X		
Agricultural Products & Game Animals				X		
External Radiation	X	X		X		
Ecological		X		X		
Cultural	X					
Meteorological						X

a. Includes collection of precipitation samples.

2.2.1 INL Contractor

The INL contractor is responsible for environmental monitoring activities at the following facilities and areas:

- Central Facilities Area (CFA)
- Critical Infrastructure Test Range Complex (CITRC)
- Materials and Fuels Complex (MFC)
- Reactor Technology Complex (RTC)
- Regional Locations
- Research and Education Campus (REC)
- Sitewide Complex (SWC)
- Specific Manufacturing Capability (SMC)
- Test Area North (TAN).

2.2.2 ICP Contractor

The ICP contractor is responsible for environmental monitoring activities at the following facilities:

- Idaho Nuclear Technology and Engineering Complex (INTEC).
- Radioactive Waste Management Complex (RWMC)

2.2.3 AMWTP

The AMWTP is designed for retrieval, characterization, and treatment of transuranic-contaminated waste stored at the Transuranic Storage Area and to prepare it for final offsite disposal. Two stacks at the AMWTP have the potential to emit radioactive airborne effluent greater than 0.1 millirem per year and are continuously monitored for radioactive effluent in accordance with 40 *Code of Federal Regulations* (CFR) 61, Subpart H, "National Emission Standard for Hazardous Air Pollutants (NESHAP)."[16] All other stacks with the potential to emit radioactive airborne effluent less than 0.1 millirem per year have periodic confirmatory measurements performed in accordance with 40 CFR 61 Subpart H.

2.2.4 ESER Program

The ESER Program, currently managed by the S. M. Stoller Corporation, primarily conducts offsite environmental surveillance for DOE-ID. The ESER Program's primary responsibility is to monitor a number of different pathways by which radiological pollutants from the INL Site could reach the public. Current services provided by the ESER Program include offsite sample collection and analyses of air, precipitation, soil, milk, wheat, lettuce, potatoes, and animal tissue samples; measurement of external ambient radiation; wildlife habitat and vegetation surveys, studies, and research on and near the INL Site; research concerning endangered species, pollutants in the environment, and revegetation; environmental education concerning ecological issues around the INL Site; and preparing the Annual Site Environmental Report (ASER) summarizing environmental monitoring activities across the INL Site.

2.2.5 USGS

The USGS collects water samples and measurements in and around the INL Site boundary to describe hydrologic and geochemical conditions and to evaluate effects of waste disposal and other activities at the INL Site on the hydrogeologic system. The data are used to prepare interpretive reports.

The USGS monitors more than 160 wells within a regional network in the SRPA, both onsite and offsite, to study contaminant migration and determine groundwater quality and quantity as they relate to INL Site operations. Well placement within the regional network and constituent selection supplements existing INL and ICP contractor's groundwater monitoring programs. The USGS also monitors seven surface water sites on the Big Lost River, Little Lost River, Birch Creek, and Mud Lake.

2.2.6 NOAA

NOAA provides meteorological services and supporting research to the INL Site through ARLFRD. ARLFRD operates a large meteorological monitoring network to characterize the meteorology and climatology of the eastern Snake River Plain, which includes the INL Site.

Meteorological monitoring data are required to characterize atmospheric transport and diffusion conditions in the vicinity of the INL Site and to represent other meteorological conditions (e.g., precipitation, temperature, and atmospheric moisture) that are important to environmental surveillance activities, such as air quality and radiological monitoring.

2.2.7 IEMP

IEMP is jointly supported by the INL Oversight Program, the ESER Program, DOE-ID, NOAA, and the Shoshone-Bannock Tribes. Four weather stations were constructed in 1997 at publicly accessible locations in southeastern Idaho. These stations are located in Idaho Falls, Fort Hall, Terreton, and the Big Lost River Rest Area on U.S. Highway 20/26. In 2001, two community monitoring stations in Blackfoot and Rexburg managed by the ESER Program were incorporated into the IEMP network. Kiosks at each station contain real-time displays of meteorological conditions, such as wind speed, wind direction, air temperature, relative humidity, barometric pressure, solar radiation, and background gamma radiation. Posters in these kiosks provide the public with easy-to-understand information about the function of the various sensors and the variables they measure.

2.3 Laboratory-wide Monitoring Committees

2.3.1 Monitoring and Surveillance Committee and Groups

The INL Site has a Monitoring and Surveillance Committee (MSC) with participating organizations from DOE-ID, INL and ICP contractors, AMWTP, NRF, ESER Program, INL Oversight Program, NOAA, USGS, and the Shoshone-Bannock Tribes. Chartered in 1997, the MSC provides a means for exchanging and sharing technical information, expertise and data. The MSC is to provide a collaborative atmosphere in which the participating organizations can communicate and discuss what they are doing in the areas of environmental monitoring and surveillance and make recommendations where appropriate.

2.3.2 Drinking Water Committee

The Drinking Water Committee was established in 1994 to coordinate drinking water related activities across the INL Site and to provide a forum for exchanging information related to drinking water systems. The committee meets quarterly and includes participants from DOE-ID, INL and ICP contractors, AMWTP, and NRF. Drinking water-related issues addressed during these meetings include

regulatory issues, the Cross-Connection Program, construction activities, facility-specific activities, sampling, analytical results, and training.

2.3.3 Water Resources Committee

The Water Resources Committee serves as a forum for coordinating and exchanging technical information on water-related activities. It is open to all INL Site agencies (e.g., DOE-ID, USGS, NOAA), contractor personnel, and, in general, those agencies that have an interest in INL Site water issues but are not necessarily part of the governing agencies. The committee was first chartered in 1991 as the INL Groundwater Committee. It broadened its scope in 1997 to include surface water and atmospheric issues.

2.3.4 Cultural Resources Working Group

The Cultural Resources Working Group (CRWG) was established in l993. Representatives from DOE-ID, The Shoshone-Bannock Heritage Tribal Office, and the INL Cultural Resources Management Office meet monthly to discuss, among many other items, properties to be monitored and projects and events that have the potential to impact sensitive cultural resources on the INL. The CRWG has served as a model for other sites.

3. EFFLUENT MONITORING

Operations of INL Site facilities have the potential to release pollutants such as radioactive and nonradioactive contaminants into the environment. These pollutants can enter the atmosphere as airborne effluents and can enter surface and groundwater as liquid effluents or storm water runoff via injection wells. The following subsections summarize the effluent monitoring currently conducted by various organizations at the INL Site.

3.1 Airborne Effluent

Regulated facilities at the INL Site are required, under Public Law 91-604 (Reference 14) and IDAPA 58.01.01 (Reference 15), to measure and estimate airborne effluents. These facilities include:

- AMWTP
- CFA
- INTEC
- CITRC
- MFC
- RWMC
- TAN
- RTC
- SMC
- IRC (INL Research Center)

Comment [ps1]: not defined before

One Tier I Operating Permit and 16 Permits to Construct air emission sources have been granted by the Idaho Department of Environmental Quality (DEQ). These permits include specific sources at the various INL Site facilities. Additionally, the IRC in Idaho Falls operates under PER-110, "Tier I Operating Permit."[17]

Numerous stack emissions are monitored for radioactive pollutants, but specific stack emission monitoring depends on the facility source term. Some monitoring is required by regulation or DOE order, and some monitoring is conducted as a best management practice or for facility information. Where monitoring is performed, emissions are normally sampled prior to abatement; otherwise, emissions are estimated on the basis of engineering calculations or process knowledge.

Continuous monitoring is required for emission points that have a potential to emit radionuclides in quantities that could result in an effective dose equivalent (EDE) to a member of the public in excess of 0.1 millirem per year, which is 1% of the of 10 millirem per year specified by 40 CFR 61, Subpart H (Reference 16).

Monitoring for compliance and screening purposes is conducted in accordance with the guidance of 40 CFR 61, Appendix B, "Method 114,"[18] ANSI N13.1, "Sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Energy Facilities,"[19] and the air monitoring recommendations of DOE/EH-0173T, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance."[20]

The contractor associated with each permitted facility at the INL Site is responsible for airborne effluent monitoring at their facility. Figure 3-1 shows the locations of those emission points (sources) that

currently require continuous monitoring by Subpart H of 40 CFR 61 (Reference 16). The following information on airborne effluent emissions and sources associated with contractor-operated facilities is summarized in DOE/ID-10890(06), "National Emission Standards for Hazardous Air Pollutants-Calendar Year 2005 INL Report for Radionuclides."[21]

Other sources with the potential to emit low quantities of radioactive emissions also exist at other contractor-operated facilities. Emissions from sources that could cause annual doses to the maximally exposed individual greater than 10^{-5} millirem are periodically monitored and included in calculating the INL Site's annual EDE to members of the public. Sources contributing less than 10^{-5} millirem to the annual dose are designated as nonsignificant contributors because the values are small enough that the emissions from these sources do not significantly affect the final dose. The sources are reevaluated every year to ensure that the emissions are below the 10^{-5} millirem threshold.

3.1.1 INL Contractor

INL contractor-operated facilities are monitored for air emissions associated with R&D and operational activities as described in the following paragraphs.

CFA. Minor releases occur from CFA facilities where work is routinely conducted with small quantities of radioactive materials. This includes operations at the RESL at CFA-690 and the Environmental Chemistry Laboratory at CFA-625. Only trace quantities of radioactive materials are used at both facilities. Additional radioactive emissions are associated with decontamination activities, sample analyses, and site remediation.

RTC. Radiological air emissions from RTC are primarily associated with operation of the Advanced Test Reactor. These emissions include noble gases, iodines, and other mixed fission and activation products. Other radiological air emissions are associated with hot cell operations, sample analysis, site remediation, and R&D activities.

REC. Radiological releases from the REC could arise from uncontrolled laboratory fume hoods within the IRC facility. Exhaust from most of the fume hoods is released directly to the outside atmosphere via the heat recovery fan system in the IRC heating, ventilating, and air conditioning system. Other potential release points include IF-603, the System Analysis Facility, and the INL Engineering Demonstration Facility.

MFC. MFC has two release points that require continuous emission monitoring as specified under 40 CFR 61, Subpart H (Reference 16): the Experimental Breeder Reactor (EBR)-II/Fuel Conditioning Facility Main Stack (MFC-764); and the Hot Fuel Examination Facility Stack (MFC-785). Additional radiological release points at MFC do not require continuous monitoring, but are sampled periodically to provide emissions data for INL reports and permit requirements as well as a best management practice.

SMC. Operations at SMC include material development, fabrication, and assembly work to produce armor packages for the U.S. Department of the Army. Other activities include developing tools and fixtures and preparing and testing metallurgical specimens. Radiological air emissions from SMC are associated with processing of depleted uranium. Potential emissions are uranium isotopes and associated radioactive progeny.

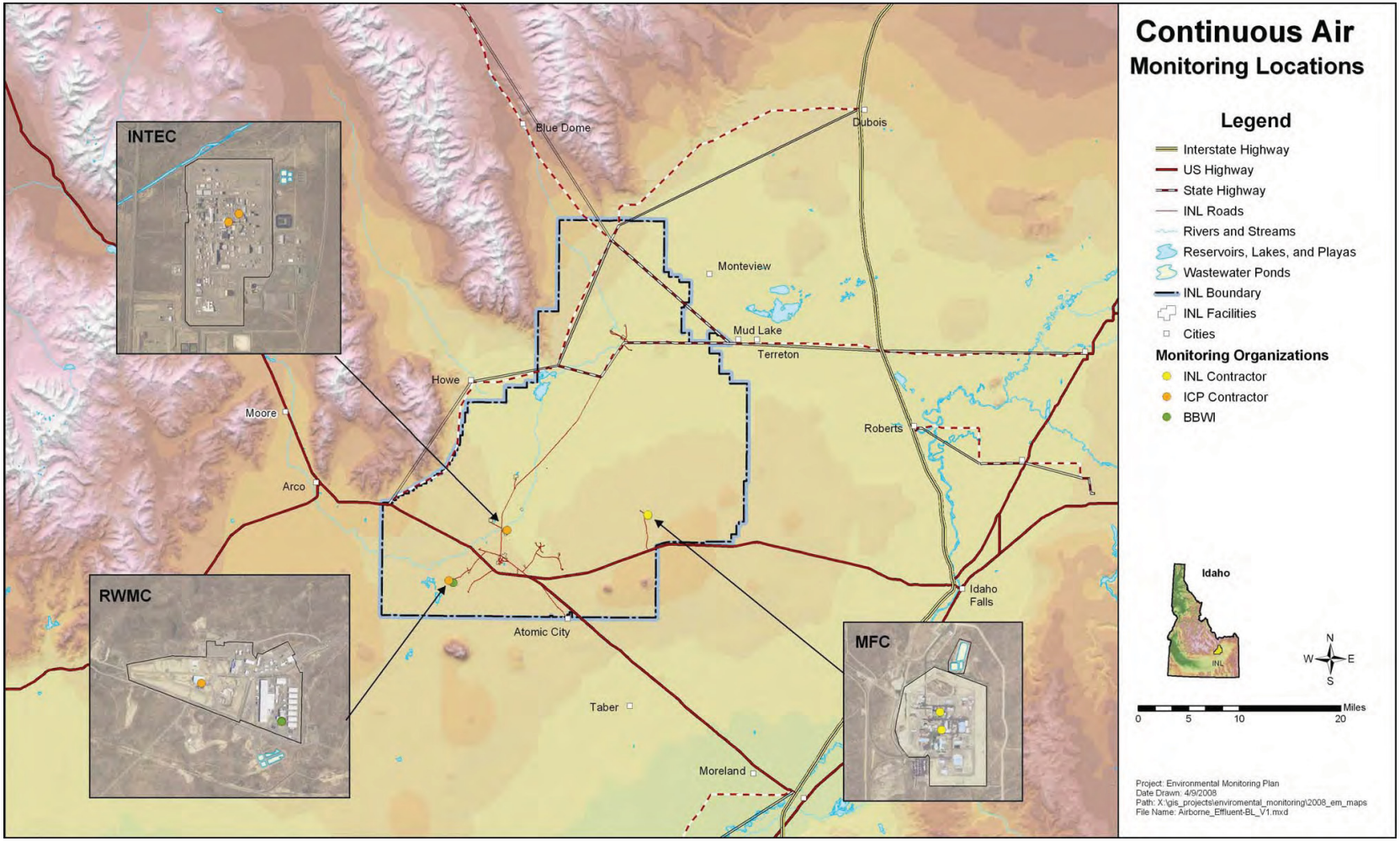

Figure 3-1. Continuous air monitoring locations.

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3.1.2 ICP Contractor

ICP remediation and waste management activities are conducted in compliance with federal and state rules and Federal Facility Agreements and Consent Orders. ICP radiological emissions originate from process equipment, deactivation/demolition activities, and waste management. ICP monitors radioactive emissions at INTEC, RWMC, and TAN as described in the following paragraphs.

INTEC. Emissions from INTEC are primarily associated with, but not limited to, spent nuclear fuel management (e.g., fuel receipt and wet and dry storage areas). Radioactive emissions include noble gases, iodines, and other mixed fission and activation products. Additional radioactive emissions are associated with decontamination and debris treatment activities, sample analysis, site remediation, R&D, radiological and hazardous waste accumulation areas, and other miscellaneous emissions from radioactively contaminated buildings and liquids in tanks. Emission monitors at the INTEC Main Exhaust Stack (CPP-708) and the New Waste Calcining Facility Stack (CPP-659-033) continuously monitor radiological emissions from these stacks.

RWMC. The SDA at RWMC provides permanent disposal of solid low-level waste generated at the INL Site. One active pit is currently used for contact-handled low-level waste disposal. Concrete-lined vaults are used for remote-handled low-level waste disposal. As disposal areas are filled, they are covered with soil. Radiological air emission point sources at the RWMC include three vapor vacuum extraction units in the SDA and the Accelerated Retrieval Projects . Gaseous forms of radionuclides (particularly, tritium and carbon-14 from activated beryllium) are released from the SDA surface soil. Tritium is released from the surface of the RWMC sewage lagoon.

TAN. Radiological air emissions from the TAN Operations area are primarily associated with the fugitive dust at CERCLA remedial action sites.

3.1.3 AMWTP

Operational features associated with the AMWTP consist of processes to vent waste containers, perform nondestructive examination of container contents, and certify, treat, store, and assemble and load waste containers for transport and disposal.

Operational activities at the AMWTP, operated by BBWI within the Transuranic Storage Area at RWMC, could potentially result in the release of radiological and other pollutants to the atmosphere. Currently, AMWTP continuously monitors for radioactive particulates at two stack locations. Periodic confirmatory stack sampling is conducted for the characterization facilities WMF-634 and WMF-636. These emissions do not require continuous monitoring for NESHAPs, but periodic confirmatory measurement is required to verify that emissions are less than 0.1 millirem per year. These emissions are monitored and calculated and are included in calculating the INL Site's annual EDE to members of the public. Monitoring requirements for emissions are specified in AMWTP-MP-EC&P-7.5, "Advanced Mixed Waste Treatment Project National Emissions Standards for Hazardous Air Pollutants Emissions of Radionuclides."[22]

3.2 Liquid Effluent

Operations at the INL Site may result in the release of liquid effluent discharges containing radioactive or nonradioactive pollutants. Effluent monitoring includes the collection and analysis of samples and other measurements to establish the type and concentrations of pollutants in liquid discharges from facilities. Monitoring also provides data to evaluate the effectiveness of liquid effluent treatment and control systems, identifies potential contaminant source areas and environmental problems, and provides a mechanism for detecting, characterizing, and reporting unplanned releases.

Direct discharge of wastewater to the land surface is regulated under IDAPA 58.01.17, "Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater,"[23] formerly the Wastewater Land Application Rules. Three facilities operated by the INL and ICP contractors have current WLAPs issued by the DEQ; all three require monitoring of liquid effluents for facility-specific parameters.

Additional liquid effluent monitoring is performed by various monitoring organizations in support of DOE environmental protection objectives. Radiological liquid effluents are monitored in accordance with DOE Order 5400.5 (Reference 4) and the recommendations of DOE/EH-0173T.[20] A risk-based approach, identified in PLN-8540, "Idaho National Laboratory Liquid Effluent Monitoring Plan,"[24] is used to determine which nonpermitted effluent streams or additional nonpermitted parameters require monitoring. The risk-based approach considers the likelihood that an effluent measurement equals or exceeds a regulatory limit or environmental release level. It will also determine the severity of the exceeded levels, were such an event to occur.

Figure 3-2 shows liquid effluent monitoring locations currently sampled across the INL Site. Some facilities have in-line alarm monitors located upstream from the routine effluent monitoring locations. These monitors are used to detect radiation or pH levels that fall outside predetermined levels.

3.2.1 INL Contractor

The INL contractor conducts sampling on the wastewater treatment systems at MFC, CFA, RTC, and REC and monitors for nonradioactive and radioactive parameters in liquid waste effluents as required by the applicable WLAP, City of Idaho Falls, and DOE environmental protection objectives. Specific liquid effluent monitoring locations, frequencies, and analytes are documented in PLN-8540[24] and associated procedures.

The wastewater reuse permit for the RTC Cold Waste Pond was issued on February 26, 2008, and expires on February 25, 2013. The WLAP for the CFA Sewage Treatment Plant (STP) was issued on January 26, 2005, and expires on January 25, 2010. A permit application has been submitted for the MFC Industrial Waste Pond. All permitted and nonpermitted facilities are monitored in accordance with State of Idaho requirements. As a best management practice and in compliance with DOE orders, the INL contractor also routinely monitors the MFC industrial waste ditch, industrial waste pond, and sanitary sewage lagoons.

The INL facilities located in Idaho Falls are required to comply with the applicable regulations in Chapter 1, Section 8 of the *Municipal Code of the City of Idaho Falls*.[25] Industrial wastewater acceptance forms are obtained for facilities that dispose liquid effluent through the City of Idaho Falls sewer system. Industrial wastewater acceptance forms include general requirements that apply to all REC facilities and specific monitoring requirements for the IRC owing to the nature of activities conducted therein.

3.2.2 ICP Contractor

The ICP contractor owns and samples the wastewater treatment systems at INTEC. Monitoring is also performed for nonradioactive and radioactive parameters in liquid waste effluents generated at INTEC as required by the applicable WLAP and DOE environmental protection objectives. Specific liquid effluent monitoring performed is documented in PLN-729, "Liquid Effluent Monitoring Program Plan."[26]

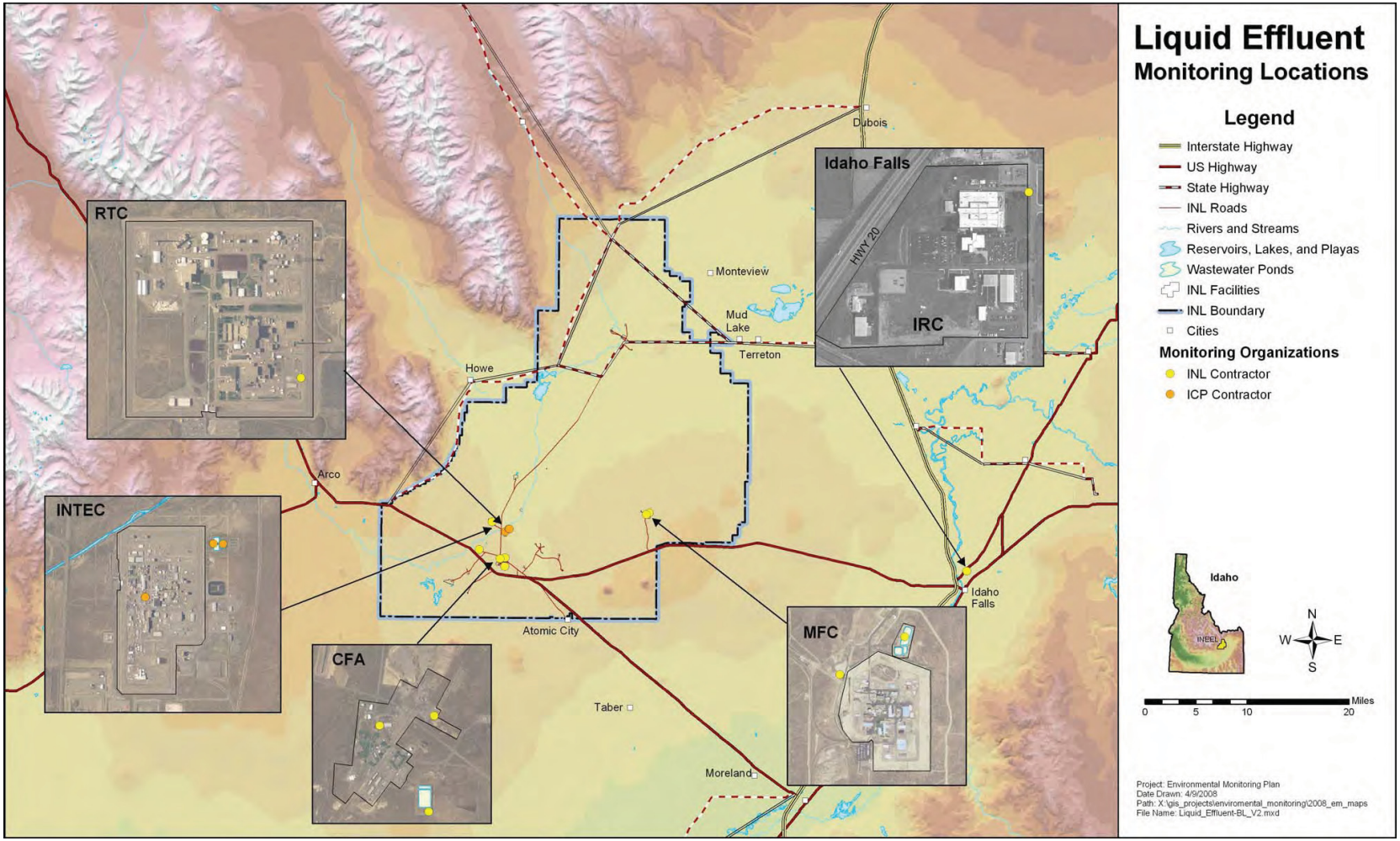

Figure 3-2. Liquid effluent monitoring locations.

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3.3 Injection Wells

Storm water discharges to injection wells are monitored to ensure compliance with State of Idaho permits (see Figure 3-3). Injection wells have been constructed to control flooding resulting from storm water or snowmelt runoff. Monitoring the runoff to these wells is required under State of Idaho injection well regulations and permits to protect underground sources of drinking water. The INL contractor monitors discharges of storm water at injection well locations during large precipitation events or snowmelt conditions to evaluate potential pollutants in the storm water.

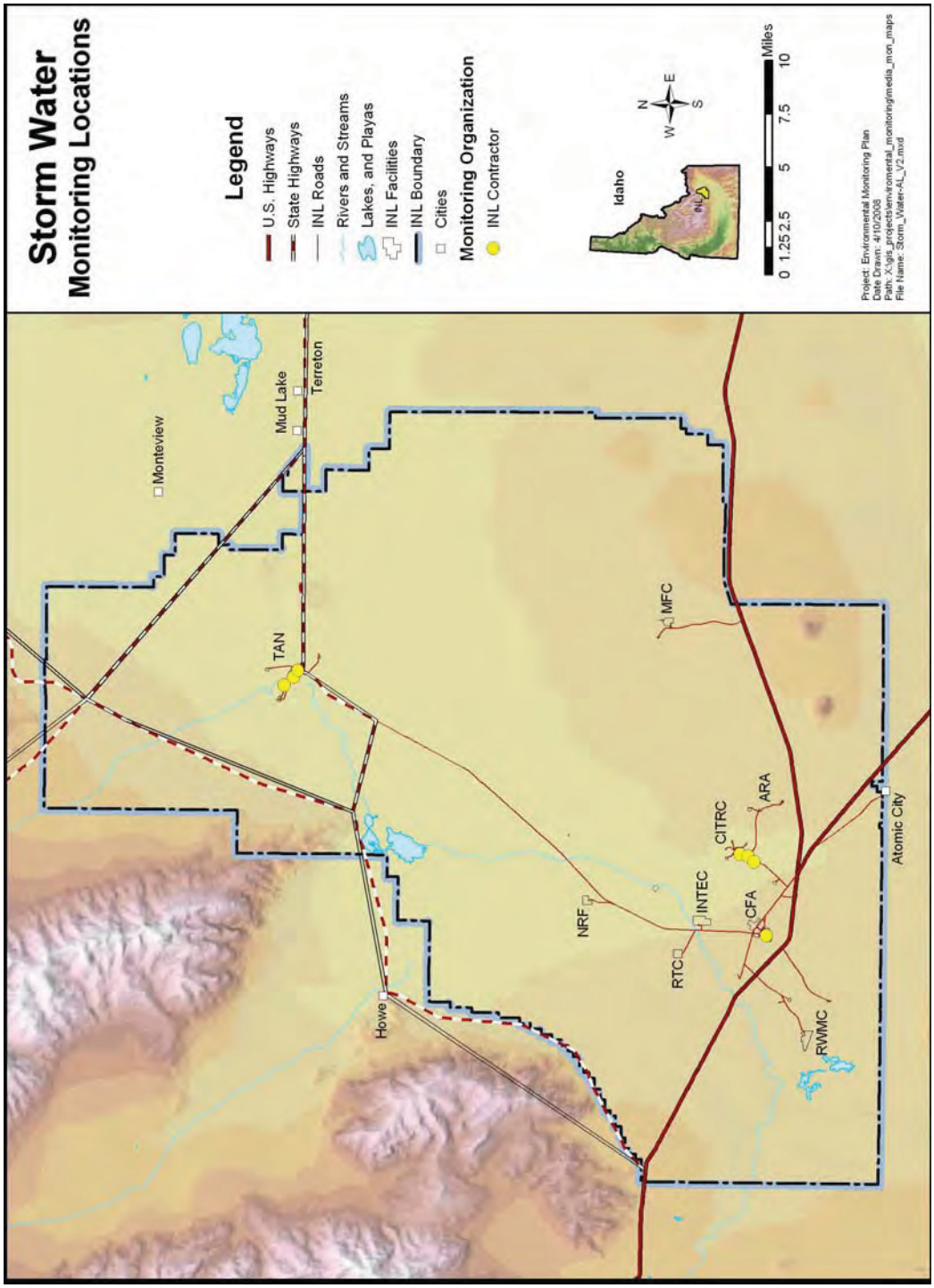

Figure 3-3. Storm water injection well basin monitoring locations.

4. ENVIRONMENTAL SURVEILLANCE

INL environmental surveillance includes the collection and analysis of samples or direct measurements of air, water, soil, biota, and agricultural products. Environmental surveillance is conducted by several organizations to support laboratory-wide compliance with DOE Order 450.1 (Reference 1), DOE Order 5400.5 (Reference 4), environmental laws and regulations and DOE agreements, and follows the criteria in DOE/EH-0173T (Reference 20) for establishing environmental surveillance programs.

Separate onsite environmental surveillance is required for waste management facility operations to meet DOE Order 435.1, "Radioactive Waste Management."[27] The SDA at RWMC is the only low-level waste disposal facility at the INL Site and is required to be monitored for DOE Order 435.1 compliance. Waste management surveillance monitoring is designed to be more facility- or source-specific than other Sitewide surveillance. Waste management surveillance monitoring is performed by the ICP contractor at the SDA for ambient air, surface water, soils, vegetation, and external radiation.

4.1 Ambient Air

The air pathway is the most likely transport pathway for which the INL contaminants could reach offsite populations according to DOE/ID-12119, "Idaho National Engineering Laboratory Historical Dose Evaluation."[28] Using a network of low-volume air monitors, several organizations monitor ambient (outdoor) air to compare onsite release location concentrations with offsite control location concentrations. The network of regional ambient air monitoring locations is shown in Figure 4-1 and a more detailed look at the onsite ambient air monitoring locations is shown in Figure 4-2. Ambient air particulate matter and airborne radionuclides are also sampled during wildfires or other emergency events. (Refer to Section 6.1 for a discussion of air monitoring performed for operational emergencies.)

The various organizations conducting air monitoring are discussed below.

4.1.1 INL Contractor

The INL contactor measures airborne radionuclides and monitors for potential trends in radioactivity in the environment per PLN-8510, "Planning and Management of Environmental Monitoring Activities."[29] The ambient air monitoring activities support INL compliance with DOE Order 450.1 (Reference 1) and the Idaho Air Quality Operating Permit. Atmospheric particulates released from INL Site facilities, natural radioactivity, and global fallout from historical nuclear detonations or nuclear accidents are collected on- and offsite using low-volume samplers and 4-in. filters. Potential gaseous iodine releases are monitored using activated charcoal cartridges. Suspended particulate matter (dust burden) is monitored using the same filters used to collect the radioactive particulate samples (to provide comparison information to other monitoring programs and to DOE-ID). Tritiated water vapor (hydrogen, tritium, oxygen) is collected using digital flow meters and molecular sieves.

4.1.2 ICP Contractor

The ICP contractor measures airborne radionuclides and monitors for potential trends in radioactivity in the environment per ICP PLN-720, "Environmental Surveillance Program Plan."[30] ICP ambient air monitoring activities support the waste management facility requirements of DOE Order 435.1 (Reference 27). A series of samplers that monitor for particulates are used around the RWMC SDA and at the Idaho CERCLA Disposal Facility (ICDF). Airborne materials from the SDA and ICDF are predominantly fugitive dusts with small amounts of sorbed radionuclides. The samplers are located along

the periphery of the SDA in predominant wind paths from disposal activities and at a control location north of Howe, Idaho.

4.1.3 ESER Program

The ESER Program conducts ambient air monitoring both onsite and offsite using a variety of monitors to determine if there is a gradient in radionuclide concentrations between the offsite locations and the INL Site. These monitors include:

- A network of low-volume air samplers on and around the INL Site to collect particulate matter on filters, gaseous radioiodine on cartridges, and suspended particulates on filters. Placement of these samplers is based on wind dispersal patterns and DOE regulatory guidance to monitor population centers.
- A high-volume air sampler in Idaho Falls that is operated as part of the EPA's RadNet Program, which monitors environmental radioactivity in the U.S. to provide high-quality data for assessing public exposure and environmental impacts resulting from nuclear emergencies and baseline data during routine operations. Filters collected from the Idaho Falls sampler by the ESER Program are shipped to an independent laboratory where they are analyzed for gross radioactive concentrations and the presence of specific radionuclides.
- Four atmospheric moisture monitors located in Idaho Falls, Atomic City, and at community monitoring stations in Blackfoot and Rexburg, which monitor for tritium in water vapor.

The ESER Program also collects precipitation samples to measure tritium in air. One sampler is located in Idaho Falls as a control or background sampler, and two others are located at the INL Site, one at CFA and the other at the Experimental Field Station near INTEC. The Idaho Falls station is operated as part of the EPA's RadNet Program. Ambient air monitoring locations, frequencies, methodologies, and analytes are specified in the ESER Program Procedures Manual.[31]

4.2 Drinking Water

Historic waste disposal practices have produced localized areas of contamination at the INL Site in the SRPA, which is the primary regional groundwater source. Because groundwater supplies the drinking water systems at the INL Site, drinking water is monitored according to regulations to ensure that the drinking water at the facilities is safe for consumption. The INL Drinking Water Program meets Idaho drinking water regulations and DOE environmental protection objectives. All onsite contractors participate in the INL Drinking Water Program and the INL Drinking Water Committee as a means of sharing information, but each contractor administers its own drinking water monitoring program.

INL Site drinking water systems are classified as either transient or nontransient, noncommunity water systems. Nontransient, noncommunity water systems have more stringent compliance requirements. Transient, noncommunity water systems on the INL Site are the EBR-I, the Gun Range, and the Main Gate. Nontransient water systems at the INL Site are INTEC, RWMC, CFA, RTC, Test Area North/Contained Test Facility, CITRC, and MFC. The INL contractor is responsible for all of them except for INTEC and RWMC, which fall under the responsibility of the ICP contractor.

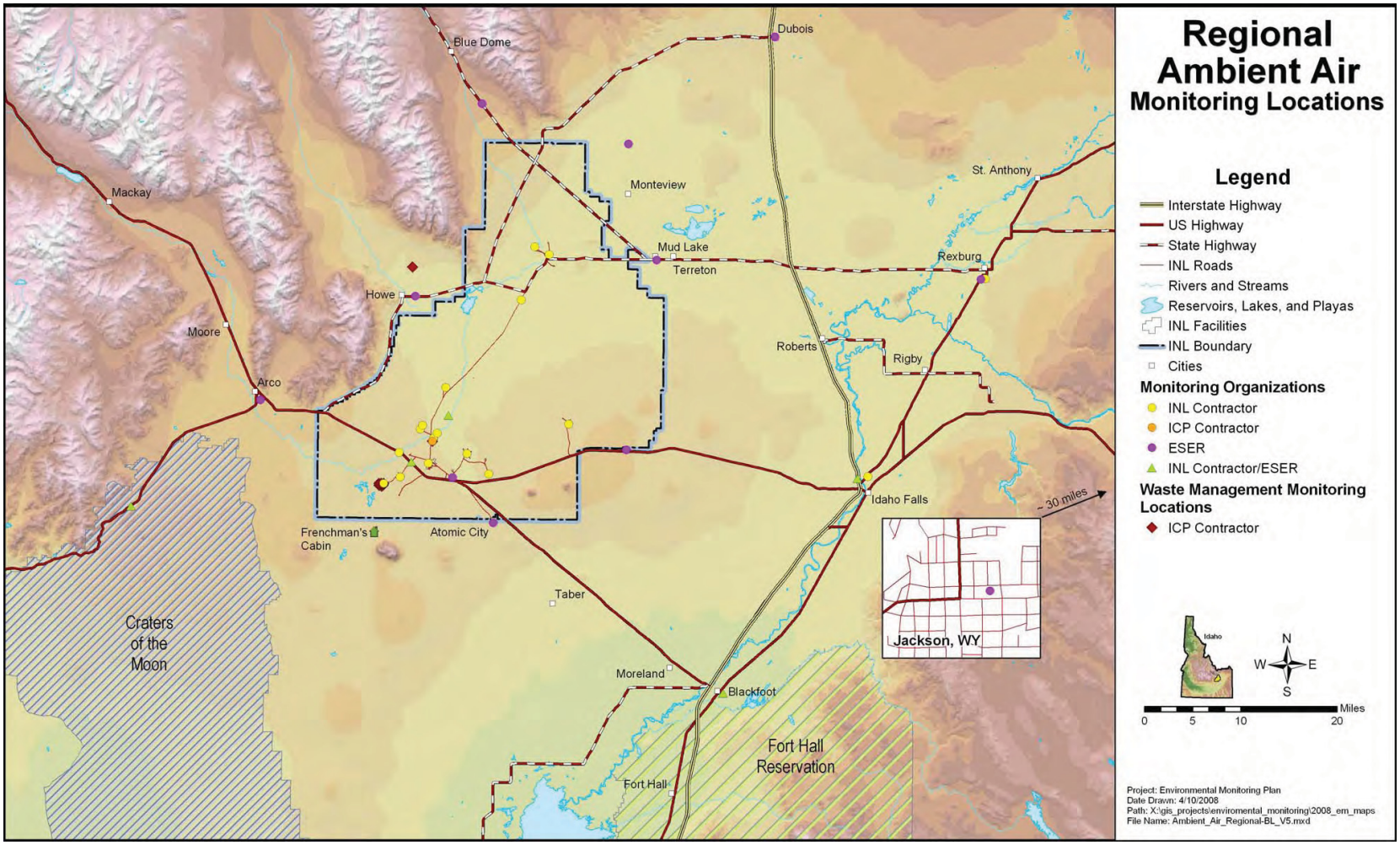

Figure 4-1. Regional ambient air monitoring locations.

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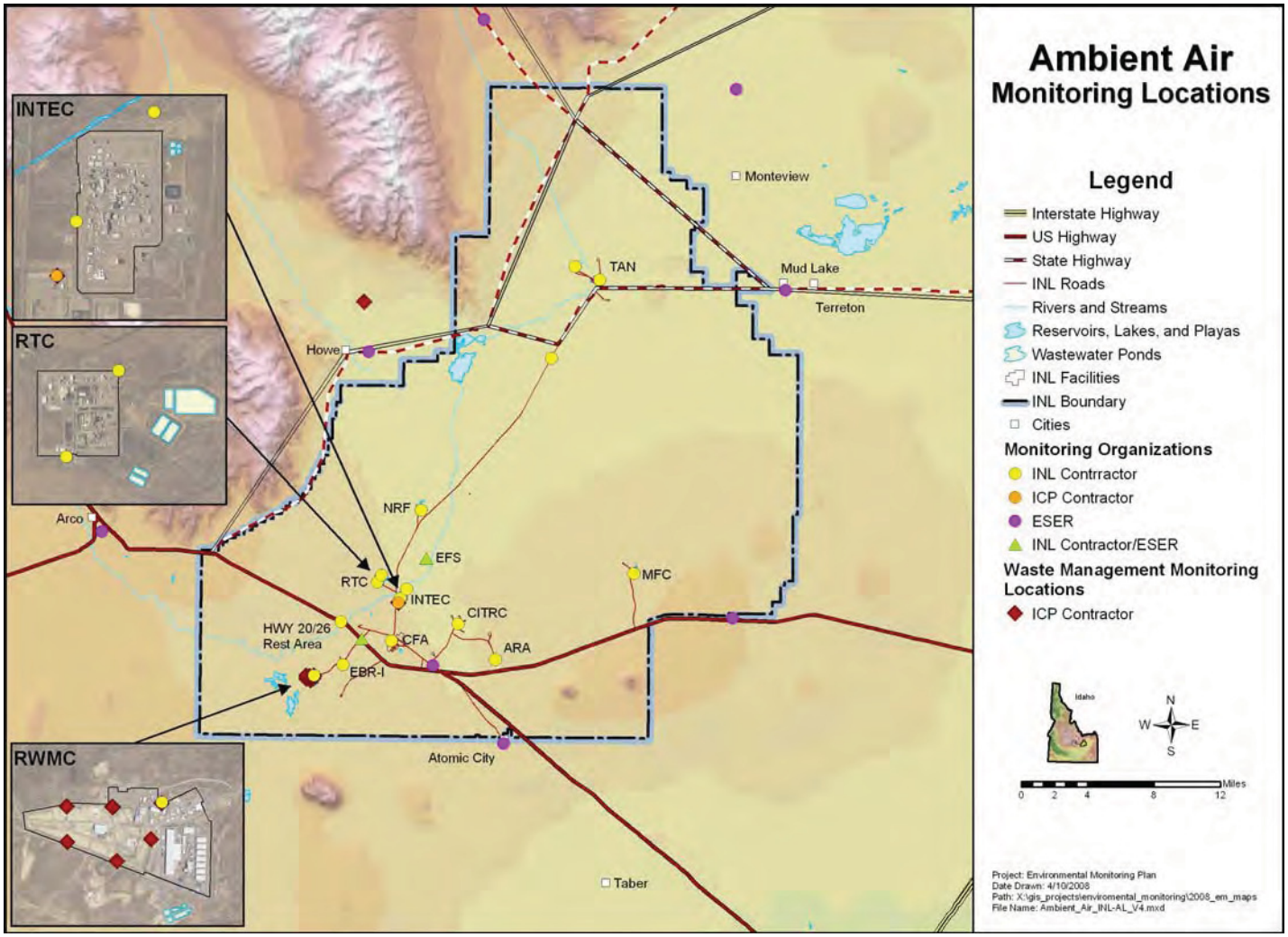

Figure 4-2. Detailed onsite ambient air monitoring locations.

INL Site drinking water systems are monitored to ensure that contaminant concentrations meet limits established by IDAPA 58.01.08, "Idaho Rules for Public Drinking Water Systems,[32] and Public Law 104-182, "Safe Drinking Water Act."[33] Monitoring is based on the classification and size of the water systems (e.g., nontransient, noncommunity or transient, noncommunity). Because of known contaminants, certain parameters are monitored more frequently than required.

Offsite drinking water systems are also monitored because of the potential for contaminants related to INL Site operations to migrate beyond the INL Site boundary. Because these samples are collected from offsite drinking water systems, they are included as drinking water samples. However, results from samples collected from these offsite drinking water systems are not used for compliance with drinking water regulations; instead, they are used to assess groundwater quality. Section 4.3 discusses the groundwater monitoring samples taken directly from wellheads.

Figure 4-3 shows regional drinking water monitoring locations. Regional drinking water samples are collected from taps. Onsite drinking water samples are collected from the point of entry to each distribution system or manifold, directly from the wellheads, and from buildings associated with each drinking water distribution system. Figure 4-4 shows the detailed locations of those manifolds and wellheads that are currently monitored across the INL Site. Individual sampling points from each drinking water distribution system are not shown on Figure 4-4 because these sample points include most buildings connected to the distribution system.

4.2.1 INL Contractor

The INL contractor performs all drinking water monitoring and is responsible for all site drinking water systems with the exception of INTEC and RWMC, which are ICP contractor facilities. Currently, the INL contractor monitors 19 wells and nine distribution systems across the INL Site for both radiological and nonradiological parameters. Sampling locations, parameters, and frequencies are documented in the PLN 8530, "Idaho National Laboratory Drinking Water Program Plan,"[34] and associated procedures.

4.2.2 ICP Contractor

The ICP contractor monitors drinking water systems at INTEC and RWMC. The ICP contractor is responsible for regulatory compliance at these facilities. Sampling locations, parameters, and frequencies are documented in PLN-730, "Idaho Cleanup Project Drinking Water Program Plan,"[35] and associated procedures.

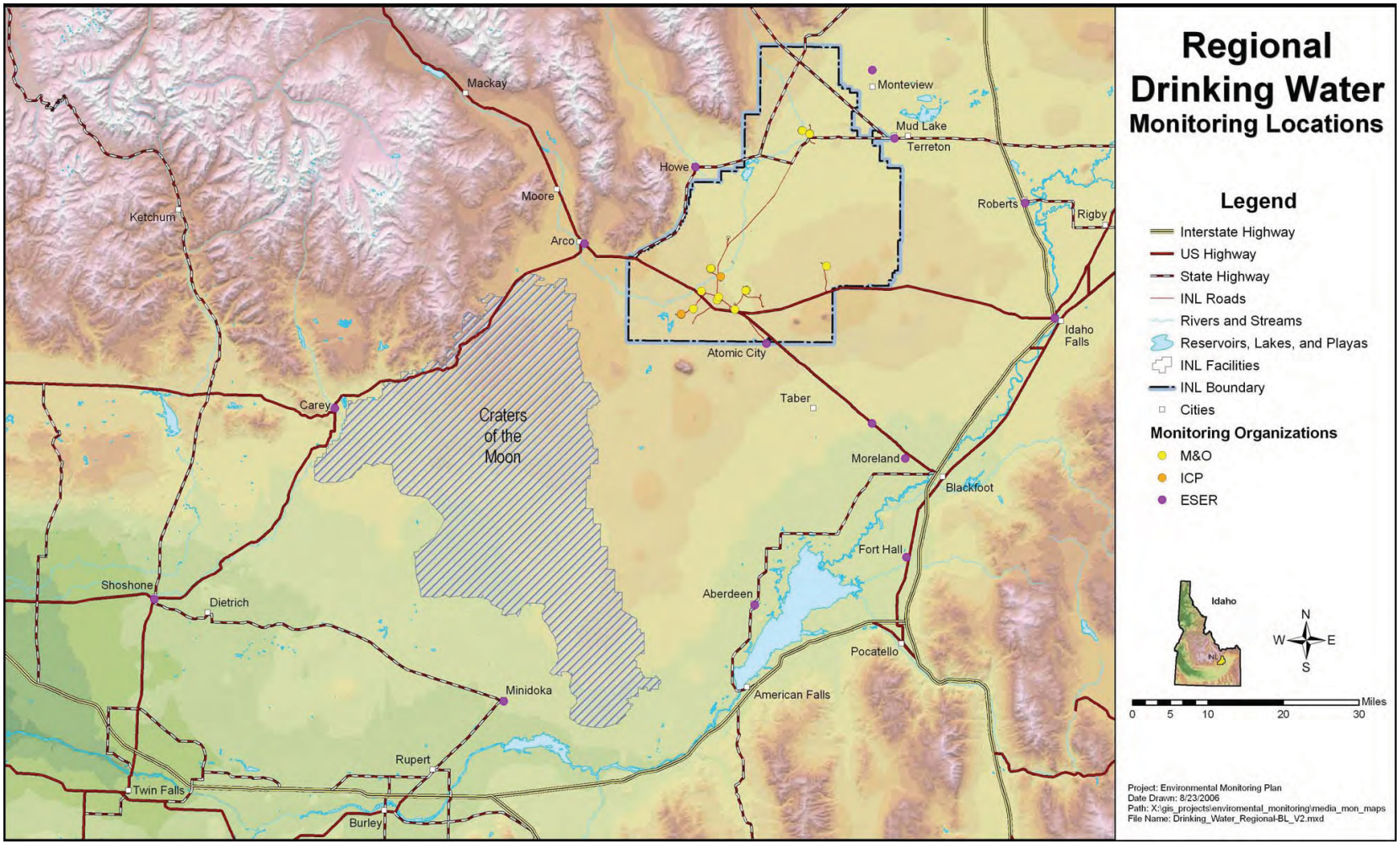

Figure 4-3. Regional drinking water monitoring locations.

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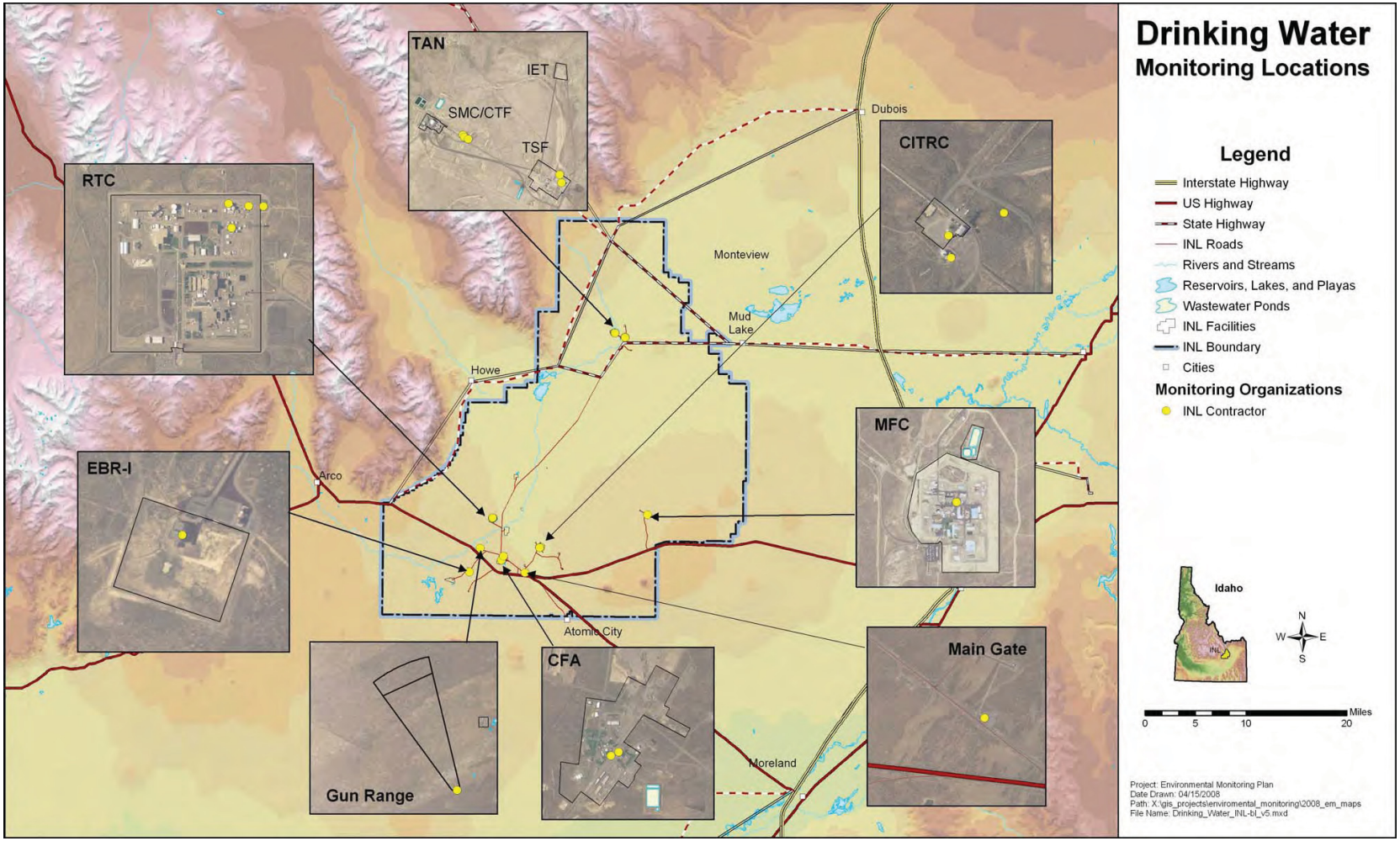

Figure 4-4. Detailed onsite drinking water monitoring locations.

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4.3 Groundwater

Historic waste disposal practices have produced localized areas of contamination in the SRPA beneath the INL Site. The SRPA is the source of regional drinking water and supplies irrigation water to a large, regional agricultural and aquaculture economy. Onsite groundwater samples are taken from wells near each facility, in areas of known contamination, and regionally across the INL Site (including upgradient of INL Site operations). Contaminants resulting from past INL Site operations have been detected in the SRPA beyond the INL Site southern boundary at concentrations far below regulatory limits. Offsite groundwater samples are taken downgradient of the INL Site near the INL Site boundary and near the terminus of the SRPA.

Onsite groundwater is currently monitored at the INL Site by multiple organizations to:

- Satisfy specific CERCLA-related remedial action objectives and/or regulatory requirements contained in RODs, RCRA regulations, WLAPs, and DOE orders
- Determine the nature and extent of groundwater contamination during CERCLA remedial investigation/feasibility study activities
- Evaluate general groundwater conditions, and contaminant fate and transport on a regional and subregional scale (as performed by the USGS and WAG 10).

The groundwater monitoring programs established by the contractors responsible for managing and operating INL Site facilities, at a minimum, address regulatory compliance and remediation goals at each of the facilities for which they have management responsibility. DOE/ID-11034, "Idaho National Engineering and Environmental Laboratory Groundwater Monitoring Plan Update,"[36] provides an overview of the routine groundwater monitoring conducted onsite and specifies how the recommended elements of a groundwater monitoring program under DOE Order 450.1 (Reference 1) are met. Figure 4-5 shows regional groundwater monitoring locations, and Figure 4-6 shows detailed onsite groundwater monitoring locations.

4.3.1 INL Contractor

The INL contractor is responsible for groundwater monitoring at the MFC facility per the CERCLA ROD, and at the RTC facility in compliance with the RTC WLAP permit. Proposed monitoring associated with the MFC WLAP application is expected to commence in 2009.

4.3.2 ICP Contractor

The ICP contractor is responsible for groundwater monitoring conducted at all other CERCLA site monitoring locations, WLAP compliance at INTEC, and RCRA closure monitoring at INTEC's Waste Calcine Facility. The ICP contractor currently performs all data interpretations to determine the cumulative impact of all CERCLA sites at the INL Site.

4.3.3 USGS

USGS monitors SRPA wells within its defined regional network (both onsite and at boundary locations) to study contaminant migration and determine groundwater quality and quantity as they relate to INL Site operations. INL Site boundaries are monitored to detect groundwater contaminants entering and leaving the INL Site. Wells within the INL Site boundary are monitored to evaluate contaminant movement in the SRPA between facilities.

Each monitoring well in the USGS regional network is monitored for the contaminants of concern specific to its locale and known or suspected contaminant sources. In general, onsite SRPA wells outside of facility fences are sampled by the USGS annually, depending on location. Samples are routinely collected and analyzed for radionuclides, volatile organic compounds, trace elements, and anions. Sampling locations, methodologies, and parameters are specified in DOE/ID-22182, "Field Methods and Quality Assurance Plan for Quality-of-Water Activities, US Geological Survey, Idaho National Engineering and Environmental Laboratory, Idaho."[37]

4.4 Surface Water

The Big Lost River system includes the Little Lost River, Big Lost River, Birch Creek, and associated tributary channels, playas, and sinks. No streams or rivers flow from within the INL Site to locations outside the boundaries, and most years, the channels of the Big Lost River system on the INL Site are dry. However, surface water samples are taken when water is present both on and around the INL Site to monitor the surface water pathway. Currently, there are no discharges of storm water or liquid effluent from INL Site facilities that require monitoring under 33 USC § 1251, "Federal Clean Water Act."[38] Figure 4-7 shows all of the surface water monitoring locations, both onsite and offsite, that are currently monitored.

4.4.1 INL Contractor

The INL contractor does not currently perform any surface water sampling at the INL Site.

4.4.2 ICP Contractor

Surface and near-surface soils at RWMC have become contaminated from waste handling and biotic intrusion during past flooding of open pits. Surface water runoff is sampled at the SDA because of the potential for surface water runoff to become contaminated. Sampling locations, parameters, and frequencies are documented in the ICP PLN-720 (Reference 30) and associated procedures. These samples are collected to comply with the following objectives:

- Meet the requirements for waste management facility monitoring per DOE Order 435.1 (Reference 27).
- Determine concentrations of radionuclides in surface water leaving the facility.
- Report comparisons of measured concentrations against derived concentration guides for the public. Derived concentration guides are calculated from DOE dose equivalent tables and based on DOE radiation protection standards given in DOE Order 5400.5 (Reference 4).
- Detect and report significant trends in measured concentrations of radionuclides in surface waters leaving the facility.

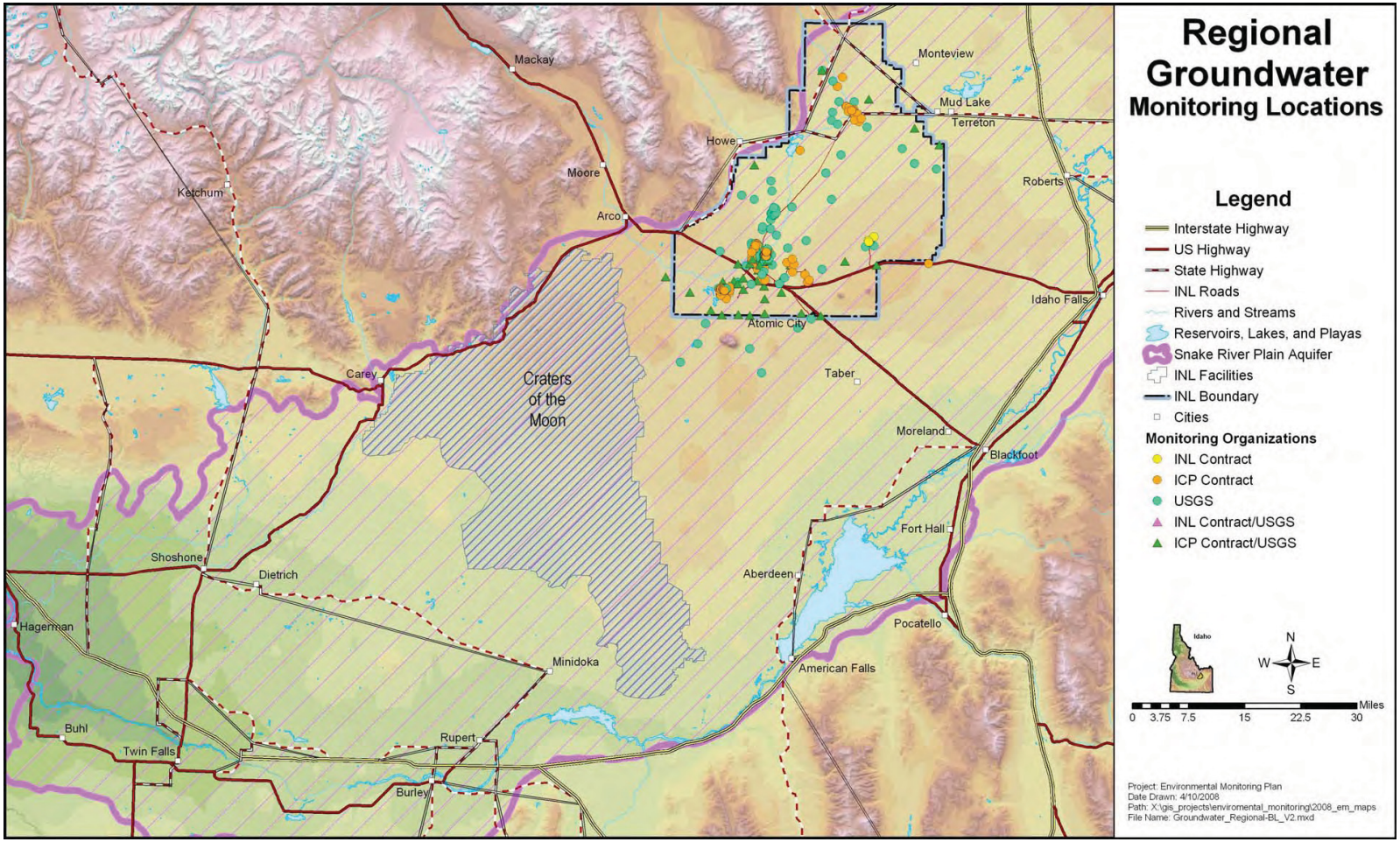

Figure 4-5. Regional groundwater monitoring locations.

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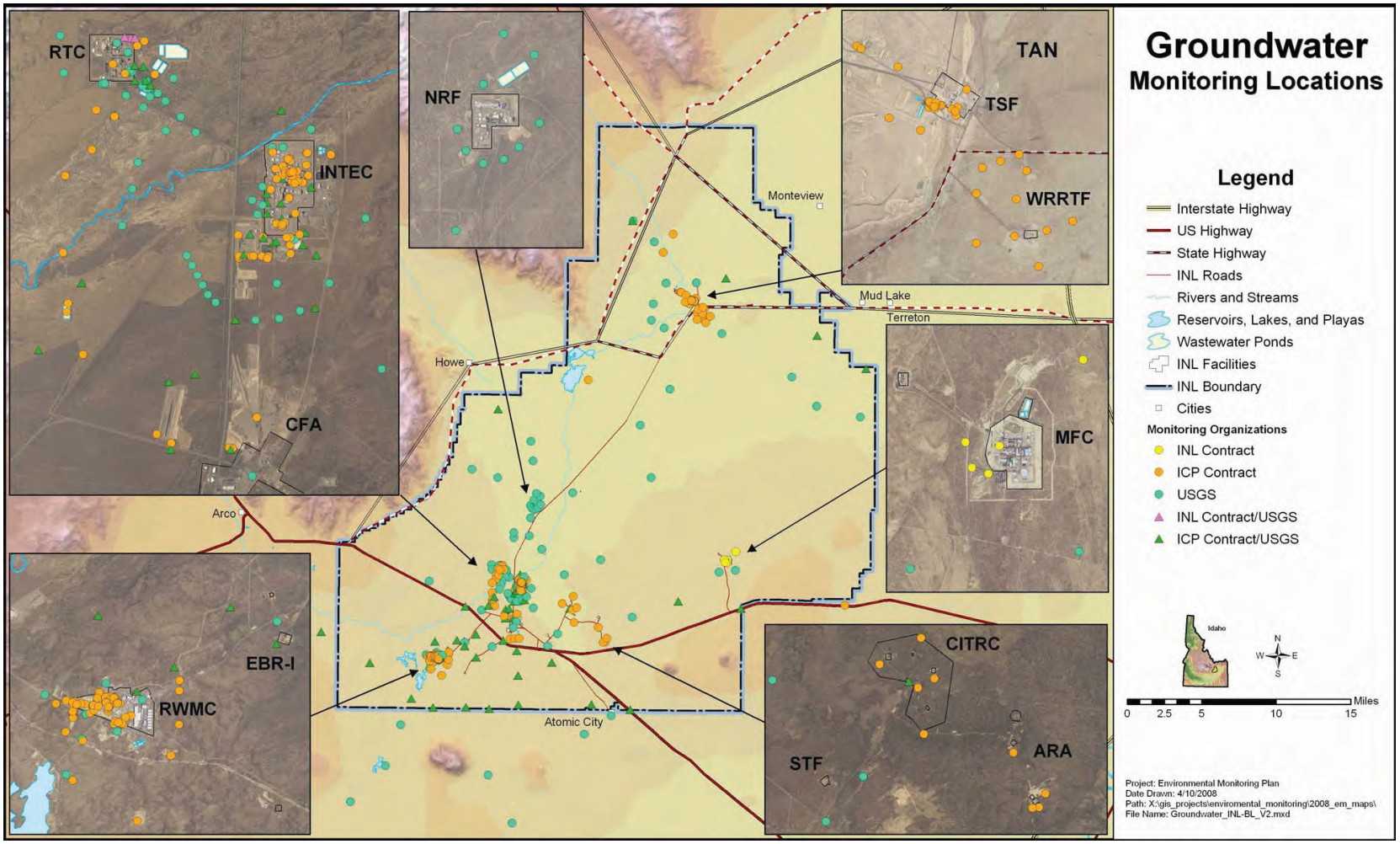

Figure 4-6. Detailed onsite groundwater monitoring locations.

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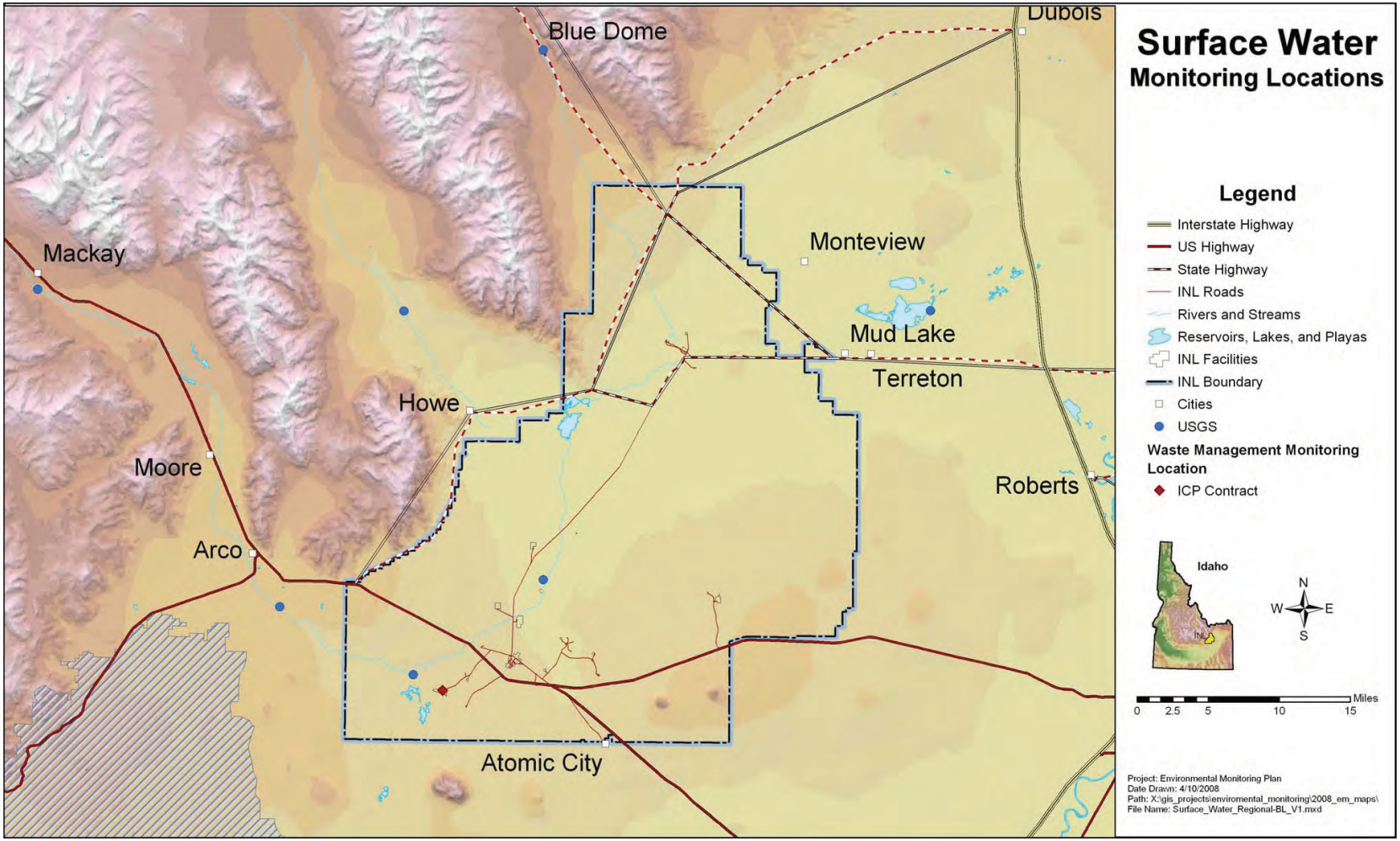

Figure 4-7. Surface water monitoring locations.

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4.4.3 USGS

When flow occurs in the Big Lost River or other selected streams, surface water samples are collected annually and submitted for radionuclide and chemical analyses to determine the effect that surface water flow has on the chemistry of groundwater beneath the INL Site.

The USGS takes surface water samples from Birch Creek, the Little Lost River, and Mud Lake, and from four locations on the Big Lost River. The Big Lost River onsite sampling locations include the INL Site Diversion Dam near RWMC and the Experimental Field Station near INTEC. The offsite sampling locations are located near Mackay and Arco. Details on the surface water sampling performed by the USGS are specified in INEEL/MIS-03-00519: DOE-ID-22182 (Reference 37).

4.5 Soil

Some INL Site soils have been contaminated by radioactive and nonradioactive effluents from INL Site operations and from nuclear weapons testing fallout. Soil sampling is conducted at the INL Site to:

- Determine present concentrations of nonradioactive contaminants and radioactivity (natural and anthropogenic) in soil
- Identify and quantify changes in contaminant concentrations in the soil caused by INL Site operations
- Comply with regulatory requirements
- Provide data used to calculate fugitive air emissions.

Figure 4-8 shows regional soil monitoring locations, and Figure 4-9 shows detailed onsite soil monitoring locations.

4.5.1 INL Contractor

The INL contractor conducts soil sampling in compliance with DOE Order 450.1 (Reference 1) requirements for monitoring to determine the impacts of operations on the environment and public health, and for compliance with WLAP requirements for the CFA STP irrigation area.

Soil monitoring activities are conducted primarily to determine if long-term deposition of airborne materials released from INL facilities have resulted in a build-up of radionuclides in the environment. Soils are analyzed on a yearly rotation schedule around all INL facilities and regionally using portable in situ gamma spectrometers capable of detecting gamma-emitting radionuclides. Soil samples are collected from 0-to 12-in. depths at select locations around facilities to determine the vertical concentration profile of Cs-137 in the soils at the INL Site. Roadways and INL Site perimeters are monitored on an annual basis using vehicle-mounted radiation detectors. These systems provide background-corrected count rate and isotopic concentration data, which is mapped for each measured roadway or INL Site perimeter. Geostatistical and trend analyses are performed on the radiological data to evaluate the soil radionuclide concentrations over time at the INL Site.

Soil samples taken in support of the CFA STP WLAP are analyzed for nonradiological contaminants to determine the effect of wastewater irrigation on soil chemistry. These soil samples are collected in accordance with the permit and company-controlled procedures.

4.5.2 ICP Contractor

The ICP contractor conducts soil sampling in compliance with DOE Order 435.1 (Reference 27). Locations of soil samples taken at the RWMC are selected from specific areas at the SDA. Surface and

near-surface soils at RWMC have become contaminated from past flooding of open pits, waste handling, and biotic intrusion. Soil sampling is performed because wind, water, and biota can transport contaminated soil particulates onsite and offsite. The areas at the SDA delineated for sampling include active areas, Pad A, inactive areas, and previously flooded areas. Soil samples are collected at the SDA every three years. Details of this sampling can be found in ICP PLN-720 (Reference 30).

Soil sampling is performed as required by the remedial investigation/feasibility study (RI/FS) activities, RODs, and as part of the CERCLA Long-Term Ecological Monitoring Program to verify that the remedial objectives of each CERCLA ROD are maintained and that the long-term INL-wide ecological impact of the contamination left in place remains within acceptable limits.

Under the CERCLA Long-Term Ecological Monitoring Program, soil samples will be taken at locations identified as sites of concern and will be monitored for both radiological and nonradiological contaminants. Soil samples will be collected from the surface to no more than 0.61 m (2 ft) below ground surface and will consist of composites from locations within the sampling plots that correspond to plants from which vegetation samples are collected. This depth is anticipated to concentrate sampling and analytical efforts on the depth most likely to pose a source of contamination to plant roots and ingestion/physical exposures to surface dwellings and burrowing animals. These soil samples are collected in accordance with INEEL/EXT-02-01191, Long-term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory."[39] Because the locations of this monitoring can be extensive and vary within each site of concern, the actual sampling locations are not depicted on the soil figures.

The ICP contractor performs additional monitoring to comply with EXT-95-00496, Record of Decision Declaration for Central Facilities Area Landfills I, II, and III (Operable Unit 4-12), and No Action Site, (Operable Unit 4-03),40 the WAG 4 ROD signed for the CFA landfills and to support ongoing work for a WAG 7 RI/FS of RWMC areas. At CFA, moisture content in the soil is monitored by neutron access tubes adjacent to the landfills; moisture infiltration through the soil cover of the landfills is monitored using time-domain reflectometry arrays; and soil gas is monitored through a series of soil-gas sampling ports at varying depths adjacent to the landfills in accordance with Idaho National Engineering Laboratory (INEL)-95/0585, Field Sampling Plan (FSP) for Post-Record of Decision (ROD) Monitoring for the Central Facilities Area (CFA) Landfills I, II, and III Under Operable Unit (OU) 4-12.41.

At RWMC, soil moisture and soil gas are monitored to support the WAG 7 CERCLA activities. The data collected for WAG 7 are also used to satisfy the requirements of DOE Order 435.1 (Reference 27). Soil moisture monitoring in the vadose zone using lysimeters at RWMC is addressed in Section 4.3.2. Soil gas is sampled in the waste zone using vapor probes placed directly in the waste at selected locations. Soil gas is sampled in the vadose zone using an extensive system of soil gas sampling ports inside and outside the SDA boundary. Figure 4-10 shows the soil gas and soil moisture monitoring locations.

4.5.3 ESER Program

Soil samples are used to establish background levels of radionuclides (both natural and those resulting from fallout from nuclear weapons testing) and to detect any long-term buildup of radionuclides from the INL Site in offsite soils. Soil is taken from 12 offsite locations during even-numbered years for transuranic and gamma-emitting radionuclide analyses. Details on the soil sampling performed by the ESER Program are specified in Reference 31.

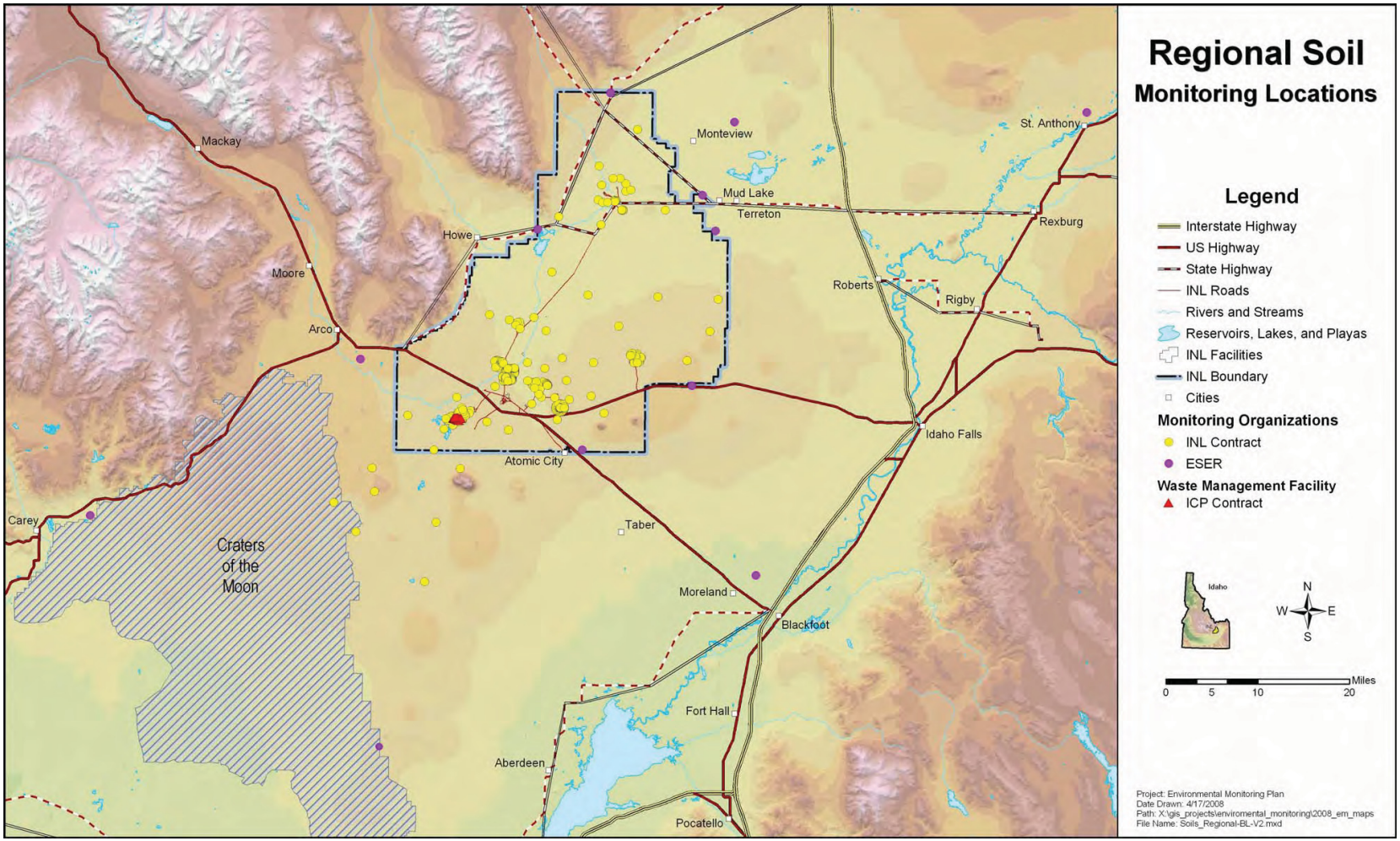

Figure 4-8. Regional soil monitoring locations.

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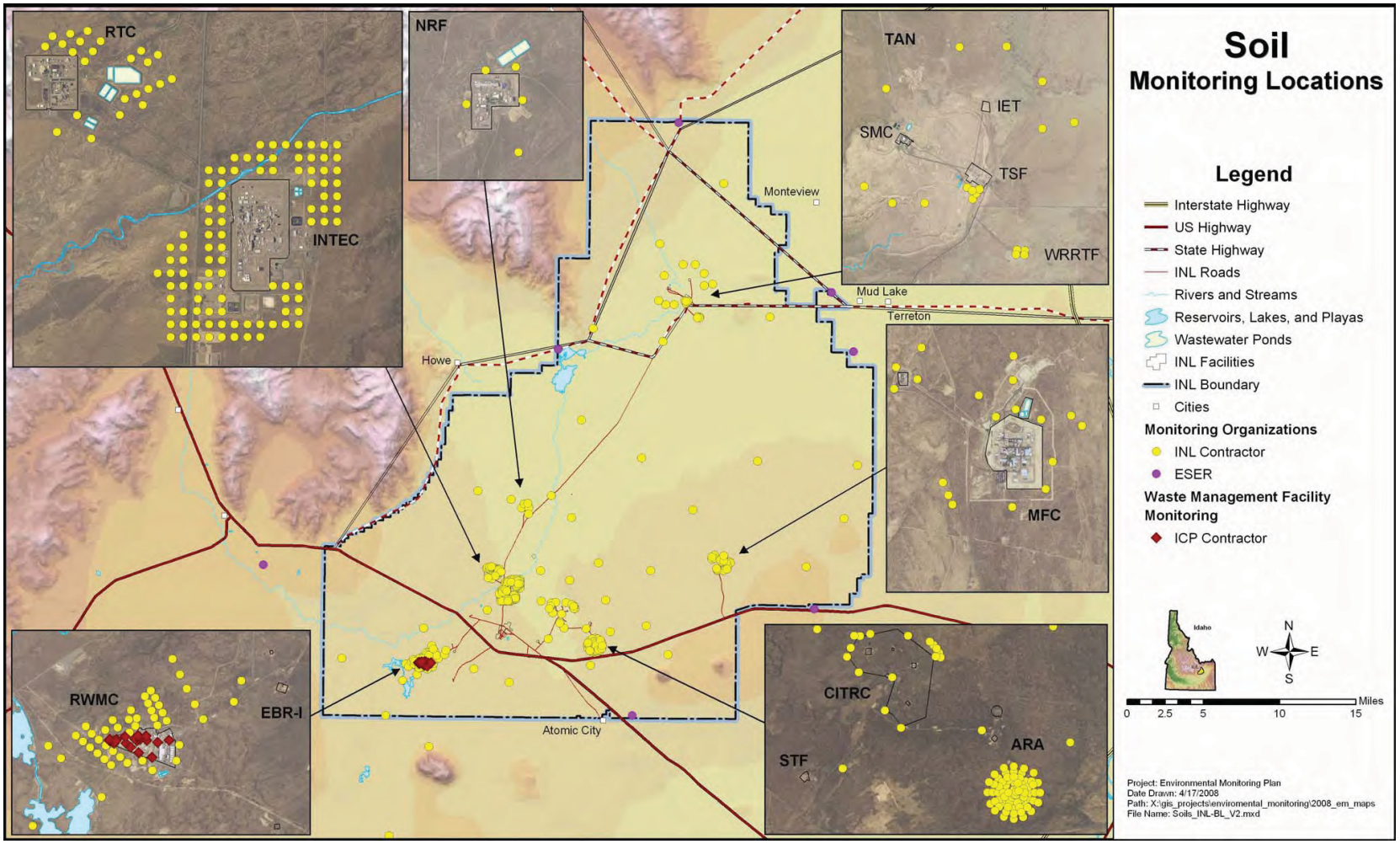

Figure 4-9. Detailed onsite soil monitoring locations.

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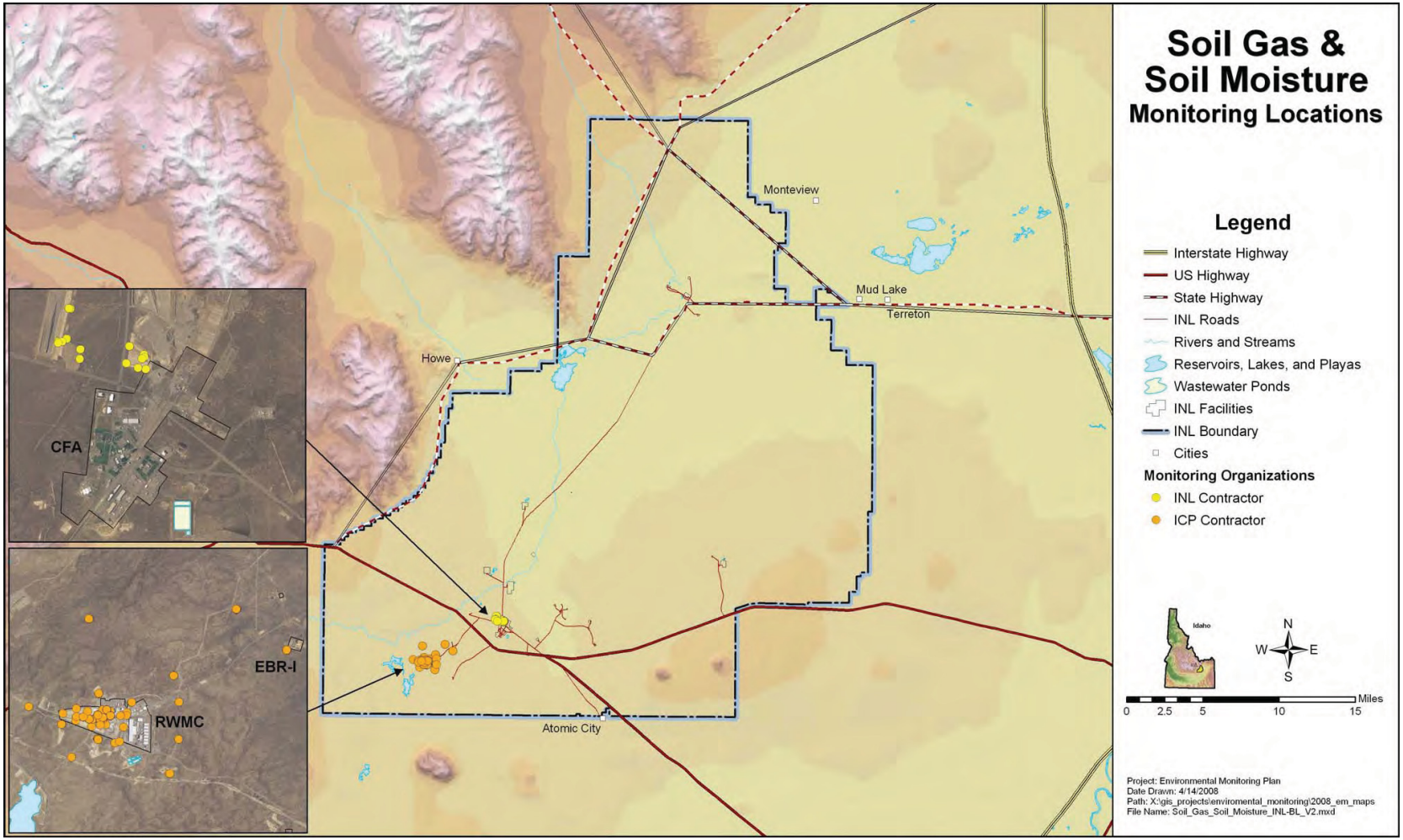

Figure 4-10. Soil gas and soil moisture monitoring locations.

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4.6 Biota

Plants represent the major linkage in transfer of soil-borne contaminants to primary consumers and higher trophic levels. The leaves, florets, and shoots of plants can accumulate constituent concentrations caused by wind-blown contamination and uptake from the soil. Belowground plant components can also accumulate certain contaminants, although most birds and mammals are expected to consume primarily aboveground components. Plants are sampled to determine potential migration of facility contaminants and to ensure waste confinement integrity.

Wildlife has access to some areas on the INL Site containing radioactive contamination. Because wildlife has the potential to move offsite and be harvested by the public for consumption, wildlife is sampled to document levels of radioactivity in the edible tissues. Small mammal species are sampled to determine long-term ecological impacts of contamination and assess waste confinement integrity. Figure 4-11 shows the biota monitoring locations.

4.6.1 INL Contractor

The INL contractor currently performs no biota sampling at the INL Site.

4.6.2 ICP Contractor

The ICP contractor performs both CERCLA and non-CERCLA biota sampling activities. Routine non-CERCLA monitoring is performed to:

- Determine if biota are transporting radionuclides from buried waste or contaminated soil
- Identify biotic conditions that may compromise waste confinement at waste storage and disposal facilities
- Detect and report significant trends in the radionuclides and concentrations in biotic samples.

Plants at the RWMC SDA are sampled to comply with DOE Order 435.1 (Reference 27) and to monitor waste confinement integrity because radionuclides may migrate away from the facility. Vegetation is collected from a control location approximately 11 km (7 mi) south of RWMC and from four representative areas at the RWMC SDA. These include active areas, Pad A, inactive areas, and previously flooded areas. Non-CERCLA plant monitoring is conducted as described in ICP PLN-720 (Reference 30) and associated procedures.

Biota sampling is performed as part of the CERCLA Long-Term Ecological Monitoring Program to verify that the remedial objectives of each CERCLA ROD are maintained and that any contamination left in place remains within acceptable limits. Vegetation harvested at each selected location includes leaves, small stems, and inflorescences for sagebrush, and leaves, culms, and inflorescences for grass. The intent of this sampling is to gather the plant material most likely to be browsed by herbivores.

Selected mammal species are obtained and analyzed for metals, explosive compounds, and radionuclide activity. Population surveys on birds and mammals, community structure surveys on soil fauna and plants, and physiological effects studies are performed annually.

Biota samples are collected on an annual basis at locations identified as sites of concern; actual sample locations are not depicted on Figure 4-11 because they can be extensive and vary within each area. These samples are monitored for both radiological and nonradiological contaminants. Sampling activities are conducted in accordance with INEEL/EXT-02-01191 (Reference 39).

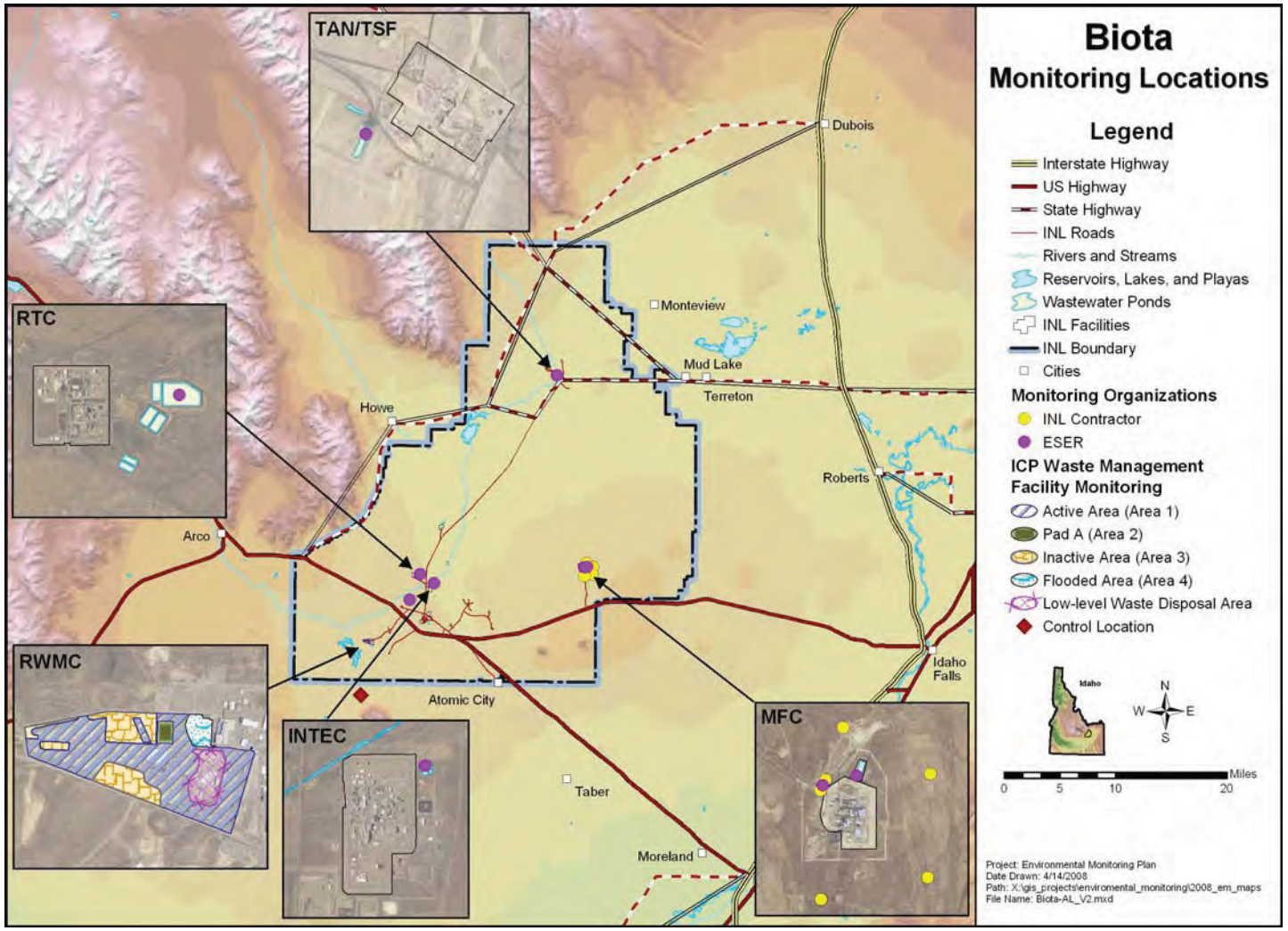

Figure 4-11. Biota monitoring locations.

4.6.3 ESER Program

Because large game animals (pronghorn antelope, mule deer, and elk) are wide ranging and are a popular food source for many area residents, the ESER Program collects samples of game animals that are killed on roadways on or near the INL Site. The collection of large game animal samples is described in the ESER Program Procedure Manual (Reference 31). The thyroid and samples of muscle and liver tissue are collected from each animal and analyzed for radioactivity. Some basic biological information such as weight, age, muscle condition, and the fat depth on various tissues may also be obtained from the animals when possible. Figure 4-12 shows ESER big-game sampling locations. These locations may vary from year to year depending on the numbers and locations of big-game/motor vehicle accidents.

The ESER Program also collects waterfowl on an annual basis from liquid waste disposal ponds on the INL Site and from offsite control areas. Ponds sampled may include the TAN/Technical Services Facility pond, the MFC Industrial and Sanitary Sewage Lagoons, the INTEC New Percolation Ponds, the INTEC STP infiltration ponds, and the hypalon-lined RTC disposal pond (Reference 31). Edible tissues, viscera and remaining tissues (feathers, skin and bones) from waterfowl (primarily ducks) are each analyzed for radioactivity.

Ecological studies, such as population surveys (on birds and mammals) and community structure surveys (on soil fauna and plants) are performed by the ESER Program at varying times during the year as described in Section 4.7.

4.7 Ecological Monitoring

The ESER Program conducts an array of ecological activities on the INL Site to provide ecological and natural resources support to DOE-ID for land management issues and to supply ecological information and expertise to support activities that affect natural resources at the INL Site. These activities include wildlife and vegetation surveys, revegetation, weed management, assessing potential impacts to ecological resources, and facilitating ecological research on the Idaho National Environmental Research Park.

Specific ecological monitoring work at the INL Site involves collecting data related to the abundance and distribution of certain species or groups of species. Results from these monitoring efforts provide information on ecological conditions and trends at the INL Site that are used to:

- Provide assessments of the condition and trend of INL Site ecological resources
- Assess compliance with federal and state regulations
- Provide assessments of the likely impacts to ecological resources from human-caused or natural disturbances
- Propose mitigative actions for minimizing adverse impacts to ecological resources from INL Site activities
- Support the long-term stewardship goal of conserving ecological resources
- Provide baseline data to support ecological research opportunities at the Idaho National Environmental Research Park.

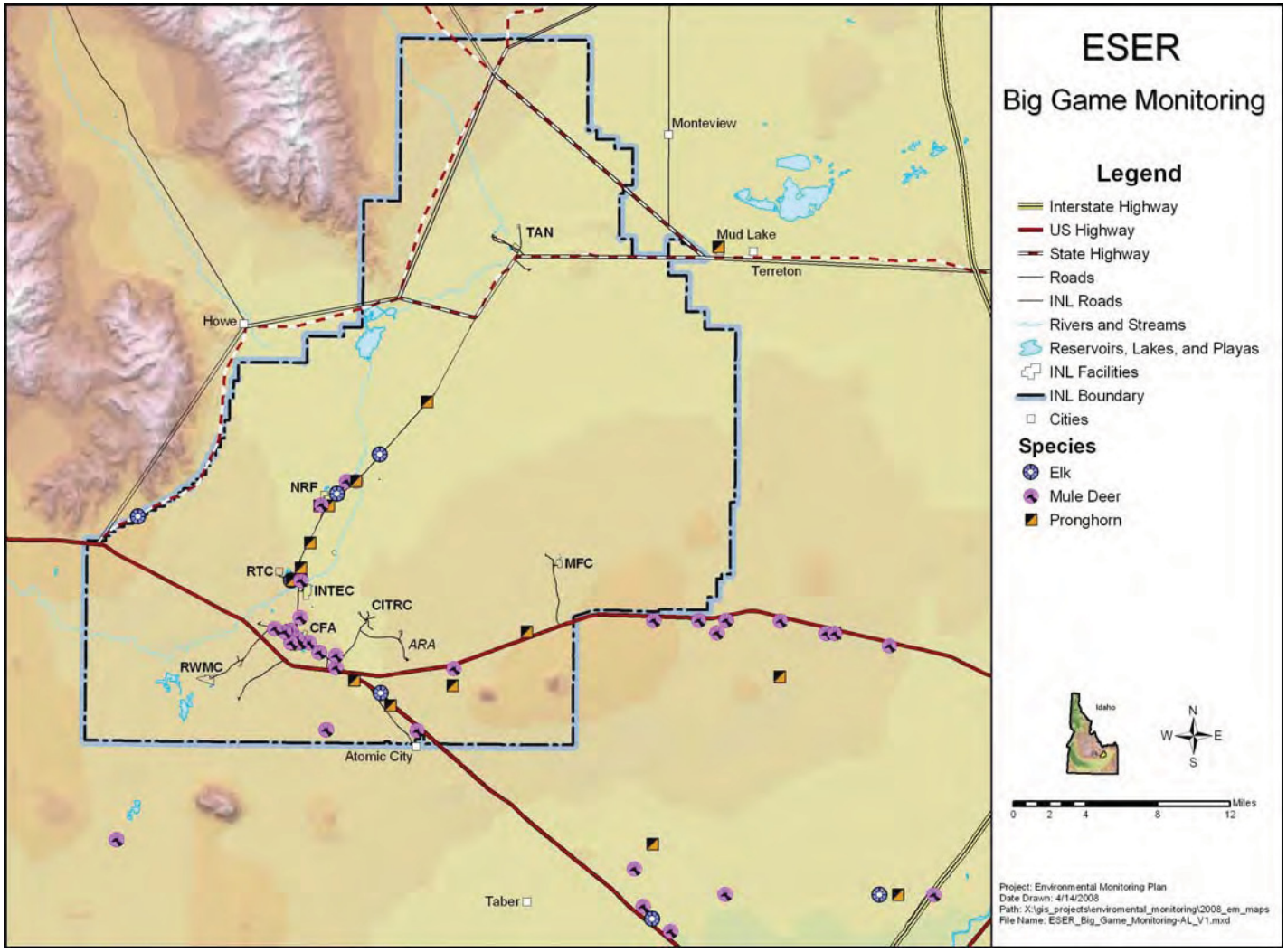

Figure 4-12. ESER Program big-game monitoring locations.

4.7.1 Native Vegetation and Noxious Weeds

Long-term vegetation plots were established in 1950 to monitor the potential effects of activities at the INL Site on ecological resources. Although they were established for that specific purpose, vegetation plots now provide one of the most significant data sets for understanding vegetation dynamics in sagebrush steppe. These plots are among the most intensive and scientifically rigorous efforts by any agency to document long-term changes in sagebrush steppe. This monitoring provides information on plant community-level changes at a landscape level. Initially, 100 permanent plots were established on two intersecting transects (see Figure 4-13). These plots are surveyed at 5-year intervals. Data collected at each plot include cover by line intercept and point interception frame and density and frequency.

Noxious weeds are also monitored through the ESER Program. At least 10 noxious weed species located on the INL Site are regulated by federal and state law. Inventories for noxious weeds are conducted each summer using funds received from the State of Idaho through the Lost River Cooperative Weed Management Area. This inventory is coordinated as an ESER Program environmental education program for high school students who use global positioning system technology to map these weed locations on the INL Site. Survey areas are determined each year based on several criteria, including:

- Areas likely at risk for invasion
- Areas where noxious weeds have been observed, but not properly recorded
- Areas that have not yet been surveyed.

All data collected conform to state guidelines and are reported annually to the State of Idaho, Cooperative Weed Management Area, and the INL contractor. The INL contractor uses the data to control weeds.

4.7.2 Mammals

Large mammal surveys are conducted in January and July each year to estimate abundance and distribution of elk, deer, and pronghorn antelope. The surveys are done from the air on a representative sample of transects. Data are collected in a manner that is comparable with those collected by neighboring agencies (Idaho Department of Fish and Game, Bureau of Land Management, and U.S. Forest Service for example).

In the early 1980s, jackrabbit populations in southeastern Idaho exploded and greatly exceeded the level that the land could sustain. As a result, many rabbits congregated on agricultural lands, including lands adjacent to the INL Site, where they became a significant and costly nuisance. A rabbit survey has been conducted annually on the INL Site since 1980 to determine population trends. Rabbits are counted along a 50-km-long, permanent survey route (Figure 4-13) in mid-spring. All rabbit species, including black-tailed jackrabbits, white-tailed jackrabbits, cottontail rabbits, and pygmy rabbits, are counted. These surveys were discontinued in 2008.

4.7.3 Birds

Sage grouse populations are monitored annually by surveying their use of leks—prebreeding display areas. Breeding and nesting generally occurs within two mi of leks. A representative sample of INL Site sage grouse leks (Figure 4-13) are monitored weekly for 3 to 6 weeks beginning in March. The surveys are conducted by visiting those leks at dawn and counting the number of individual birds. As with large mammal surveys, the methods used provide comparable data to those collected by neighboring agencies.

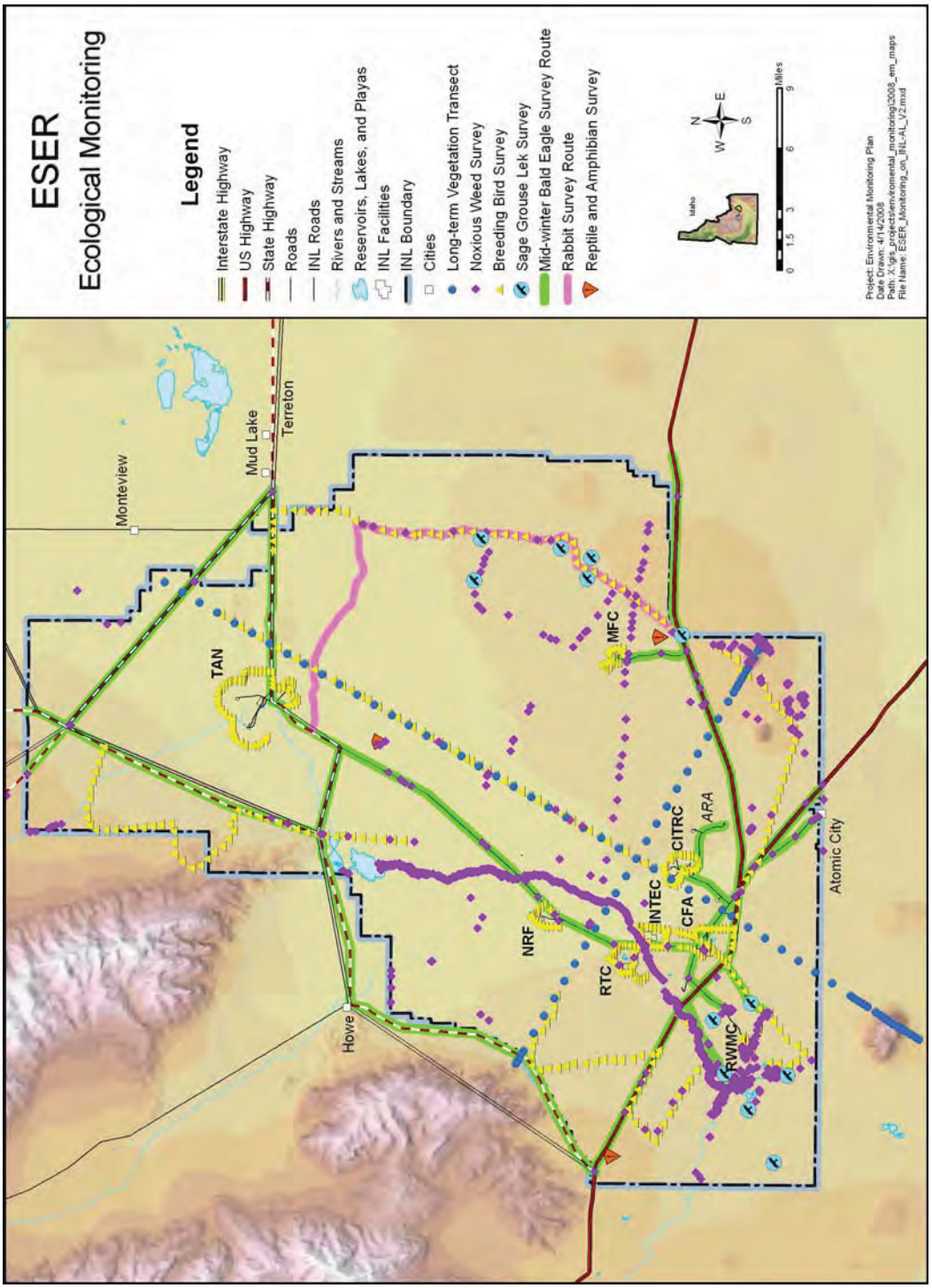

Figure 4-13. ESER Program ecological monitoring locations.

Raptors are surveyed annually on the INL Site through mid-winter raptor counts in collaboration with the United States Geological Survey Biological Resources Discipline (USGS-BRD). Raptor populations tend to fluctuate with slight changes in the environment, such as prey availability and weather conditions. Therefore, they are often used as environmental indicators to determine effects of human development on the environment and the general health of the ecosystem. INL Site raptor surveys are conducted in conjunction with the nationwide USGS-BRD Mid-winter Bald Eagle Survey. The ESER Program surveys two official USGS-BRD Mid-winter Bald Eagle Survey routes (Figure 4-13). In addition to surveying for bald eagles, ESER surveys include all eagles, hawks, falcons, shrikes, owls, ravens, crows, and magpies.

The Breeding Bird Survey (BBS) is a large-scale survey of North American birds. It is a roadside route survey of avifauna designed to monitor abundance and distribution of birds primarily covering the continental U.S. and southern Canada. It is administered by the USGS-BRD. These surveys yield useful information about population dynamics, effects of weather and fire on avian abundance, effects of INL Site operations on avifauna, and the breeding status of a number of bird species of concern, including sagebrush obligate species and other species exhibiting declines throughout their range. Thirteen BBS routes are surveyed on the INL Site (Figure 4-13). Five remote routes are standard 40-km BBS routes, data from which are reported to the USGS-BRD annually. These routes traverse the remote areas of the INL Site and include major habitat types throughout the site. Eight facility routes are located in and around major INL Site facility complexes. Each remote route consists of 50 stop locations at approximately 0.5-mi (0.8 km) intervals. Facility routes consist of 18–60 stop locations at approximately 0.2-mi (0.32 km) intervals. The data collected are comparable to those collected by other neighboring agencies.

4.7.4 Reptiles and Amphibians

Many amphibian and reptile species have characteristics that make them sensitive environmental indicators. The main goal of this monitoring is to determine the distribution and population trends of amphibians and reptiles on the INL Site. This monitoring focuses on snakes. Snake population numbers are monitored at three hibernacula (Figure 4-13) as they leave in the spring and again as they return to the hibernacula in the fall. Secondarily, this program provides safety education to INL Site employees who may encounter venomous reptiles on the INL Site. These surveys were discontinued in 2008.

Ecological monitoring data are provided in various technical reports and presented on the ESER web site at http://www.stoller-eser.com. The data are reported to DOE-ID and various state and federal natural resource and agricultural agencies with whom the ESER Program collaborates.

4.8 Agricultural Products

The INL Site is situated in a large agricultural area that produces many food products of significant economic importance to the state. These food products are monitored because they are a direct route of human exposure through ingestion. Milk, meat, and produce may become contaminated via atmospheric deposition, irrigation using contaminated water, and ingesting contaminated water or feed. Figure 4-14 shows the locations where agricultural products are monitored.

4.8.1 ESER Program

The ESER Program performs most of the agricultural monitoring in the vicinity of the INL Site. The agricultural products monitored are chosen for their abundance in the upper Snake River Valley and their availability for testing.

Milk is monitored at offsite locations because it is a potential pathway for radioactive materials from the INL Site to the public, particularly radioiodine and strontium-90. Some samples are taken from single-

family dairies, others are taken from commercial dairies. A single-family farm in Ucon is sampled weekly; the rest are sampled monthly. The ESER Program Description (Reference 31) details the collection and processing of milk samples.

Lettuce samples are collected annually to measure the uptake of radionuclides from soil and deposition from air and because lettuce is a part of the typical diet. The ESER Program Description (Reference 31) details the collection and processing of lettuce samples, which are taken from portable lettuce growers, set up by the ESER Program at select onsite and offsite locations

Wheat is sampled because it potentially represents a major part of the typical diet. The ESER Program Description (Reference 31) details the collection and processing of wheat samples taken from a number of areas in southeastern Idaho. These samples are collected annually during harvest time at local grain elevators.

Although potatoes were not generally considered to be as good an indicator of radionuclide uptake as leafy vegetables, routine potato sampling was resumed in 1994, owing to public interest in Idaho's most famous product. Potato samples are obtained annually during the harvest from potato warehouses located in the vicinity of the INL Site. Potatoes are also obtained from friends and relatives living out of state from areas as distant as Maine and Alaska to serve as control samples. The ESER Program Description (Reference 31) details the collection and processing of potato samples.

Grazing is allowed on certain portions of the INL Site in Bureau of Land Management allotments. Commonly used areas on the INL Site include the area between Atomic City and the Twin Buttes, the eastern part of the INL Site in the area east of MFC known as Tractor Flats, and the north portion in the vicinity of Circular and Antelope Buttes. In the past, two sheep were collected annually from each of the northern and southern allotments and two sheep were collected from an operator whose sheep graze in areas distant to the INL Site as controls. The thyroid and samples of muscle and liver tissue were sampled from each animal and analyzed for radioactivity. Sheep sampling was discontinued in 2007 as the data did not indicate any radionuclide uptake by these grazing animals from INL releases. It is more likely to detect radionuclides from INL activities in game animals, which have access to INL Site facility areas.

4.9 External Radiation

External (or penetrating) radiation is measured using radiation dosimeters, pressurized ion chambers, and gamma radiation detectors at facilities, roadways, and surrounding communities. Sources of external radiation include natural radioactivity, cosmic radiation, fallout from nuclear weapons testing, radioactivity from fossil fuel burning, and radioactive effluents from INL Site operations. The contribution of INL Site operations to background radiation exposure is determined by comparing exposures measured at the INL Site boundary locations to those at distant locations. Figure 4-15 shows the regional external radiation monitoring locations, and Figure 4-16 shows detailed onsite monitoring locations.

Radiation monitoring is performed at the INL Site to:

- Characterize penetrating radiation levels at specific points of interest at waste management facilities and at the perimeter of INL Site facilities
- Detect and report significant trends in measured levels of penetrating radiation.

To meet these objectives, INL Site contractors measure gamma radiation exposure rates and cumulative exposures and perform gamma-radiation surveys both onsite and offsite.

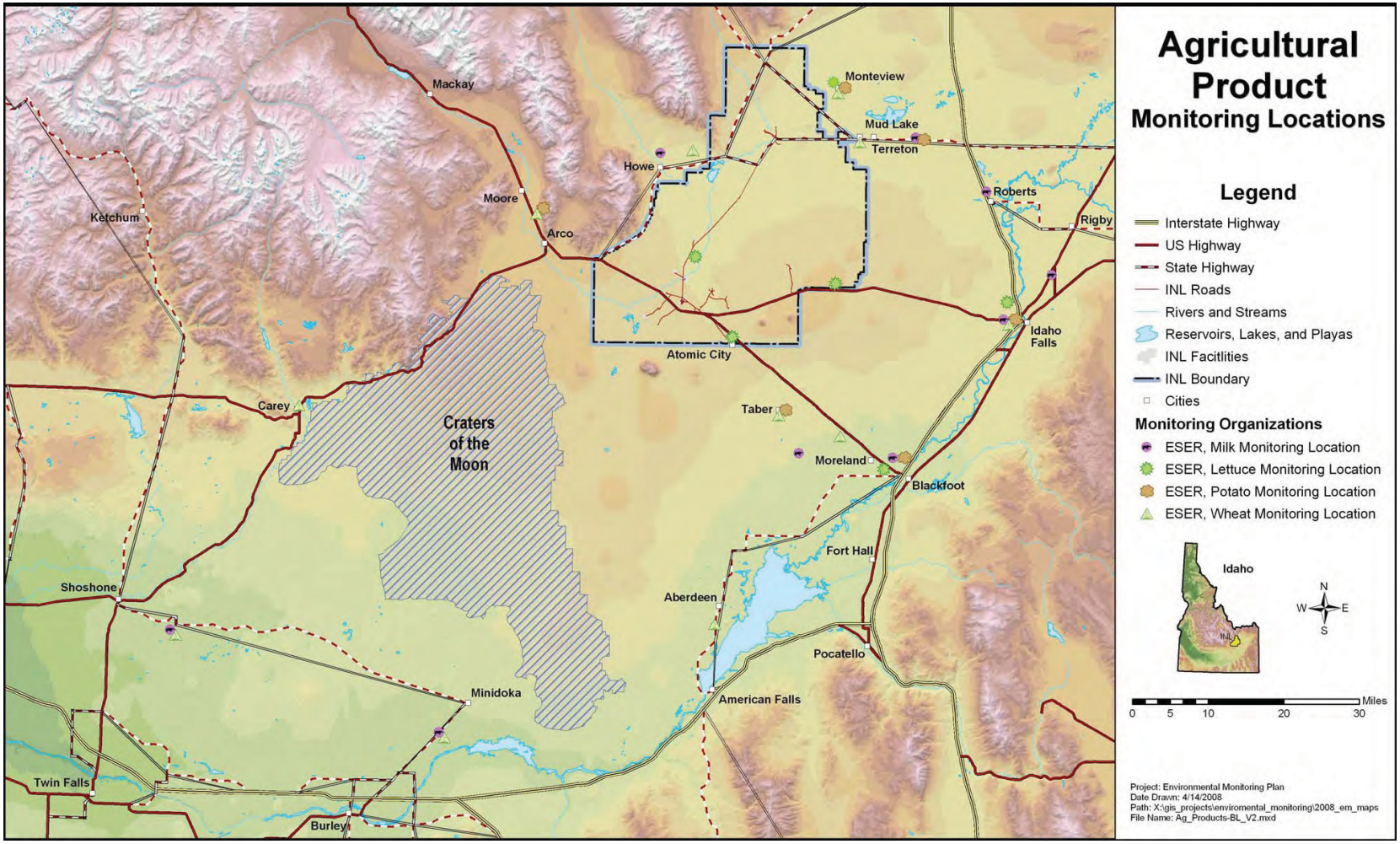

Figure 4-14. Agricultural products monitoring locations.

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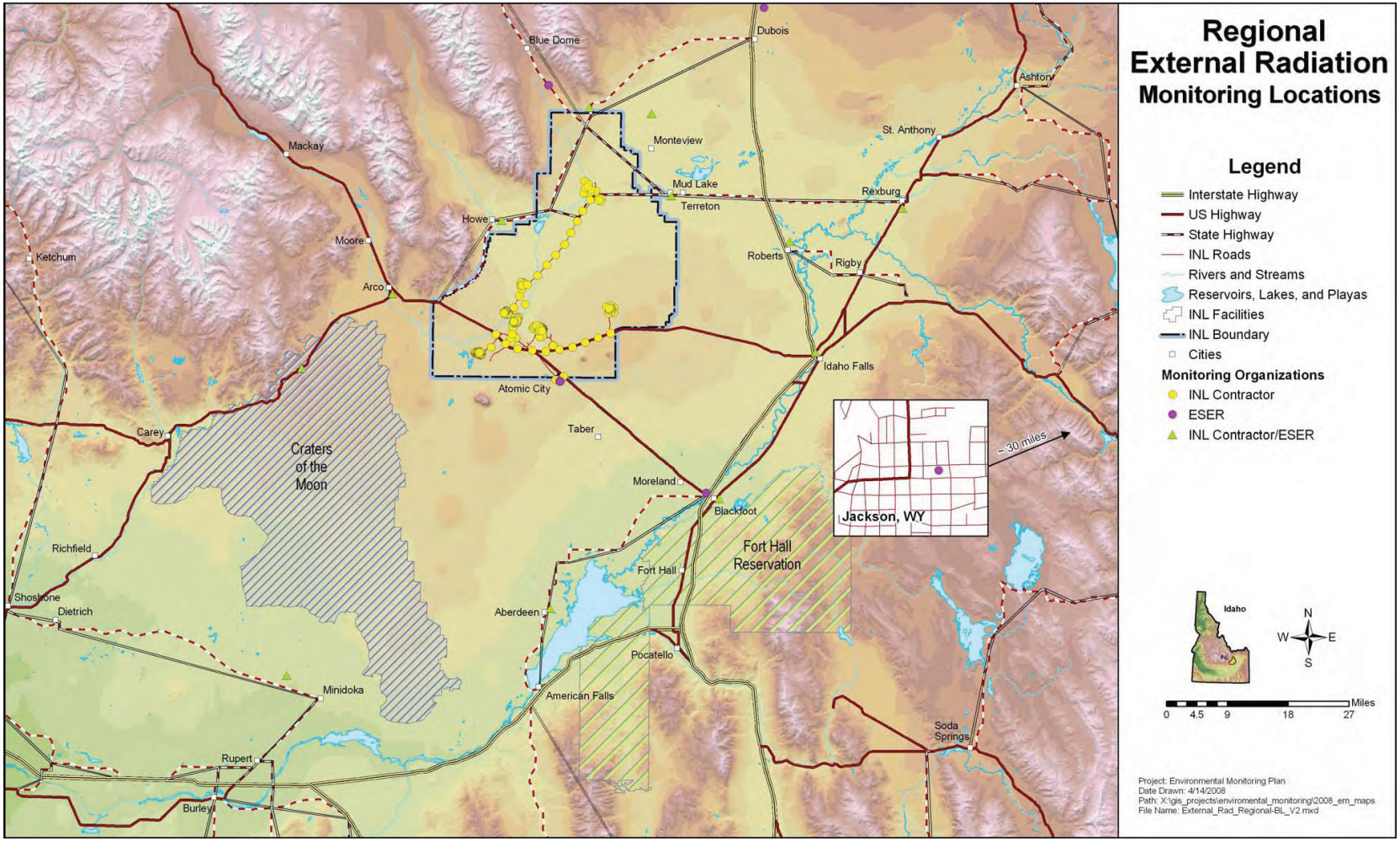

Figure 4-15. Regional external radiation monitoring locations.

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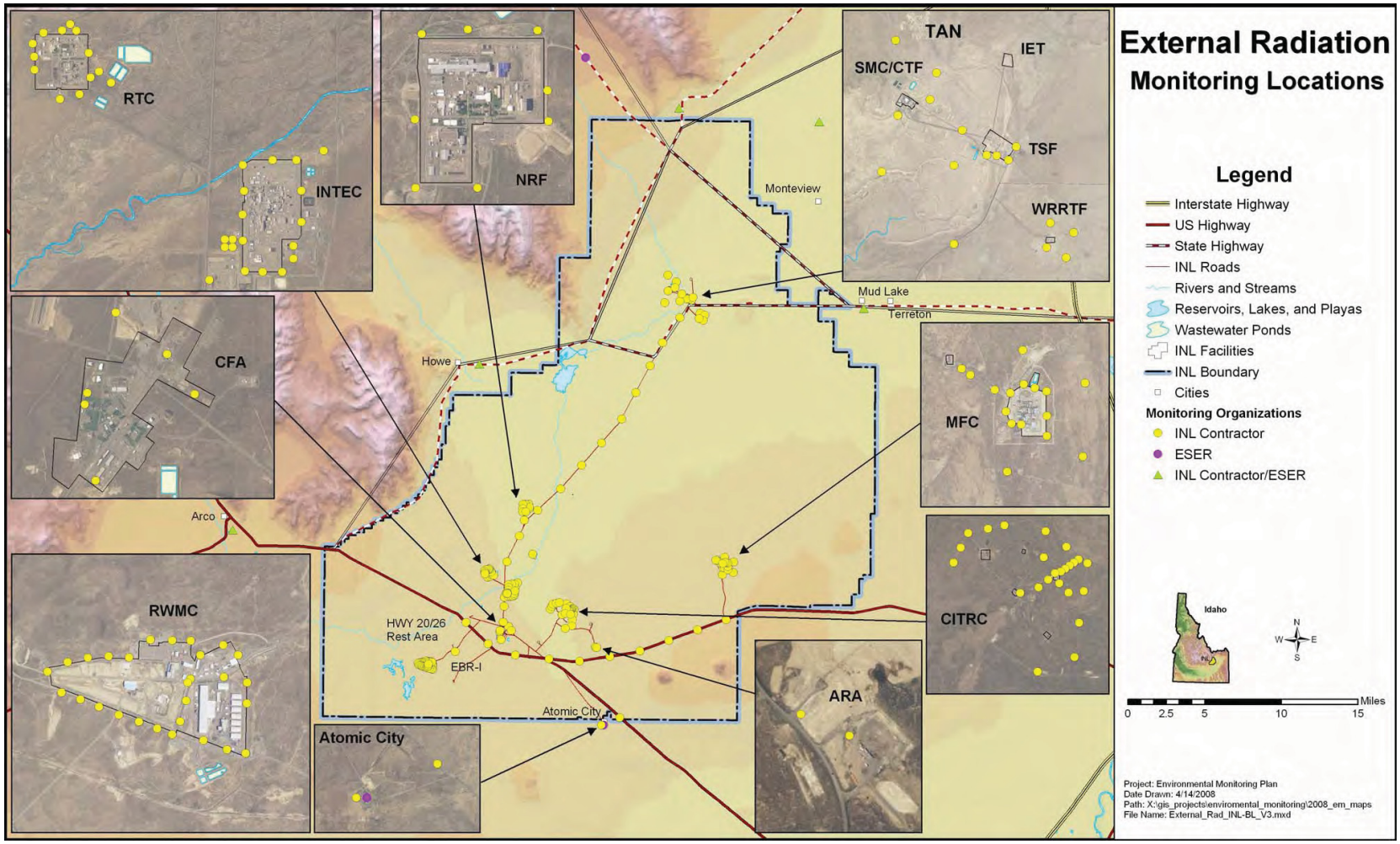

Figure 4-16. Detailed onsite external radiation monitoring locations.

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Thermoluminescent dosimeters (TLDs) are used to measure cumulative exposures to ambient penetrating radiation for monitoring locations. The TLDs measure changes in ambient exposures possibly attributed to handling, processing, transporting, or disposing radioactive waste. TLDs are located along major highways, in surrounding communities, and around the perimeter fences of each major facility. The TLDs are placed 0.9 m (3 ft) above ground, and are collected and analyzed in May and November of each year to determine background exposures resulting from natural terrestrial sources, cosmic radiation, and fallout from testing nuclear weapons.

In addition to TLDs, a global positioning radiometric scanner (GPRS) system is used to conduct gamma-radiation surveys. These surveys measure gross gamma radiation and are used to identify general areas of radioactivity. They differ from the in situ soils analysis discussed in Section 4.5.1.1, which are used to identify specific radionuclides and activity levels. Gamma-radiation surveys are used to screen soils that have become contaminated with gamma-emitting nuclides and to detect penetrating radiation exposures outside the fenced areas from a variety of possible sources inside the facility.

The GPRS is mounted on a four-wheel drive vehicle. Annual gamma-radiation surveys are conducted along major roads for radiation contamination and around the perimeter of selected facilities on a 3-year schedule to document penetrating radiation fields. Two plastic scintillation detectors identify contaminated areas, and both the global positioning system and radiometric data are recorded. Because these surveys involve all roads and facility perimeters, these monitoring locations are not displayed on either of the external radiation figures.

4.9.1 INL Contractor

External radiation monitoring is performed by the INL contractor as described in the PLN-8510 (Reference 29) and associated procedures. Environmental TLD are maintained at locations on the INL Site along major highways, around the perimeter fences of each major facility, and offsite locations.

High-pressure ion chambers (HPIC) are used at a CFA location and the Experimental Field Station to continuously measure the gamma radiation exposure rate. HPIC are capable of measuring background levels of radiation in the environment and additional contributions from man-made activities.

A GPRS is used for sitewide radiological monitoring and sitewide emergency response. The GPRS units used are primarily for collecting long-term stewardship data and yearly monitoring of gross radiation levels at INL Site perimeters and roadways. These data are used to identify and analyze year-to-year trends.

4.9.2 ICP Contractor

External radiation monitoring is performed by the ICP contractor as described in ICP PLN-720, (Reference 30) and associated procedures. Annual surveys are conducted per DOE Order 435.1 (Reference 27) compliance requirements for detecting gross gamma radiation at the RWMC SDA, which is the only low-level waste disposal facility at the INL Site. ICP uses a separate GPRS unit specifically to monitor ICP operational facilities.

4.9.3 ESER Program

The ESER Program monitors external radiation at seven INL Site boundary and ten offsite locations (Figure 4-15) using environmental dosimeters. A dosimeter containing a TLD packet of four lithium-fluoride chips is placed at each location one meter above the ground surface. The dosimeters are changed semiannually, normally in early May and again in early November.

The Operational Dosimetry Section of the ICP contractor analyzes the environmental dosimeters. The four chips are read separately and a mean response is determined for each set. This value is converted to the exposure in milliroentgen based on a detailed calibration procedure. Dosimeter data are interpreted by comparing exposures measured at the boundary locations to those at distant locations.

The ESER Program also maintains two HPIC to monitor exposure rates in "real time" at the Rexburg and Blackfoot Community Monitoring Stations. Data collected at these locations are transmitted to the NOAA office in Idaho Falls via a radio telemetry network. The data are displayed on NOAA's Mesonet web site at http://www.noaa.inel.gov/windV/windV.asp.

4.9.4 NOAA

The NOAA ARLFRD is primarily responsible for meteorological monitoring at the INL Site (see Section 5). However, external radiation sensors have been installed at all towers in the meteorological monitoring network; most of the sensors are for event monitoring and are described in Section 6. All external radiation sensors used for environmental surveillance are owned and maintained by other organizations. ARLFRD's primary role with these sensors is to collect and archive the data. Sixteen towers have HPIC, two owned by the ESER Program and the others owned by the State of Idaho.

5. METEOROLOGICAL MONITORING

The meteorological monitoring program supports laboratory-wide environmental monitoring activities as well as emergency response. Short- and long-term weather conditions have a substantial effect on the INL Site environment, particularly with respect to the movement of contaminants in air and the groundwater system. Meteorological monitoring is performed to record weather conditions such as wind speed and direction, temperature, and precipitation so that this information may be used with predictive models to estimate the concentration of contaminants after they have been released to the environment. Meteorological monitoring results are also used to plan environmental measurement programs or for modeling required for compliance with air quality regulations. For example, the INL Site contractors perform modeling to show compliance with ambient air quality regulations and to comply with requirements to estimate offsite dose (see Section 9 for a discussion of dose assessment modeling). Figure 5-1 shows the meteorological monitoring locations.

Results of past work related to the tower network are summarized in DOE-ID-12118, (Reference 2), and DOE-ID-12119 ” (Reference 28).

5.1 NOAA

Meteorological services and supporting research are provided to the INL Site by the NOAA ARLFRD. ARLFRD provides real-time meteorological data, climatological data, weather predictions, and dispersion calculations for routine operations and emergency response.

ARLFRD operates a meteorological monitoring network that covers an area of approximately 3,885,000 hectare (15,000 mi^2) to characterize the meteorology and climatology of the INL Site. The network consists of five meteorological towers both on and around the INL Site. Most of the towers are 15 m (49 ft) tall and take wind speeds and direction measurements at 15 m (49 ft), temperatures at 2 m and 15 m (2.7 and 49 ft), and relative humidity at 2 m (2.7 ft) above ground level. Three taller towers range from 46 m to 76 m (150 ft to 249 ft) high and are instrumented at multiple levels. Many towers have additional sensors for precipitation, solar radiation, and barometric pressure. All the tower measurements are averaged over 5-minute periods and transmitted to ARLFRD in near real-time via radio-frequency communication. All the ARLFRD towers are outfitted with Geiger-Müller tubes for detecting ionizing gamma radiation in the air. The radiological measurements are transmitted and archived with the meteorological data.

In addition to the meteorological towers, ARLFRD operates a 915-MHz radar wind profiler with a Radio Acoustic Sounding System at a site just north of INTEC. These systems provide wind speed and direction profiles up to about 4 km (2.5 mi) above ground level and temperature profiles up to about 1 km (0.6 mi) above ground level, thereby providing crucial information about winds and temperatures aloft. More recently, ARLFRD added a minisodar system capable of providing high-resolution wind and turbulence measurements up to 100-150 m (330-500 ft) above the ground.

ARLFRD has also developed a program called INEELViz to display data in near real-time from the tower network and the vertical profilers. INEELViz has been installed at many office locations both within and outside the INL Site. It is widely used to support INL Site operations and is a major part of ARLFRD’s support to the INL Site Emergency Operations Center. A real-time display of the meteorological data is also available at http://www.noaa.inel.gov/windV/windV.asp. In addition, ARLFRD now maintains an INL Weather Center at http://niwc.noaa.inel.gov that provides a range of meteorological information relevant to INL.

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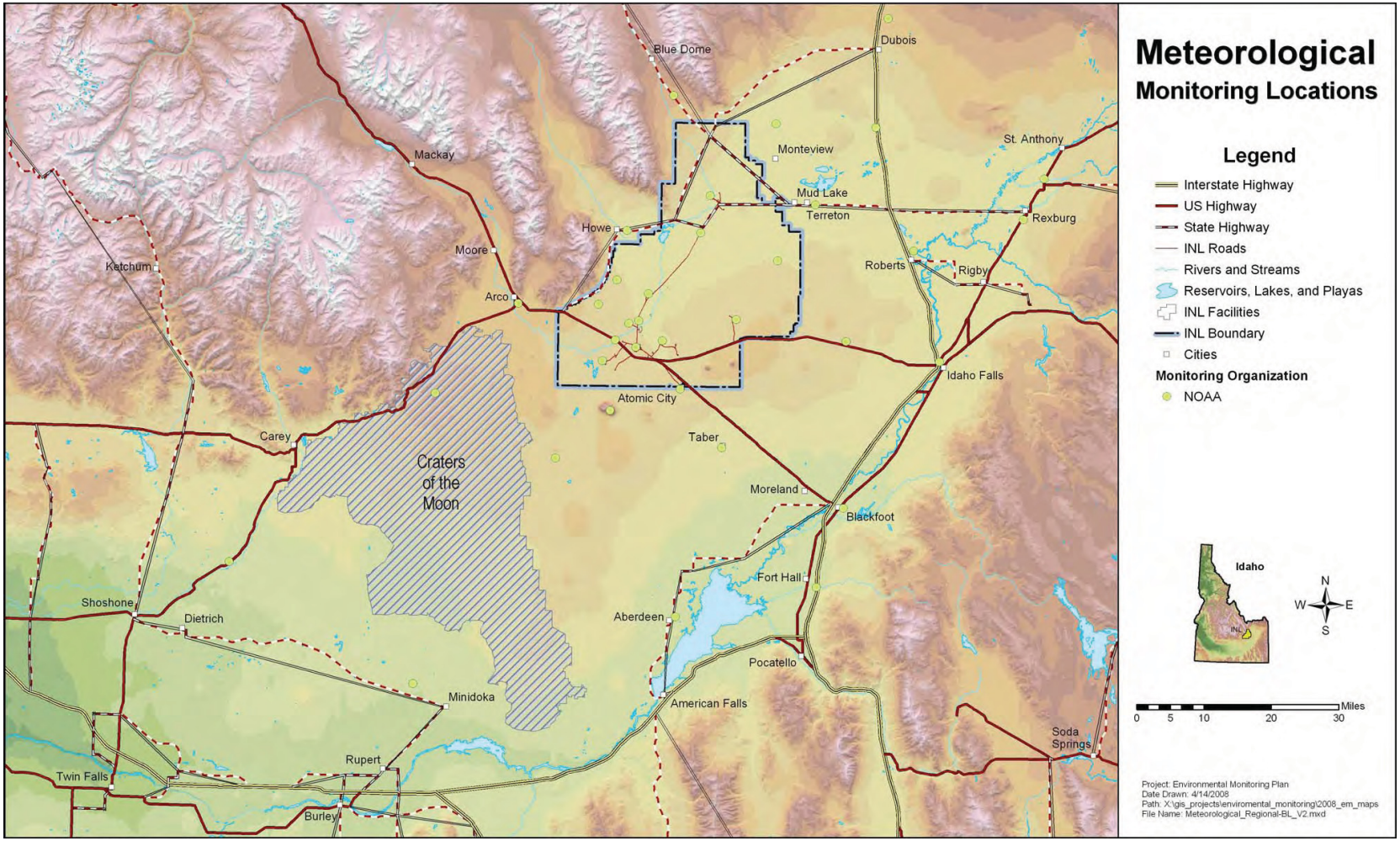

Figure 5-1. Meteorological monitoring locations.

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6. ENVIRONMENTAL EVENT MONITORING

Environmental event monitoring is an essential part of safe operations because of the potential impacts a release of radioactive or regulated materials from INL Site facilities, either from unplanned/accidental operational events or natural events, could have on the environment and the public. Environmental events at the INL Site can be widespread (e.g., a wildland fire spread by high winds) or facility-specific (e.g., a chemical spill limited to a small area immediately around the spill). Data from event-specific monitoring are used to evaluate the potential impact of an event to personnel, the environment, and the public.

Responses to environmental events vary depending on the severity of the event and are conducted by the responsible contractor. The INL contractor responds to all wildfire events. Figure 6-1 shows the locations of samplers specifically intended for use during an environmental event. Locations of portable or routine samplers are not shown.

6.1 Response to an Emergency or Unplanned Release

The INL Site has an extensive program to identify chemical/radioactive hazards, evaluate associated risks, prevent accidental releases, and respond appropriately in the event of a release. This comprehensive INL Site Emergency Preparedness Program is addressed in PLN-114, "INL Emergency Plan/RCRA Contingency Plan."[42] The Plan is used by the Emergency Response Organization and other trained personnel in the event of an emergency and provides the overall process for responding to and mitigating consequences of emergencies that might arise at the INL Site. Emergency plans for the INL Site consolidate all emergency-planning requirements for federal, state, and local agencies. Mutual aid agreements are in place between the INL Site and state and local agencies to respond to emergencies. One such agreement allows local fire departments to respond to fires on the INL Site and allows the INL Site fire department to respond to fires offsite.

The Plan also includes spill prevention and response requirements for each facility. Spills and releases are reported to the INL Site Spill Notification Teams. The INL Site Spill Notification Teams determine if the spill or release is reportable and provides assistance to operations for making appropriate release notifications.

If an unplanned radioactive release or an event such as a wildland fire occurs at the INL Site, the INL contractor Environmental Monitoring organization collects field data. Data collected include readings of penetrating radiation levels, airborne and surface contamination levels, and radiation surveys outside of facility fences. The INL contractor Environmental Monitoring organization reports the field data results to the Emergency Response Organization.

In the event of an emergency or unplanned release, anthropogenic or natural radioactivity can be released into the air. These releases could result from direct atmospheric release from a facility, or by redistribution by fire or winds of anthropogenic or natural radioactivity contained in soil and vegetation. Three types of air samples can be taken during environmental events that are declared operational emergencies or which involve soil contamination areas:

- Immediate short-term "grab" samples
- Stationary 24-hour samples at strategic locations specific to the event
- Routine environmental samples taken at standard locations (continuous monitoring).

Short-term grab samples are taken in the field by the INL contractor Environmental Monitoring organization to provide gross radiation levels for early indication of event conditions. The grab samples

are taken using high-volume air monitors to assess exposure potentials, verify the effectiveness of onsite protective actions, and determine the need for offsite protective actions. The high-volume air monitor locations are selected by the Emergency Operations Center (EOC) based on wind direction and conditions specific to the event. High-volume air monitors are capable of drawing large quantities of air through a particulate filter over a short period of time (approximately 15 minutes) and are used to detect gross alpha and gross beta. Results of short-term samples are generally available within 1 to 2 hours after samples are collected.

Event-specific monitoring provides data to evaluate potential radiological doses associated with events resulting in accidental or unplanned radiological releases from INL Site operations or wildland fires. Ambient air samples are taken using stationary high-volume air samplers located at the NOAA towers or with other high-volume samplers mobilized to a location based on conditions specific to the event. The stationary samplers are located to effectively surround the site, be near facilities, and account for the direction of prevailing winds. Stationary samplers can be activated remotely, which allows for focused sampling without endangering site workers. During the fire season, the INL contractor temporarily exchanges some of the ARLFRD high-volume air samplers, which are of an old design, with newer samplers. These samplers can be activated during wildfires in situations where the fire may burn through areas with radiological contamination. Because most events are short term, ambient air is sampled for 24 hours to obtain the required airflow through the samplers and desired detection levels for specific radionuclide measurements. These samplers are not weather-hardened and are used only during the wildland fire season (May through September).

The INL contractor maintains a routine monitoring network of low-volume air samplers at fixed locations that take continuous air samples. Results from these routine environmental samples are used to supplement other event-specific measurements to determine and document the nature and quantity of any radioactive material detected in ambient air on and around the INL Site.

6.1.1 AMWTP

Spills or releases greater than a preset reportable quantity are reported to the INL Site Spill Notification Teams. The AMWTP also has a "Spill Response Procedure" (AMWTP-MP-EC&P-7.10)[43] and an "Advanced Mixed Waste Treatment Project Emergency Plan/RCRA Contingency Plan (AMWTP-MP-EP&C-12.1)."[44]

AMWTP has installed ANSI N13.1 (Reference 19) compliant monitors with alarms on two stacks at the AMWTP. If the stack monitors initiate an alarm, AMWTP will respond using a graded approach to minimize the release by switching filter banks and/or shutting down the processes.

6.1.2 NOAA

All the ARLFRD towers are outfitted with Geiger-Müller tubes for detecting ionizing gamma radiation in the air. This information is available for use in assessing impacts of any unplanned releases or wildland fire. High-volume air samplers are located at 32 of the ARLFRD tower locations operated by NOAA. Samplers are intended for use in the event of a radiological accident at the INL Site, and are therefore not used for routine environmental monitoring. Samplers can be turned on and off remotely upon request from DOE-ID by an operator stationed at ARLFRD or in the EOC.

Data from the towers are available from the ARLFRD Weather Center at http://nwic.noaa.inel.gov. In addition to displaying data in nearly real time, this site allows visitors to interactively generate various products, including meteograms, text summaries, and graphical summaries. Four of the towers are part of the IEMP, available at http://www.noaa.inel.gov/projects/iemp/iemp.htm. The towers have kiosks at their base which provide the public with informational displays of the tower data.

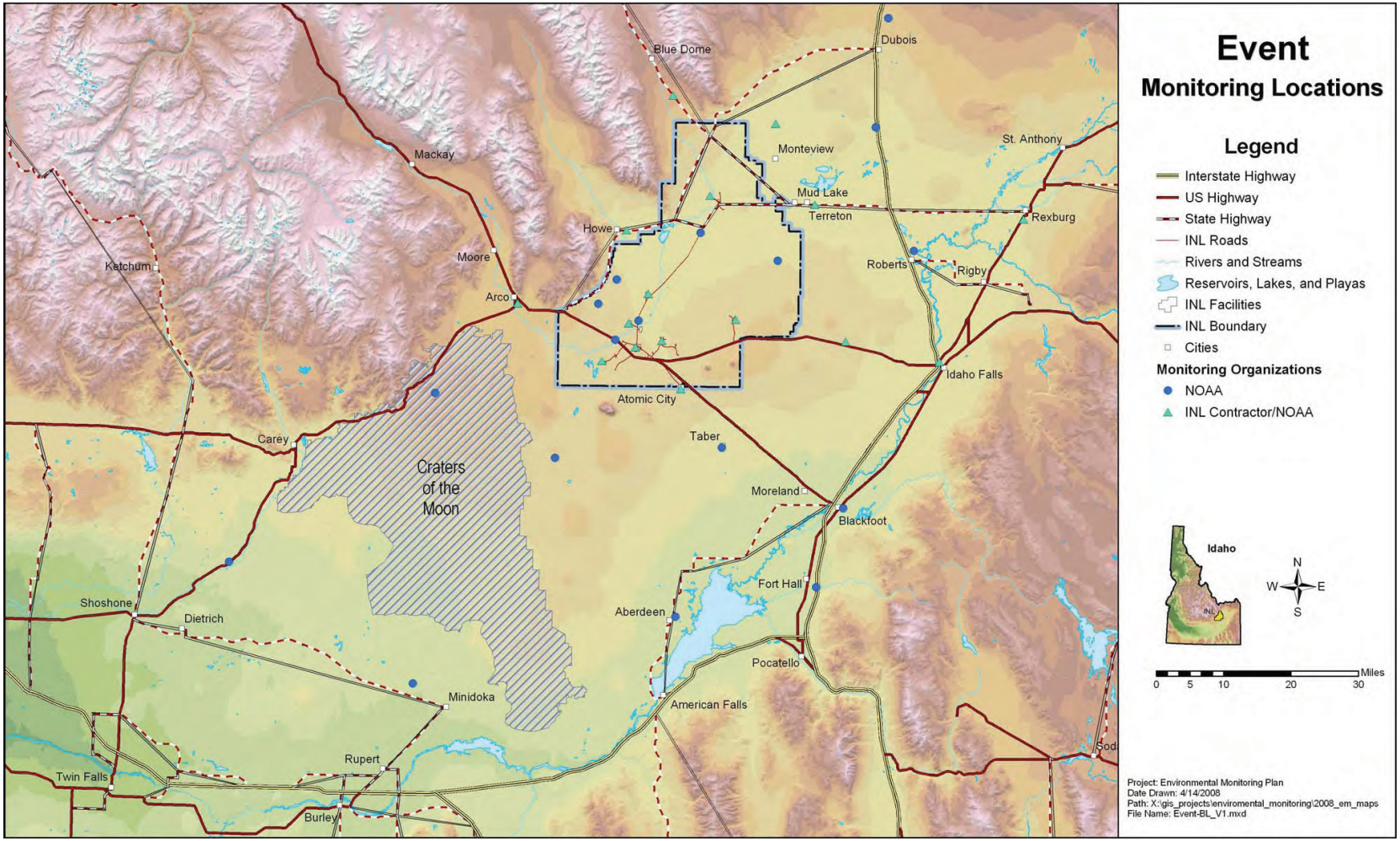

Figure 6-1. Event monitoring locations.

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6.2 Response to an Exceedance

Each INL Site contractor maintains their own plans or procedures to ensure that appropriate, timely notifications to appropriate authorities occur, and that corrective actions are taken in the event that monitoring results exceed a regulatory limit or, in some cases, a preset trigger level. Specific actions to be taken when validated monitoring results are above certain trigger levels are identified in the applicable permits and regulations (e.g., RCRA, WLAP, Safe Drinking Water Act [Reference 33]). These actions include reporting any exceedances to the appropriate federal, state, or local agencies, along with initiating appropriate corrective actions in a timely manner. The types of corrective actions could vary depending on the specific regulation and could include follow-up reanalysis or confirmation sampling, removing potable water well from service, or remedial action.

For reportable occurrences, specific actions to be taken are identified in the DOE Order 231.1A, "Environment, Safety and Health Reporting,"[45] which establishes reporting requirements and categorizes releases of radionuclide and hazardous substances or regulated pollutants. Taking the following general steps when responding to an environmental data exceedance will ensure that coordinated actions are taken and INL Site stakeholders are notified in a timely manner:

1. Discover, confirm, and make initial notification.
2. Categorize environmental data exceedance.
3. Determine and initiate appropriate response.
4. Complete necessary reporting and notification.

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7. REPORTS

General reporting requirements for effluent monitoring and environmental monitoring activities at the INL Site are outlined in DOE Order 231.1A (Reference 45) and DOE Order 5400.5 (Reference 4). These orders specify the reporting responsibilities, timing, and distribution of several routine environmental reports. The requirements for preparing and distributing accident-related or unusual occurrence reports are included in DOE Order 231.1A.

Following are the principal objectives of DOE's reporting system, as stated in DOE/EH-0173T (Reference 20):

- Alert DOE management to occurrences for the purpose of investigating and evaluating causes, and identify appropriate measures to prevent recurrences
- Obtain early, complete, and factual information on occurrences as a basis for reports to the Secretary of Energy, Congress, other federal agencies, and the public, as appropriate
- Identify trends in areas of concern for DOE and contractor operations
- Provide a basis for improving codes, guides, and standards used in the DOE and contractor operations
- Monitor, evaluate, and report onsite discharges, liquid and airborne effluents, and environmental conditions in the vicinity of DOE sites to assess the levels of radioactive pollutants and their impact on the public and the environment
- Comply with regulations and DOE orders.

Compliance monitoring data driven by specific permits or regulatory requirements are reported to federal, state, and local agencies in formats and frequencies specified by the respective regulatory document.

7.1 Reporting Requirements

INL and ICP contractors are responsible for reporting requirements for their respective facilities with regard to:

- Source-specific and sitewide air permits required for compliance with Public Law 91-604, "Clean Air Act Amendments of 1990" (Reference 14) and with IDAPA 58.01.01, "Rules for the Control of Air Pollution in Idaho" (Reference 15)
- Permits required for compliance with IDAPA 58.01.17, "Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater" (Reference 23).
- Permits required for compliance with IDAPA 37.03.03, "Rules for the Construction and Use of Injection Wells in the State of Idaho"[46]
- Laboratory-wide permits and records required under the RCRA; Public Law 94-469, "Toxic Substances Control Act"[47]; 42 USC 11001, "Emergency Planning and Community Right-to-Know Act,"[48] and 7 USC 136, "Federal Insecticide, Fungicide, and Rodenticide Act"[49]
- 42 USC 9601, "Comprehensive Environmental Response, Compensation, and Liability Act" (Reference 12)
- Public Law 104-182, "Safe Drinking Water Act" (Reference 33).

The INL contractor is also responsible for reporting requirements associated with the following:

- City Order Chapter 1, Section 8, "Permits required for compliance with City of Idaho Falls Sewer Ordinance and Municipal Stormwater Discharge Permit" (Reference 25).

7.2 ESER Program Reporting

The ESER Program prepares the ASER each calendar year, with input from the various organizations performing environmental monitoring on and around the INL Site. The ASER is available electronically, summarizes data from effluent monitoring programs, environmental monitoring activities, and includes a yearly environmental compliance summary for the INL Site. The ASER is prepared as required by DOE Order 231.1A (Reference 45).

The ESER Program prepares quarterly reports summarizing offsite monitoring results and distributes these electronically. A number of other topical reports summarizing trends in data for a particular medium or dealing with other environmental monitoring subjects are produced periodically.

The ESER Program also maintains an environmental public communications and education program. Articles covering environmental monitoring and other ESER Program activities are published in the ESER Program newsletter and in press releases. The ESER Program has established a web site at http://www.stoller-eser.com/index2.htm containing information on the various aspects of the program, all ESER Program data, and recently published reports.

7.3 USGS Survey Reporting

All data collected by the USGS INL Project Office are publicly available after review. Most data are published in periodic data reports and used in interpretive reports. The ASER contains an appendix listing the abstracts of USGS publications for the calendar year. The USGS National Water Information System web site is open to the public. This system permits public electronic access and retrieval of USGS water data, including groundwater and water quality data. The web site address is http://waterdata.usgs.gov/nwis/.

7.4 NOAA Reporting

The NOAA-ARLFRD, "Quality Program Plan, NOAA Air Resources Laboratory Field Research Division,"[50] addresses the requirements of DOE Order 414.1A, "Quality Assurance,"[51] and is consistent with ANSI/ANS-3.11-2005, "Determining Meteorological Information at Nuclear Facilities."[52] Implementing procedures include regular independent system and performance audits, written procedures and checklists, follow-up actions, and continuous automated and visual data checks to ensure representation and accuracy. The plan and implementing procedures provide the framework to ensure that the INL Meteorological Monitoring Network meets the elements of DOE/EH-0173T (Reference 20).

Network meteorological data are transmitted every 5 minutes from each station in NOAA's meteorological network via radio to the central ARLFRD facility in Idaho Falls. The data receive nearly continuous monitoring and quality control screening. Data are recorded on electronic media and stored in a dedicated, computerized archive, with backup media maintained as recommended by DOE/EH-0173T (Reference 20).

Specific climatological data from the IEMP are available in real time to the public electronically at http://www.noaa.inel.gov/. ARLFRD data specific to the INL Site are available in near real time electronically at http://niwc.noaa.inel.gov/windV/. Results of past work are summarized in DOE/ID-12118 (Reference 2) and DOE/ID-12119 (Reference 28).

8. QUALITY ASSURANCE

An effective quality assurance (QA) program is essential to collect quality data. This section presents QA procedures and practices used as part of the effluent monitoring and environmental monitoring programs. This section does not provide a QA plan for monitoring at the INL Site but rather defines QA requirements applicable to environmental programs. Each monitoring organization incorporates the required components into its QA documentation for environmental monitoring.

The primary policy, requirements, and responsibilities for establishing and maintaining plans and actions that ensure QA in DOE activities are provided in DOE Order 414.1A (Reference 51), "Quality Assurance," 10 CFR 830, Subpart A, "Quality Assurance Requirements,"[53] and American Society of Mechanical Engineers (ASME) NQA-1-2004, "Quality Assurance Requirement for Nuclear Facility Applications."[54] ASME NQA-1-2004 is the preferred standard for activities at nuclear facilities. Additional QA program requirements found in 40 CFR 61, Appendix B (Reference 18) must be met for all radiological air emission sources continuously monitored for compliance with 40 CFR 61, Subpart H (Reference 16).

The EPA policy on QA plans is based on the national consensus standard ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs."[55] The EPA approach to data quality centers on the data quality objective process. Data quality objectives are project dependent and are determined on the basis of the data users' needs and the purpose for which data are generated. EPA/240/B-01/003, "EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5),"[56] specifically addresses those quality elements applicable to environmental monitoring and decision-making. These elements are included in the following general categories:

- Project management
- Data generation and acquisition
- Assessment and oversight
- Data validation and usability.

8.1 QA Requirements

The QA procedures are designed to ensure sample integrity, precision, and accuracy in the analytical results and to ensure that the environmental data is representative and complete. The following subsections describe how each monitoring organization implements the above QA requirements.

8.1.1 INL Contractor

The INL contractor integrates applicable requirements from *Manual 13A—Quality and Requirements Management Program Documents*,[57] into the implementing monitoring program plans and procedures for non-CERCLA monitoring activities. The program plans address the QA elements as stated in EPA/240/B-01/003 (Reference 56) to ensure that the required standards of data quality are met.

8.1.2 ICP Contractor

All CERCLA monitoring activities at the INL Site are conducted in accordance with DOE/ID-10587, "Quality Assurance Project Plan (QAPjP) for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites."[58] The Quality Assurance Project Plan was written in accordance with EPA/540/G-89/004, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Office of Emergency and Remedial Response."[59] In addition, the ICP contractor uses:

- PLN-720, “Environmental Surveillance Program Plan” (Reference 30)
- PLN-729, “Liquid Effluent Monitoring Program Plan” (Reference 26)
- PLN-730, “Idaho Cleanup Project Drinking Water Program Plan” (Reference 35)
- PLN-1305, “Groundwater Monitoring Program Plan.”[60]

8.1.3 AMWTP

AMWTP maintains a QA program in accordance with 40 CFR 61, Appendix B (Reference 18), as required of all radiological air emission sources continuously monitored for compliance with 40 CFR 61, Subpart H (Reference 16). The QA requirements are documented in AMWTP-PD-EC&P-02, “Quality Assurance Project Plan for the WMF 676 NESHAPs Stack Monitoring System.”[61]

8.1.4 ESER Program

The ESER Program maintains a QA program consistent with the requirements of 10 CFR 830 (Reference 53) and DOE Order 414.1A (Reference 51) that is implemented through the ESER “Quality Management Plan for the Environmental Surveillance, Education and Research Program.”[62] Additional QA requirements for monitoring activities are provided in the ESER “Quality Assurance Project Plan for the INL Offsite Environmental Surveillance Program.”[63] Analytical laboratories used by the ESER Program maintain their own QA programs consistent with DOE requirements.

8.1.5 USGS

The INEEL/MIS-03-00519: DOE-ID-22182, (Reference 37) defines procedures and tasks performed by project-office personnel that ensure the reliability of water quality data. The plan addresses all elements needed to ensure reliability:

- Reliability of the water-quality data
- Compatibility of the data with data collected by other organizations at the INL Site
- That data meet the programmatic needs of the DOE and its contractors and the scientific and regulatory communities.

The USGS conducts performance audits on field personnel collecting the sample and of the analytical laboratories that analyze their environmental monitoring samples.

8.1.6 NOAA

A QA plan (Reference 50) addresses the requirements of DOE Order 414.1A (Reference 51), and is consistent with ASME. Implementing procedures include regular independent system and performance audits, written procedures and checklists, follow-up actions, and continuous automated and visual data checks to ensure representativeness and accuracy. The plan and implementing procedures provide the framework to ensure that the INL Site Meteorological Monitoring Network meets the elements of DOE/EH-0173T (Reference 20).

All the meteorological sensors in the ARLFRD tower network are inspected, serviced, and calibrated semiannually as recommended by American Nuclear Society guidelines found in ANSI/ANS-3.11-2005 (Reference 52). Unscheduled service is also promptly performed whenever a sensor malfunctions.

8.2 Sample and Analysis Management Activities

Sample and analysis management activities are performed separately by the various monitoring organizations. Functions performed by each of these monitoring organizations include:

- Developing a Sample and Analysis Plan or equivalent
- Coordinating sampling
- Obtaining analytical laboratory services
- Processing analytical laboratory data packages
- Managing sample and analytical data
- Validating analytical data (where applicable)
- Coordinating sample disposition.

Subcontract laboratories used by the INL and ICP contractors are audited by the DOE Consolidated Audit Program. This program uses trained and certified personnel to perform in-depth audits of subcontract laboratories to review:

- Personnel training and qualification
- Detailed analytical procedures
- Calibration of instrumentation
- Participation in an inter-comparison program
- Use of blind controls
- Analysis of calibration standards.

Audit results are maintained by the DOE Consolidated Audit Program. Laboratories are required to provide corrective action plans for audit findings.

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9. RADIOLOGICAL DOSE EVALUATION

Potential radiological doses to the public from INL Site operations are evaluated to determine compliance with pertinent regulations and limits. Two different computer codes are used to estimate doses. The EDE for a maximally exposed individual (MEI) to INL Site airborne releases of radionuclides is calculated annually and documented in an annual NESHAP report for radionuclides (Reference 21). The annual dose to the public for the MEI and the collective 80-km (50-mi) population, and the biota dose are estimated annually and documented in DOE/ID-12082, "Idaho National Engineering and Environmental Laboratory Site Environmental Report."[64]

9.1 Maximum Individual Dose—Airborne Emissions Pathway

The EDE to an individual member of the public is calculated from airborne emission sources across the INL Site to demonstrate compliance with Subpart H of 40 CFR 61 (Reference 16), DOE Order 450.1 (Reference 1), and DOE Order 5400.5 (Reference 4). Subpart H requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an EDE of 10 millirem per year. The objective of DOE Order 450.1 (Reference 1) is to implement sound stewardship practices that protect the air, water, land, and other natural and cultural resources impacted by DOE operations, and by which DOE cost effectively meets or exceeds compliance with applicable environmental, public health, and resource protection laws, regulations, and DOE requirements. DOE Order 5400.5 states it is also a DOE objective that potential exposures to members of the public be as far below the limits as is reasonable achievable.

Because individual radiological impacts to the public surrounding the INL Site remain too small to be measured by available monitoring techniques, the dose to the public from INL Site operations is calculated using the reported amounts of radionuclides released from the INL Site facilities and EPA-approved air dispersion codes. Compliance to Subpart H of 40 CFR 61 (Reference 16) is demonstrated primarily through the use of the CAP-88 computer code. The mesoscale diffusion (MDIFF) air dispersion model (NOAA-TM-OAR-ARL-238, PB-2001-014789)[65] was developed by NOAA to evaluate dispersion of pollutants in arid environments, such as those at the INL Site, and is used to comply with DOE Order 450.1 (Reference 1).

9.1.1 Dose Evaluation Using CAP-88 Computer Code

Use of the CAP-88 computer code is required by the EPA to demonstrate compliance with the "Clean Air Act Amendments of 1990" (Reference 14). Using the CAP-88 code and information on the reported amounts of radionuclides released from the INL Site facilities, the EDE to the MEI is estimated. CAP-88 uses dose and risk tables developed by the EPA. It does not include shielding by housing materials, but does include a factor to allow for shielding by surface soil contours from radioactivity on the ground surface. ARLFRD performs annual meteorological and dispersion assessments as part of the environmental compliance at the INL Site. Yearly wind statistics are generated for many of the towers in the meteorological network; these are used to run the CAP-88 plume dispersion code required for NESHAP (Reference 16) compliance. CAP-88 makes its calculations based on the joint frequency of wind conditions from a single wind station located near a facility (or emission source) in a straight line from that source and ignores recirculation.

9.1.2 Dose Evaluation Using MDIFF Dispersion Model

ARLFRD developed and maintains a puff transportation and dispersion model called MDIFF to estimate radiological pollutant emissions from the INL Site. MDIFF calculations of total integrated concentrations are used to evaluate the dose to members of the public to show compliance with DOE

Order 450.1 (Reference 1). This method offers a more realistic dose estimate for the INL Site than that from the CAP-88 code. The dispersion algorithms within the code, which are derived in part from field data collected at the INL Site and the puff transport, are driven by the wind data from the ARLFRD tower network. MDIFF is used both for emergency response and environmental compliance. Unlike CAP-88, MDIFF can account for spatial and temporal wind variations associated with the complex topography near the INL Site.

ARLFRD has also developed a program called INEELViz to display data in near real time from the tower network and the vertical profilers. The program contains a user interface to the MDIFF puff dispersion code. INEELViz has been installed at about 50 locations in and around the INL Site. It is widely used to support INL Site operations, and is a major part of ARLFRD's support to the INL EOC.

9.2 80-Kilometer (50-Mile) Population Dose

An estimate of the collective EDE, or population dose, from inhalation, submersion, ingestion, and deposition resulting from airborne releases of radionuclides from the INL Site is determined from the MDIFF evaluations and information on the population within 80 ki (50 mi) of an INL Site facility. Results of the MDIFF population dose evaluations are used to show compliance with DOE Order 450.1 (Reference 1). The population dose is calculated from the average dispersion coefficient for the county census division, the population in each census division within that county, and the normalized dose received at the location of the MEI from the MDIFF evaluation. This gives an approximation of the dose received by the entire population in a given county division. Total population dose is the sum of the population dose for the various county divisions. The calculation overestimates dose because radioactive decay and deposition of the isotopes is not calculated during transport over distances greater than that to the MEI. Population estimates are reviewed and updated annually, as necessary.

9.3 Biotic Dose

Maximum radionuclide concentrations in collected waterfowl, game animals, and marmots are used to estimate a potential dose from ingestion. Estimates of the potential dose an individual may receive from occasionally ingesting meat from game animals take into account that waterfowl may reside briefly at the various waste disposal ponds on the INL Site and those game birds and other game animals may reside on or migrate across the INL Site. The potential dose estimate is based on the highest concentrations of radionuclides in waterfowl or game animals sampled from the INL Site.

A graded approach is used to evaluate the potential dose to aquatic and terrestrial biota from contaminated soil and water DOE-STD-1153-2002, “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota.”[66] The graded approach evaluates the impacts of a given set of radionuclides on aquatic and terrestrial ecosystems by comparing available concentration data in soils and water with biota concentration guides. North Wind, Inc. developed NW-ID-2003-062, “Biota Dose Assessment Guidance for the INEEL,”[67] for applying the graded approach at the INL Site on a laboratory-wide level.

10. FACILITY-SPECIFIC MONITORING

This section contains maps that show monitoring locations by facility.

- Figure 10-1: Auxiliary Reactor Area (ARA) monitoring locations
- Figure 10-2: Central Facilities Area (CFA) monitoring locations
- Figure 10-3: Critical Infrastructure Test Range Complex (CITRC) monitoring locations
- Figure 10-4: Idaho Nuclear Technology and Engineering Center (INTEC) monitoring locations
- Figure 10-5: Materials and Fuels Complex (MFC) monitoring locations
- Figure 10-6: Naval Reactors Facility (NRF) monitoring locations performed by INL Contractor
- Figure 10-7: Reactor Technology Complex (RTC) monitoring locations
- Figure 10-8: Radioactive Waste Management Complex (RWMC) monitoring locations
- Figure 10-9: Specific Manufacturing Capability (SMC) monitoring locations
- Figure 10-10: Technical Services Facility (TSF) monitoring locations
- Figure 10-11: Water Reactor Research Test Facility (WRRTF) monitoring locations
- Figure 10-12: Waste Management monitoring locations.

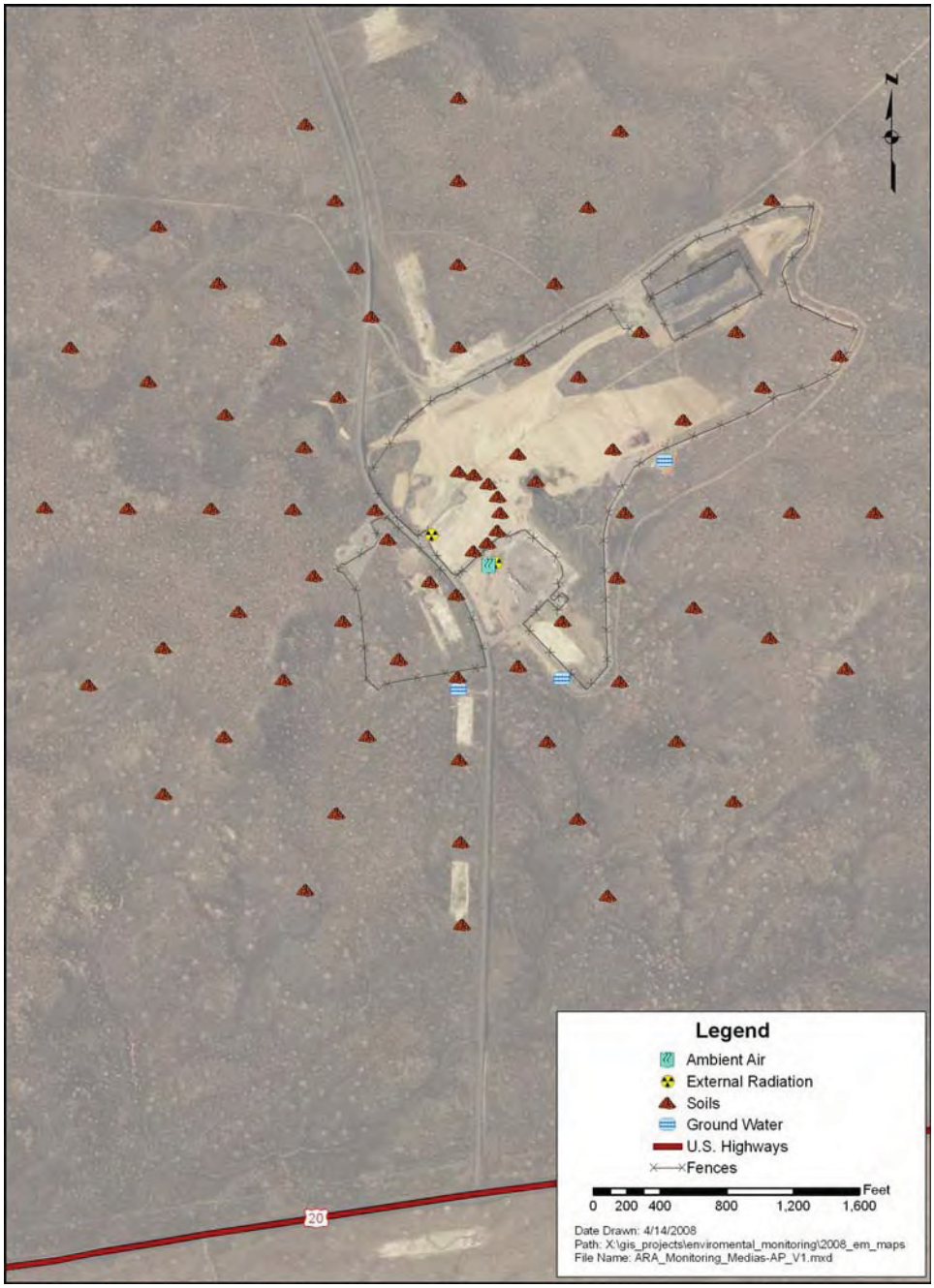

Figure 10-1. Auxiliary Reactor Area monitoring locations.

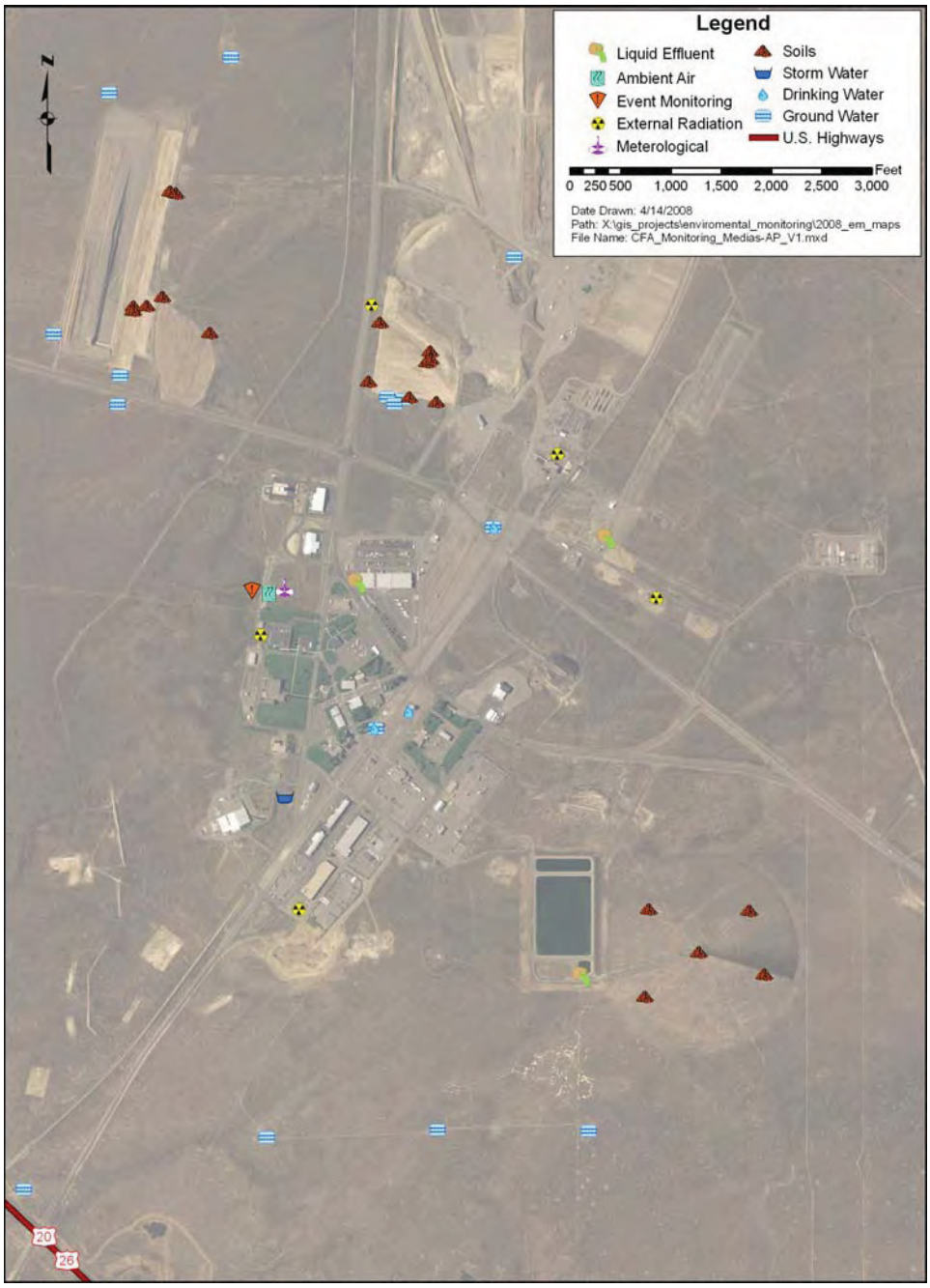

Figure 10-2. CFA monitoring locations.

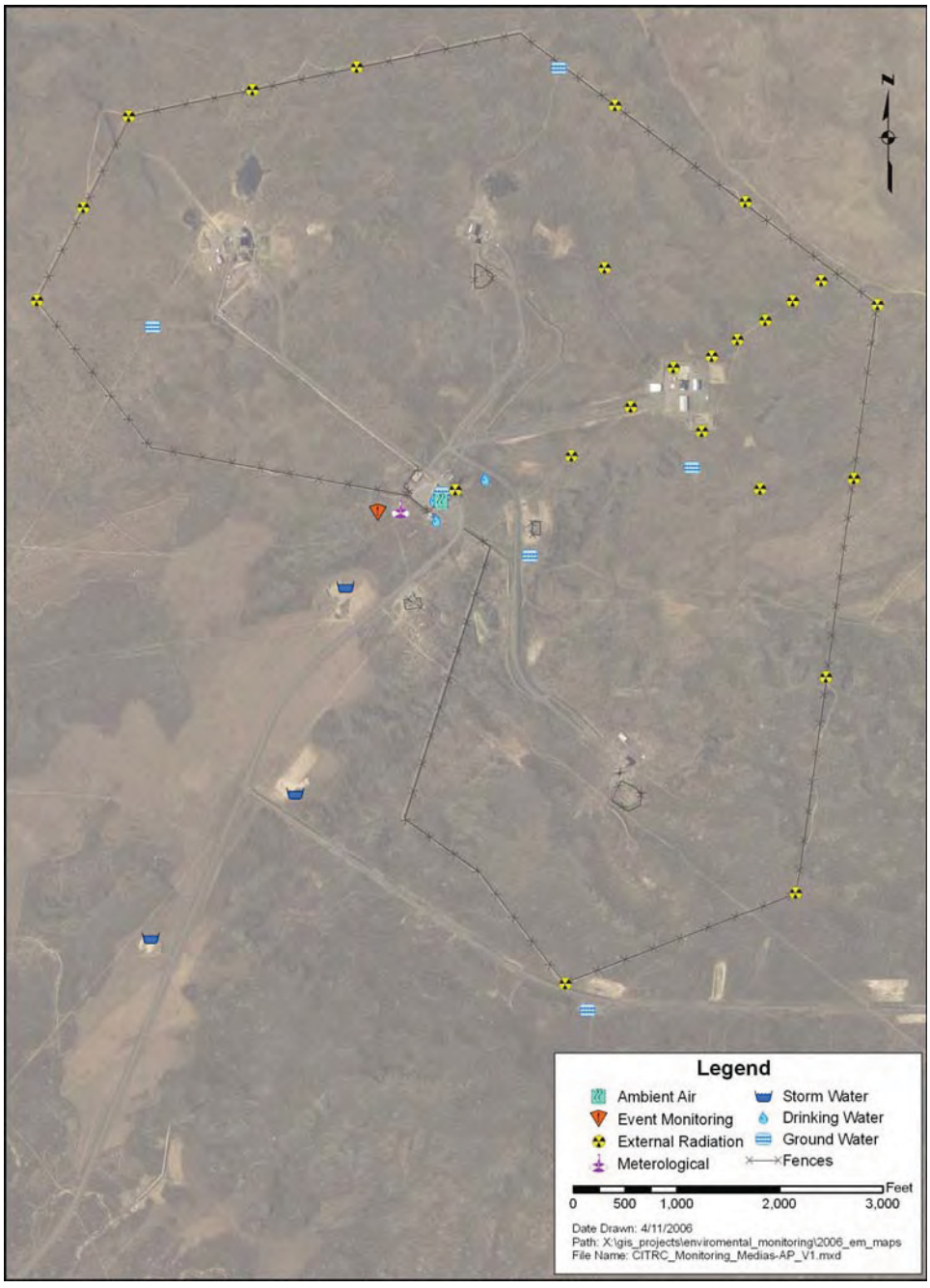

Figure 10-3. CITRC monitoring locations.

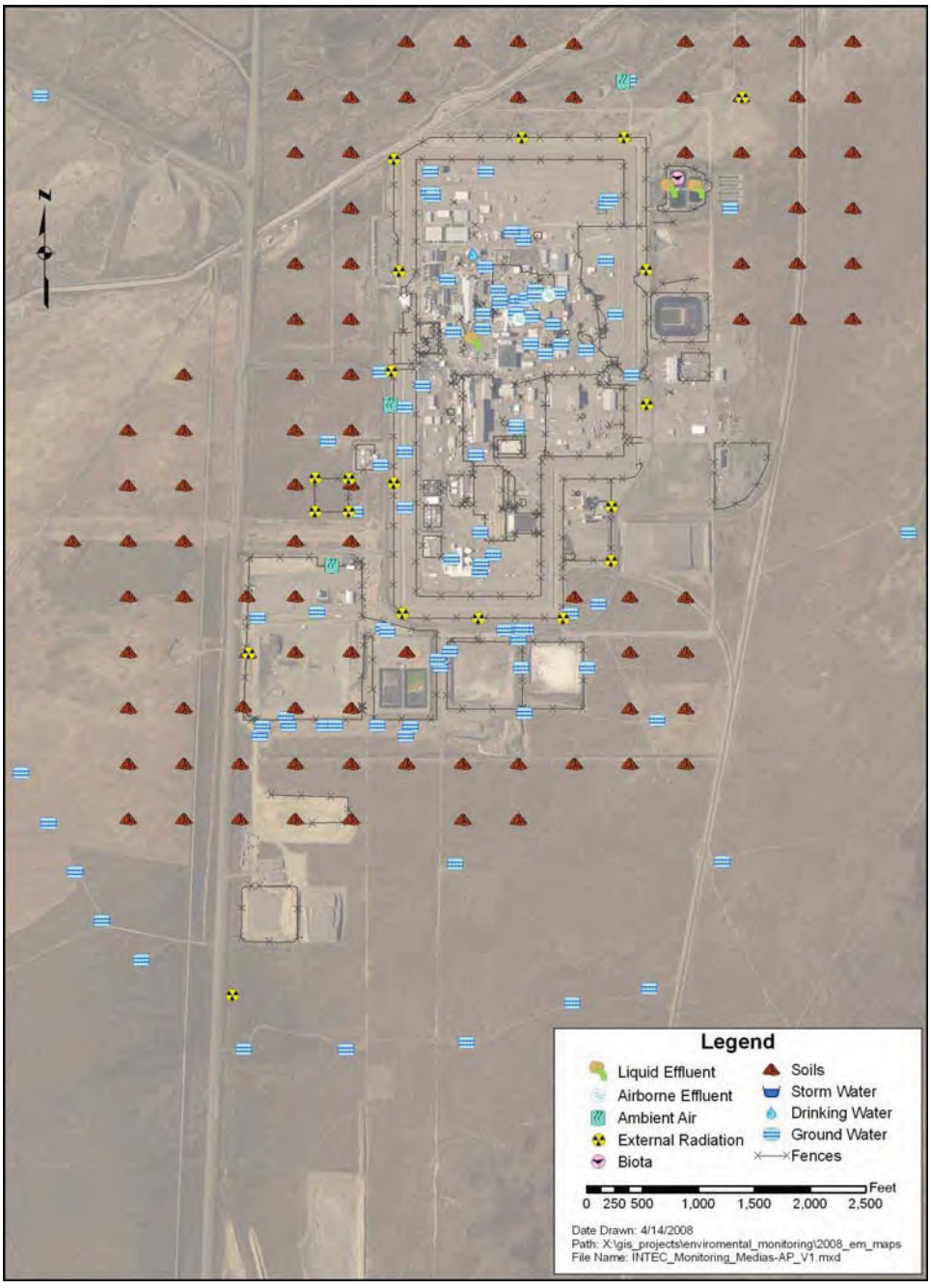

Figure 10-4. INTEC monitoring locations.

Figure 10-5. MFC monitoring locations.

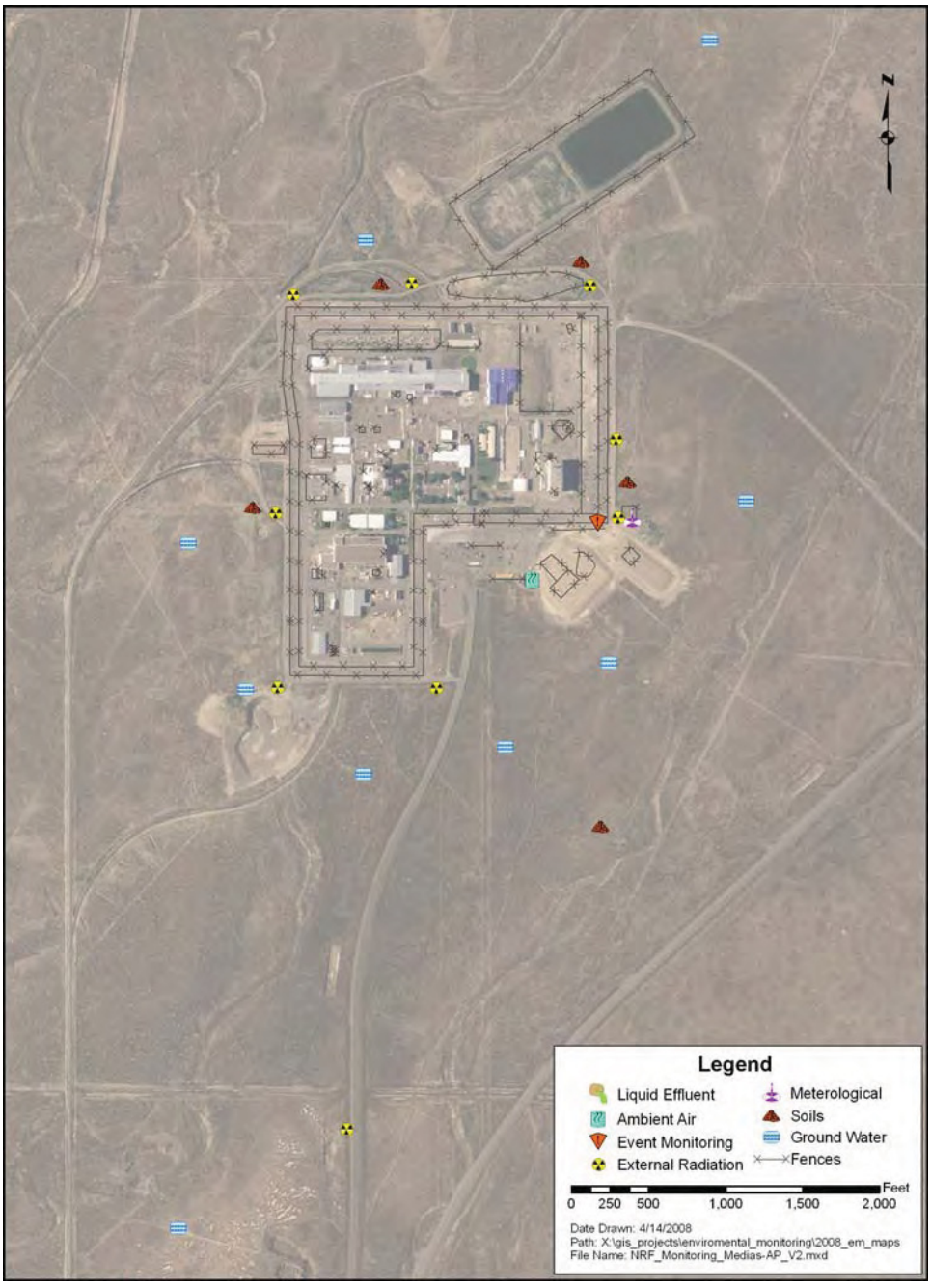

Figure 10-6. NRF monitoring locations performed by INL contractor.

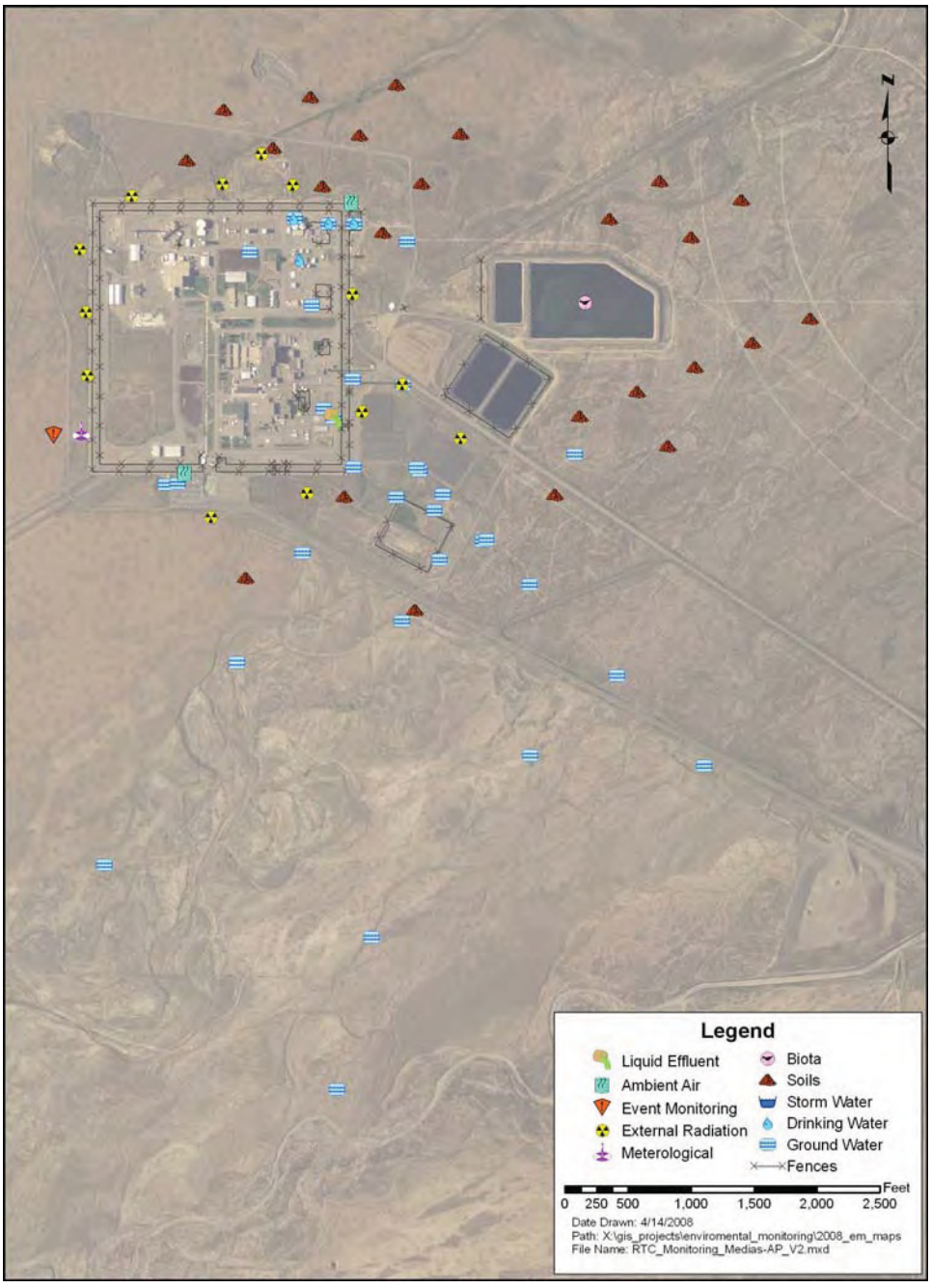

Figure 10-7. RTC monitoring locations.

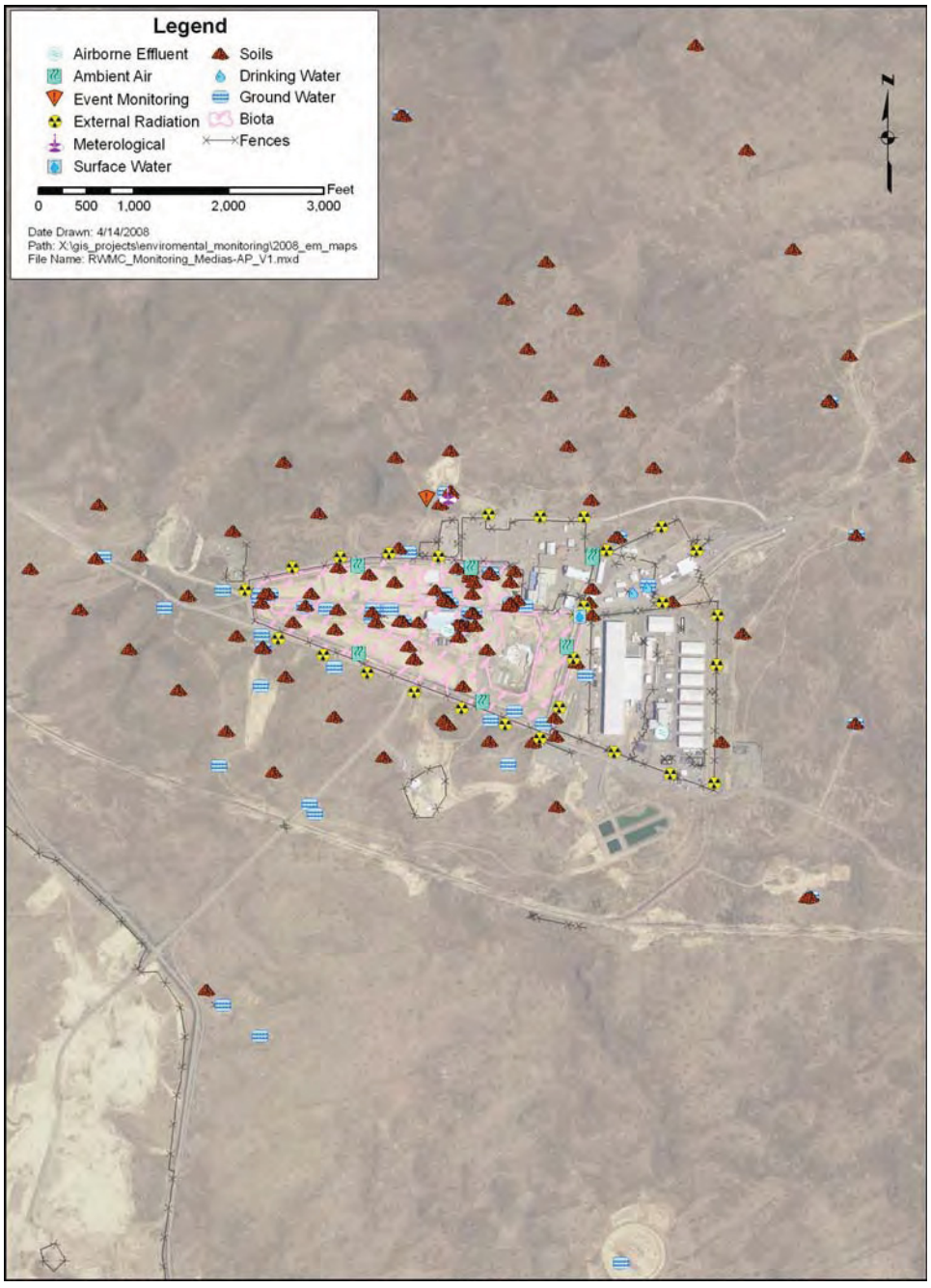

Figure 10-8. RWMC monitoring locations.

Figure 10-9. SMC monitoring locations.

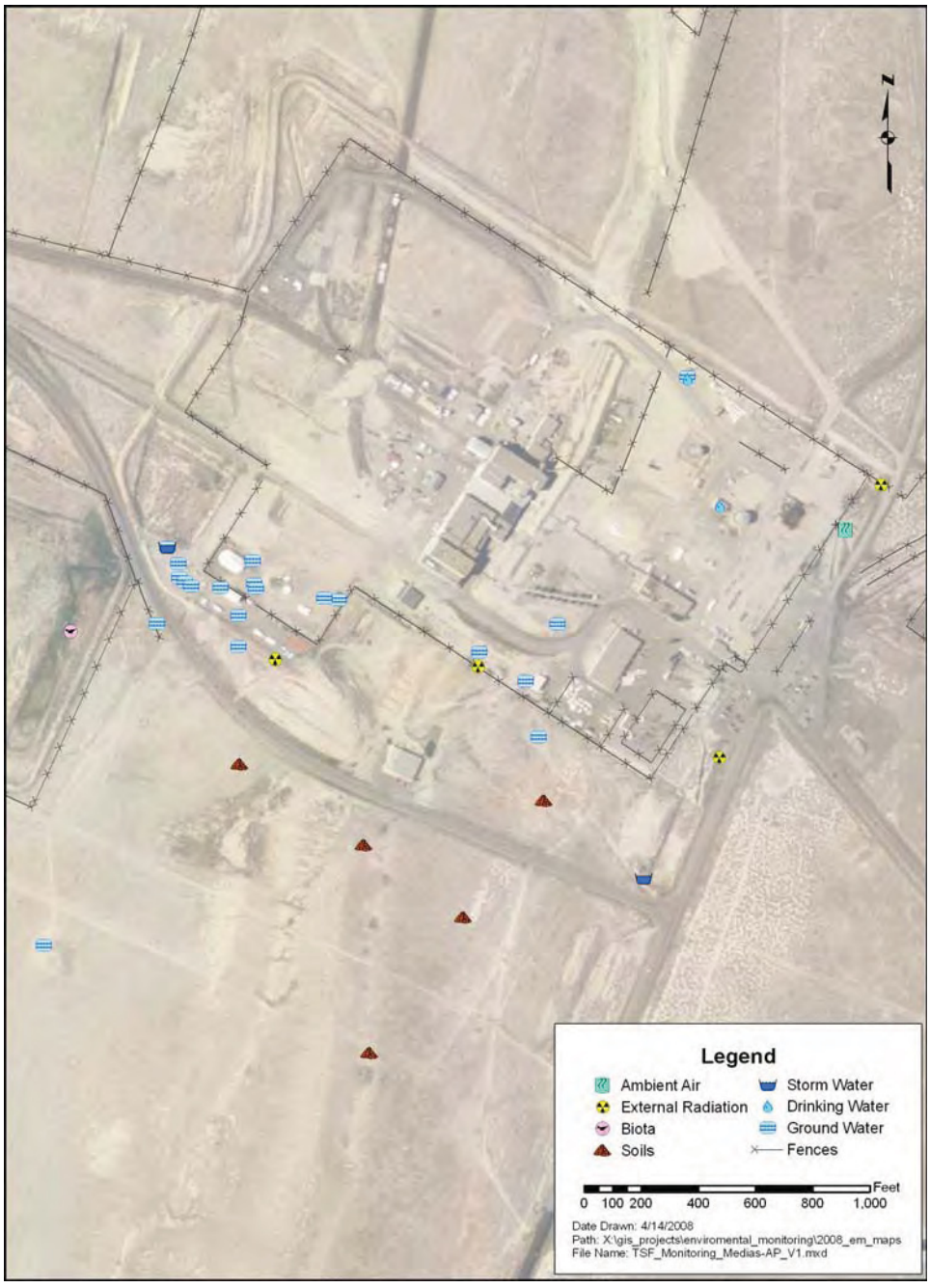

Figure 10-10. TSF monitoring locations.

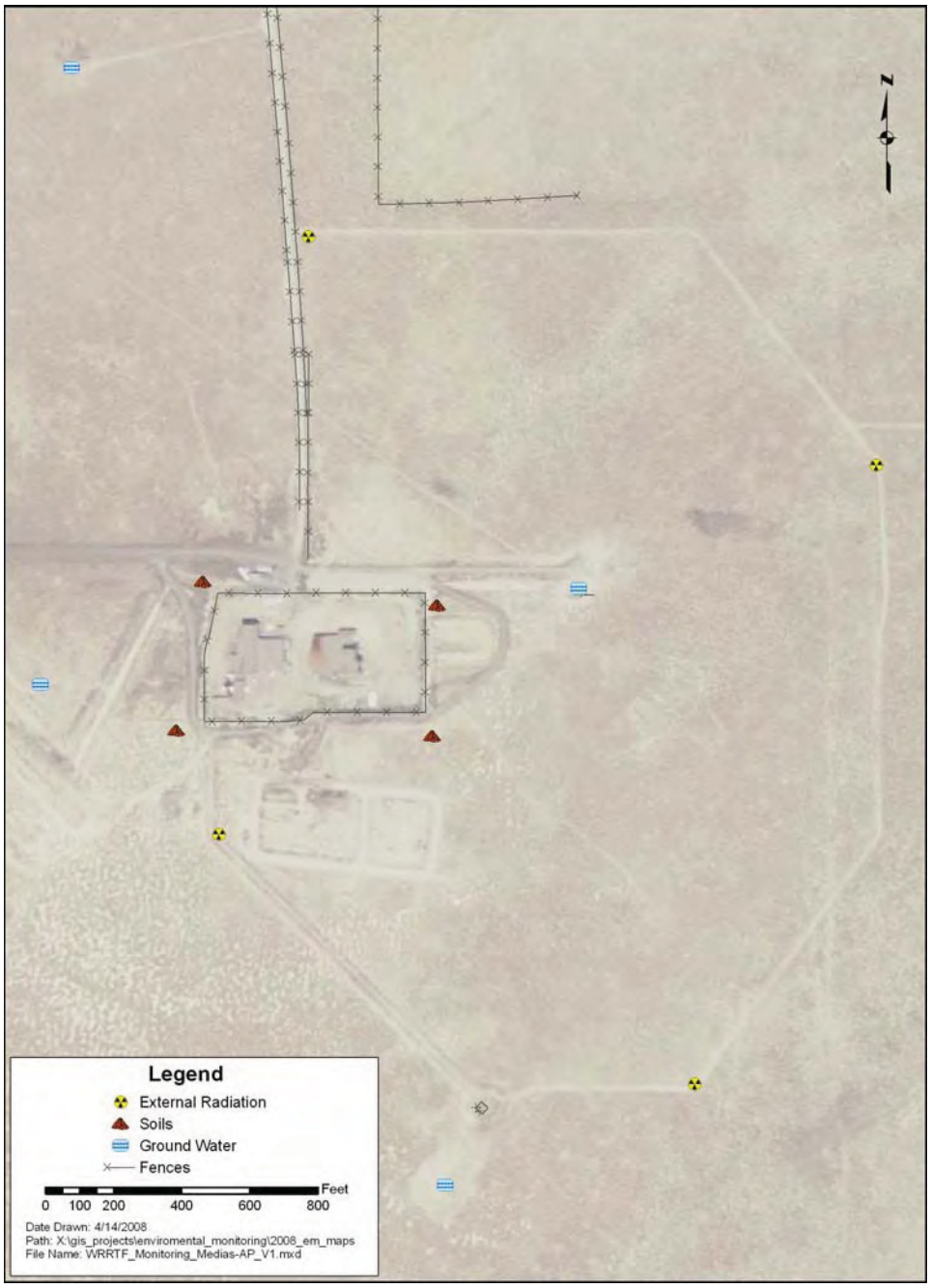

Figure 10-11. WRRTF monitoring locations.

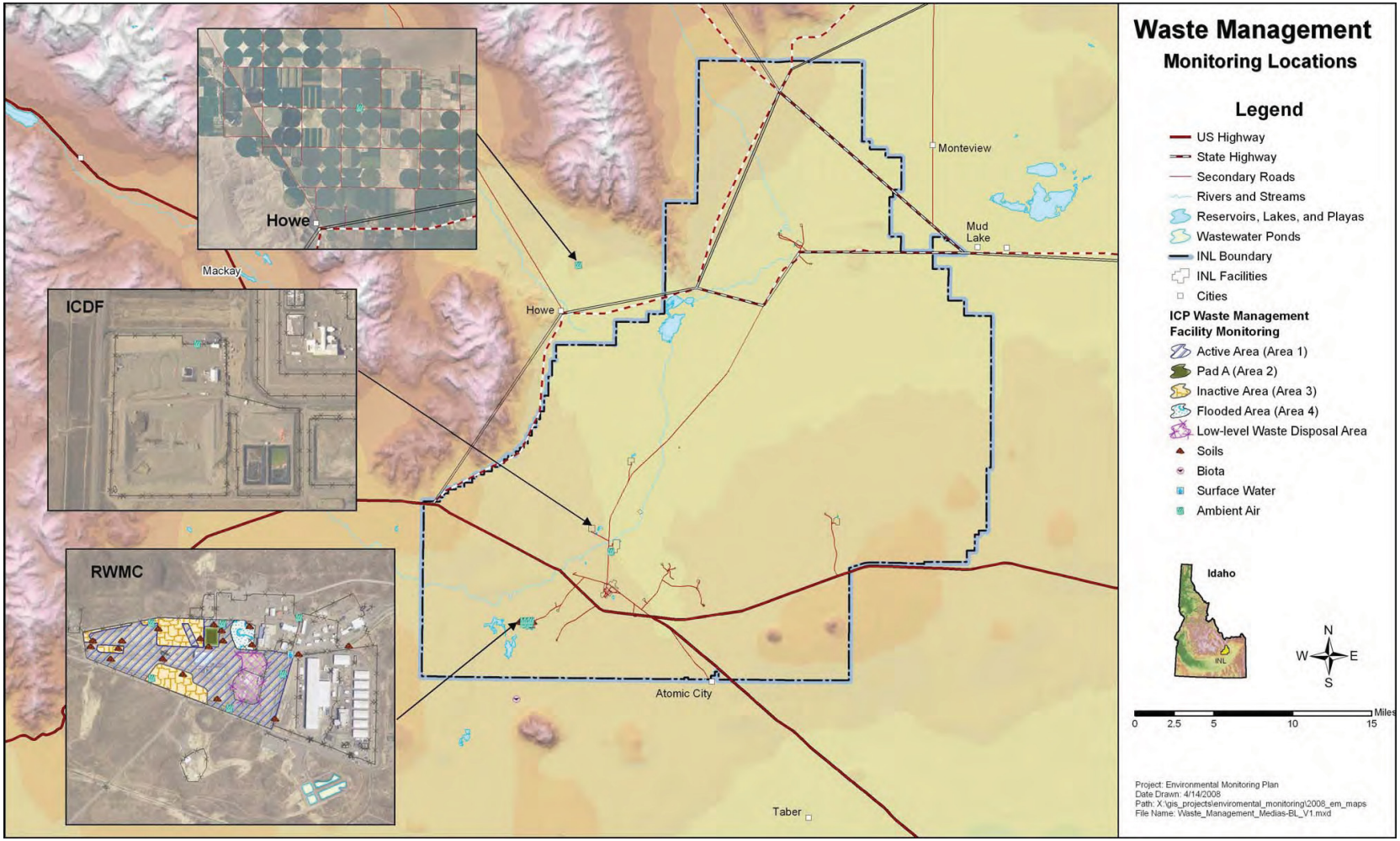

Figure 10-12. Waste management monitoring locations.

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